

For the reasons set out in the preamble, title 40, chapter I, parts 53 and 58 of the Code of Federal Regulations are proposed to be amended as follows:

PART 53--[AMENDED]

1. The authority citation for part 53 continues to read as follows:

Authority: Sec. 301(a) of the Clean Air Act (42 U.S.C. sec. 1857g(a)), as amended by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713, unless otherwise noted.

Subpart A--[Amended]

2. Subpart A of part 53 is amended by revising §§53.1 through 53.5, §53.8, and §53.9 to read as follows:

§53.1 Definitions.

Terms used but not defined in this part shall have the meaning given them by the Act.

Act means the Clean Air Act (42 U.S.C. 1857-18571), as amended.

Additive and multiplicative bias means the linear regression intercept and slope of a linear plot fitted to corresponding candidate and reference method mean measurement data pairs.

Administrator means the Administrator of the

Environmental Protection Agency (EPA) or his or her authorized representative.

Agency means the Environmental Protection Agency.

Applicant means a person or entity who submits an application for a reference or equivalent method determination under §53.4, or a person or entity who assumes the rights and obligations of an applicant under §53.7. Applicant may include a manufacturer, distributor, supplier, or vendor.

Automated method or analyzer means a method for measuring concentrations of an ambient air pollutant in which sample collection (if necessary), analysis, and measurement are performed automatically by an instrument.

Candidate method means a method for measuring the concentration of an air pollutant in the ambient air for which an application for a reference method determination or an equivalent method determination is submitted in accordance with §53.4, or a method tested at the initiative of the Administrator in accordance with §53.7.

Class I equivalent method means an equivalent method for $PM_{2.5}$ or $PM_{10-2.5}$ which is based on a sampler that is very similar to the sampler specified for reference methods in

appendix L or appendix O (as applicable) of part 50 of this chapter, with only minor deviations or modifications, as determined by EPA.

Class II equivalent method means an equivalent method for $PM_{2.5}$ or $PM_{10-2.5}$ that utilizes a $PM_{2.5}$ sampler or $PM_{10-2.5}$ sampler in which integrated $PM_{2.5}$ samples or $PM_{10-2.5}$ samples are obtained from the atmosphere by filtration and subjected to a subsequent filter conditioning process followed by a gravimetric mass determination, but which is not a Class I equivalent method because of substantial deviations from the design specifications of the sampler specified for reference methods in appendix L or appendix O (as applicable) of part 50 of this chapter, as determined by EPA.

Class III equivalent method means an equivalent method for $PM_{2.5}$ or $PM_{10-2.5}$ that is an analyzer capable of providing $PM_{2.5}$ or $PM_{10-2.5}$ ambient air measurements representative of one-hour or less integrated $PM_{2.5}$ or $PM_{10-2.5}$ concentrations as well as 24-hour measurements determined as, or equivalent to, the mean of 24 one-hour consecutive measurements.

CO means carbon monoxide.

Collocated means two or more air samplers, analyzers, or other instruments that are operated simultaneously while located side by side, separated by a distance that is large

enough to preclude the air sampled by any of the devices from being affected by any of the other devices, but small enough so that all devices obtain identical or uniform ambient air samples that are equally representative of the general area in which the group of devices is located.

Equivalent method means a method for measuring the concentration of an air pollutant in the ambient air that has been designated as an equivalent method in accordance with this part; it does not include a method for which an equivalent method designation has been canceled in accordance with §53.11 or §53.16.

ISO 9001-registered facility means a manufacturing facility that is either:

(1) An International Organization for Standardization (ISO) 9001-registered manufacturing facility, registered to the ISO 9001 standard (by the Registrar Accreditation Board (RAB) of the American Society for Quality Control (ASQC) in the United States), with registration maintained continuously.

(2) A facility that can be demonstrated, on the basis of information submitted to the EPA, to be operated according to an EPA-approved and periodically audited quality system which meets, to the extent appropriate, the

same general requirements as an ISO 9001-registered facility for the design and manufacture of designated reference and equivalent method samplers and monitors.

ISO-certified auditor means an auditor who is either certified by the Registrar Accreditation Board (in the United States) as being qualified to audit quality systems using the requirements of recognized standards such as ISO 9001, or who, based on information submitted to the EPA, meets the same general requirements as provided for ISO-certified auditors.

Manual method means a method for measuring concentrations of an ambient air pollutant in which sample collection, analysis, or measurement, or some combination thereof, is performed manually. A method for PM₁₀ or PM_{2.5} which utilizes a sampler that requires manual preparation, loading, and weighing of filter samples is considered a manual method even though the sampler may be capable of automatically collecting a series of sequential samples.

NO₂ means nitrogen dioxide. NO means nitrogen oxide. NO_x means oxides of nitrogen and is defined as the sum of the concentrations of NO₂ and NO.

O₃ means ozone.

Operated simultaneously means that two or more

collocated samplers or analyzers are operated concurrently with no significant difference in the start time, stop time, and duration of the sampling or measurement period.

Pb means lead.

PM means PM_{10} , PM_{10c} , $PM_{2.5}$, $PM_{10-2.5}$, or particulate matter of unspecified size range.

PM_{10} means particulate matter as defined in section 1.1 of appendix J to part 50 of this chapter.

$PM_{2.5}$ means particulate matter as defined in section 1.1 of appendix L to part 50 of this chapter.

$PM_{10-2.5}$ means particulate matter as defined in section 1.1 of appendix O to part 50 of this chapter.

PM_{10c} means PM_{10} particulate matter or PM_{10} measurements obtained with a PM_{10c} sampler.

$PM_{2.5}$ sampler means a device, associated with a manual method for measuring $PM_{2.5}$, designed to collect $PM_{2.5}$ from an ambient air sample, but lacking the ability to automatically analyze or measure the collected sample to determine the mass concentrations of $PM_{2.5}$ in the sampled air.

PM_{10} sampler means a device, associated with a manual method for measuring PM_{10} , designed to collect PM_{10} from an ambient air sample, but lacking the ability to automatically analyze or measure the collected sample to determine the

mass concentrations of PM_{10} in the sampled air.

PM_{10c} sampler means a PM_{10} sampler that meets the special requirements for a PM_{10c} sampler that is part of a $PM_{10-2.5}$ reference method sampler, as specified in appendix O to part 50 of this chapter, or a PM_{10} sampler that is part of a $PM_{10-2.5}$ sampler that has been designated as an equivalent method for $PM_{10-2.5}$.

$PM_{10-2.5}$ sampler means a sampler, or a collocated pair of samplers, associated with a manual method for measuring $PM_{10-2.5}$ and designed to collect either $PM_{10-2.5}$ directly or PM_{10c} and $PM_{2.5}$ separately and simultaneously from concurrent ambient air samples, but lacking the ability to automatically analyze or measure the collected sample(s) to determine the mass concentrations of $PM_{10-2.5}$ in the sampled air.

Reference method means a method of sampling and analyzing the ambient air for an air pollutant that is specified as a reference method in an appendix to part 50 of this chapter, or a method that has been designated as a reference method in accordance with this part; it does not include a method for which a reference method designation has been canceled in accordance with §53.11 or §53.16.

Sequential samples for PM samplers means two or more PM

samples for sequential (but not necessarily contiguous) time periods that are collected automatically by the same sampler without the need for intervening operator service.

SO₂ means sulfur dioxide.

Test analyzer means an analyzer subjected to testing as part of a candidate method in accordance with subparts B, C, D, E, or F of this part, as applicable.

Test sampler means a PM₁₀ sampler, PM_{2.5} sampler, or PM_{10-2.5} sampler subjected to testing as part of a candidate method in accordance with subparts C, D, E, or F of this part.

Ultimate purchaser means the first person or entity who purchases a reference method or an equivalent method for purposes other than resale.

§53.2 General requirements for a reference method determination.

The following general requirements for a reference method determination are summarized in table A-1 of this subpart.

(a) Manual methods. (1) Sulfur dioxide (SO₂) and lead. For measuring SO₂ and lead, appendices A and G of part 50 of this chapter specify unique manual reference methods for measuring these pollutants. Except as provided

in §53.16, other manual methods for SO₂ and lead will not be considered for reference method determinations under this part.

(2) PM₁₀. A reference method for measuring PM₁₀ must be a manual method that meets all requirements specified in appendix J of part 50 of this chapter and must include a PM₁₀ sampler that has been shown in accordance with this part to meet all requirements specified in this subpart A and subpart D of this part.

(3) PM_{2.5}. A reference method for measuring PM_{2.5} must be a manual method that meets all requirements specified in appendix L of part 50 of this chapter and must include a PM_{2.5} sampler that has been shown in accordance with this part to meet the applicable requirements specified in this subpart A and subpart E of this part. Further, reference method samplers must be manufactured in an ISO 9001-registered facility, as defined in §53.1 and as set forth in §53.51.

(4) PM_{10-2.5}. A reference method for measuring PM_{10-2.5} must be a manual method that meets all requirements specified in appendix O of part 50 of this chapter and must include PM_{10c} and PM_{2.5} samplers that have been shown in accordance with this part to meet the applicable

requirements specified in this subpart A and subpart E of this part. Further, $PM_{10-2.5}$ reference method samplers must be manufactured in an ISO 9001-registered facility, as defined in §53.1 and as set forth in §53.51.

(b) Automated methods. An automated reference method for measuring CO , O_3 , or NO_2 must utilize the measurement principle and calibration procedure specified in the appropriate appendix to part 50 of this chapter and must have been shown in accordance with this part to meet the requirements specified in this subpart A and subpart B of this part.

§53.3 General requirements for an equivalent method determination.

(a) Manual methods. A manual equivalent method must have been shown in accordance with this part to satisfy the applicable requirements specified in this subpart A and subpart C of this part. In addition, a PM sampler associated with a manual equivalent method for PM_{10} , $PM_{2.5}$, or $PM_{10-2.5}$ must have been shown in accordance with this part to satisfy the following additional requirements, as applicable:

(1) PM_{10} . A PM_{10} sampler associated with a manual method for PM_{10} must satisfy the requirements of subpart D

of this part.

(2) PM_{2.5} Class I. A PM_{2.5} Class I equivalent method sampler must also satisfy all requirements of subpart E of this part, which shall include appropriate demonstration that each and every deviation or modification from the reference method sampler specifications does not significantly alter the performance of the sampler.

(3) PM_{2.5} Class II. (i) A PM_{2.5} Class II equivalent method sampler must also satisfy the applicable requirements of subparts E and F of this part or the alternative requirements in paragraph (a)(3)(ii) of this section.

(ii) In lieu of the applicable requirements specified for Class II PM_{2.5} methods in subparts C and F of this part, a Class II PM_{2.5} equivalent method sampler may alternatively meet the applicable requirements in paragraphs (b)(3)(i) through (iii) of this section and the testing, performance, and comparability requirements specified for Class III equivalent methods for PM_{2.5} in subpart C of this part.

(4) PM_{10-2.5} Class I. A PM_{10-2.5} Class I equivalent method sampler must also satisfy the applicable requirements of subpart E of this part (there are no additional requirements specifically for Class I PM_{10-2.5} methods in subpart C of this part).

(5) PM_{10-2.5} Class II. (i) A PM_{10-2.5} Class II equivalent method must also satisfy the applicable requirements of subpart C of this part and also the applicable requirements and provisions of paragraphs (b) (3) (i) through (iii) of this section, or the alternative requirements in paragraph (a) (5) (ii) of this section.

(ii) In lieu of the applicable requirements specified for Class II PM_{10-2.5} methods in subpart C of this part and in paragraph (b) (3) (iii) of this section, a Class II PM_{10-2.5} equivalent method sampler may alternatively meet the applicable requirements in paragraphs (b) (3) (i) and (ii) of this section and the testing, performance, and comparability requirements specified for Class III equivalent methods for PM_{10-2.5} in subpart C of this part.

(6) ISO 9001. All designated equivalent methods for PM_{2.5} or PM_{10-2.5} must be manufactured in an ISO 9001-registered facility, as defined in §53.1 and as set forth in §53.51.

(b) Automated methods. All types of automated equivalent methods must have been shown in accordance with this part to satisfy the applicable requirements specified in this subpart A and subpart C of this part. In addition, an automated equivalent method must have been shown in

accordance with this part to satisfy the following additional requirements, as applicable:

(1) An automated equivalent method for pollutants other than PM must be shown in accordance with this part to satisfy the applicable requirements specified in subpart B of this part.

(2) An automated equivalent method for PM_{10} must be shown in accordance with this part to satisfy the applicable requirements of subpart D of this part.

(3) A Class III automated equivalent method for $PM_{2.5}$ or $PM_{10-2.5}$ must be shown in accordance with this part to satisfy the requirements in paragraphs (b)(3)(i) through (iii) of this section, as applicable.

(i) All pertinent requirements of 40 CFR part 50, appendix L, including sampling height, range of operational conditions, ambient temperature and pressure sensors, outdoor enclosure, electrical power supply, control devices and operator interfaces, data output port, operation/instruction manual, data output and reporting requirements, and any other requirements that would be reasonably applicable to the method, unless adequate (as determined by the Administrator) rationale can be provided to support the contention that a particular requirement does

not or should not be applicable to the particular candidate method.

(ii) All pertinent tests and requirements of subpart E of this part, such as instrument manufacturing quality control; final assembly and inspection; manufacturer's audit checklists; leak checks; flow rate accuracy, measurement accuracy, and flow rate cut-off; operation following power interruptions; effect of variations in power line voltage, ambient temperature and ambient pressure; and aerosol transport; unless adequate (as determined by the Administrator) rationale can be provided to support the contention that a particular test or requirement does not or should not be applicable to the particular candidate method.

(iii) Candidate methods shall be tested for and meet any performance requirements, such as inlet aspiration, particle size separation or selection characteristics, change in particle separation or selection characteristics due to loading or other operational conditions, or effects of surface exposure and particle volatility, determined by the Administrator to be necessary based on the nature, design, and specifics of the candidate method and the extent to which it deviates from the design and performance characteristics of the reference method. These performance

requirements and the specific test(s) for them will be determined by Administrator for each specific candidate method or type of candidate method and may be similar to or based on corresponding tests and requirements set forth in subpart F of this part or may be special requirements and tests tailored by the Administrator to the specific nature, design, and operational characteristics of the candidate method. For example, a candidate method with an inlet design deviating substantially from the design of the reference method inlet would likely be subject to an inlet aspiration test similar to that set forth in §53.63. Similarly, a candidate method having an inertial fractionation system substantially different from that of the reference method would likely be subject to a static fractionation test and a loading test similar to those set forth in §§53.64 and 53.65, respectively. A candidate method with more extensive or profound deviations from the design and function of the reference method may be subject to other tests, full wind-tunnel tests similar to those described in §53.62, or to special tests adapted or developed individually to accommodate the specific type of measurement or operation of the candidate method.

(4) All designated equivalent methods for $PM_{2.5}$ or

PM_{10-2.5} must be manufactured in an ISO 9001-registered facility, as defined in §53.1 and as set forth in §53.51.

§53.4 Applications for reference or equivalent method determinations.

(a) Applications for reference or equivalent method determinations shall be submitted in duplicate to:

Director, National Exposure Research Laboratory, Reference and Equivalent Method Program (MD-D205-03), U.S.

Environmental Protection Agency, Research Triangle Park, North Carolina 27711 (Commercial delivery address: 4930 Old Page Road, Durham, North Carolina 27703).

(b) Each application shall be signed by an authorized representative of the applicant, shall be marked in accordance with §53.15 (if applicable), and shall contain the following:

(1) A clear identification of the candidate method, which will distinguish it from all other methods such that the method may be referred to unambiguously. This identification must consist of a unique series of descriptors such as title, identification number, analyte, measurement principle, manufacturer, brand, model, etc., as necessary to distinguish the method from all other methods or method variations, both within and outside the

applicant's organization.

(2) A detailed description of the candidate method, including but not limited to the following: The measurement principle, manufacturer, name, model number and other forms of identification, a list of the significant components, schematic diagrams, design drawings, and a detailed description of the apparatus and measurement procedures. Drawings and descriptions pertaining to candidate methods or samplers for $PM_{2.5}$ or $PM_{10-2.5}$ must meet all applicable requirements in reference 1 of appendix A of this subpart, using appropriate graphical, nomenclature, and mathematical conventions such as those specified in references 3 and 4 of appendix A of this subpart.

(3) A copy of a comprehensive operation or instruction manual providing a complete and detailed description of the operational, maintenance, and calibration procedures prescribed for field use of the candidate method and all instruments utilized as part of that method (under §53.9(a)).

(i) As a minimum this manual shall include:

(A) Description of the method and associated instruments.

(B) Explanation of all indicators, information

displays, and controls.

(C) Complete setup and installation instructions, including any additional materials or supplies required.

(D) Details of all initial or startup checks or acceptance tests and any auxiliary equipment required.

(E) Complete operational instructions.

(F) Calibration procedures and descriptions of required calibration equipment and standards.

(G) Instructions for verification of correct or proper operation.

(H) Trouble-shooting guidance and suggested corrective actions for abnormal operation.

(I) Required or recommended routine, periodic, and preventative maintenance and maintenance schedules.

(J) Any calculations required to derive final concentration measurements.

(K) Appropriate references to any applicable appendix of part 50 of this chapter; reference 6 of appendix A of this subpart; and any other pertinent guidelines.

(ii) The manual shall also include adequate warning of potential safety hazards that may result from normal use and/or malfunction of the method and a description of necessary safety precautions. (See §53.9(b).) However, the

previous requirement shall not be interpreted to constitute or imply any warranty of safety of the method by EPA. For samplers and automated methods, the manual shall include a clear description of all procedures pertaining to installation, operation, preventive maintenance, and troubleshooting and shall also include parts identification diagrams. The manual may be used to satisfy the requirements of paragraphs (b) (1) and (2) of this section to the extent that it includes information necessary to meet those requirements.

(4) A statement that the candidate method has been tested in accordance with the procedures described in subparts B, C, D, E, and/or F of this part, as applicable.

(5) Descriptions of test facilities and test configurations, test data, records, calculations, and test results as specified in subparts B, C, D, E, and/or F of this part, as applicable. Data must be sufficiently detailed to meet appropriate principles described in part B, sections 3.3.1 (paragraph 1) and 3.5.1 and part C, section 4.6 of reference 2 of appendix A of this subpart; and in paragraphs 1 through 3 of section 4.8 (Records) of reference 5 of appendix A of this subpart. Salient requirements from these references include the following:

(i) The applicant shall maintain and include records of all relevant measuring equipment, including the make, type, and serial number or other identification, and most recent calibration with identification of the measurement standard or standards used and their National Institute of Standards and Technology (NIST) traceability. These records shall demonstrate the measurement capability of each item of measuring equipment used for the application and include a description and justification (if needed) of the measurement setup or configuration in which it was used for the tests. The calibration results shall be recorded and identified in sufficient detail so that the traceability of all measurements can be determined and any measurement could be reproduced under conditions close to the original conditions, if necessary, to resolve any anomalies.

(ii) Test data shall be collected according to the standards of good practice and by qualified personnel. Test anomalies or irregularities shall be documented and explained or justified. The impact and significance of the deviation on test results and conclusions shall be determined. Data collected shall correspond directly to the specified test requirement and be labeled and identified clearly so that results can be verified and evaluated

against the test requirement. Calculations or data manipulations must be explained in detail so that they can be verified.

(6) A statement that the method, analyzer, or sampler tested in accordance with this part is representative of the candidate method described in the application.

(c) For candidate automated methods and candidate manual methods for PM_{10} , $PM_{2.5}$, and $PM_{10-2.5}$ the application shall also contain the following:

(1) A detailed description of the quality system that will be utilized, if the candidate method is designated as a reference or equivalent method, to ensure that all analyzers or samplers offered for sale under that designation will have essentially the same performance characteristics as the analyzer(s) or samplers tested in accordance with this part. In addition, the quality system requirements for candidate methods for $PM_{2.5}$ and $PM_{10-2.5}$ must be described in sufficient detail, based on the elements described in section 4 of reference 1 (Quality System Requirements) of appendix A of this subpart. Further clarification is provided in the following sections of reference 2 of appendix A of this subpart: part A (Management Systems), sections 2.2 (Quality System and Description), 2.3 (Personnel Qualification and

Training), 2.4 (Procurement of Items and Services), 2.5 (Documents and Records), and 2.7 (Planning); part B (Collection and Evaluation of Environmental Data), sections 3.1 (Planning and Scoping), 3.2 (Design of Data Collection Operations), and 3.5 (Assessment and Verification of Data Usability); and part C (Operation of Environmental Technology), sections 4.1 (Planning), 4.2 (Design of Systems), and 4.4 (Operation of Systems).

(2) A description of the durability characteristics of such analyzers or samplers (see §53.9(c)). For methods for $PM_{2.5}$ and $PM_{10-2.5}$ the warranty program must ensure that the required specifications (see Table A-1 to this subpart) will be met throughout the warranty period and that the applicant accepts responsibility and liability for ensuring this conformance or for resolving any nonconformities, including all necessary components of the system, regardless of the original manufacturer. The warranty program must be described in sufficient detail to meet appropriate provisions of the ANSI/ASQC and ISO 9001 standards (references 1 and 2 in appendix A of this subpart) for controlling conformance and resolving nonconformance, particularly sections 4.12, 4.13, and 4.14 of reference 1 in appendix A of this subpart.

(i) Section 4.12 in reference 1 of appendix A of this subpart requires the manufacturer to establish and maintain a system of procedures for identifying and maintaining the identification of inspection and test status throughout all phases of manufacturing to ensure that only instruments that have passed the required inspections and tests are released for sale.

(ii) Section 4.13 in reference 1 of appendix A of this subpart requires documented procedures for control of nonconforming product, including review and acceptable alternatives for disposition; section 4.14 in reference 1 of appendix A of this subpart requires documented procedures for implementing corrective (4.14.2) and preventive (4.14.3) action to eliminate the causes of actual or potential nonconformities. In particular, section 4.14.3 requires that potential causes of nonconformities be eliminated by using information such as service reports and customer complaints to eliminate potential causes of nonconformities.

(d) For candidate reference or equivalent methods for $PM_{2.5}$ and Class II or Class III equivalent methods for $PM_{10-2.5}$, the applicant, if requested by EPA, shall provide to EPA for test purposes one sampler or analyzer that is representative of the sampler or analyzer associated with

the candidate method. The sampler or analyzer shall be shipped FOB destination to Director, National Exposure Research Laboratory, Reference and Equivalent Method Program (MD-D205-03), U.S. Environmental Protection Agency, 4930 Old Page Road, Durham, North Carolina 27703, scheduled to arrive concurrent with or within 30 days of the arrival of the other application materials. This analyzer or sampler may be subjected to various tests that EPA determines to be necessary or appropriate under §53.5(f), and such tests may include special tests not described in this part. If the instrument submitted under this paragraph malfunctions, becomes inoperative, or fails to perform as represented in the application before the necessary EPA testing is completed, the applicant shall be afforded an opportunity to repair or replace the device at no cost to EPA. Upon completion of EPA testing, the analyzer or sampler submitted under this paragraph shall be repacked by EPA for return shipment to the applicant, using the same packing materials used for shipping the instrument to EPA unless alternative packing is provided by the applicant. Arrangements for, and the cost of, return shipment shall be the responsibility of the applicant. EPA does not warrant or assume any liability for the condition of the analyzer or sampler upon return to

the applicant.

§53.5 Processing of applications.

After receiving an application for a reference or equivalent method determination, the Administrator will, within 120 calendar days after receipt of the application, take one or more of the following actions:

(a) Send notice to the applicant, in accordance with §53.8, that the candidate method has been determined to be a reference or equivalent method.

(b) Send notice to the applicant that the application has been rejected, including a statement of reasons for rejection.

(c) Send notice to the applicant that additional information must be submitted before a determination can be made and specify the additional information that is needed (in such cases, the 120-day period shall commence upon receipt of the additional information).

(d) Send notice to the applicant that additional test data must be submitted and specify what tests are necessary and how the tests shall be interpreted (in such cases, the 120-day period shall commence upon receipt of the additional test data).

(e) Send notice to the applicant that the application

has been found to be substantially deficient or incomplete and cannot be processed until additional information is submitted to complete the application and specify the general areas of substantial deficiency.

(f) Send notice to the applicant that additional tests will be conducted by the Administrator, specifying the nature of and reasons for the additional tests and the estimated time required (in such cases, the 120-day period shall commence 1 calendar day after the additional tests have been completed).

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§53.8 Designation of reference and equivalent methods.

(a) A candidate method determined by the Administrator to satisfy the applicable requirements of this part shall be designated as a reference method or equivalent method (as applicable) by and upon publication of a notice of the designation in the FEDERAL REGISTER.

(b) Upon designation, a notice indicating that the method has been designated as a reference method or an equivalent method shall be sent to the applicant.

(c) The Administrator will maintain a current list of methods designated as reference or equivalent methods in accordance with this part and will send a copy of the list

to any person or group upon request. A copy of the list will be available for inspection or copying at EPA Regional Offices and may be available via the Internet or other sources.

§53.9 Conditions of designation.

Designation of a candidate method as a reference method or equivalent method shall be conditioned to the applicant's compliance with the following requirements. Failure to comply with any of the requirements shall constitute a ground for cancellation of the designation in accordance with §53.11.

(a) Any method offered for sale as a reference or equivalent method shall be accompanied by a copy of the manual referred to in §53.4(b) (3) when delivered to any ultimate purchaser, and an electronic copy of the manual suitable for incorporating into user specific standard operating procedure documents shall be readily available to any users.

(b) Any method offered for sale as a reference or equivalent method shall generate no unreasonable hazard to operators or to the environment during normal use or when malfunctioning.

(c) Any analyzer, PM₁₀ sampler, PM_{2.5} sampler, or PM_{10-2.5}

sampler offered for sale as part of a reference or equivalent method shall function within the limits of the performance specifications referred to in §53.20(a), §53.30(a), §53.50, or §53.60, as applicable, for at least 1 year after delivery and acceptance when maintained and operated in accordance with the manual referred to in §53.4(b)(3).

(d) Any analyzer, PM₁₀ sampler, PM_{2.5} sampler, or PM_{10-2.5} sampler offered for sale as a reference or equivalent method shall bear a prominent, permanently affixed label or sticker indicating that the analyzer or sampler has been designated by EPA as a reference method or as an equivalent method (as applicable) in accordance with this part and displaying any designated method identification number that may be assigned by EPA.

(e) If an analyzer is offered for sale as a reference or equivalent method and has one or more selectable ranges, the label or sticker required by paragraph (d) of this section shall be placed in close proximity to the range selector and shall indicate clearly which range or ranges have been designated as parts of the reference or equivalent method.

(f) An applicant who offers analyzers, PM₁₀ samplers,

PM_{2.5} samplers, or PM_{10-2.5} samplers for sale as reference or equivalent methods shall maintain an accurate and current list of the names and mailing addresses of all ultimate purchasers of such analyzers or samplers. For a period of 7 years after publication of the reference or equivalent method designation applicable to such an analyzer or sampler, the applicant shall notify all ultimate purchasers of the analyzer or sampler within 30 days if the designation has been canceled in accordance with §53.11 or §53.16 or if adjustment of the analyzer or sampler is necessary under §53.11(b).

(g) If an applicant modifies an analyzer, PM₁₀ sampler, PM_{2.5} sampler, or PM_{10-2.5} sampler that has been designated as a reference or equivalent method, the applicant shall not sell the modified analyzer or sampler as a reference or equivalent method nor attach a label or sticker to the modified analyzer or sampler under paragraph (d) or (e) of this section until the applicant has received notice under §53.14(c) that the existing designation or a new designation will apply to the modified analyzer or sampler or has applied for and received notice under §53.8(b) of a new reference or equivalent method determination for the modified analyzer or sampler.

(h) An applicant who has offered PM_{2.5} or PM_{10-2.5} samplers or analyzers for sale as part of a reference or equivalent method may continue to do so only so long as the facility in which the samplers or analyzers are manufactured continues to be an ISO 9001-registered facility, as set forth in subpart E of this part. In the event that the ISO 9001 registration for the facility is withdrawn, suspended, or otherwise becomes inapplicable, either permanently or for some specified time interval, such that the facility is no longer an ISO 9001-registered facility, the applicant shall notify EPA within 30 days of the date the facility becomes other than an ISO 9001-registered facility, and upon such notification, EPA shall issue a preliminary finding and notification of possible cancellation of the reference or equivalent method designation under §53.11.

(i) An applicant who has offered PM_{2.5} or PM_{10-2.5} samplers or analyzers for sale as part of a reference or equivalent method may continue to do so only so long as updates of the Product Manufacturing Checklist set forth in subpart E of this part are submitted annually. In the event that an annual Checklist update is not received by EPA within 12 months of the date of the last such submitted Checklist or Checklist update, EPA shall notify the

applicant within 30 days that the Checklist update has not been received and shall, within 30 days from the issuance of such notification, issue a preliminary finding and notification of possible cancellation of the reference or equivalent method designation under §53.11.

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3. Table A-1 to subpart A of part 53 is revised to read as follows:

TABLE A-1 TO SUBPART A OF PART 53. SUMMARY OF APPLICABLE REQUIREMENTS FOR REFERENCE AND EQUIVALENT METHODS FOR AIR MONITORING OF CRITERIA POLLUTANTS.

Pollutant	Ref. or Equivalent	Manual or Automated	Applicable part 50 Appendix	Applicable subparts of part 53					
				A	B	C	D	E	F
SO ₂	Reference	Manual	A						
	Equivalent	Manual		✓		✓			
		Automated		✓	✓	✓			
CO	Reference	Automated	C	✓	✓				
	Equivalent	Manual		✓		✓			
		Automated		✓	✓	✓			
O ₃	Reference	Automated	D	✓	✓				
	Equivalent	Manual		✓		✓			
		Automated		✓	✓	✓			
NO ₂	Reference	Automated	F	✓	✓				
	Equivalent	Manual		✓		✓			
		Automated		✓	✓	✓			
Pb	Reference	Manual	G						
	Equivalent	Manual		✓		✓			
PM ₁₀	Reference	Manual	J	✓			✓		
	Equivalent	Manual		✓		✓	✓		
		Automated		✓		✓	✓		
PM _{2.5}	Reference	Manual	L	✓				✓	
	Equivalent Class I	Manual	L	✓		✓		✓	
	Equivalent Class II	Manual	L ¹	✓		✓ ²		✓	✓ ^{1,2}
	Equivalent Class III	Automated	L ¹	✓		✓		✓ ¹	✓ ¹

PM _{10-2.5}	Reference	Manual	O ²	✓				✓	
	Equivalent Class I	Manual	O ²	✓				✓	
	Equivalent Class II	Manual	O ²	✓		✓ ²		✓ ¹	✓ ^{1,2}
	Equivalent Class III	Automated	L ¹ , O ^{1,2}	✓		✓		✓ ¹	✓ ¹

¹ Some requirements may apply, based on the nature of each particular candidate method, as determined by the Administrator.

² Alternative Class III requirements may be substituted.

4. Paragraph (6) of appendix A to subpart A of part 53 is revised to read as follows:

Appendix A to Subpart A [Amended]

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(6) Quality Assurance Guidance Document 2.12. Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods. U.S. EPA, National Exposure Research Laboratory, Research Triangle Park, NC, November 1998 or later edition. Currently available at <http://www.epa.gov/ttn/amtic/pmqainf.html>.

* * * * *

SUBPART C-- [Amended]

5. Section 53.30 is revised to read as follows:

§53.30 General provisions.

(a) Determination of comparability. The test procedures prescribed in this subpart shall be used to determine if a candidate method is comparable to a reference method when both methods measure pollutant concentrations in ambient air. Minor deviations in testing requirements and acceptance requirements set forth in this subpart, in connection with any documented extenuating circumstances, may be determined by the Administrator to be acceptable, at the discretion of the Administrator.

(b) Selection of test sites. (1) Each test site shall be in an area which can be shown to have at least moderate concentrations of various pollutants. Each site shall be clearly identified and shall be justified as an appropriate test site with suitable supporting evidence such as a description of the surrounding area, characterization of the sources and pollutants typical in the area, maps, population density data, vehicular traffic data, emission inventories, pollutant measurements from previous years, concurrent pollutant measurements, meteorological data, and other information useful in supporting the suitability of the site for the comparison test or tests.

(2) If approval of one or more proposed test sites is desired prior to conducting the tests, a written request for approval of the test site or sites must be submitted to the address given in §53.4. The request should include information identifying the type of candidate method and one or more specific proposed test sites along with a justification for each proposed specific site as described in paragraph (b)(1) of this section. The EPA will evaluate each proposed site and approve the site, disapprove the site, or request more information about the site. Any such pre-test approval of a test site by the EPA shall indicate

only that the site meets the applicable test site requirements for the candidate method type; it shall not indicate, suggest, or imply that test data obtained at the site will necessarily meet any of the applicable data acceptance requirements. The Administrator may exercise discretion in selecting a different site (or sites) for any additional tests the Administrator decides to conduct.

(c) Test atmosphere. Ambient air sampled at an appropriate test site or sites shall be used for these tests. Simultaneous concentration measurements shall be made in each of the concentration ranges specified in tables C-1, C-3, or C-4 of this subpart, as appropriate.

(d) Sampling or sample collection. All test concentration measurements or samples shall be taken in such a way that both the candidate method and the reference method obtain air samples that are alike or as nearly identical as practical.

(e) Operation. Set-up and start-up of the test analyzer(s), test sampler(s), and reference method analyzers or samplers shall be in strict accordance with the applicable operation manual(s).

(f) Calibration. The reference method shall be calibrated according to the appropriate appendix to part 50

of this chapter (if it is a manual method) or according to the applicable operation manual(s) (if it is an automated method). A candidate method (or portion thereof) shall be calibrated according to the applicable operation manual(s), if such calibration is a part of the method.

(g) Submission of test data and other information.

All recorder charts, calibration data, records, test results, procedural descriptions and details, and other documentation obtained from (or pertinent to) these tests shall be identified, dated, signed by the analyst performing the test, and submitted. For candidate methods for $PM_{2.5}$ and $PM_{10-2.5}$, all submitted information must meet the requirements of the ANSI/ASQC E4 Standard, sections 3.3.1, paragraphs 1 and 2 (reference 1 of appendix A of this subpart).

6. Section 53.31 is removed and reserved.

7. Section 53.32 is revised to read as follows:

§53.32 Test procedures for methods for SO_2 , CO, O_3 , and NO_2 .

(a) Comparability. Comparability is shown for SO_2 , CO, O_3 , and NO_2 methods when the differences between:

(1) Measurements made by a candidate manual method or by a test analyzer representative of a candidate automated method, and;

(2) Measurements made simultaneously by a reference

method are less than or equal to the values for maximum discrepancy specified in table C-1 of this subpart.

(b) Test measurements. All test measurements are to be made at the same test site. If necessary, the concentration of pollutant in the sampled ambient air may be augmented with artificially generated pollutant to facilitate measurements in the specified ranges, as described under paragraph (f)(4) of this section.

(c) Requirements for measurements or samples. All test measurements made or test samples collected by means of a sample manifold as specified in paragraph (f)(4) of this section shall be at a room temperature between 20° and 30°C, and at a line voltage between 105 and 125 volts. All methods shall be calibrated as specified in §53.30(f) prior to initiation of the tests.

(d) Set-up and start-up. (1) Set-up and start-up of the test analyzer, test sampler(s), and reference method shall be in strict accordance with the applicable operation manual(s). If the test analyzer does not have an integral strip chart or digital data recorder, connect the analyzer output to a suitable strip chart or digital data recorder. This recorder shall have a chart width of at least 25 centimeters, a response time of 1 second or less, a deadband

of not more than 0.25 percent of full scale, and capability of either reading measurements at least 5 percent below zero or offsetting the zero by at least 5 percent. Digital data shall be recorded at appropriate time intervals such that trend plots similar to a strip chart recording may be constructed with a similar or suitable level of detail.

(2) Other data acquisition components may be used along with the chart recorder during the conduct of these tests. Use of the chart recorder is intended only to facilitate visual evaluation of data submitted.

(3) Allow adequate warmup or stabilization time as indicated in the applicable operation manual(s) before beginning the tests.

(e) Range. (1) Except as provided in paragraph (e)(2) of this section, each method shall be operated in the range specified for the reference method in the appropriate appendix to part 50 of this chapter (for manual reference methods), or specified in table B-1 of subpart B of this part (for automated reference methods).

(2) For a candidate method having more than one selectable range, one range must be that specified in table B-1 of subpart B of this part, and a test analyzer representative of the method must pass the tests required by

this subpart while operated on that range. The tests may be repeated for a broader range (i.e., one extending to higher concentrations) than the one specified in table B-1 of subpart B of this part, provided that the range does not extend to concentrations more than two times the upper range limit specified in table B-1 of subpart B of this part and that the test analyzer has passed the tests required by subpart B of this part (if applicable) for the broader range. If the tests required by this subpart are conducted or passed only for the range specified in table B-1 of subpart B of this part, any equivalent method determination with respect to the method will be limited to that range. If the tests are passed for both the specified range and a broader range (or ranges), any such determination will include the broader range(s) as well as the specified range. Appropriate test data shall be submitted for each range sought to be included in such a determination.

(f) Operation of automated methods. (1) Once the test analyzer has been set up and calibrated and tests started, manual adjustment or normal periodic maintenance, as specified in the manual referred to in §53.4(b)(3), is permitted only every 3 days. Automatic adjustments which the test analyzer performs by itself are permitted at any

time. The submitted records shall show clearly when manual adjustments were made and describe the operations performed.

(2) All test measurements shall be made with the same test analyzer; use of multiple test analyzers is not permitted. The test analyzer shall be operated continuously during the entire series of test measurements.

(3) If a test analyzer should malfunction during any of these tests, the entire set of measurements shall be repeated, and a detailed explanation of the malfunction, remedial action taken, and whether recalibration was necessary (along with all pertinent records and charts) shall be submitted.

(4) Ambient air shall be sampled from a common intake and distribution manifold designed to deliver homogenous air samples to both methods. Precautions shall be taken in the design and construction of this manifold to minimize the removal of particulate matter and trace gases, and to insure that identical samples reach the two methods. If necessary, the concentration of pollutant in the sampled ambient air may be augmented with artificially generated pollutant. However, at all times the air sample measured by the candidate and reference methods under test shall consist of not less than 80 percent ambient air by volume. Schematic

drawings, physical illustrations, descriptions, and complete details of the manifold system and the augmentation system (if used) shall be submitted.

(g) Tests. (1) Conduct the first set of simultaneous measurements with the candidate and reference methods:

(i) Table C-1 of this subpart specifies the type (1- or 24-hour) and number of measurements to be made in each of the three test concentration ranges.

(ii) The pollutant concentration must fall within the specified range as measured by the reference method.

(iii) The measurements shall be made in the sequence specified in table C-2 of this subpart, except for the 1-hour SO₂ measurements, which are all in the high range.

(2) For each pair of measurements, determine the difference (discrepancy) between the candidate method measurement and reference method measurement. A discrepancy which exceeds the discrepancy specified in table C-1 of this subpart constitutes a failure. Figure C-1 of this subpart contains a suggested format for reporting the test results.

(3) The results of the first set of measurements shall be interpreted as follows:

(i) Zero failures: The candidate method passes the test for comparability.

(ii) Three or more failures: The candidate method fails the test for comparability.

(iii) One or two failures: Conduct a second set of simultaneous measurements as specified in table C-1 of this subpart. The results of the combined total of first-set and second-set measurements shall be interpreted as follows:

(A) One or two failures: The candidate method passes the test for comparability.

(B) Three or more failures: The candidate method fails the test for comparability.

(iv) For SO₂, the 1-hour and 24-hour measurements shall be interpreted separately, and the candidate method must pass the tests for both 1- and 24-hour measurements to pass the test for comparability.

(4) A 1-hour measurement consists of the integral of the instantaneous concentration over a 60-minute continuous period divided by the time period. Integration of the instantaneous concentration may be performed by any appropriate means such as chemical, electronic, mechanical, visual judgment, or by calculating the mean of not less than 12 equally-spaced instantaneous readings. Appropriate allowances or corrections shall be made in cases where significant errors could occur due to characteristic lag

time or rise/fall time differences between the candidate and reference methods. Details of the means of integration and any corrections shall be submitted.

(5) A 24-hour measurement consists of the integral of the instantaneous concentration over a 24-hour continuous period divided by the time period. This integration may be performed by any appropriate means such as chemical, electronic, mechanical, or by calculating the mean of twenty-four (24) sequential 1-hour measurements.

(6) For O₃ and CO, no more than six 1-hour measurements shall be made per day. For SO₂, no more than four 1-hour measurements or one 24-hour measurement shall be made per day. One-hour measurements may be made concurrently with 24-hour measurements if appropriate.

(7) For applicable methods, control or calibration checks may be performed once per day without adjusting the test analyzer or method. These checks may be used as a basis for a linear interpolation-type correction to be applied to the measurements to correct for drift. If such a correction is used, it shall be applied to all measurements made with the method, and the correction procedure shall become a part of the method.

8. Section 53.33 is revised to read as follows:

§53.33 Test procedure for methods for Pb.

(a) Comparability. Comparability is shown for Pb methods when the differences between:

- (1) Measurements made by a candidate method, and
- (2) Measurements made by the reference method on simultaneously collected Pb samples (or the same sample, if applicable), are less than or equal to the value specified in table C-3 of this subpart.

(b) Test measurements. Test measurements may be made at any number of test sites. Augmentation of pollutant concentrations is not permitted, hence an appropriate test site or sites must be selected to provide Pb concentrations in the specified range.

(c) Collocated samplers. The ambient air intake points of all the candidate and reference method collocated samplers shall be positioned at the same height above the ground level, and between 2 meters (1 meter for samplers with flow rates less than 200 liters per minute (L/min)) and 4 meters apart. The samplers shall be oriented in a manner that will minimize spatial and wind directional effects on sample collection.

(d) Sample collection. Collect simultaneous 24-hour samples (filters) of Pb at the test site or sites with both

the reference and candidate methods until at least 10 filter pairs have been obtained. A candidate method which employs a sampler and sample collection procedure that are identical to the sampler and sample collection procedure specified in the reference method, but uses a different analytical procedure, may be tested by analyzing common samples. The common samples shall be collected according to the sample collection procedure specified by the reference method and each shall be divided for respective analysis in accordance with the analytical procedures of the candidate method and the reference method.

(e) Audit samples. Three audit samples must be obtained from the address given in §53.4(a). The audit samples are 3/4 × 8-inch glass fiber strips containing known amounts of Pb at the following nominal levels: 100 micrograms per strip (µg/strip); 300 µg/strip; 750 µg/strip. The true amount of Pb, in total µg/strip, will be provided with each audit sample.

(f) Filter analysis. (1) For both the reference method samples and the audit samples, analyze each filter extract three times in accordance with the reference method analytical procedure. The analysis of replicates should not be performed sequentially, i.e., a single sample should not

be analyzed three times in sequence. Calculate the indicated Pb concentrations for the reference method samples in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for each analysis of each filter. Calculate the indicated total Pb amount for the audit samples in $\mu\text{g}/\text{strip}$ for each analysis of each strip. Label these test results as R_{1A} , R_{1B} , R_{1C} , R_{2A} , R_{2B} , . . . , Q_{1A} , Q_{1B} , Q_{1C} ,, where R denotes results from the reference method samples; Q denotes results from the audit samples; 1, 2, 3 indicate the filter number, and A, B, C indicate the first, second, and third analysis of each filter, respectively.

(2) For the candidate method samples, analyze each sample filter or filter extract three times and calculate, in accordance with the candidate method, the indicated Pb concentration in $\mu\text{g}/\text{m}^3$ for each analysis of each filter. Label these test results as C_{1A} , C_{1B} , C_{2C} , . . . , where C denotes results from the candidate method. For candidate methods which provide a direct measurement of Pb concentrations without a separable procedure, $C_{1A}=C_{1B}=C_{1C}$, $C_{2A}=C_{2B}=C_{2C}$, etc.

(g) Average Pb concentration. For the reference method, calculate the average Pb concentration for each filter by averaging the concentrations calculated from the

three analyses using equation 1 of this section:

Equation 1

$$R_{i \text{ ave}} = \frac{R_{iA} + R_{iB} + R_{iC}}{3}$$

where, i is the filter number.

(h) Accuracy. (1) (i) For the audit samples, calculate the average Pb concentration for each strip by averaging the concentrations calculated from the three analyses using equation 2 of this section:

Equation 2

$$Q_{i \text{ ave}} = \frac{Q_{iA} + Q_{iB} + Q_{iC}}{3}$$

where, i is audit sample number.

(ii) Calculate the percent difference (D_q) between the indicated Pb concentration for each audit sample and the true Pb concentration (T_q) using equation 3 of this section:

Equation 3

$$D_{qi} = \frac{Q_{i \text{ ave}} - T_{qi}}{T_{qi}} \times 100\%$$

(2) If any difference value (D_{qi}) exceeds ± 5 percent, the accuracy of the reference method analytical procedure is out-of-control. Corrective action must be taken to determine the source of the error(s) (e.g., calibration standard discrepancies, extraction problems, etc.) and the reference method and audit sample determinations must be repeated according to paragraph (f) of this section, or the entire test procedure (starting with paragraph (d) of this section) must be repeated.

(i) Acceptable filter pairs. Disregard all filter pairs for which the Pb concentration, as determined in paragraph (g) of this section by the average of the three reference method determinations, falls outside the range of 0.5 to 4.0 $\mu\text{g}/\text{m}^3$. All remaining filter pairs must be subjected to the tests for precision and comparability in paragraphs (j) and (k) of this section. At least five filter pairs must be within the 0.5 to 4.0 $\mu\text{g}/\text{m}^3$ range for the tests to be valid.

(j) Test for precision. (1) Calculate the precision (P) of the analysis (in percent) for each filter and for

each method, as the maximum minus the minimum divided by the average of the three concentration values, using equation 4 or equation 5 of this section:

Equation 4

$$P_{Ri} = \frac{R_{i \max} - R_{i \min}}{R_{i \text{ ave}}} \times 100\%$$

or

Equation 5

$$P_{Ci} = \frac{C_{i \max} - C_{i \min}}{C_{i \text{ ave}}} \times 100\%$$

where, i indicates the filter number.

(2) If any reference method precision value (P_{Ri}) exceeds 15 percent, the precision of the reference method analytical procedure is out-of-control. Corrective action must be taken to determine the source(s) of imprecision, and the reference method determinations must be repeated according to paragraph (f) of this section, or the entire test procedure (starting with paragraph (d) of this section) must be repeated.

(3) If any candidate method precision value (P_{Ci}) exceeds 15 percent, the candidate method fails the precision test.

(4) The candidate method passes this test if all precision values (i.e., all P_{Ri} 's and all P_{Ci} 's) are less than 15 percent.

(k) Test for comparability. (1) For each filter or analytical sample pair, calculate all nine possible percent differences (D) between the reference and candidate methods, using all nine possible combinations of the three determinations (A, B, and C) for each method using equation 6 of this section:

Equation 6

$$D_{in} = \frac{C_{ij} - R_{ik}}{R_{ik}} \times 100\%$$

where, i is the filter number, and n numbers from 1 to 9 for the nine possible difference combinations for the three determinations for each method (j = A, B, C, candidate; k = A, B, C, reference).

(2) If none of the percent differences (D) exceeds ± 20 percent, the candidate method passes the test for

comparability.

(3) If one or more of the percent differences (D) exceed ± 20 percent, the candidate method fails the test for comparability.

(4) The candidate method must pass both the precision test (paragraph (j) of this section) and the comparability test (paragraph (k) of this section) to qualify for designation as an equivalent method.

9. Section 53.34 is revised to read as follows:

§53.34 Test procedure for methods for PM_{10} and Class I methods for $PM_{2.5}$.

(a) Comparability. Comparability is shown for PM_{10} methods and for Class I methods for $PM_{2.5}$ when the relationship between:

(1) Measurements made by a candidate method, and
(2) Measurements made by a corresponding reference method on simultaneously collected samples (or the same sample, if applicable) at each of one or more test sites (as required) is such that the linear regression parameters (slope, intercept, and correlation coefficient) describing the relationship meet the requirements specified in table C-4 of this subpart.

(b) Methods for PM_{10} . Test measurements must be made,

or derived from particulate samples collected, at not less than two test sites, each of which must be located in a geographical area characterized by ambient particulate matter that is significantly different in nature and composition from that at the other test site(s).

Augmentation of pollutant concentrations is not permitted, hence appropriate test sites must be selected to provide the minimum number of test PM_{10} concentrations in the ranges specified in table C-4 of this subpart. The tests at the two sites may be conducted in different calendar seasons, if appropriate, to provide PM_{10} concentrations in the specified ranges.

(c) PM_{10} methods employing the same sampling procedure as the reference method but a different analytical method.

Candidate methods for PM_{10} which employ a sampler and sample collection procedure that are identical to the sampler and sample collection procedure specified in the reference method, but use a different analytical procedure, may be tested by analyzing common samples. The common samples shall be collected according to the sample collection procedure specified by the reference method and shall be analyzed in accordance with the analytical procedures of both the candidate method and the reference method.

(d) Methods for PM_{2.5}. Augmentation of pollutant concentrations is not permitted, hence appropriate test sites must be selected to provide the minimum number of test measurement sets to meet the requirements for PM_{2.5} concentrations in the ranges specified in table C-4 of this subpart. Only one test site is required, and the site need only meet the PM_{2.5} ambient concentration levels required by table C-4 of this subpart. A total of 10 valid measurement sets is required.

(e) Collocated measurements. (1) Set up three reference method samplers collocated with three candidate method samplers or analyzers at each of the number of test sites specified in table C-4 of this subpart.

(2) The ambient air intake points of all the candidate and reference method collocated samplers or analyzers shall be positioned at the same height above the ground level, and between 2 meters (1 meter for samplers or analyzers with flow rates less than 200 L/min) and 4 meters apart. The samplers shall be oriented in a manner that will minimize spatial and wind directional effects on sample collection.

(3) At each site, obtain as many sets of simultaneous PM₁₀ or PM_{2.5} measurements as necessary (see table C-4 of this subpart), each set consisting of three reference method and

three candidate method measurements, all obtained simultaneously.

(4) Candidate PM_{10} method measurements shall be nominal 24-hour (± 1 hour) integrated measurements or shall be averaged to obtain the mean concentration for a nominal 24-hour period. $PM_{2.5}$ measurements may be either nominal 24- or 48-hour integrated measurements. All collocated measurements in a measurement set must cover the same nominal 24- or 48-hour time period.

(5) For samplers, retrieve the samples promptly after sample collection and analyze each sample according to the reference method or candidate method, as appropriate, and determine the PM_{10} or $PM_{2.5}$ concentration in $\mu\text{g}/\text{m}^3$. If the conditions of paragraph (c) of this section apply, collect sample sets only with the three reference method samplers. Guidance for quality assurance procedures for $PM_{2.5}$ methods is found in "Quality Assurance Document 2.12" (reference (2) in appendix A to this subpart).

(f) Sequential samplers. For sequential samplers, the sampler shall be configured for the maximum number of sequential samples and shall be set for automatic collection of all samples sequentially such that the test samples are collected equally, to the extent possible, among all

available sequential channels or utilizing the full available sequential capability.

(g) Calculation of reference method averages and precisions. (1) For each of the measurement sets, calculate the average PM_{10} or $PM_{2.5}$ concentration obtained with the reference method samplers, using equation 7 of this section:

Equation 7

$$\bar{R}_j = \frac{\sum_{i=1}^3 R_{i,j}}{3}$$

where:

R = The concentration measurements from the reference methods;
 i = The sampler number; and
 j = The measurement set number.

(2) For each of the measurement sets, calculate the precision of the reference method PM_{10} or $PM_{2.5}$ measurements as the standard deviation, P_{Rj} , using equation 8 of this section:

Equation 8

$$P_{Rj} = \sqrt{\frac{\sum_{i=1}^3 R_{i,j}^2 - \frac{1}{3} \left(\sum_{i=1}^3 R_{i,j} \right)^2}{2}}$$

(3) For each measurement set, also calculate the precision of the reference method PM₁₀ or PM_{2.5} measurements as the relative standard deviation, RP_{Rj}, in percent, using equation 9 of this section:

Equation 9

$$RP_{Rj} = \frac{P_{Rj}}{\bar{R}_j} \times 100\%$$

(h) Acceptability of measurement sets. Each measurement set is acceptable and valid only if the three reference method measurements and the three candidate method measurements are obtained and are valid, \bar{R}_j falls within the acceptable concentration range specified in table C-4 of this subpart, and either P_{Rj} or RP_{Rj} is within the corresponding limit for reference method precision specified in table C-4 of this subpart. For each site, table C-4 of this subpart specifies the minimum number of measurement sets required having \bar{R}_j above and below specified concentrations for 24- or 48-hour samples. Additional measurement sets shall be obtained, as necessary, to provide the minimum number of acceptable measurement sets for each

category and the minimum total number of acceptable measurement sets for each test site. If more than the minimum number of measurement sets are collected that meet the acceptability criteria, all such measurement sets shall be used to demonstrate comparability.

(i) Candidate method average concentration measurement. For each of the acceptable measurement sets, calculate the average PM₁₀ or PM_{2.5} concentration measurements obtained with the candidate method samplers, using equation 10 of this section:

Equation 10

$$\bar{C}_j = \frac{\sum_{i=1}^3 C_{i,j}}{3}$$

where:

C = The concentration measurements from the candidate methods;

i = The measurement number in the set; and

j = The measurement set number.

(j) Test for comparability. (1) For each site, plot all of the average PM₁₀ or PM_{2.5} measurements obtained with the candidate method (\bar{C}_j) against the corresponding average PM₁₀ or PM_{2.5} measurements obtained with the reference method (\bar{R}_j). For each site, calculate and record the linear regression slope and intercept, and the correlation

coefficient.

(2) To pass the test for comparability, the slope, intercept, and correlation coefficient calculated under paragraph (j)(1) of this section must be within the limits specified in table C-4 of this subpart for all test sites.

10. Section 53.35 is added to read as follows:

§53.35 Test procedure for Class II and Class III methods for $PM_{2.5}$ and $PM_{10-2.5}$.

(a) Overview. Class II and Class III candidate equivalent methods shall be tested for comparability of $PM_{2.5}$ or $PM_{10-2.5}$ measurements to corresponding collocated $PM_{2.5}$ or $PM_{10-2.5}$ reference method measurements at each of multiple field sites, as required. Comparability is shown for the candidate method when simultaneous collocated measurements made by candidate and reference methods meet the comparability requirements specified in this section §53.35 and in table C-4 of this subpart at each of the required test sites.

(b) Test sites and seasons. (1) Test sites. Comparability testing is required at each of the applicable test sites required by this paragraph (b). Each test site must also meet the general test site requirements specified in §53.30(b).

(i) PM_{2.5} Class II and Class III candidate methods.

Test sites should be chosen to provide representative chemical and meteorological characteristics with respect to nitrates, sulfates, organic compounds, and various levels of humidity, wind, and elevation. For Class III methods, one test site shall be selected in each of the following general locations. For Class II methods, two test sites, one eastern site and one western site, shall be selected from these locations. Test site A shall be in the Los Angeles basin area in a location that is characterized by relatively high PM_{2.5}, nitrates, and semi-volatile organic pollutants. Test site B shall be in a northeastern or mid-Atlantic U.S. city that is seasonally characterized by high sulfate concentrations, high relative humidity, and wintertime conditions. Test site C shall be in a western U.S. city such as Denver, Salt Lake City, or Albuquerque in a location that is in an area characterized by cold weather, higher elevation, winds, and dust.

(ii) PM_{10-2.5} Class II and Class III candidate methods.

Test sites shall be chosen to provide modest to high levels of PM_{10-2.5} representative of locations in proximity to urban sources of PM_{10-2.5} such as high-density traffic on paved roads, industrial sources, and construction activities. For

Class III methods, one test site shall be selected in each of the following general locations. At least one of the test sites shall have characteristic wintertime temperatures of 0°C or lower. For Class II methods, two test sites, one eastern site and one western site, shall be selected from these locations. Test site A shall be in the Los Angeles basin or the California Central Valley area. Test site B shall be in a large U.S. city east of the Mississippi River, having characteristically high humidity levels. Test site C shall be in a western U.S. city characterized by a high ratio of $PM_{10-2.5}$ to $PM_{2.5}$, with exposure to rural windblown dust, such as Las Vegas or Phoenix.

(2) Test seasons. (i) For $PM_{2.5}$ and $PM_{10-2.5}$ Class III candidate methods, test campaigns are required in both summer and winter seasons at test sites A and B. A test campaign is required only in the winter season at test site C. (A total of 5 test campaigns is required.) The summer season shall be defined as the typically warmest 3 or 4 months of the year at the site; the winter season shall be defined as the typically coolest 3 or 4 months of the year at the site.

(ii) For Class II $PM_{2.5}$ and $PM_{10-2.5}$ candidate methods, only one test campaign is required at each site, at any time

of year (total of 2 test campaigns).

(3) Test concentrations. The test sites should be selected to provide ambient concentrations within the concentration limits specified in table C-4 of this subpart, and also to provide a wide range of test concentrations. A narrow range of test concentrations may result in a low concentration coefficient of variation statistic for the test measurements, making the test for correlation coefficient more difficult to pass (see paragraph (h) of this section, test for comparison correlation).

(4) Pre-approval of test sites. The EPA recommends that the applicant seek EPA approval of each proposed test site prior to conducting test measurements at the site. To do so, the applicant should submit a request for approval as described in §53.30(b)(2).

(c) Collocated measurements. (1) For each test campaign, three reference method samplers and three candidate method samplers or analyzers shall be installed and operated concurrently at each test site within each required season (if applicable), as specified in paragraph (b) of this section. All reference method samplers shall be of single-filter design (not multi-filter, sequential sample design). Each candidate method shall be setup and operated

in accordance with its associated manual referred to in §53.4(b)(3) and in accordance with applicable guidance in "Quality Assurance Document 2.12" (reference (2) in appendix A to this subpart). All samplers or analyzers shall be placed so that they sample or measure air representative of the surrounding area (within one kilometer) and are not unduly affected by adjacent buildings, air handling equipment, industrial operations, traffic, or other local influences. The ambient air inlet points of all samplers and analyzers shall be positioned at the same height above the ground level and between 2 meters (1 meter for instruments having sample inlet flow rates less than 200 L/min) and 4 meters apart.

(2) A minimum of 23 valid and acceptable measurement sets of $PM_{2.5}$ or $PM_{10-2.5}$ 24-hour (nominal) concurrent concentration measurements shall be obtained during each test campaign at each test site. To be considered acceptable for the test, each measurement set shall consist of at least two valid reference method measurements and at least two valid candidate method measurements, and the $PM_{2.5}$ or $PM_{10-2.5}$ measured concentration, as determined by the average of the reference method measurements, must fall within the acceptable concentration range specified in table

C-4 of this subpart. Each measurement set shall include all valid measurements obtained. For each measurement set containing fewer than three reference method measurements or fewer than three candidate method measurements, an explanation and appropriate justification shall be provided to account for the missing measurement or measurements.

(3) More than 23 valid measurement sets may be obtained during a particular test campaign to provide a more advantageous range of concentrations, more representative conditions, additional higher or lower measurements, or to otherwise improve the comparison of the methods. All valid data sets obtained during each test campaign shall be submitted and shall be included in the analysis of the data.

(4) The integrated-sample reference method measurements shall be of at least 22 hours and not more than 25 hours duration. Each reference method sample shall be retrieved promptly after sample collection and analyzed according to the reference method to determine the $PM_{2.5}$ or $PM_{10-2.5}$ measured concentration in $\mu g/m^3$. Guidance and quality assurance procedures applicable to $PM_{2.5}$ or $PM_{10-2.5}$ reference methods are found in "Quality Assurance Document 2.12" (reference (2) in appendix A to this subpart).

(5) Candidate method measurements shall be timed or

processed and averaged as appropriate to determine an equivalent mean concentration representative of the same time period as that of the concurrent integrated-sample reference method measurements, such that all measurements in a measurement set shall be representative of the same time period. In addition, hourly average concentration measurements shall be obtained from each of the Class III candidate method analyzers for each valid measurement set and submitted as part of the application records.

(6) In the following tests, all measurement sets obtained at a particular test site, from both seasonal campaigns if applicable, shall be combined and included in the test data analysis for the site. Data obtained at different test sites shall be analyzed separately. All measurements should be reported as normally obtained, and no measurement values should be rounded or truncated prior to data analysis. In particular, no negative measurement value, if otherwise apparently valid, should be modified, adjusted, replaced, or eliminated merely because its value is negative. Calculated mean concentrations or calculated intermediate quantities should retain at least one order-of-magnitude greater resolution than the input values. All measurement data and calculations shall be recorded and

submitted in accordance with §53.30(g), including hourly test measurements obtained from Class III candidate methods.

(d) Calculation of mean concentrations. (1) Reference method outlier test. For each of the measurement sets for each test site, check each reference method measurement to see if it might be an anomalous value (outlier) as follows, where $R_{i,j}$ is the measurement of reference method sampler i on test day j . In the event that one of the reference method measurements is missing or invalid due to a specific, positively-identified physical cause (e.g., sampler malfunction, operator error, accidental damage to the filter, etc.; see paragraph (c) (2) of this section), then substitute zero for the missing measurement, for the purposes of this outlier test only.

(i) Calculate the quantities $2 \times R_{1,j} / (R_{1,j} + R_{2,j})$ and $2 \times R_{1,j} / (R_{1,j} + R_{3,j})$. If both quantities fall outside of the interval, (0.93, 1.07), then $R_{1,j}$ is an outlier.

(ii) Calculate the quantities $2 \times R_{2,j} / (R_{2,j} + R_{1,j})$ and $2 \times R_{2,j} / (R_{2,j} + R_{3,j})$. If both quantities fall outside of the interval, (0.93, 1.07), then $R_{2,j}$ is an outlier.

(iii) Calculate the quantities $2 \times R_{3,j} / (R_{3,j} + R_{1,j})$ and $2 \times R_{3,j} / (R_{3,j} + R_{2,j})$. If both quantities fall outside of the interval, (0.93, 1.07), then $R_{3,j}$ is an outlier.

(iv) If this test indicates that one of the reference method measurements in the measurement set is an outlier, the outlier measurement shall be eliminated from the measurement set, and the other two measurements considered valid. If the test indicates that more than one reference method measurement in the measurement set is an outlier, the entire measurement set (both reference and candidate method measurements) shall be excluded from further data analysis for the tests of this section.

(2) For each of the measurement sets for each test site, calculate the mean concentration for the reference method measurements, using equation 11 of this section:

Equation 11

$$\bar{R}_j = \frac{1}{n} \sum_{i=1}^n R_{i,j}$$

where:

\bar{R}_j = The mean concentration measured by the reference method for the measurement set;

$R_{i,j}$ = The measurement of reference method sampler i on test day j ; and

n = The number of valid reference method measurements in the measurement set (normally 3).

(3) Any measurement set for which \bar{R}_j does not fall in the acceptable concentration range specified in table C-4 of this subpart is not valid, and the entire measurement set

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(both reference and candidate method measurements) must be eliminated from further data analysis.

(4) For each of the valid measurement sets at each test site, calculate the mean concentration for the candidate method measurements, using equation 12 of this section. (The outlier test in paragraph (d)(1) of this section shall not be applied to the candidate method measurements.)

Equation 12

$$\bar{C}_j = \frac{1}{m} \sum_{i=1}^m C_{i,j}$$

where:

- \bar{C}_j = The mean concentration measured by the candidate method for the measurement set;
 $C_{i,j}$ = The measurement of candidate method analyzer i on test day j; and
 m = The number of valid candidate method measurements in the measurement set (normally 3).

(e) Test for reference method precision. (1) For each of the measurement sets for each site, calculate an estimate for the relative precision of the reference method measurements, RP_j , using equation 13 of this section:

Equation 13

$$RP_j = \frac{1}{\bar{R}_j} \sqrt{\frac{\sum_{i=1}^n R_{i,j}^2 - \frac{1}{n} (\sum_{i=1}^n R_{i,j})^2}{n-1}} \times 100\%$$

(2) For each site, calculate an estimate of reference method relative precision for the site, RP , using the root mean square calculation of equation 14 of this section:

Equation 14

$$RP = \sqrt{\frac{1}{J} \sum_{j=1}^J (RP_j)^2}$$

where, J is the total number of valid measurement sets for the site.

(3) Verify that the estimate for reference method relative precision for the site, RP , is not greater than the value specified for reference method precision in table C-4 of this subpart. A reference method relative precision greater than the value specified in table C-4 of this subpart indicates that quality control for the reference method is inadequate, and corrective measures must be implemented before proceeding with the test.

(f) Test for candidate method precision. (1) For each of the measurement sets, for each site, calculate an

estimate for the relative precision of the candidate method measurements, CP_j , using equation 15 of this section:

Equation 15

$$CP_j = \frac{1}{\bar{C}_j} \sqrt{\frac{\sum_{i=1}^m C_{i,j}^2 - \frac{1}{m} (\sum_{i=1}^m C_{i,j})^2}{m-1}} \times 100\%$$

(2) For each site, calculate an estimate of candidate method relative precision for the site, CP , using the root mean square calculation of equation 16 of this section:

Equation 16

$$CP = \sqrt{\frac{1}{J} \sum_{j=1}^J (CP_j)^2}$$

where, J is the total number of valid measurement sets for the site.

(3) To pass the test for precision, the mean candidate method relative precision at each site must not be greater than the value for candidate method precision specified in table C-4 of this subpart.

(g) Test for additive and multiplicative bias (comparative slope and intercept). (1) For each test site,

calculate the mean concentration measured by the reference method, \bar{R} , using equation 17 of this section:

Equation 17

$$\bar{R} = \frac{1}{J} \sum_{j=1}^J \bar{R}_j$$

(2) For each test site, calculate the mean concentration measured by the candidate method, \bar{C} , using equation 18 of this section:

Equation 18

$$\bar{C} = \frac{1}{J} \sum_{j=1}^J \bar{C}_j$$

(3) For each test site, calculate the linear regression slope and intercept of the mean candidate method measurements (\bar{C}_j) against the mean reference method measurements (\bar{R}_j), using equations 19 and 20 of this section, respectively:

Equation 19

$$\text{Slope} = \frac{\sum_{j=1}^J (\bar{R}_j - \bar{R})(\bar{C}_j - \bar{C})}{\sum_{j=1}^J (\bar{R}_j - \bar{R})^2}$$

Equation 20

$$\mathbf{Intercept} = \bar{C} - \mathbf{slope} \times \bar{R}$$

(4) To pass this test, at each test site:

(i) The slope must be in the interval specified for regression slope in table C-4 of this subpart; and

(ii) The intercept must be in the interval specified for regression intercept in table C-4 of this subpart.

(iii) The slope and intercept limits are illustrated in figures C-2 and C-3 of this subpart.

(h) Tests for comparison correlation. (1) For each test site, calculate the (Pearson) correlation coefficient, r (not the coefficient of determination, r^2), using equation 21 of this section:

Equation 21

$$r = \frac{\sum_{j=1}^J (\bar{R}_j - \bar{R})(\bar{C}_j - \bar{C})}{\sqrt{\sum_{j=1}^J (\bar{R}_j - \bar{R})^2 \sum_{j=1}^J (\bar{C}_j - \bar{C})^2}}$$

(2) For each test site, calculate the concentration

coefficient of variation, CCV , using equation 22 of this section:

Equation 22

$$CCV = \frac{1}{\bar{R}} \sqrt{\frac{\sum_{j=1}^J (\bar{R}_j - \bar{R})^2}{J-1}}$$

(3) To pass the test, the correlation coefficient, r , for each test site must not be less than the values, for various values of CCV , specified for correlation in table C-4 of this subpart. These limits are illustrated in figure C-4 of this subpart.

11. Tables C-1, C-2, and C-4 to subpart C are revised to read as follows:

TABLE C-1 TO SUBPART C OF PART 53—TEST CONCENTRATION RANGES, NUMBER OF MEASUREMENTS REQUIRED, AND MAXIMUM DISCREPANCY SPECIFICATION

Pollutant	Concentration range, parts per million	Simultaneous measurements required				Maximum discrepancy specification, parts per million
		1-hr		24-hr		
		First set	Second set	First set	Second set	
Ozone	Low 0.06 to 0.10 .	5	6	. . . . .	. . . . .	0.02
	Med 0.15 to 0.25 .	5	6	. . . . .	. . . . .	.03
	High 0.35 to 0.45 .	4	6	. . . . .	. . . . .	.04
	Total	14	18	. . . . .	. . . . .	. . . . .
Carbon monoxide . .	Low 7 to 11	5	6	. . . . .	. . . . .	1.5
	Med 20 to 30	5	6	. . . . .	. . . . .	2.0
	High 35 to 45	4	6	. . . . .	. . . . .	3.0
	Total	14	18	. . . . .	. . . . .	. . . . .
Sulfur dioxide	Low 0.02 to 0.05 .	. . . . .	. . . . .	3	3	0.02
	Med 0.10 to 0.15 .	. . . . .	. . . . .	2	3	.03
	High 0.30 to 0.50 .	7	8	2	2	.04
	Total	7	8	7	8	. . . . .
Nitrogen dioxide	Low 0.02 to 0.08 .	. . . . .	. . . . .	3	3	0.02
	Med 0.10 to 0.20 .	. . . . .	. . . . .	2	3	.03
	High 0.25 to 0.35 .	. . . . .	. . . . .	2	2	.03
	Total . . . . .	. . . . .	. . . . .	7	8	. . . . .

TABLE C-2 TO SUBPART C OF PART 53—SEQUENCE OF TEST MEASUREMENTS

Measurement	Concentration Range	
	First Set	Second Set
1	Low	Medium
2	High	High
3	Medium	Low
4	High	High
5	Low	Medium
6	Medium	Low
7	Low	Medium
8	Medium	Low
9	High	High
10	Medium	Low
11	High	Medium
12	Low	High
13	Medium	Medium
14	Low	High
15 . . . . .	. . . . .	Low
16 . . . . .	. . . . .	Medium
17 . . . . .	. . . . .	Low
18 . . . . .	. . . . .	High

TABLE C-3 TO SUBPART C OF PART 53—TEST SPECIFICATIONS FOR Pb METHODS

Concentration range, $\mu\text{g}/\text{m}^3$	0.5 - 4.0
Minimum number of 24-hr measurements	5
Maximum analytical precision, percent	15
Maximum analytical accuracy, percent	± 5
Maximum difference, percent of reference method	± 20

TABLE C-4 TO SUBPART C—TEST SPECIFICATIONS FOR PM_{10} , $PM_{2.5}$ AND $PM_{10-2.5}$
CANDIDATE EQUIVALENT METHODS

Specification	PM_{10}	$PM_{2.5}$			$PM_{10-2.5}$	
		Class I	Class II	Class III	Class II	Class III
Acceptable concentration range (R_j), $\mu\text{g}/\text{m}^3$	15 - 300	3 - 200	3 - 200	3 - 200	3 - 200	3 - 200
Minimum number of test sites	2	1	2	3	2	3
Minimum number of candidate method samplers or analyzers per site	3	3	3 ¹	3 ¹	3 ¹	3 ¹
Number of reference method samplers per site	3	3	3 ¹	3 ¹	3 ¹	3 ¹
Minimum number of acceptable sample sets per site for PM_{10} methods:						
$R_j < 60 \mu\text{g}/\text{m}^3$	3					
$R_j > 60 \mu\text{g}/\text{m}^3$	3					
Total	10					
Minimum number of acceptable sample sets per site for $PM_{2.5}$ and $PM_{10-2.5}$ candidate equivalent methods:						
$R_j < 30 \mu\text{g}/\text{m}^3$ for 24-hr or $R_j < 20 \mu\text{g}/\text{m}^3$ for 48-hr samples		3				
$R_j > 30 \mu\text{g}/\text{m}^3$ for 24-hr or $R_j > 20 \mu\text{g}/\text{m}^3$ for 48-hr samples		3				
Each season		10	23	23	23	23
Total, each site		10	23	46 (23 for single season site)	23	46 (23 for single season site)

Specification	PM ₁₀	PM _{2.5}			PM _{10-2.5}	
		Class I	Class II	Class III	Class II	Class III
Precision of replicate reference method measurements, P _{Rj} or RP _{Rj} , respectively; RP for Class II or III PM _{2.5} or PM _{10-2.5} , maximum	5 µg/m ³ or 7%	2 µg/m ³ or 5%	10% ²	10% ²	10% ²	10% ²
Precision of PM _{2.5} or PM _{10-2.5} candidate method, CP, each site			10% ²	15% ²	15% ²	15% ²
Slope of regression relationship	1±0.1	1±0.05	1±0.10	1±0.10	1±0.10	1±0.12
Intercept of regression relationship, µg/m ³	0±5	0±1	Between: 13.55-(15.05 × slope), but not less than -1.5; and 16.56-(15.05 × slope), but not more than +1.5	Between: 15.05-(17.32 × slope); and 15.05-(13.20 × slope)	Between: 59.93-(70.50 × slope), but not less than -7.0; and 81.08-(70.50 × slope), but not more than +7.0	Between: 70.50-(82.93 × slope); and 70.50-(61.16 × slope)
Correlation of reference method and candidate method measurements . . .	≥0.97	≥0.97	≥0.93 for CCV≤0.4; ≥0.85+0.2×CCV . . . for 0.4≤CCV≤0.5; ≥0.95 for CCV≥0.5			

¹Some missing daily measurement values may be permitted; see test procedure.

²Calculated as the root mean square over all measurement sets.

11. Figure C-1 to subpart C is revised to read as follows:

Figure C-1 to Subpart C of Part 53—Suggested Format for Reporting Test Results for Methods for SO₂, CO, O₃, NO₂

Candidate Method _____

Reference Method _____

Applicant _____

First Set Second Set Type 1 Hour 24 Hour

Concentration Range		Date	Time	Concentration, ppm		Difference	Table C-1 Spec.	Pass or Fail
				Candidate	Reference			
Low _____ ppm to _____ ppm	1							
	2							
	3							
	4							
	5							
	6							
Medium _____ ppm to _____ ppm	1							
	2							
	3							
	4							
	5							
	6							
High _____ ppm to _____ ppm	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
							Total Failures:	

13. Figures C-2, C-3, and C-4 are added to subpart C to read as follows:

FIGURE C-2 TO SUBPART C OF PART 53—ILLUSTRATION OF THE SLOPE AND INTERCEPT LIMITS FOR CLASS II AND CLASS III PM_{2.5} CANDIDATE EQUIVALENT METHODS.

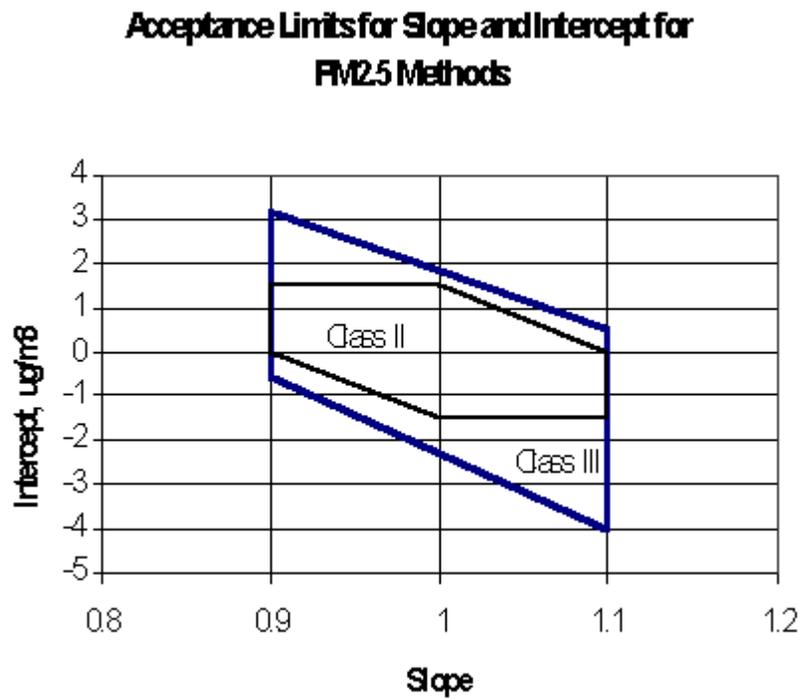


FIGURE C-3 TO SUBPART C OF PART 53—ILLUSTRATION OF THE SLOPE AND INTERCEPT LIMITS FOR CLASS II AND CLASS III PM_{10-2.5} CANDIDATE EQUIVALENT METHODS.

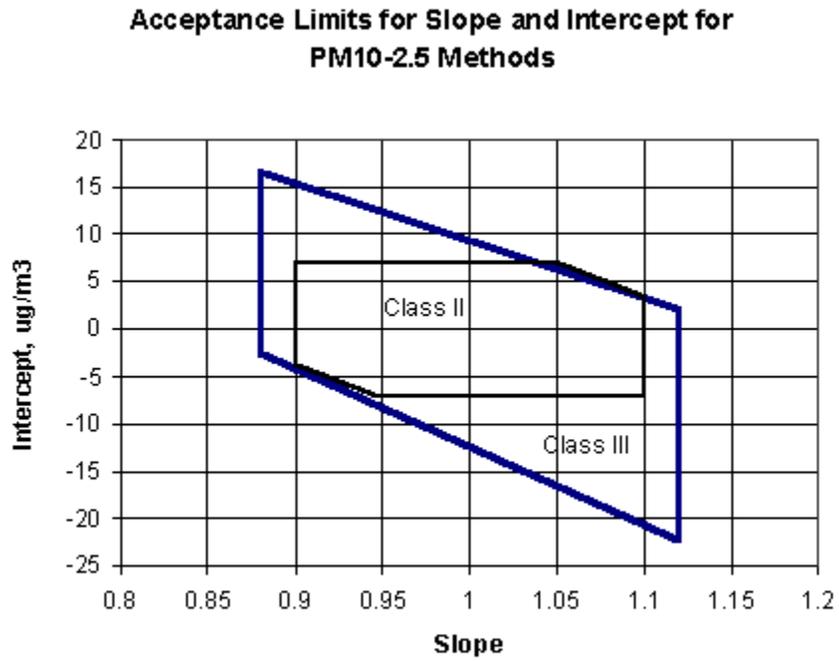
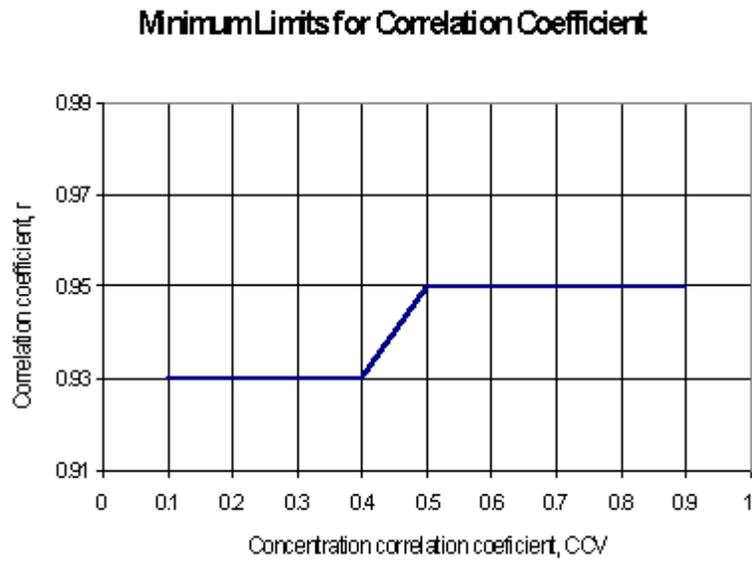


FIGURE C-4 TO SUBPART C OF PART 53—ILLUSTRATION OF THE MINIMUM LIMITS FOR CORRELATION COEFFICIENT FOR $PM_{2.5}$ AND $PM_{10-2.5}$ CLASS II AND III METHODS.



14. Reference (2) in appendix A is added to subpart C to read as follows:

Appendix A to Subpart C - References

* * * * *

(2) Quality Assurance Guidance Document 2.12. Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods. U.S. EPA, National Exposure Research Laboratory, Research Triangle Park, NC, November 1998 or later edition. Currently available at <http://www.epa.gov/ttn/amtic/pmqainf.html>.

* * * * *

Subpart E--Procedures for Testing Physical (Design) and Performance Characteristics of Reference Methods and Class I and Class II Equivalent Methods for PM_{2.5} or PM_{10-2.5}

15. The heading for subpart E is revised as set out above.

16. Section 53.50 is revised to read as follows:

§53.50 General provisions.

(a) A candidate method for PM_{2.5} or PM_{10-2.5} described in an application for a reference or equivalent method determination submitted under §53.4 shall be determined by the EPA to be a reference method or a Class I, II, or III

equivalent method on the basis of the definitions for such methods given in §53.1. This subpart sets forth the specific tests that must be carried out and the test results, evidence, documentation, and other materials that must be provided to EPA to demonstrate that a PM_{2.5} or PM_{10-2.5} sampler associated with a candidate reference method or Class I or Class II equivalent method meets all design and performance specifications set forth in appendix L or O, respectively, of part 50 of this chapter as well as additional requirements specified in this subpart E. Some or all of these tests may also be applicable to a candidate Class III equivalent method or analyzer, as may be determined under §53.3(b) (3).

(b) PM_{2.5} methods. (1) Reference method. A sampler associated with a candidate reference method for PM_{2.5} shall be subject to the provisions, specifications, and test procedures prescribed in §§53.51 through 53.58.

(2) Class I method. A sampler associated with a candidate Class I equivalent method for PM_{2.5} shall be subject to the provisions, specifications, and test procedures prescribed in all sections of this subpart.

(3) Class II method. A sampler associated with a candidate Class II equivalent method for PM_{2.5} shall be

subject to the provisions, specifications, and test procedures prescribed in all applicable sections of this subpart, as specified in subpart F of this part or as specified in §53.3(a)(3).

(c) PM_{10-2.5} methods. (1) Reference method. A sampler associated with a reference method for PM_{10-2.5}, as specified in appendix O to part 50 of this chapter, shall be subject to the requirements in this paragraph (c)(1).

(i) The PM_{2.5} sampler of the PM_{10-2.5} sampler pair shall be verified to be either currently designated under this part 53 as a reference method for PM_{2.5}, or shown to meet all requirements for designation as a reference method for PM_{2.5}, in accordance with this part 53.

(ii) The PM_{10c} sampler of the PM_{10-2.5} sampler pair shall be verified to be of like manufacturer, design, configuration, and fabrication to the PM_{2.5} sampler of the PM_{10-2.5} sampler pair, except for replacement of the particle size separator specified in section 7.3.4 of appendix L to part 50 of this chapter with the downtube extension as specified in Figure O-1 of appendix O to part 50 of this chapter.

(iii) For samplers that meet the provisions of paragraphs (c)(1)(i) and (ii) of this section, the candidate

PM_{10-2.5} reference method may be determined to be a reference method without further testing.

(2) Class I method. A sampler associated with a Class I candidate equivalent method for PM_{10-2.5} shall meet the requirements in this paragraph (c) (2).

(i) The PM_{2.5} sampler of the PM_{10-2.5} sampler pair shall be verified to be either currently designated under this part 53 as a reference method or Class I equivalent method for PM_{2.5}, or shown to meet all requirements for designation as a reference method or Class I equivalent method for PM_{2.5}, in accordance with this part 53.

(ii) The PM_{10c} sampler of the PM_{10-2.5} sampler pair shall be verified to be of similar design to the PM_{10-2.5} sampler and to meet all requirements for designation as a reference method or Class I equivalent method for PM_{2.5}, in accordance with this part 53, except for replacement of the particle size separator specified in section 7.3.4 of appendix L to part 50 of this chapter with the downtube extension as specified in Figure O-1 of appendix O to part 50 of this chapter.

(iii) For samplers that meet the provisions of paragraphs (c) (2) (i) and (ii) of this section, the candidate PM_{10-2.5} method may be determined to be a Class I equivalent

method without further testing.

(3) Class II method. A sampler associated with a Class II candidate equivalent method for $PM_{10-2.5}$ shall be subject to the applicable requirements of this subpart E, as described in §53.3(a)(5).

(d) The provisions of §53.51 pertain to test results and documentation required to demonstrate compliance of a candidate method sampler with the design specifications set forth in 40 CFR part 50, appendix L or O, as applicable. The test procedures prescribed in §§53.52 through 53.59 pertain to performance tests required to demonstrate compliance of a candidate method sampler with the performance specifications set forth in 40 CFR part 50, appendix L or O, as applicable, as well as additional requirements specified in this subpart E. These latter test procedures shall be used to test the performance of candidate samplers against the performance specifications and requirements specified in each procedure and summarized in table E-1 of this subpart.

(e) Test procedures prescribed in §53.59 do not apply to candidate reference method samplers. These procedures apply primarily to candidate Class I or Class II equivalent method samplers for $PM_{2.5}$ or $PM_{10-2.5}$ that have a sample air

flow path configuration upstream of the sample filter that is modified from that specified for the reference method sampler, as set forth in 40 CFR part 50, appendix L, Figures L-1 to L-29 or 40 CFR part 50 appendix O, Figure O-1, if applicable, such as might be necessary to provide for sequential sample capability. The additional tests determine the adequacy of aerosol transport through any altered components or supplemental devices that are used in a candidate sampler upstream of the filter. In addition to the other test procedures in this subpart, these test procedures shall be used to further test the performance of such an equivalent method sampler against the performance specifications given in the procedure and summarized in table E-1 of this subpart.

(f) A 10-day operational field test of measurement precision is required under §53.58 for both reference and Class I equivalent method samplers for $PM_{2.5}$. This test requires collocated operation of 3 candidate method samplers at a field test site. For candidate equivalent method samplers, this test may be combined and carried out concurrently with the test for comparability to the reference method specified under §53.34, which requires collocated operation of three reference method samplers and

three candidate equivalent method samplers.

(g) All tests and collection of test data shall be performed in accordance with the requirements of reference 1, section 4.10.5 (ISO 9001) and reference 2, part B, section 3.3.1, paragraphs 1 and 2 and Part C, section 4.6 (ANSI/ASQC E4) in appendix A of this subpart. All test data and other documentation obtained specifically from or pertinent to these tests shall be identified, dated, signed by the analyst performing the test, and submitted to EPA in accordance with subpart A of this part.

17. Section 53.51 is revised to read as follows:

§53.51 Demonstration of compliance with design specifications and manufacturing and test requirements.

(a) Overview. (1) The subsequent paragraphs of this section specify certain documentation that must be submitted and tests that are required to demonstrate that samplers associated with a designated reference or equivalent method for PM_{2.5} or PM_{10-2.5} are properly manufactured to meet all applicable design and performance specifications and have been properly tested according to all applicable test requirements for such designation. Documentation is required to show that instruments and components of a PM_{2.5} or PM_{10-2.5} sampler are manufactured in an ISO 9001-registered

facility under a quality system that meets ISO-9001 requirements for manufacturing quality control and testing.

(2) In addition, specific tests are required by paragraph (d) of this section to verify that critical features of reference method samplers - the particle size separator and the surface finish of surfaces specified to be anodized - meet the specifications of 40 CFR part 50, appendix L or appendix O, as applicable. A checklist is required to provide certification by an ISO-certified auditor that all performance and other required tests have been properly and appropriately conducted, based on a reasonable and appropriate sample of the actual operations or their documented records. Following designation of the method, another checklist is required initially to provide an ISO-certified auditor's certification that the sampler manufacturing process is being implemented under an adequate and appropriate quality system.

(3) For the purposes of this section, the definitions of ISO 9001-registered facility and ISO-certified auditor are found in §53.1. An exception to the reliance by EPA on ISO-certified auditors is the requirement for the submission of the operation or instruction manual associated with the candidate method to EPA as part of the application. This

manual is required under §53.4(b)(3). The EPA has determined that acceptable technical judgment for review of this manual may not be assured by ISO-certified auditors, and approval of this manual will therefore be performed by EPA.

(b) ISO registration of manufacturing facility. The applicant must submit documentation verifying that the samplers identified and sold as part of a designated PM_{2.5} or PM_{10-2.5} reference or equivalent method will be manufactured in an ISO 9001-registered facility and that the manufacturing facility is maintained in compliance with all applicable ISO 9001 requirements (reference 1 in appendix A of this subpart). The documentation shall indicate the date of the original ISO 9001 registration for the facility and shall include a copy of the most recent certification of continued ISO 9001 facility registration. If the manufacturer does not wish to initiate or complete ISO 9001 registration for the manufacturing facility, documentation must be included in the application to EPA describing an alternative method to demonstrate that the facility meets the same general requirements as required for registration to ISO-9001. In this case, the applicant must provide documentation in the application to demonstrate, by required ISO-certified

auditor's inspections, that a quality system is in place which is adequate to document and monitor that the sampler system components and final assembled samplers all conform to the design, performance and other requirements specified in this part and in 40 CFR part 50, appendix L.

(c) Sampler manufacturing quality control. The manufacturer must ensure that all components used in the manufacture of PM_{2.5} or PM_{10-2.5} samplers to be sold as part of a reference or equivalent method and that are specified by design in 40 CFR part 50, appendix L or O (as applicable), are fabricated or manufactured exactly as specified. If the manufacturer's quality records show that its quality control (QC) and quality assurance (QA) system of standard process control inspections (of a set number and frequency of testing that is less than 100 percent) complies with the applicable QA provisions of section 4 of reference 4 in appendix A of this subpart and prevents nonconformances, 100 percent testing shall not be required until that conclusion is disproved by customer return or other independent manufacturer or customer test records. If problems are uncovered, inspection to verify conformance to the drawings, specifications, and tolerances shall be performed. Refer also to paragraph (e) of this section-final assembly and

inspection requirements.

(d) Specific tests and supporting documentation required to verify conformance to critical component specifications. (1) Verification of PM_{2.5} (WINS) impactor jet diameter. For samplers utilizing the WINS impactor particle size separator specified in paragraphs 7.3.4.1, 7.3.4.2, and 7.3.4.3 of appendix L to part 50 of this chapter, the diameter of the jet of each impactor manufactured for a PM_{2.5} or PM_{10-2.5} sampler under the impactor design specifications set forth in 40 CFR part 50, appendix L, shall be verified against the tolerance specified on the drawing, using standard, NIST-traceable ZZ go/no go plug gages. This test shall be a final check of the jet diameter following all fabrication operations, and a record shall be kept of this final check. The manufacturer shall submit evidence that this procedure is incorporated into the manufacturing procedure, that the test is or will be routinely implemented, and that an appropriate procedure is in place for the disposition of units that fail this tolerance test.

(2) VSCC separator. For samplers utilizing the BGI VSCC™ Very Sharp Cut Cyclone particle size separator specified in paragraph 7.3.4.4 of appendix L to part 50 of

this chapter, the VSCC manufacturer shall identify the critical dimensions and manufacturing tolerances for the device, develop appropriate test procedures to verify that the critical dimensions and tolerances are maintained during the manufacturing process, and carry out those procedures on each VSCC manufactured to verify conformance of the manufactured products. The manufacturer shall also maintain records of these tests and their results and submit evidence that this procedure is incorporated into the manufacturing procedure, that the test is or will be routinely implemented, and that an appropriate procedure is in place for the disposition of units that fail this tolerance test.

(3) Verification of surface finish. The anodization process used to treat surfaces specified to be anodized shall be verified by testing treated specimen surfaces for weight and corrosion resistance to ensure that the coating obtained conforms to the coating specification. The specimen surfaces shall be finished in accordance with military standard specification 8625F, Type II, Class I (reference 4 in appendix A of this subpart) in the same way the sampler surfaces are finished, and tested, prior to sealing, as specified in section 4.5.2 of reference 4 in appendix A of this subpart.

(e) Final assembly and inspection requirements. Each sampler shall be tested after manufacture and before delivery to the final user. Each manufacturer shall document its post-manufacturing test procedures. As a minimum, each test shall consist of the following: Tests of the overall integrity of the sampler, including leak tests; calibration or verification of the calibration of the flow measurement device, barometric pressure sensor, and temperature sensors; and operation of the sampler with a filter in place over a period of at least 48 hours. The results of each test shall be suitably documented and shall be subject to review by an ISO-certified auditor.

(f) Manufacturer's audit checklists. Manufacturers shall require an ISO-certified auditor to sign and date a statement indicating that the auditor is aware of the appropriate manufacturing specifications contained in 40 CFR part 50, appendix L or O (as applicable), and the test or verification requirements in this subpart. Manufacturers shall also require an ISO-certified auditor to complete the checklists, shown in figures E-1 and E-2 of this subpart, which describe the manufacturer's ability to meet the requirements of the standard for both designation testing and product manufacture.

(1) Designation testing checklist. The completed statement and checklist as shown in figure E-1 of this subpart shall be submitted with the application for reference or equivalent method determination.

(2) Product manufacturing checklist. Manufacturers shall require an ISO-certified auditor to complete a Product Manufacturing Checklist (figure E-2 of this subpart), which evaluates the manufacturer on its ability to meet the requirements of the standard in maintaining quality control in the production of reference or equivalent devices. The completed checklist shall be submitted with the application for reference or equivalent method determination.

18. Section 53.52 is amended by revising paragraph (e) (1) to read as follows:

§53.52 Leak check test.

* * * * *

(e) Test setup. (1) The test sampler shall be set up for testing as described in the sampler's operation or instruction manual referred to in §53.4(b) (3). The sampler shall be installed upright and set up in its normal configuration for collecting PM samples, except that the sample air inlet shall be removed and the flow rate measurement adaptor shall be installed on the sampler's

downtube.

* * * * *

19. Section 53.53 is amended by revising paragraph (e) (1) to read as follows:

§53.53 Test for flow rate accuracy, regulation, measurement accuracy, and cut-off.

* * * * *

(e) Test setup. (1) Setup of the sampler shall be as required in this paragraph (e) and otherwise as described in the sampler's operation or instruction manual referred to in §53.4(b) (3). The sampler shall be installed upright and set up in its normal configuration for collecting PM samples. A sample filter and (or) the device for creating an additional 55 mm Hg pressure drop shall be installed for the duration of these tests. The sampler's ambient temperature, ambient pressure, and flow rate measurement systems shall all be calibrated per the sampler's operation or instruction manual within 7 days prior to this test.

* * * * *

20. Section 53.54 is amended by revising paragraph (d) (4) to read as follows:

§53.54 Test for proper sampler operation following power

interruptions.

* * * * *

(d) Test setup. (1) Setup of the sampler shall be performed as required in this paragraph (d) and otherwise as described in the sampler's operation or instruction manual referred to in §53.4(b)(3). The sampler shall be installed upright and set up in its normal configuration for collecting PM samples. A sample filter and (or) the device for creating an additional 55 mm Hg pressure drop shall be installed for the duration of these tests. The sampler's ambient temperature, ambient pressure, and flow measurement systems shall all be calibrated per the sampler's operating manual within 7 days prior to this test.

* * * * *

21. Section 53.55 is amended as follows:

- a. By revising paragraphs (a)(1) introductory text and (a)(2).
- b. By revising paragraph (e)(1).
- c. By revising paragraph (g)(5)(i).

§53.55 Test for effect of variations in power line voltage and ambient temperature.

(a) Overview. (1) This test procedure is a combined procedure to test various performance parameters under

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variations in power line voltage and ambient temperature. Tests shall be conducted in a temperature controlled environment over four 6-hour time periods during which reference temperature and flow rate measurements shall be made at intervals not to exceed 5 minutes. Specific parameters to be evaluated at line voltages of 105 and 125 volts and temperatures of -20°C and +40°C are as follows:

* * * * *

(2) The performance parameters tested under this procedure, the corresponding minimum performance specifications, and the applicable test conditions are summarized in table E-1 of this subpart. Each performance parameter tested, as described or determined in the test procedure, must meet or exceed the associated performance specification given. The candidate sampler must meet all specifications for the associated PM_{2.5} or PM_{10-2.5} method (as applicable) to pass this test procedure.

* * * * *

(e) * * * (1) Setup of the sampler shall be performed as required in this paragraph (e) and otherwise as described in the sampler's operation or instruction manual referred to in §53.4(b)(3). The sampler shall be installed upright and set up in the temperature-controlled chamber in

its normal configuration for collecting PM samples. A sample filter and (or) the device for creating an additional 55 mm Hg pressure drop shall be installed for the duration of these tests. The sampler's ambient temperature, ambient pressure, and flow measurement systems shall all be calibrated per the sampler's operating manual within 7 days prior to this test.

* * * * *

(g) * * *

(5) * * * (i) Calculate the absolute value of the difference between the mean ambient air temperature indicated by the test sampler and the mean ambient (chamber) air temperature measured with the ambient air temperature recorder as:

Equation 16

$$T_{diff} = |T_{ind,ave} - T_{ref,ave}|$$

where:

$T_{ind,ave}$ = mean ambient air temperature indicated by the test sampler, °C; and

$T_{ref,ave}$ = mean ambient air temperature measured by the reference temperature instrument, °C.

* * * * *

22. Section 53.56 is amended by revising paragraphs (a) (2) and (e) (1) to read as follows:

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§53.56 Test for effect of variations in ambient pressure.

(a) * * *

(2) The performance parameters tested under this procedure, the corresponding minimum performance specifications, and the applicable test conditions are summarized in table E-1 of this subpart. Each performance parameter tested, as described or determined in the test procedure, must meet or exceed the associated performance specification given. The candidate sampler must meet all specifications for the associated PM_{2.5} or PM_{10-2.5} method (as applicable) to pass this test procedure.

* * * * *

(e) * * * (1) Setup of the sampler shall be performed as required in this paragraph (e) and otherwise as described in the sampler's operation or instruction manual referred to in §53.4(b)(3). The sampler shall be installed upright and set up in the pressure-controlled chamber in its normal configuration for collecting PM samples. A sample filter and (or) the device for creating an additional 55 mm Hg pressure drop shall be installed for the duration of these tests. The sampler's ambient temperature, ambient pressure, and flow measurement systems shall all be calibrated per the sampler's operating manual within 7 days

prior to this test.

* * * * *

23. Section 53.57 is amended by revising paragraphs (a), (b), and (e) (1) to read as follows:

§53.57 Test for filter temperature control during sampling and post-sampling periods.

(a) Overview. This test is intended to measure the candidate sampler's ability to prevent excessive overheating of the PM sample collection filter (or filters) under conditions of elevated solar insolation. The test evaluates radiative effects on filter temperature during a 4-hour period of active sampling as well as during a subsequent 4-hour non-sampling time period prior to filter retrieval. Tests shall be conducted in an environmental chamber which provides the proper radiant wavelengths and energies to adequately simulate the sun's radiant effects under clear conditions at sea level. For additional guidance on conducting solar radiative tests under controlled conditions, consult military standard specification 810-E (reference 6 in appendix A of this subpart). The performance parameters tested under this procedure, the corresponding minimum performance specifications, and the applicable test conditions are summarized in table E-1 of

this subpart. Each performance parameter tested, as described or determined in the test procedure, must meet or exceed the associated performance specification to successfully pass this test.

(b) Technical definition. Filter temperature control during sampling is the ability of a sampler to maintain the temperature of the particulate matter sample filter within the specified deviation (5 °C) from ambient temperature during any active sampling period. Post-sampling temperature control is the ability of a sampler to maintain the temperature of the particulate matter sample filter within the specified deviation from ambient temperature during the period from the end of active sample collection by the sampler until the filter is retrieved from the sampler for laboratory analysis.

* * * * *

(e) * * * (1) Setup of the sampler shall be performed as required in this paragraph (e) and otherwise as described in the sampler's operation or instruction manual referred to in §53.4(b)(3). The sampler shall be installed upright and set up in the solar radiation environmental chamber in its normal configuration for collecting PM samples (with the inlet installed). The sampler's ambient

and filter temperature measurement systems shall be calibrated per the sampler's operating manual within 7 days prior to this test. A sample filter shall be installed for the duration of this test. For sequential samplers, a sample filter shall also be installed in each available sequential channel or station intended for collection of a sequential sample (or at least 5 additional filters for magazine-type sequential samplers) as directed by the sampler's operation or instruction manual.

* * * * *

24. Section 53.58 is revised to read as follows:

§53.58 Operational field precision and blank test.

(a) Overview. This test is intended to determine the operational precision of the candidate sampler during a minimum of 10 days of field operation, using three collocated test samplers. Measurements of PM are made at a test site with all of the samplers and then compared to determine replicate precision. Candidate sequential samplers are also subject to a test for possible deposition of particulate matter on inactive filters during a period of storage in the sampler. This procedure is applicable to both reference and equivalent methods. In the case of equivalent methods, this test may be combined and conducted

concurrently with the comparability test for equivalent methods (described in subpart C of this part), using three reference method samplers collocated with three candidate equivalent method samplers and meeting the applicable site and other requirements of subpart C of this part.

(b) Technical definition. (1) Field precision is defined as the standard deviation or relative standard deviation of a set of PM measurements obtained concurrently with three or more collocated samplers in actual ambient air field operation.

(2) Storage deposition is defined as the mass of material inadvertently deposited on a sample filter that is stored in a sequential sampler either prior to or subsequent to the active sample collection period.

(c) Test site. Any outdoor test site having $PM_{2.5}$ (or $PM_{10-2.5}$, as applicable) concentrations that are reasonably uniform over the test area and that meet the minimum level requirement of paragraph (g)(2) of this section is acceptable for this test.

(d) Required facilities and equipment. (1) An appropriate test site and suitable electrical power to accommodate three test samplers are required.

(2) Teflon sample filters, as specified in section 6

of 40 CFR part 50, appendix L, conditioned and preweighed as required by section 8 of 40 CFR part 50, appendix L, as needed for the test samples.

(e) Test setup. (1) Three identical test samplers shall be installed at the test site in their normal configuration for collecting PM samples in accordance with the instructions in the associated manual referred to in §53.4(b)(3) and also in accordance with applicable supplemental guidance provided in reference 3 in appendix A of this subpart. The test samplers' inlet openings shall be located at the same height above ground and between 2 (1 for samplers with flow rates less than 200 L/min.) and 4 meters apart horizontally. The samplers shall be arranged or oriented in a manner that will minimize the spatial and wind directional effects on sample collection of one sampler on any other sampler.

(2) Each test sampler shall be successfully leak checked, calibrated, and set up for normal operation in accordance with the instruction manual and with any applicable supplemental guidance provided in reference 3 in appendix A of this subpart.

(f) Test procedure. (1) Install a conditioned, preweighed filter in each test sampler and otherwise prepare

each sampler for normal sample collection. Set identical sample collection start and stop times for each sampler. For sequential samplers, install a conditioned, preweighed specified filter in each available channel or station intended for automatic sequential sample filter collection (or at least 5 additional filters for magazine-type sequential samplers), as directed by the sampler's operation or instruction manual. Since the inactive sequential channels are used for the storage deposition part of the test, they may not be used to collect the active PM test samples.

(2) Collect either a nominal 24-hour or 48-hour atmospheric PM sample simultaneously with each of the three test samplers.

(3) Following sample collection, retrieve the collected sample from each sampler. For sequential samplers, retrieve the additional stored (blank, unsampled) filters after at least 5 days (120 hours) storage in the sampler if the active samples are 24-hour samples, or after at least 10 days (240 hours) if the active samples are 48-hour samples.

(4) Determine the measured PM mass concentration for each sample in accordance with the applicable procedures

prescribed for the candidate method in appendix L or appendix O, as applicable, of part 50 of this chapter, or in accordance with the associated manual referred to in §53.4(b)(3) and supplemental guidance in reference 2 in appendix A of this subpart. For sequential samplers, also similarly determine the storage deposition as the net weight gain of each blank, unsampled filter after the 5-day (or 10-day) period of storage in the sampler.

(5) Repeat this procedure to obtain a total of 10 sets of any combination of (nominal) 24-hour or 48-hour PM measurements over 10 test periods. For sequential samplers, repeat the 5-day (or 10-day) storage test of additional blank filters once for a total of two sets of blank filters.

(g) Calculations. (1) Record the PM concentration for each test sampler for each test period as $C_{i,j}$, where i is the sampler number ($i = 1,2,3$) and j is the test period ($j = 1,2, . . . 10$).

(2)(i) For each test period, calculate and record the average of the three measured PM concentrations as $C_{ave, j}$ where j is the test period using equation 26 of this section:

Equation 26

$$C_{ave,j} = \frac{1}{3} \times \sum_{i=1}^3 C_{ij}$$

(ii) If $C_{ave,j} < 3 \mu\text{g}/\text{m}^3$ for any test period, data from that test period are unacceptable, and an additional sample collection set must be obtained to replace the unacceptable data.

(3) (i) Calculate and record the precision for each of the 10 test periods, as the standard deviation, using equation 27 of this section:

Equation 27

$$P_j = \sqrt{\frac{\sum_{i=1}^3 C_{ij}^2 - \frac{1}{3}(\sum_{i=1}^3 C_{ij})^2}{2}}$$

(ii) For each of the 10 test periods, also calculate and record the precision as the relative standard deviation, in percent, using equation 28 of this section:

Equation 28

$$RP_j = 100\% \times \frac{P_j}{C_{ave,j}}$$

(h) Test results. (1) The candidate method passes the precision test if either P_j or RP_j is less than or equal to the corresponding specification in table E-1 of this subpart for all 10 test periods.

(2) The candidate sequential sampler passes the blank filter storage deposition test if the average net storage deposition weight gain of each set of blank filters (total of the net weight gain of each blank filter divided by the number of filters in the set) from each test sampler (six sets in all) is less than 50 μg .

25. Section 53.59 is amended by revising paragraphs (a) and (b) (5) to read as follows:

§53.59 Aerosol transport test for Class I equivalent method samplers.

(a) Overview. This test is intended to verify adequate aerosol transport through any modified or air flow splitting components that may be used in a Class I candidate equivalent method sampler such as may be necessary to achieve sequential sampling capability. This test is applicable to all Class I candidate samplers in which the aerosol flow path (the flow path through which sample air passes upstream of sample collection filter) differs significantly from that specified for reference method

samplers as specified in 40 CFR part 50, appendix L or appendix O, as applicable. The test requirements and performance specifications for this test are summarized in table E-1 of this subpart.

(b) * * *

(5) An added component is any physical part of the sampler which is different in some way from that specified for a reference method sampler in 40 CFR part 50, appendix L or appendix O, as applicable, such as a device or means to allow or cause the aerosol to be routed to one of several channels.

* * * * *

26. Table E-1 to subpart E is revised to read as follows:

TABLE E-1 TO SUBPART E—SUMMARY OF TEST REQUIREMENTS FOR REFERENCE AND CLASS I EQUIVALENT METHODS FOR $PM_{2.5}$ AND $PM_{10-2.5}$

Subpart E Procedure	Performance Test	Performance Specification	Test Conditions	Part 50, Appendix L Reference
§53.52 Sample leak check test.	Sampler leak check facility	External leakage: 80 mL/min, max Internal leakage: 80 mL/min, max	Controlled leak flow rate of 80 mL/min	Sec. 7.4.6
§53.53 Base flow rate test	Sample flow rate 1. Mean 2. Regulation 3. Meas accuracy 4. CV accuracy 5. Cut-off	1. $16.67 \pm 5\%$ L/min 2. 2%, max 3. 2%, max 4. 0.3% max 5. Flow rate cut-off if flow rate deviates more than 10% from design flow rate for $>60 \pm 30$ seconds	(a) 6-hour normal operational test plus flow rate cut-off test (b) Normal conditions (c) Additional 55 mm Hg pressure drop to simulate loaded filter (d) Variable flow restriction used for cut-off test	Sec. 7.4.1, Sec. 7.4.2 Sec. 7.4.3 Sec. 7.4.4 Sec. 7.4.5
§53.54 Power interruption test	Sample flow rate: 1. Mean 2. Regulation 3. Meas. accuracy 4. CV accuracy 5. Occurrence time of power interruptions 6. Elapsed sample time 7. Sample volume	1. $16.67 \pm 5\%$ L/min 2. 2%, max 3. 2%, max 4. 0.3% max 5. ± 2 min if >60 seconds 6. ± 20 seconds 7. $\pm 2\%$, max	(a) 6-hour normal operational test (b) Nominal conditions (c) Additional 55 mm Hg pressure drop to simulate loaded filter (d) 6 power interruptions of various durations.	Sec. 7.4.1, Sec. 7.4.2 Sec. 7.4.3 Sec. 7.4.5 Sec. 7.4.12 Sec. 7.4.13 Sec. 7.4.15.4 Sec. 7.4.15.5
§53.55 Temperature and line voltage test	Sample flow rate 1. Mean 2. Regulation 3. Meas. accuracy 4. CV accuracy 5. Temperature meas. accuracy 6. Proper operation	1. $16.67 \pm 5\%$ L/min 2. 2%, max 3. 2%, max 4. 0.3% max 5. 2 °C	(a) 6-hour normal operational test (b) Normal conditions (c) Additional 55 mm Hg pressure drop to simulate loaded filter (d) Ambient temperature at -20 and +40 °C (e) Line voltage: 105 Vac to 125 Vac	Sec. 7.4.1, Sec. 7.4.2 Sec. 7.4.3 Sec. 7.4.5 Sec. 7.4.8 Sec. 7.4.15.1

Subpart E Procedure	Performance Test	Performance Specification	Test Conditions	Part 50, Appendix L Reference
§53.56 Barometric pressure effect test	Sample flow rate 1. Mean 2. Regulation 3. Meas. accuracy 4. CV accuracy 5. Pressure meas. accuracy 6. Proper operation	1. $16.67 \pm 5\%$ L/min 2. 2%, max 3. 2%, max 4. 0.3% max 5. 10 mm Hg	(a) 6-hour normal operational test (b) Normal conditions (c) Additional 55 mm Hg pressure drop to simulate loaded filter (d) Barometric pressure at 600 and 800 mm Hg.	Sec. 7.4.1, Sec. 7.4.2 Sec. 7.4.3 Sec. 7.4.5 Sec. 7.4.9
§53.57 Filter temperature control test	1. Filter temp meas. accuracy 2. Ambient temp. meas. accuracy 3. Filter temp. control accuracy, sampling and non-sampling	1. 2 °C 2. 2 °C 3. Not more than 5 °C above ambient temp. for more than 30 min.	(a) 4-hour simulated solar radiation, sampling (b) 4-hour simulated solar radiation, non-sampling (c) Solar flux of 1000 ± 50 W/m ²	Sec. 7.4.8 Sec. 7.4.10 Sec. 7.4.11
§53.58 Field precision test	1. Measurement precision 2. Storage deposition test for sequential samplers	1. $P_j < 2 \mu\text{g}/\text{m}^3$ or $RP_j < 5\%$ 2. 50 μg max. average weight gain/blank filter.	(a) 3 collocated samplers at 1 site for at least 10 days; (b) $PM_{1.5}$ conc. $> 3 \mu\text{g}/\text{m}^3$ (c) 24- or 48-hour samples (d) 5- or 10-day storage period for inactive stored filters	Sec. 5.1 Sec. 7.3.5 Sec. 8 Sec. 9 Sec 10
The Following Requirement Is Applicable to Class I Candidate Equivalent Methods Only				
§53.59 Aerosol transport test	Aerosol transport	97%, min. for all channels	Determine aerosol transport through any new or modified components with respect to the reference method sampler before the filter for each channel.	

27. References (3) and (5) in appendix A to subpart E of part 53 are revised to read as follows:

Appendix A to Subpart E of Part 53-References.

* * * * *

(3). Quality Assurance Guidance Document 2.12. Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods. U.S. EPA, National Exposure Research Laboratory, Research Triangle Park, NC, November 1998 or later edition. Currently available at <http://www.epa.gov/ttn/amtic/pmqainf.html>.

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(5). Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements. Revised March, 1995. EPA-600/R-94-038d. Available from National Technical Information Service, Springfield, VA 22161, (800-553-6847, www.ntis.gov). NTIS number PB95-199782INZ.

* * * * *

Subpart F--[Amended]

28. Section 53.60 is amended by revising paragraphs (b), (c), (d) introductory text, and (f) (4) to read as follows:

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§53.60 General provisions.

* * * * *

(b) A candidate method described in an application for a reference or equivalent method determination submitted under §53.4 shall be determined by the EPA to be a Class II candidate equivalent method on the basis of the definition of a Class II equivalent method given in §53.1.

(c) Any sampler associated with a Class II candidate equivalent method (Class II sampler) must meet all applicable requirements for reference method samplers or Class I equivalent method samplers specified in subpart E of this part, as appropriate. Except as provided in §53.3(a)(3), a Class II PM_{2.5} sampler must meet the additional requirements as specified in paragraph (d) of this section.

(d) Except as provided in paragraphs (d)(1), (2), and (3) of this section, all Class II samplers are subject to the additional tests and performance requirements specified in §53.62 (full wind tunnel test), §53.65 (loading test), and §53.66 (volatility test). Alternative tests and performance requirements, as described in paragraphs (d)(1), (2), and (3) of this section, are optionally available for certain Class II samplers which meet the requirements for

reference method or Class I equivalent method samplers given in 40 CFR part 50, appendix L, and in subpart E of this part, except for specific deviations of the inlet, fractionator, or filter.

* * * * *

(f) * * *

(4) Loading test. The loading test is conducted to ensure that the performance of a candidate sampler is not significantly affected by the amount of particulate deposited on its interior surfaces between periodic cleanings. The candidate sampler is artificially loaded by sampling a test environment containing aerosolized, standard test dust. The duration of the loading phase is dependent on both the time between cleaning as specified by the candidate method and the aerosol mass concentration in the test environment. After loading, the candidate's performance must then be evaluated by §53.62 (full wind tunnel evaluation), §53.63 (wind tunnel inlet aspiration test), or §53.64 (static fractionator test). If the results of the appropriate test meet the criteria presented in table F-1 of this subpart, then the candidate sampler passes the loading test under the condition that it be cleaned at least as often as the cleaning frequency proposed by the candidate

method and that has been demonstrated to be acceptable by this test.

* * * * *

§53.61 Test conditions.

29. The section heading of §53.61 is revised as set forth above.

30. Section 53.66 is amended by revising paragraph (e) (2) (iii) to read as follows:

§53.66 Test procedure: Volatility test.

* * * * *

(e) * * *

(2) * * *

(iii) Operate the candidate and the reference samplers such that they simultaneously sample the test aerosol for 2 hours for a candidate sampler operating at 16.7 L/min or higher, or proportionately longer for a candidate sampler operating at a lower flow rate.

* * * * *

31. Table F-1 to subpart F is revised to read as follows:

TABLE F-1 TO SUBPART F—PERFORMANCE SPECIFICATIONS FOR PM_{2.5} CLASS II EQUIVALENT SAMPLERS

Performance Test	Specifications	Acceptance Criteria
§53.62 Full Wind Tunnel Evaluation	Solid VOAG produced aerosol at 2 km/hr and 24 km/hr.	Dp ₅₀ = 2.5 µm ± 0.2 µm Numerical Analysis Results: 95% ≤ R _c ≤ 105%
§53.63 Wind Tunnel Inlet Aspiration Test	Liquid VOAG produced aerosol at 2 km/hr and 24 km/hr.	Relative Aspiration: 95% ≤ A ≤ 105%
§53.64 Static Fractionator Test	Evaluation of the fractionator under static conditions.	Dp ₅₀ = 2.5 µm ± 0.2 µm Numerical Analysis Results: 95% ≤ R _c ≤ 105%
§53.65 Loading Test	Loading of the clean candidate under laboratory conditions.	Acceptance criteria as specified in the post-loading evaluation test (§53.62, §53.63, or §53.64)
§53.66 Volatility Test	Polydisperse liquid aerosol produced by air nebulization of A.C.S. reagent grade glycerol, 99.5% minimum purity.	Regression Parameters Slope = 1 ± 0.1, Intercept = 0 ± 0.15 mg r ≥ 0.97

32. In Figure E-1 to subpart F, the figure number "E-1" is revised to read "F-1."

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PART 58--[AMENDED]

33. The authority citation for part 58 continues to read as follows:

Authority: 42 U.S.C. 7410, 7601(a), 7613, and 7619.

Subpart A--[Amended]

34. Section 58.1 is revised to read as follows:

§58.1 Definitions.

As used in this part, all terms not defined herein have the meaning given them in the Act.

Act means the Clean Air Act as amended (42 U.S.C. 7401, et seq.)

Additive and multiplicative bias means the linear regression intercept and slope of a linear plot fitted to corresponding candidate and reference method mean measurement data pairs.

Administrator means the Administrator of the Environmental Protection Agency (EPA) or his or her authorized representative.

Air Quality System (AQS) means EPA's computerized system for storing and reporting of information relating to ambient air quality data.

Approved regional method (ARM) means a continuous PM_{2.5}

method that has been approved specifically within a State or local air monitoring network for purposes of comparison to the NAAQS and to meet other monitoring objectives.

AOCR means air quality control region.

CO means carbon monoxide.

Community monitoring zone (CMZ) means an optional averaging area with established, well defined boundaries, such as county or census block, within an MPA that has relatively uniform concentrations of annual $PM_{2.5}$ as defined by appendix N of part 50 of this chapter. Two or more community-oriented SLAMS monitors within a CMZ that meet certain requirements as set forth in appendix N of part 50 of this chapter may be averaged for making comparisons to the annual $PM_{2.5}$ NAAQS.

Combined statistical area (CSA) is defined by the U.S. Office of Management and Budget as a geographical area consisting of two or more adjacent Core Based Statistical Areas (CBSAs) with employment interchange of at least 15 percent. Combination is automatic if the employment interchange is 25 percent and determined by local opinion if more than 15 but less than 25 percent (<http://www.census.gov/population/estimates/metro-city/List6.txt>).

Core-based statistical area (CBSA) is defined by the U.S. Office of Management and Budget, as a statistical geographic entity consisting of the county or counties associated with at least one urbanized area/urban cluster of at least 10,000 population, plus adjacent counties having a high degree of social and economic integration. Metropolitan and micropolitan statistical areas (MSAs) are the two categories of CBSA (metropolitan areas have populations greater than 50,000; and micropolitan areas have populations between 10,000 and 50,000). In the case of very large cities where two or more CBSA are combined, these larger areas are referred to as combined statistical areas (<http://www.census.gov/population/estimates/metro-city/List1.txt>).

Corrected concentration pertains to the result of an accuracy or precision assessment test of an open path analyzer in which a high-concentration test or audit standard gas contained in a short test cell is inserted into the optical measurement beam of the instrument. When the pollutant concentration measured by the analyzer in such a test includes both the pollutant concentration in the test cell and the concentration in the atmosphere, the atmospheric pollutant concentration must be subtracted from

the test measurement to obtain the corrected concentration test result. The corrected concentration is equal to the measured concentration minus the average of the atmospheric pollutant concentrations measured (without the test cell) immediately before and immediately after the test.

Design value means the calculated concentration according to the applicable appendix of part 50 of this chapter for the highest site in an attainment or nonattainment area.

EDO means environmental data operations.

Effective concentration pertains to testing an open path analyzer with a high-concentration calibration or audit standard gas contained in a short test cell inserted into the optical measurement beam of the instrument. Effective concentration is the equivalent ambient-level concentration that would produce the same spectral absorbance over the actual atmospheric monitoring path length as produced by the high-concentration gas in the short test cell.

Quantitatively, effective concentration is equal to the actual concentration of the gas standard in the test cell multiplied by the ratio of the path length of the test cell to the actual atmospheric monitoring path length.

Equivalent method means a method of sampling and

analyzing the ambient air for an air pollutant that has been designated as an equivalent method in accordance with part 53 of this chapter; it does not include a method for which an equivalent method designation has been canceled in accordance with §53.11 or §53.16 of this chapter.

HNO₃ means nitric acid.

Local agency means any local government agency, other than the State agency, which is charged by a State with the responsibility for carrying out a portion of the plan.

Meteorological measurements means measurements of wind speed, wind direction, barometric pressure, temperature, relative humidity, solar radiation, ultraviolet radiation, and precipitation.

Metropolitan Statistical Area (MSA) means a CBSA associated with at least one urbanized area of at least 50,000 population. The central county plus adjacent counties with a high degree of integration comprise the area.

Monitor means an instrument, sampler, analyzer, or other device that measures or assists in the measurement of atmospheric air pollutants and which is acceptable for use in ambient air surveillance under the applicable provisions of appendix C to this part.

Monitoring agency means a State or local agency responsible for meeting the requirements of this part.

Monitoring organization means a State, local, or other monitoring organization responsible for operating a monitoring site for which the QA regulations apply.

Monitoring path for an open path analyzer means the actual path in space between two geographical locations over which the pollutant concentration is measured and averaged.

Monitoring path length of an open path analyzer means the length of the monitoring path in the atmosphere over which the average pollutant concentration measurement (path-averaged concentration) is determined. See also, optical measurement path length.

Monitoring planning area (MPA) means a contiguous geographic area with established, well defined boundaries, such as a core based statistical area, county or State, having a common area that is used for planning monitoring locations for PM_{2.5}. A MPA may cross State boundaries, such as the Philadelphia PA-NJ MSA, and be further subdivided into community monitoring zones. MPA are generally oriented toward CBSA or CSA with populations greater than 200,000, but for convenience, those portions of a State that are not associated with CBSA can be considered as a single MPA.

NATTS means the national air toxics trends stations. This network provides hazardous air pollution ambient data.

NCore means the National Core multi-pollutant monitoring stations. Monitors at these sites are required to measure particles (PM_{2.5}, speciated PM_{2.5}, PM_{10-2.5}), O₃, SO₂, CO, nitrogen oxides (NO/NO₂/NO_y), and basic meteorology.

Network means all stations of a given type or types.

NH₃ means ammonia.

NO₂ means nitrogen dioxide. NO means nitrogen oxide. NO_x means oxides of nitrogen and is defined as the sum of the concentrations of NO₂ and NO.

NO_y means the sum of all total reactive nitrogen oxides, including NO, NO₂, and other nitrogen oxides referred to as NO₂.

O₃ means ozone.

Open path analyzer means an automated analytical method that measures the average atmospheric pollutant concentration in situ along one or more monitoring paths having a monitoring path length of 5 meters or more and that has been designated as a reference or equivalent method under the provisions of part 53 of this chapter.

Optical measurement path length means the actual length of the optical beam over which measurement of the pollutant

is determined. The path-integrated pollutant concentration measured by the analyzer is divided by the optical measurement path length to determine the path-averaged concentration. Generally, the optical measurement path length is:

(1) Equal to the monitoring path length for a (bistatic) system having a transmitter and a receiver at opposite ends of the monitoring path;

(2) Equal to twice the monitoring path length for a (monostatic) system having a transmitter and receiver at one end of the monitoring path and a mirror or retroreflector at the other end; or

(3) Equal to some multiple of the monitoring path length for more complex systems having multiple passes of the measurement beam through the monitoring path.

PAMS means photochemical assessment monitoring stations.

Pb means lead.

Plan means a implementation plan approved or promulgated pursuant to section 110 of the Act.

PM_{2.5} means particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers as measured by a reference method based on appendix L of part

50 of this chapter and designated in accordance with part 53 of this chapter, by an equivalent method designated in accordance with part 53 of this chapter, or by an approved regional method designated in accordance with appendix C to this part.

PM₁₀ means particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers as measured by a reference method based on appendix J of part 50 of this chapter and designated in accordance with part 53 of this chapter or by an equivalent method designated in accordance with part 53 of this chapter.

PM_{10c} means particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers as measured by a reference method based on appendix O of part 50 of this chapter and designated in accordance with part 53 of this chapter or by an equivalent method designated in accordance with part 53 of this chapter.

PM_{10-2.5} means particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers and greater than a nominal 2.5 micrometers as measured by a reference method based on appendix O to part 50 of this chapter and designated in accordance with part 53 of this chapter or by an equivalent method designated in accordance

with part 53 of this chapter.

Point analyzer means an automated analytical method that measures pollutant concentration in an ambient air sample extracted from the atmosphere at a specific inlet probe point and that has been designated as a reference or equivalent method in accordance with part 53 of this chapter.

Population-oriented monitoring (or sites) means residential areas, commercial areas, recreational areas, industrial areas where workers from more than one company are located, and other areas where a substantial number of people may spend a significant fraction of their day.

Primary Quality Assurance Organization means a monitoring organization or other organization that is responsible for a set of stations that monitors the same pollutant and for which data quality assessments can be pooled. Each criteria pollutant sampler/monitor at a monitoring station in the SLAMS and SPM networks must be associated with one, and only one, primary quality assurance organization.

Probe means the actual inlet where an air sample is extracted from the atmosphere for delivery to a sampler or point analyzer for pollutant analysis.

PSD station means any station operated for the purpose of establishing the effect on air quality of the emissions from a proposed source for purposes of prevention of significant deterioration as required by §51.24(n) of this chapter.

Reference method means a method of sampling and analyzing the ambient air for an air pollutant that is specified as a reference method in an appendix to part 50 of this chapter, or a method that has been designated as a reference method in accordance with this part; it does not include a method for which a reference method designation has been canceled in accordance with §53.11 or §53.16 of this chapter.

Regional Administrator means the Administrator of one of the ten EPA Regional Offices or his or her authorized representative.

Reporting organization means an entity, such as a State, local, or Tribal monitoring agency, that collects and reports air quality data to EPA.

Site means a geographic location. One or more stations may be at the same site.

SLAMS means State or Local Air Monitoring Stations. The SLAMS make up the ambient air quality monitoring sites

that are primarily needed for NAAQS comparisons, but may serve other data purposes. SLAMS excludes special purpose monitor (SPM) stations and includes NCore, PAMS, and all other State or locally operated stations that have not been designated as SPM stations.

SO₂ means sulfur dioxide.

Special purpose monitor (SPM) station means a monitor included in an agency's monitoring network that the agency has designated as a special purpose monitor station in its monitoring network plan and in the Air Quality System, and which the agency does not count when showing compliance with the minimum requirements of this subpart for the number and siting of monitors of various types.

STN station means a PM_{2.5} speciation station designated to be part of the speciation trends network. This network provides chemical species data of fine particulate.

State agency means the air pollution control agency primarily responsible for development and implementation of a plan under the Act.

State Speciation Site means a supplemental PM_{2.5} speciation station that is not part of the speciation trends network.

Station means a single monitor, or a group of monitors

with a shared objective, located at a particular site.

Traceable means that a local standard has been compared and certified, either directly or via not more than one intermediate standard, to a National Institute of Standards and Technology (NIST)-certified primary standard such as a NIST-traceable Reference Material (NTRM) or a NIST-certified Gas Manufacturer's Internal Standard (GMIS).

TSP (total suspended particulates) means particulate matter as measured by the method described in appendix B of part 50 of this chapter.

VOC means volatile organic compounds.

35. Section 58.2 is amended by revising paragraph (a) introductory text and by adding paragraphs (a)(5) and (a)(6) to read as follows:

§58.2 Purpose.

(a) This part contains requirements for measuring ambient air quality and for reporting ambient air quality data and related information. The monitoring criteria pertain to the following areas:

* * * * *

(5) Minimum ambient air quality monitoring network requirements used to provide support to the State Implementation Plans, national air quality assessments, and

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policy decisions. These minimums are described as part of the network design requirements, including minimum numbers and placement of monitors of each type.

(6) Air quality data reporting, and requirements for the daily reporting of an index of ambient air quality.

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36. Section 58.3 is amended by revising paragraph (b) to read as follows:

§58.3 Applicability

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(b) Any local air pollution control agency to which the State has delegated authority to operate a portion of the State's SLAMS network.

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Subpart B--Monitoring Network

37. The heading for subpart B is revised as set forth above.

38. Sections 58.10 through 58.14 are revised to read as follows:

§58.10 Annual monitoring network plan and periodic network assessment.

(a) (1) Beginning July 1, 2007, the State, or where

applicable local, agency shall adopt and submit to the Regional Administrator an annual monitoring network plan which shall provide for the establishment and maintenance of an air quality surveillance system that consists of a network of monitoring stations including FRM, FEM, and ARM monitors that are part of SLAMS, NCore stations, STN stations, State Speciation Stations, special purpose monitoring stations, and/or, in serious, severe and extreme ozone nonattainment areas, PAMS stations. The plan shall include a statement of purpose for each monitor and a evidence that siting and operation of each monitor meets the requirements of appendices A, C, D, and E of this part, where applicable. The annual monitoring network plan must be made available for public inspection for at least 30 days prior to submission to EPA.

(2) Any annual monitoring network plan that proposes SLAMS network modifications including new monitoring sites is subject to the approval of the EPA Regional Administrator, who shall provide opportunity for public comment and shall approve or disapprove the plan and schedule within 120 days.

(3) $PM_{10-2.5}$ stations.

(i) The plan for establishing a network of $PM_{10-2.5}$

stations is due not later than January 1, 2008 as an addendum to the annual monitoring network plan required to be submitted July 1, 2007, unless the Regional Administrator extends this due date to July 1, 2008 in which case it shall be part of the annual monitoring network plan due by that date.

(ii) The plan shall provide for required $PM_{10-2.5}$ stations to be operational by January 1, 2009.

(iii) The plan shall identify whether each planned $PM_{10-2.5}$ station is suitable for comparison with the $PM_{10-2.5}$ NAAQS under the criteria of §58.30 (b), and shall include evidence for that identification including the information obtained and conclusions reached in each site-specific assessment.

(iv) Identification of existing and proposed sites as suitable for comparison against the 24-hour $PM_{10-2.5}$ NAAQS are subject to approval by the EPA Regional Administrator as part of the approval of the plan for the $PM_{10-2.5}$ monitoring network. Such approval will constitute a final action by EPA.

(4) The plan for establishing required NCore multipollutant stations is due July 1, 2009. The plan shall provide for all required stations to be operational by January 1, 2011.

(b) The annual monitoring network plan must contain cost information for the network and the following information for each existing and proposed site:

(1) The AQS site identification number.

(2) The location, including street address and geographical coordinates.

(3) The sampling and analysis method(s) for each measured parameter.

(4) The operating schedules for each monitor.

(5) Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.

(6) The monitoring objective and spatial scale of representativeness for each monitor as defined in appendix D to this part.

(7) The identification of any sites that are suitable and sites that are not suitable for comparison against the annual $PM_{2.5}$ NAAQS or 24-hour $PM_{10-2.5}$ NAAQS as described in §58.30.

(8) Information supporting the basis for determining that $PM_{10-2.5}$ sites are either suitable or not suitable for comparison to the 24-hour $PM_{10-2.5}$ NAAQS as described in §58.30 (b) .

(9) The MSA, CBSA, CSA or other area represented by the monitor.

(c) The annual monitoring network plan must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies.

(d) The annual monitoring network plan must document how States and local agencies provide for the review of changes to a PM_{2.5} monitoring network that impact the location of a violating PM_{2.5} monitor or the creation/change to a community monitoring zone, including a description of the proposed use of spatial averaging for purposes of making comparisons to the annual PM_{2.5} NAAQS as set forth in appendix N of part 50 of this chapter. The affected State or local agency must document the process for providing public hearings and include any comments received through the public notification process within their submitted plan.

(e) The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an

assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D of this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The first assessment is due July 1, 2009. For $PM_{10-2.5}$, each assessment due on or after July 1, 2014 must identify needed changes to the identification of whether each site is suitable or unsuitable for comparison to the NAAQS under the criteria of §58.30 (b), based on changes in emissions sources affecting the site or better information about these sources.

(f) All proposed additions and discontinuations of monitors in annual monitoring network plans and periodic network assessments are subject to approval according to §58.14.

§58.11 Network technical requirements.

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(a) State and local governments shall follow the applicable quality assurance criteria contained in appendix A to this part when operating the SLAMS and SPM networks. The owner or operator of an existing or a proposed source shall follow the quality assurance criteria in appendix A to this part that apply to PSD monitoring when operating a PSD site.

(b) State and local governments must follow the criteria in appendix C to this part to determine acceptable monitoring methods or instruments for use in SLAMS networks. Appendix C criteria are optional at SPM stations.

(c) State and local governments must follow the network design criteria contained in appendix D to this part in designing and maintaining the SLAMS stations. The final network design and all changes in design are subject to approval of the Regional Administrator. NCore, STN, and PAMS network design and changes are also subject to approval of the Administrator. Changes in SPM stations do not require approvals, but a change in the designation of a monitoring site from SLAMS to SPM requires approval of the Regional Administrator.

(d) State and local governments must follow the criteria contained in appendix E to this part for siting

monitor inlets, paths or probes at SLAMS stations. Appendix E adherence is optional for SPM stations that do not use appendix C methods.

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§58.12 Operating schedules.

State and local governments shall collect ambient air quality data at any SLAMS station on the following operational schedules:

(a) For continuous analyzers, consecutive hourly averages must be collected except during:

- (1) Periods of routine maintenance,
- (2) Periods of instrument calibration, or
- (3) Periods or monitoring seasons exempted by the

Regional Administrator.

(b) For Pb and PM₁₀ manual methods, at least one 24-hour sample must be collected every 6 days except during periods or seasons exempted by the Regional Administrator.

(c) For PAMS VOC samplers, samples must be collected as specified in section 5 of appendix D to this part.

Area-specific PAMS operating schedules must be included as part of the PAMS network description and must be approved by the Regional Administrator.

(d) For manual PM_{2.5} samplers,

(1) Manual PM_{2.5} samplers at other SLAMS stations must operate on at least a 1-in-3 day schedule at sites without a

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collocated continuously operating $PM_{2.5}$ monitor. For SLAMS $PM_{2.5}$ sites with both manual and continuous $PM_{2.5}$ monitors operating, the $PM_{2.5}$ manual sampler may be operated with a 1-in-6 day sampling frequency under certain conditions. A monitoring agency may request approval for a reduction to 1-in-6 day $PM_{2.5}$ sampling at SLAMS stations or for seasonal sampling from the EPA Regional Administrator. The EPA Regional Administrator may grant sampling frequency reductions after consideration of the historical $PM_{2.5}$ data quality assessments, the location of current $PM_{2.5}$ design value sites, and their regulatory data needs. Sites that have design values that are within ± 10 percent of the NAAQS; and sites where the 24-hour values exceed the NAAQS for a period of 3 years are required to maintain at least a 1-in-3 day sampling frequency.

(2) Manual $PM_{2.5}$ samplers at NCore stations and required regional background and regional transport sites must operate on at least a 1-in-3 day sampling frequency.

(3) Manual $PM_{2.5}$ speciation samplers at STN stations must operate on a 1-in-3 day sampling frequency.

(e) For manual $PM_{10-2.5}$ samplers,

(1) Manual $PM_{10-2.5}$ samplers at SLAMS stations must operate on a daily schedule at sites without a collocated

continuously operating equivalent $PM_{10-2.5}$ method that has been designated in accordance with part 53 of this chapter.

§58.13 Monitoring network completion.

(a) The network of $PM_{10-2.5}$ sites must be physically established no later than January 1, 2009, and at that time, operating under all of the requirements of this part, including the requirements of appendices A, C, D, E, and G to this part.

(b) The network of NCore multipollutant sites must be physically established no later than January 1, 2011, and at that time, operating under all of the requirements of this part, including the requirements of appendices A, C, D, E, and G to this part.

§58.14 System modification.

(a) The State, or where appropriate local, agency shall develop and implement a plan and schedule to modify the ambient air quality monitoring network that complies with the findings of the network assessments required every 5 years by §58.10(f). The State or local agency shall consult with the EPA Regional Administrator during the development of the schedule to modify the monitoring program, and shall make the plan and schedule available to the public for 30 days prior to submission to the EPA

Regional Administrator. The final plan and schedule are subject to the approval of the EPA Regional Administrator, who shall provide opportunity for public comment and shall approve or disapprove the plan and schedule within 120 days.

(b) Nothing in this section shall preclude the State, or where appropriate local, agency from making modifications to the SLAMS network for reasons other than those resulting from the periodic network assessments. These modifications must be reviewed and approved by the Regional Administrator. Each monitoring network may make or be required to make changes between the 5-year assessment periods, including for example, site relocations or the addition of PAMS networks in bumped-up ozone nonattainment areas. The State, or where appropriate local, agency shall provide written communication describing the network changes to the Regional Administrator for review and approval as these changes are identified.

(c) State, or where appropriate, local agency requests for monitor station discontinuation, subject to the review of the Regional Administrator, will be approved if any of the following criteria are met. Other requests for discontinuation may also be approved on a case by case basis if discontinuance does not compromise data collection needed

for implementation of a NAAQS.

(1) Any $PM_{2.5}$, O_3 , CO , PM_{10} , SO_2 , Pb , or NO_2 monitor which has shown attainment during the previous five years, that has a probability of less than 10 percent of exceeding 80 percent of the applicable NAAQS during the next three years based on the levels, trends, and variability observed in the past, and which is not specifically required by an attainment plan or maintenance plan.

(2) Any monitor for CO , PM_{10} , SO_2 , or NO_2 which has consistently measured lower concentrations than another monitor for the same pollutant in the same county and same nonattainment area during the previous five years, and which is not specifically required by an attainment plan or maintenance plan, if control measures scheduled to be implemented or discontinued during the next five years would apply to the areas around both monitors and have similar effects on measured concentrations, such that the retained monitor would remain the higher reading of the two monitors being compared.

(3) For any pollutant, the highest reading monitor (which may be the only monitor) in a county (or portion of a county within a distinct nonattainment or maintenance area) provided the monitor has not measured violations of the

applicable NAAQS in the previous five years, the MSA or CSA within which the county lies (if in any) would still meet requirements for the minimum number of monitors for the applicable pollutant if any, and the approved SIP provides for a specific, reproducible approach to representing the air quality of the affected county in the absence of actual monitoring data.

(4) A monitor which EPA has determined cannot be compared to the relevant NAAQS because of the siting of the monitor, in accordance with §58.30.

(5) A monitor that is designed to measure concentrations upwind of an urban area for purposes of characterizing transport into the area and that has not recorded violations of the relevant NAAQS in the previous five years, if discontinuation of the monitor is tied to start-up of another station also characterizing transport.

39. Sections 58.15 and 58.16 are added to read as follows:

§58.15 Annual air monitoring data certification.

(a) Beginning May 1, 2009, the State, or where appropriate local, agency shall submit to the EPA Regional Administrator an annual air monitoring data certification letter to certify data collected at all SLAMS and at all SPM

stations that meet appendix C and appendix E criteria from January 1 to December 31 of the previous year. The senior air pollution control officer in each agency, or their designee, shall certify that the previous year of ambient concentration and quality assurance data are completely submitted to AQS and that the ambient concentration data are accurate to the best of her or his knowledge, taking into consideration the quality assurance findings.

(b) Along with each certification letter, the State shall submit to the Administrator (through the appropriate Regional Office) an annual summary report of all the ambient air quality data from all monitoring stations designated as SLAMS. The State also shall submit an annual summary to the appropriate Regional Administrator of all the ambient air quality monitoring data from all FRM, FEM, and ARM at SPM stations that are described in the State's current monitoring network description. The annual report(s) shall be submitted for data collected from January 1 to December 31 of the previous year. The annual summary report(s) must contain all information and data required by the State's approved plan and be submitted by July 1 of each year, unless an approved alternative date is included in the plan. The annual summary serves as the record of the specific data

that is the object of the certification letter.

§58.16 Data submittal.

(a) The State, or where appropriate, local agency, shall report to the Administrator, via AQS all ambient air quality data and associated quality assurance data for SO₂, CO, O₃, NO₂, NO, NO_y, Pb, PM₁₀, PM_{2.5} mass concentration, for filter-based PM_{2.5} FRM/FEM (field blank mass, sampler-generated average daily temperature, sampler-generated average daily pressure), chemically speciated PM_{2.5} mass concentration data, PM_{10-2.5} (mass concentration and chemically speciated data), meteorological data from NCore and PAMS sites, and metadata records and information specified by the AQS Data Coding Manual (www.epa.gov/ttn/airs/airsaqs/manuals/manuals.htm). Such air quality data and information must be submitted directly to the AQS via electronic transmission on the specified quarterly schedule described in paragraph (b) of this section.

(b) The specific quarterly reporting periods are January 1-March 31, April 1-June 30, July 1-September 30, and October 1-December 31. The data and information reported for each reporting period must contain all data and information gathered during the reporting period, and be

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received in the AQS within 90 days after the end of the quarterly reporting period. For example, the data for the reporting period January 1-March 31 are due on or before June 30 of that year.

(c) Air quality data submitted for each reporting period must be edited, validated, and entered into the AQS (within the time limits specified in paragraph (b) of this section) pursuant to appropriate AQS procedures. The procedures for editing and validating data are described in the AQS Data Coding Manual and in each monitoring agency's quality assurance project plan.

(d) The State shall report VOC and if collected, carbonyl, NH_3 , and HNO_3 data, from PAMS sites to AQS within 6 months following the end of each quarterly reporting period listed in paragraph (b) of this section.

(e) The State shall also submit any portion or all of the SLAMS and SPM data to the appropriate Regional Administrator upon request.

Subpart C--Special Purpose Monitors

40. The heading for subpart C is revised as set forth above.

41. Section 58.20 (including the heading) is revised to read as follows:

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§58.20 Special purpose monitors (SPM).

(a) A SPM is defined as any monitor included in an agency's monitoring network that the agency has designated as a special purpose monitor in its annual monitoring network plan and in AQS, and which the agency does not count when showing compliance with the minimum requirements of this subpart for the number and siting of monitors of various types. Any SPM operated by an air monitoring agency must be included in the periodic assessments and annual monitoring network plan required by §58.10. The plan shall include a statement of purpose for each SPM monitor and a evidence that siting and operation of each monitor meets the requirements of appendix A where applicable. The monitoring agency may designate a monitor as an SPM after January 1, 2007 only if it is a new monitor not previously included in the monitoring plan.

(b) Any SPM data collected by an air monitoring agency using a federal reference method, equivalent method, or approved regional method must meet the requirements of §58.11, §58.12, and appendices A and C to this part. Compliance with appendix E to this part is optional but encouraged except when the monitoring agency's data objectives are inconsistent with those requirements. Data

collected at an SPM meeting these requirements must be submitted to AQS according to the requirements of §58.16. The monitoring agency must also submit to AQS an indication of whether the monitor meets the requirements of appendix E to this part.

(c) All data from an SPM using a Federal reference method, equivalent method, or approved regional method which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the conditions of §58.30, unless the air monitoring agency demonstrates in the documentation required in paragraph (a) of this section that the data from a particular period does not meet the requirements in paragraph (b) of this section.

(d) If an SPM using a Federal reference method, equivalent method, or approved regional method is discontinued within 24 months of start-up, the Administrator will not use data from the SPM for NAAQS violation determinations for the $PM_{2.5}$, $PM_{10-2.5}$, ozone, or the annual PM_{10} NAAQS.

(e) If an SPM using a Federal reference method, equivalent method, or approved regional method is discontinued within 24 months of start-up, the Administrator will not use data from the SPM for NAAQS violation

determinations for purposes of designating an area as nonattainment, for the CO, SO₂, NO₂, Pb, or 24-hour PM₁₀ NAAQS. Such data is eligible for use in determinations of whether a nonattainment area has attained one of these NAAQS.

(f) Prior approval from EPA is not required for discontinuance of an SPM.

42. Sections 58.21 through 58.28 are removed.

Subpart D-Comparability of Ambient Data to NAAQS

43. The heading for subpart D is revised as set forth above.

44. Section 58.30 is revised to read as follows:

§58.30 Special considerations for data comparisons to the NAAQS.

(a) Comparability of PM_{2.5} data.

(1) There are two forms of the PM_{2.5} NAAQS described in part 50 of this chapter. The PM_{2.5} monitoring site characteristics impact how the resulting PM_{2.5} data can be compared to the annual PM_{2.5} NAAQS form. PM_{2.5} data that are representative, not of areawide but rather, of relatively unique population-oriented microscale, or localized hot spot, or unique population-oriented middle-scale impact

sites are only eligible for comparison to the 24-hour $PM_{2.5}$ NAAQS. For example, if the $PM_{2.5}$ monitoring site is adjacent to a unique dominating local $PM_{2.5}$ source or can be shown to have average 24-hour concentrations representative of a smaller than neighborhood spatial scale, then data from a monitor at the site would only be eligible for comparison to the 24-hour $PM_{2.5}$ NAAQS.

(2) There are cases where certain population-oriented, microscale or middle scale $PM_{2.5}$ monitoring sites are determined by the Regional Administrator to collectively identify a larger region of localized high ambient $PM_{2.5}$ concentrations. In those cases, data from these population-oriented sites would be eligible for comparison to the annual $PM_{2.5}$ NAAQS.

(b) Comparability of $PM_{10-2.5}$ data.

To be eligible (or suitable) for comparison to the $PM_{10-2.5}$ NAAQS, $PM_{10-2.5}$ data must be from a monitoring site that meets all five of the following conditions.

(1) The site must be within the boundaries of an urbanized area as defined by the U.S. Bureau of the Census.

(2) The site must be in census block group with a population density of 500 or more persons per square mile. Alternatively, the site may be in a census block group with

a lower population density if the block group is part of an enclave that is not more than five square miles in land area.

(3) The site must be population-oriented.

(4) The site may not be in a source-influenced microenvironments (such as microscale or localized hot spot sites) not eligible for comparison to the annual $PM_{2.5}$ NAAQS under the conditions of paragraph (b). For example, if the $PM_{10-2.5}$ monitoring site is located on the fenceline of a dominating local $PM_{10-2.5}$ source, then data from a monitor at the site would not be eligible for comparison to the 24-hour $PM_{10-2.5}$ NAAQS.

(5) $PM_{10-2.5}$ concentrations at the site must be dominated by coarse fraction particulate matter generated by high density traffic on paved roads, industrial sources, and construction activities, and must not be dominated by rural windblown dust and soils and agricultural and mining sources, as determined by the State (and approved by the Regional Administrator) in a site-specific assessment.

45. Sections 58.31 through 58.36 are removed.

Subpart E--[Reserved]

46. Subpart E of part 58 is removed and reserved.

Subpart F--[Amended]

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47. Section 58.50 is revised to read as follows:

§58.50 Index reporting.

(a) The State or where applicable, local agency shall report to the general public on a daily basis through prominent notice an air quality index that complies with the requirements of appendix G to this part.

(b) Reporting is required for all individual MSA with a population exceeding 350,000.

(c) The population of a MSA for purposes of index reporting is the most recent decennial U.S. census population.

Subpart G-- [Amended]

48. Section 58.60 is amended to read as follows:

§58.60 Federal monitoring.

The Administrator may locate and operate an ambient air monitoring site if the State or local agency fails to locate, or schedule to be located, during the initial network design process, or as a result of the 5-year network assessments required within §58.10, a SLAMS station at a site which is necessary in the judgement of the Regional Administrator to meet the objectives defined in appendix D to this part.

49. Appendix A to part 58 is revised to read as

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follows:

**Appendix A to Part 58--Quality Assurance Requirements for
SLAMS, NCore, and Prevention of Significant Deterioration
(PSD) Air Monitoring**

- 1.0 General Information.
- 2.0 Quality System Requirements.
- 3.0 Measurement Quality Check Requirements.
- 4.0 Calculations for Data Quality Assessments.
- 5.0 Reporting Requirements.
- 6.0 References.

1. General Information.

This appendix specifies the minimum quality system requirements applicable to SLAMS air monitoring data and PSD data submitted to EPA. In this section, NCore stations and SPM stations (using FRM, FEM, or ARM methods) will be considered a subset of the SLAMS network. Monitoring organizations are encouraged to develop and maintain quality systems more extensive than the required minimums. The permit-granting authority for PSD may require more frequent or more stringent requirements. Monitoring organizations may, based on their quality objectives, be required to develop and maintain quality systems beyond the required minimum. Additional guidance for the requirements reflected in this appendix can be found in the "Quality Assurance Handbook for Air Pollution Measurement Systems", volume II,

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part 1 (see reference 10 of this appendix) and at a national level in references 1, 2, and 3 of this appendix.

1.1 Similarities and Differences Between SLAMS and PSD Monitoring. In most cases, the quality assurance requirements for SLAMS and PSD are the same. Table A-1 of this appendix summarizes the major similarities and differences of the requirements for SLAMS and PSD. Both programs require:

- (a) the development, documentation, and implementation of an approved quality system;
- (b) the assessment of data quality;
- (c) the use of reference, equivalent, or approved methods (optional for SPM);
- (d) the use of calibration standards traceable to NIST or other primary standard;
- (e) Performance evaluations and systems.

1.1.1 The monitoring and quality assurance responsibilities for SLAMS are with the State or local agency, hereafter called the monitoring organization, whereas for PSD they are with the owner/operator seeking the permit. The monitoring duration for SLAMS is indefinite, whereas for PSD the duration is usually 12 months. Whereas the reporting period for precision and accuracy data is on

an annual or calendar quarter basis for SLAMS, it is on a continuing sampler quarter basis for PSD - since the monitoring may not commence at the beginning of a calendar quarter.

1.1.2 The performance evaluations for PSD must be conducted by personnel different from those who perform routine span checks and calibrations, whereas for SLAMS, it is the preferred but not the required condition. For PSD, the evaluation rate is 100 percent of the sites per reporting quarter whereas for SLAMS it is 25 percent of the sites or instruments quarterly. Note that monitoring for sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) for PSD must be done with automated analyzers--the manual bubbler methods are not permitted.

1.1.3 The requirements for precision assessment for the automated methods are the same for both SLAMS and PSD. However, for manual methods, only one collocated site is required for PSD.

1.1.4 The precision, accuracy and bias data for PSD are reported separately for each sampler (site), whereas for SLAMS, the report may be by sampler (site) or primary quality assurance organization, depending on the pollutant. SLAMS data are required to be reported to the Air Quality

System (AQS), PSD data are required to be reported to the permit-granting authority. Requirements in this appendix, with the exception to the differences discussed in this section, and in Table A-1 of this appendix will be expected to be followed by both SLAMS and PSD networks unless directly specified in a particular section.

1.2 Measurement Uncertainty. Measurement uncertainty is a term used to describe deviations from a true concentration or estimate that are related to the measurement process and not to spatial or temporal population attributes of the air being measured. Monitoring organizations must develop quality assurance project plans (QAPP) which describe how the organization intends to control measurement uncertainty to an appropriate level in order to achieve the data quality objectives. Data quality indicators associated with measurement uncertainty include:

(a) Precision. A measurement of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, expressed generally in terms of the standard deviation.

(b) Bias. The systematic or persistent distortion of a measurement process which causes errors in one direction.

(c) Accuracy. The degree of agreement between an

observed value and an accepted reference value. Accuracy includes a combination of random error (imprecision) and systematic error (bias) components which are due to sampling and analytical operations.

(d) Completeness. A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

(e) Detectability. The low critical range value of a characteristic that a method specific procedure can reliably discern.

1.3 Measurement Quality Checks. The SLAMS measurement quality checks described in sections 3.2 and 3.3 of this appendix shall be reported to AQS and are included in the data required for certification. The PSD network is required to implement the measurement quality checks and submit this information quarterly along with assessment information to the permit-granting authority.

1.4 Assessments and Reports. Periodic assessments and documentation of data quality are required to be reported to EPA or to the permit granting authority (PSD). To provide national uniformity in this assessment and reporting of data quality for all networks, specific assessment and reporting

procedures are prescribed in detail in sections 3, 4, and 5 of this appendix. On the other hand, the selection and extent of the quality assurance and quality control activities used by a monitoring organization depend on a number of local factors such as field and laboratory conditions, the objectives for monitoring, the level of data quality needed, the expertise of assigned personnel, the cost of control procedures, pollutant concentration levels, etc. Therefore, quality system requirements in section 2 of this appendix are specified in general terms to allow each monitoring organization to develop a quality system that is most efficient and effective for its own circumstances while achieving the data quality objectives required for the SLAMS sites.

2. Quality System Requirements.

A quality system is the means by which an organization manages the quality of the monitoring information it produces in a systematic, organized manner. It provides a framework for planning, implementing, assessing and reporting work performed by an organization and for carrying out required quality assurance and quality control activities.

2.1 Quality Management Plans and Quality Assurance

Project Plans. All monitoring organizations must develop a quality system that is described and approved in quality management plans (QMP) and QAPP to ensure that the monitoring results:

- (a) meet a well-defined need, use, or purpose;
- (b) provide data of adequate quality for the intended monitoring objectives;
- (c) satisfy stakeholder expectations;
- (d) comply with applicable standards specifications;
- (e) comply with statutory (and other) requirements of society; and
- (f) reflect consideration of cost and economics.

2.1.1 The QMP describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, assessing and reporting activities involving environmental data operations (EDO). The QMP must be suitably documented in accordance with EPA requirements (reference 2 of this appendix), and approved by the appropriate Regional Administrator, or Regional Administrator's designee. The quality system will be reviewed during the systems audits described in section 2.5 of this appendix. Organizations that implement long-

term monitoring programs with EPA funds should have a separate QMP document. Smaller organizations or organizations that do infrequent work with EPA funds may combine the QMP with the QAPP based on negotiations with the funding agency. Additional guidance on this process can be found in reference 10 of this appendix. Approval of the recipient's QMP by the appropriate Regional Administrator, or the Regional Administrator's designee, may allow delegation of the authority to review and approve QAPP to the recipient, based on adequacy of quality assurance procedures described and documented in the QMP. The QAPP will be reviewed by EPA during systems audits or circumstances related to data quality.

2.1.2 The QAPP is a formal document describing, in sufficient detail, the quality system that must be implemented to ensure that the results of work performed will satisfy the stated objectives. The quality assurance policy of the EPA requires every EDO to have written and approved QAPP prior to the start of the EDO. It is the responsibility of the monitoring organization to adhere to this policy. The QAPP must be suitably documented in accordance with EPA requirements (reference 3 of this appendix).

2.1.3 The monitoring organizations' quality system must have adequate resources both in personnel and funding to plan, implement, assess and report on the achievement of the requirements of this appendix and its approved QAPP.

2.2 Independence of Quality Assurance. The monitoring organization must provide for a quality assurance management function; that aspect of the overall management system of the organization that determines and implements the quality policy defined in a monitoring organization's QMP. Quality management includes strategic planning, allocation of resources and other systematic planning activities (e.g. planning, implementation, assessing and reporting) pertaining to the quality system. The quality assurance management function must have sufficient technical expertise and management authority to conduct independent oversight and assure the implementation of the organization's quality system relative to the Ambient Air Quality Monitoring Program and should be organizationally independent of environmental data generation activities.

2.3. Data Quality Performance Requirements

2.3.1 Data Quality Objectives. Data quality objectives (DQO) or the results of other systematic planning processes are statements that define the appropriate type of

data to collect and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the objectives of the SLAMS stations. DQO will be developed by EPA to support the primary SLAMS objectives for each criteria pollutant. As they are developed they will be added to the regulation. DQO or the results of other systematic planning processes for PSD or other monitoring will be the responsibility of the monitoring organizations. The quality of the conclusions made from data interpretation can be affected by population uncertainty (spatial or temporal uncertainty) and measurement uncertainty (uncertainty associated with collecting, analyzing, reducing and reporting concentration data). This appendix focuses on assessing and controlling measurement uncertainty.

2.3.1.1 Measurement Uncertainty for Automated and Manual PM_{2.5} Methods. The goal for acceptable measurement uncertainty is defined as 10 percent coefficient of variation (CV) for total precision and ± 10 percent for total bias.

2.3.1.2 Measurement Uncertainty for Automated Ozone Methods. The goal for acceptable measurement uncertainty is defined for precision as an upper 95 percent confidence

limit for the coefficient variation (CV) of 7 percent and for bias as an upper 95 percent confidence limit for the absolute bias of 7 percent.

2.3.1.3 Measurement Uncertainty for PM_{10-2.5} Methods.

The goal for acceptable measurement uncertainty is defined for precision as an upper 95 percent confidence limit for the coefficient variation (CV) of 15 percent and for bias as an upper 95 percent confidence limit for the absolute bias of 15 percent.

2.4 National Performance Evaluation Programs.

Monitoring plans or QAPP shall provide for the implementation of a program of independent and adequate audits of all monitors providing data for SLAMS and PSD including the provision of adequate resources for such audit programs. A monitoring plan (or QAPP) which provides for monitoring organization participation in EPA's National Performance Audit Program (NPAP) and the PM Performance Evaluation Program (PEP) program and which indicates the consent of the monitoring organization for EPA to apply an appropriate portion of the grant funds, which EPA would otherwise award to the monitoring organization for monitoring activities, will be deemed by EPA to meet this requirement. For clarification and to participate,

monitoring organizations should contact either the appropriate EPA Regional Quality Assurance (QA) Coordinator at the appropriate EPA Regional Office location, or the NPEP Coordinator, Emissions Monitoring and Analysis Division (D205-02), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

2.5 Technical Systems Audit Program. Technical systems audits of each ambient air monitoring organization shall be conducted at least every 3 years by the appropriate EPA Regional Office and reported to the AQS. Systems audit programs are described in reference 10 of this appendix. For further instructions, monitoring organizations should contact the appropriate EPA Regional QA Coordinator.

2.6 Gaseous and Flow Rate Audit Standards.

2.6.1 Gaseous pollutant concentration standards (permeation devices or cylinders of compressed gas) used to obtain test concentrations for carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxide (NO), and nitrogen dioxide (NO₂) must be traceable to either a National Institute of Standards and Technology (NIST) Traceable Reference Material (NTRM) or a NIST-certified Gas Manufacturer's Internal Standard (GMIS), certified in accordance with one of the procedures given in reference 4 of this appendix. Vendors

advertising certification with the procedures provided in reference 4 of this appendix and distributing gasses as "EPA Protocol Gas" must participate in the EPA Protocol Gas Verification Program or not use "EPA" in any form of advertising.

2.6.2 Test concentrations for ozone (O_3) must be obtained in accordance with the ultra violet photometric calibration procedure specified in appendix D to part 50 of this chapter, or by means of a certified O_3 transfer standard. Consult references 7 and 8 of this appendix for guidance on primary and transfer standards for O_3 .

2.6.3 Flow rate measurements must be made by a flow measuring instrument that is traceable to an authoritative volume or other applicable standard. Guidance for certifying some types of flowmeters is provided in reference 10 of this appendix.

2.7 Primary Requirements and Guidance. Requirements and guidance documents for developing the quality system are contained in references 1 through 10 of this appendix, which also contain many suggested procedures, checks, and control specifications. Reference 10 of this appendix describes specific guidance for the development of a quality system for SLAMS. Many specific quality control checks and

specifications for methods are included in the respective reference methods described in part 50 of this chapter or in the respective equivalent method descriptions available from EPA (reference 6 of this appendix). Similarly, quality control procedures related to specifically designated reference and equivalent method analyzers are contained in the respective operation or instruction manuals associated with those analyzers.

3. Measurement Quality Check Requirements.

This section provides the requirements for performing the measurement quality checks that can be used to assess data quality and with the exception of the flow rate verifications (sections 3.2.3 and 3.3.2 of this appendix) are required to be submitted to the AQS within the same time frame requirements as routine data. Section 3.2 of this appendix describes checks of automated or continuous instruments while section 3.3 describe checks associated with manual sampling instruments. Other quality control samples are identified in the various references described earlier and can be used to control certain aspects of the measurement system.

3.1 Primary Quality Assurance Organization. Estimates of data quality will be calculated on the basis of single

monitors, and primary quality assurance organizations. A primary quality assurance organization is defined as a monitoring organization or other organization that is responsible for a set of stations that monitors the same pollutant and for which data quality assessments can be pooled. Each criteria pollutant sampler/monitor at a monitoring station in the SLAMS network must be associated with one, and only one, primary quality assurance organization.

3.1.1 Each primary quality assurance organization shall be defined such that measurement uncertainty among all stations in the organization can be expected to be reasonably homogeneous, as a result of common factors. Common factors that should be considered by monitoring organizations in defining primary quality assurance organizations include:

- (a) operation by a common team of field operators according to a common set of procedures;
- (b) use of a common QAPP or standard operating procedures;
- (c) common calibration facilities and standards;
- (d) oversight by a common quality assurance organization; and

(e) support by a common management, laboratory or headquarters.

3.1.2 Primary quality assurance organizations are not necessarily related to the organization reporting data to the AQS. Monitoring organizations having difficulty in defining the primary quality assurance organizations or in assigning specific sites to primary quality assurance organizations should consult with the appropriate EPA Regional Office. All definitions of primary quality assurance organizations shall be subject to final approval by the appropriate EPA Regional Office during scheduled network reviews or systems audits.

3.1.3 Assessment results shall be reported as specified in section 5 of this appendix.

3.2 Measurement Quality Checks of Automated Methods. Table A-2 of this appendix provides a summary of the types and frequency of the measurement quality checks that will be described in this section.

3.2.1 One-Point Quality Control Check for SO₂, NO₂, O₃, and CO. A one-point quality control (QC) check must be performed at least once every 2 weeks on each automated analyzer used to measure SO₂, NO₂, O₃ and CO. The frequency of QC checks may be reduced based upon review, assessment

and approval of the EPA Regional Administrator. However, with the advent of automated calibration systems more frequent checking is encouraged. See Reference 10 of this appendix for guidance on the review procedure. The QC check is made by challenging the analyzer with a QC check gas of known concentration (effective concentration for open path analyzers) between 0.01 and 0.10 parts per million (ppm) for SO₂, NO₂, and O₃, and between 1 and 10 ppm for CO analyzers. The ranges allow for appropriate check gas selection for SLAMS sites that may be sampling for different objectives, i.e., trace gas monitoring vs. comparison to National Ambient Air Quality Standards (NAAQS). It is suggested that the QC check gas concentration selected should be related to the routine concentrations normally measured at sites within the monitoring network in order to appropriately reflect the precision and bias at these routine concentration ranges. To check the precision and bias of SLAMS analyzers operating at ranges either above or below the levels identified, use check gases of appropriate concentrations as approved by the appropriate EPA Regional Administrator or their designee. The standards from which check concentrations are obtained must meet the specifications of section 2.6 of this appendix.

3.2.1.1 Except for certain CO analyzers described below, point analyzers must operate in their normal sampling mode during the QC check, and the test atmosphere must pass through all filters, scrubbers, conditioners and other components used during normal ambient sampling and as much of the ambient air inlet system as is practicable. If permitted by the associated operation or instruction manual, a CO point analyzer may be temporarily modified during the QC check to reduce vent or purge flows, or the test atmosphere may enter the analyzer at a point other than the normal sample inlet, provided that the analyzer's response is not likely to be altered by these deviations from the normal operational mode. If a QC check is made in conjunction with a zero or span adjustment, it must be made prior to such zero or span adjustments.

3.2.1.2 Open path analyzers are tested by inserting a test cell containing a QC check gas concentration into the optical measurement beam of the instrument. If possible, the normally used transmitter, receiver, and as appropriate, reflecting devices should be used during the test and the normal monitoring configuration of the instrument should be altered as little as possible to accommodate the test cell for the test. However, if permitted by the associated

operation or instruction manual, an alternate local light source or an alternate optical path that does not include the normal atmospheric monitoring path may be used. The actual concentration of the QC check gas in the test cell must be selected to produce an effective concentration in the range specified earlier in this section. Generally, the QC test concentration measurement will be the sum of the atmospheric pollutant concentration and the QC test concentration. If so, the result must be corrected to remove the atmospheric concentration contribution. The corrected concentration is obtained by subtracting the average of the atmospheric concentrations measured by the open path instrument under test immediately before and immediately after the QC test from the QC check gas concentration measurement. If the difference between these before and after measurements is greater than 20 percent of the effective concentration of the test gas, discard the test result and repeat the test. If possible, open path analyzers should be tested during periods when the atmospheric pollutant concentrations are relatively low and steady.

3.2.1.3 Report the audit concentration (effective concentration for open path analyzers) of the QC gas and the

corresponding measured concentration (corrected concentration, if applicable, for open path analyzers) indicated by the analyzer. The percent differences between these concentrations are used to assess the precision and bias of the monitoring data as described in sections 4.1.2 (precision) and 4.1.3 (bias) of this appendix.

3.2.2 Performance evaluation for SO₂, NO₂, O₃, or CO. Each calendar quarter (during which analyzers are operated), evaluate at least 25 percent of the SLAMS analyzers that monitor for SO₂, NO₂, O₃, or CO such that each analyzer is evaluated at least once per year. If there are fewer than four analyzers for a pollutant within a primary quality assurance organization, it is suggested to randomly evaluate one or more analyzers so that at least one analyzer for that pollutant is evaluated each calendar quarter. Where possible, EPA strongly encourages more frequent evaluations, up to a frequency of once per quarter for each SLAMS analyzer. It is also suggested that the evaluation be conducted by a trained experienced technician other than the routine site operator.

3.2.2.1 The evaluation is made by challenging the analyzer with audit gas standard of known concentration (effective concentration for open path analyzers) from at

least three consecutive ranges that are applicable to the analyzer being evaluated:

Audit level	Concentration range, ppm			
	O ₃	SO ₂ ,	NO ₂	CO
1.....	0.02-0.05	0.0003-0.005	0.0002-0.002	0.08-0.10
2.....	0.06-0.10	0.006-0.01	0.003-0.005	0.50-1.00
3.....	0.11-0.20	0.02-0.10	0.006-0.10	1.50-4.00
4.....	0.21-0.30	0.11-0.40	0.11-0.30	5-15
5.....	0.31-0.90	0.41-0.90	0.31-0.60	20-50

An additional 4th range is encouraged for those monitors that have the potential for exceeding the concentration ranges described by the initial three selected.

3.2.2.2 NO₂ audit gas for chemiluminescence-type NO₂ analyzers must also contain at least 0.08 ppm NO. NO concentrations substantially higher than 0.08 ppm, as may occur when using some gas phase titration (GPT) techniques, may lead to evaluation errors in chemiluminescence analyzers due to inevitable minor NO-NO_x channel imbalance. Such errors may be atypical of routine monitoring errors to the extent that such NO concentrations exceed typical ambient NO concentrations at the site. These errors may be minimized by modifying the GPT technique to lower the NO concentrations remaining in the NO₂ audit gas to levels

closer to typical ambient NO concentrations at the site.

To evaluate SLAMS analyzers operating on ranges higher than 0 to 1.0 ppm for SO₂, NO₂, and O₃ or 0 to 50 ppm for CO, use audit gases of appropriately higher concentration as approved by the appropriate EPA Regional Administrator or the Administrators's designee.

3.2.2.3 The standards from which audit gas test concentrations are obtained must meet the specifications of section 2.6 of this appendix. The gas standards and equipment used for evaluations must not be the same as the standards and equipment used for calibration or calibration span adjustments. For SLAMS sites, the auditor should not be the operator or analyst who conducts the routine monitoring, calibration, and analysis. For PSD sites the auditor must not be the operator or analyst who conducts the routine monitoring, calibration, and analysis.

3.2.2.4 For point analyzers, the evaluation shall be carried out by allowing the analyzer to analyze the audit gas test atmosphere in its normal sampling mode such that the test atmosphere passes through all filters, scrubbers, conditioners, and other sample inlet components used during normal ambient sampling and as much of the ambient air inlet system as is practicable. The exception provided in section

3.2.1 of this appendix for certain CO analyzers does not apply for evaluations.

3.2.2.5 Open path analyzers are evaluated by inserting a test cell containing the various audit gas concentrations into the optical measurement beam of the instrument. If possible, the normally used transmitter, receiver, and, as appropriate, reflecting devices should be used during the evaluation, and the normal monitoring configuration of the instrument should be modified as little as possible to accommodate the test cell for the evaluation. However, if permitted by the associated operation or instruction manual, an alternate local light source or an alternate optical path that does not include the normal atmospheric monitoring path may be used. The actual concentrations of the audit gas in the test cell must be selected to produce effective concentrations in the evaluation level ranges specified in this section of this appendix. Generally, each evaluation concentration measurement result will be the sum of the atmospheric pollutant concentration and the evaluation test concentration. If so, the result must be corrected to remove the atmospheric concentration contribution. The corrected concentration is obtained by subtracting the

average of the atmospheric concentrations measured by the open path instrument under test immediately before and immediately after the evaluation test (or preferably before and after each evaluation concentration level) from the evaluation concentration measurement. If the difference between the before and after measurements is greater than 20 percent of the effective concentration of the test gas standard, discard the test result for that concentration level and repeat the test for that level. If possible, open path analyzers should be evaluated during periods when the atmospheric pollutant concentrations are relatively low and steady. Also, the monitoring path length must be reverified to within ± 3 percent to validate the evaluation, since the monitoring path length is critical to the determination of the effective concentration.

3.2.2.6 Report both the evaluation concentrations (effective concentrations for open path analyzers) of the audit gases and the corresponding measured concentration (corrected concentrations, if applicable, for open path analyzers) indicated or produced by the analyzer being tested. The percent differences between these concentrations are used to assess the quality of the monitoring data as described in section 4.1.4 of this

appendix.

3.2.3 Flow Rate Verification for Particulate Matter.

A one-point flow rate verification check must be performed at least once every month on each automated analyzer used to measure PM_{10} , $PM_{10-2.5}$ and $PM_{2.5}$. The verification is made by checking the operational flow rate of the analyzer. If the verification is made in conjunction with a flow rate adjustment, it must be made prior to such flow rate adjustment. Randomization of the flow rate verification with respect to time of day, day of week, and routine service and adjustments is encouraged where possible. For the standard procedure, use a flow rate transfer standard certified in accordance with section 2.6 of this appendix to check the analyzer's normal flow rate. Care should be used in selecting and using the flow rate measurement device such that it does not alter the normal operating flow rate of the analyzer. Report the flow rate of the transfer standard and the corresponding flow rate measured (indicated) by the analyzer. The percent differences between the audit and measured flow rates are used to assess the bias of the monitoring data as described in section 4.2.2 of this appendix (using flow rates in lieu of concentrations).

3.2.4 Semi-Annual Flow Rate Audit for Particulate

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Matter. Every 6 months, audit the flow rate of the PM₁₀, PM_{10-2.5} and PM_{2.5} particulate analyzers. Where possible, EPA strongly encourages more frequent auditing. It is also suggested that the audit be conducted by a trained experienced technician other than the routine site operator. The audit is made by measuring the analyzer's normal operating flow rate using a flow rate transfer standard certified in accordance with section 2.6 of this appendix. The flow rate standard used for auditing must not be the same flow rate standard used to calibrate the analyzer. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Great care must be used in auditing the flow rate to be certain that the flow measurement device does not alter the normal operating flow rate of the analyzer. Report the audit flow rate of the transfer standard and the corresponding flow rate measured (indicated) by the analyzer. The percent differences between these flow rates are used to validate the one-point flow rate verification checks used to estimate bias as described in section 4.2.3 of this appendix.

3.2.5 Collocated Procedures for PM_{10-2.5} and PM_{2.5}. For each pair of collocated monitors, designate one sampler as

the primary monitor whose concentrations will be used to report air quality for the site, and designate the other as the audit monitor.

3.2.5.1 Each EPA designated Federal reference method (FRM) or Federal equivalent method (FEM) within a primary quality assurance organization must:

(a) Have 15 percent of the monitors collocated (values of .5 and greater round up); and

(b) Have at least 1 collocated monitor (if the total number of monitors is less than 3). The first collocated monitor must be a designated FRM monitor.

3.2.5.2 In addition, monitors selected for collocation must also meet the following requirements:

(a) A primary monitor designated as an EPA FRM shall be collocated with an audit monitor having the same EPA FRM method designation.

(b) For each primary monitor designated as an EPA FEM, 50 percent of the monitors designated for collocation shall be collocated with an audit monitor having the same method designation and 50 percent of the monitors shall be collocated with an FRM audit monitor. If the primary quality assurance organization only has one FEM monitor it shall be collocated with an FRM audit monitor. If there are

an odd number of collocated monitors required, the additional monitor shall be an FRM audit monitor. An example of this procedure is found in Table A-3 of this appendix.

3.2.5.3 The collocated monitors should be deployed according to the following protocol:

(a) 80 percent of the collocated audit monitors should be deployed at sites with annual average or daily concentrations estimated to be within ± 20 percent of the applicable NAAQS and the remainder at what the monitoring organizations designate as high value sites;

(b) If an organization has no sites with annual average or daily concentrations within ± 20 percent of the annual NAAQS (or 24-hour NAAQS if that is affecting the area), 60 percent of the collocated audit monitors should be deployed at those sites with the annual mean concentrations (or 24-hour NAAQS if that is affecting the area) among the highest 25 percent for all sites in the network.

3.2.5.4 In determining the number of collocated sites required for $PM_{2.5}$, monitoring networks for visibility assessments should not be treated independently from networks for particulate matter, as the separate networks may share one or more common samplers. However, for Class I

visibility areas, EPA will accept visibility aerosol mass measurement instead of a $PM_{2.5}$ measurement if the latter measurement is unavailable. Any $PM_{2.5}$ monitoring site which does not have a monitor which is an EPA FRM or FEM is not required to be included in the number of sites which are used to determine the number of collocated monitors.

3.2.5.5 For each PSD monitoring network, one site must be collocated. A site with the predicted highest 24-hour pollutant concentration must be selected.

3.2.5.6 The two collocated monitors must be within 4 meters of each other and at least 2 meters apart for flow rates greater than 200 liters/min or at least 1 meter apart for samplers having flow rates less than 200 liters/min to preclude airflow interference. Calibration, sampling, and analysis must be the same for both collocated samplers and the same as for all other samplers in the network.

3.2.5.7 Sample the collocated audit monitor for SLAMS sites on a 12-day schedule; sample PSD sites on a 6-day schedule or every third day for PSD daily monitors. If a primary quality assurance organization has only one collocated monitor, higher sampling frequencies than the 12-day schedule may be needed in order to produce ~25 valid sample pairs a year. Report the measurements from both

primary and collocated audit monitors at each collocated sampling site. The calculations for evaluating precision between the two collocated monitors are described in section 4.3.1 of this appendix.

3.2.6 Performance Evaluation Procedures for $PM_{10-2.5}$ and $PM_{2.5}$. The performance evaluation is an independent assessment used to estimate total measurement system bias. These evaluations will be performed under the PM Performance Evaluation Program (PEP) (section 2.4 of this appendix) or a comparable program. Performance evaluations will be performed on the SLAMS monitors annually within each primary quality assurance organization. For primary quality assurance organizations with less than or equal to five monitoring sites, five valid performance evaluation audits must be collected and reported each year. For primary quality assurance organizations with greater than five monitoring sites, eight valid performance evaluation audits must be collected and reported each year. A valid performance evaluation audit means that both the primary monitor and PEP audit concentrations are valid and above $3 \mu\text{g}/\text{m}^3$. Additionally, each year, every designated FRM or FEM within a primary quality assurance organization must:

- (a) have each method designation evaluated each year;

and,

(b) have all FRM or FEM samplers subject to an PEP audit at least once every six years; which equates to approximately 15 percent of the monitoring sites audited each year.

Additional information concerning the Performance Evaluation Program is contained in reference 10 of this appendix. The calculations for evaluating bias between the primary monitor and the performance evaluation monitor for $PM_{2.5}$ are described in section 4.3.2 of this appendix. The calculations for evaluating bias between the primary monitor(s) and the performance evaluation monitors for $PM_{10-2.5}$ are described in section 4.1.3 of this appendix.

3.3 Measurement Quality Checks of Manual Methods.

Table A-2 of this appendix provides a summary of the types and frequency of the measurement quality checks that will be described in this section.

3.3.1 Collocated Procedures for PM_{10} . For each network of manual PM_{10} methods, select 15 percent (or at least one) of the monitoring sites within the primary quality assurance organization for collocated sampling. For purposes of precision assessment, networks for measuring total suspended particulate (TSP) and PM_{10} shall be

considered separately from one another. PM_{10} and TSP sites having annual mean particulate matter concentrations among the highest 25 percent of the annual mean concentrations for all the sites in the network must be selected or, if such sites are impractical, alternative sites approved by the EPA Regional Administrator may be selected.

3.3.1.1 In determining the number of collocated sites required for PM_{10} , monitoring networks for lead (Pb) should be treated independently from networks for particulate matter (PM), even though the separate networks may share one or more common samplers. However, a single pair of samplers collocated at a common-sampler monitoring site that meets the requirements for both a collocated Pb site and a collocated PM site may serve as a collocated site for both networks.

3.3.1.2 The two collocated monitors must be within 4 meters of each other and at least 2 meters apart for flow rates greater than 200 liters/min or at least 1 meter apart for samplers having flow rates less than 200 liters/min to preclude airflow interference. Calibration, sampling, analysis and verification/validation procedures must be the same for both collocated samplers and the same as for all other samplers in the network.

3.3.1.3 For each pair of collocated samplers, designate one sampler as the primary sampler whose samples will be used to report air quality for the site, and designate the other as the audit sampler. Sample SLAMS sites on a 12-day schedule; sample PSD sites on a 6-day schedule or every third day for PSD daily samplers. If a primary quality assurance organization has only one collocated monitor, higher sampling frequencies than the 12-day schedule may be needed in order to produce ~25 valid sample pairs a year. Report the measurements from both samplers at each collocated sampling site. The calculations for evaluating precision between the two collocated samplers are described in section 4.2.1 of this appendix.

3.3.2 Flow Rate Verification for Particulate Matter. Follow the same procedure as described in section 3.2.3 of this appendix for $PM_{2.5}$, PM_{10} , $PM_{10-2.5}$ and TSP instruments. The percent differences between the audit and measured flow rates are used to assess the bias of the monitoring data as described in section 4.2.2 of this appendix.

3.3.3 Semi-Annual Flow Rate Audit for Particulate Matter. Follow the same procedure as described in section 3.2.4 of this appendix for $PM_{2.5}$, PM_{10} , $PM_{10-2.5}$ and TSP instruments. The percent differences between these flow

rates are used to validate the one-point flow rate verification checks used to estimate bias as described in section 4.2.3 of this appendix. Great care must be used in auditing high-volume particulate matter samplers having flow regulators because the introduction of resistance plates in the audit flow standard device can cause abnormal flow patterns at the point of flow sensing. For this reason, the flow audit standard should be used with a normal filter in place and without resistance plates in auditing flow-regulated high-volume samplers, or other steps should be taken to assure that flow patterns are not perturbed at the point of flow sensing.

3.3.4 Pb Methods.

3.3.4.1 Annual Flow Rate. For the Pb Reference Method (40 CFR part 50, appendix G), the flow rates of the high-volume Pb samplers shall be verified and audited using the same procedures described in sections 3.3.2 and 3.3.3 of this appendix.

3.3.4.2 Pb Strips. Each calendar quarter or sampling quarter (PSD), audit the Pb Reference Method analytical procedure using glass fiber filter strips containing a known quantity of Pb. These audit sample strips are prepared by depositing a Pb solution on unexposed glass fiber filter

strips of dimensions 1.9 centimeters (cm) by 20.3 cm (3/4 inch by 8 inch) and allowing them to dry thoroughly. The audit samples must be prepared using batches of reagents different from those used to calibrate the Pb analytical equipment being audited. Prepare audit samples in the following concentration ranges:

Range	Pb Concentration, $\mu\text{g}/\text{Strip}$	Equivalent Ambient Pb Concentration, $\mu\text{g}/\text{m}^3$ ¹
1.....	100-300	0.5-1.5
2.....	400-1000	3.0-5.0

¹ Equivalent ambient Pb concentration in $\mu\text{g}/\text{m}^3$ is based on sampling at 1.7 m^3/min for 24 hours on a 20.3 cm x 25.4 cm (8 inch x 10 inch) glass fiber filter.

(a) Audit samples must be extracted using the same extraction procedure used for exposed filters.

(b) Analyze three audit samples in each of the two ranges each quarter samples are analyzed. The audit sample analyses shall be distributed as much as possible over the entire calendar quarter.

(c) Report the audit concentrations (in μg Pb/strip) and the corresponding measured concentrations (in μg Pb/strip) using AQS unit code 077. The relative percent differences between the concentrations are used to calculate analytical accuracy as described in section 4.4.2 of this

appendix.

(d) The audits of an equivalent Pb method are conducted and assessed in the same manner as for the reference method. The flow auditing device and Pb analysis audit samples must be compatible with the specific requirements of the equivalent method.

3.3.5 Collocated Procedures for $PM_{10-2.5}$ and $PM_{2.5}$. Follow the same procedure as described in section 3.2.5 of this appendix.

3.3.6 Performance Evaluation Procedures for $PM_{10-2.5}$ and $PM_{2.5}$. Follow the same procedure as described in section 3.2.6 of this appendix.

4. Calculations for Data Quality Assessment.

(a) Calculations of measurement uncertainty are carried out by EPA according to the following procedures. Primary quality assurance organizations should report the data for all appropriate measurement quality checks as specified in this appendix even though they may elect to perform some or all of the calculations in this section on their own.

(b) The EPA will provide annual assessments of data quality aggregated by site and primary quality assurance organization for SO_2 , NO_2 , O_3 and CO and by primary quality

assurance organization for PM_{10} , $PM_{2.5}$, $PM_{10-2.5}$ and Pb.

(c) At low concentrations, agreement between the measurements of collocated samplers, expressed as relative percent difference or percent difference, may be relatively poor. For this reason, collocated measurement pairs are selected for use in the precision and bias calculations only when both measurements are equal to or above the following limits:

- (1) TSP: $20 \mu\text{g}/\text{m}^3$.
- (2) Pb: $0.15 \mu\text{g}/\text{m}^3$.
- (3) PM_{10} (Hi-Vol): $15 \mu\text{g}/\text{m}^3$.
- (4) PM_{10} (Lo-Vol): $3 \mu\text{g}/\text{m}^3$.
- (5) $PM_{10-2.5}$ and $PM_{2.5}$: $3 \mu\text{g}/\text{m}^3$.

4.1 Statistics for the Assessment of QC Checks for SO_2 , NO_2 , O_3 and CO.

4.1.1 Percent Difference. All measurement quality checks start with a comparison of an audit concentration or value (flowrate) to the concentration/value measured by the analyzer and use percent difference as the comparison statistic as described in equation 1 of this section. For each single point check, calculate the percent difference, d_i , as follows:

Equation 1

$$d_i = \frac{\text{meas} - \text{audit}}{\text{audit}} \cdot 100$$

where, meas is the concentration indicated by the monitoring organization's instrument and *audit* is the audit concentration of the standard used in the QC check being measured.

4.1.2 Precision Estimate. The precision estimate is used to assess the one-point QC checks for SO₂, NO₂, O₃, or CO described in section 3.2.1 of this appendix. The precision estimator is the coefficient of variation upper bound and is calculated using equation 2 of this section:

Equation 2

$$CV = \sqrt{\frac{n \cdot \sum_{i=1}^n d_i^2 - \left(\sum_{i=1}^n d_i \right)^2}{n(n-1)}} \cdot \sqrt{\frac{n-1}{X^2_{0.1, n-1}}}$$

where, $X_{0.1, n-1}$ is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom.

4.1.3 Bias Estimate. The bias estimate is calculated using the one-point QC checks for SO₂, NO₂, O₃, or CO described in section 3.2.1 of this appendix and the performance evaluation program for PM_{10-2.5} described in section 3.2.6 of this appendix. The bias estimator is an upper bound on the mean absolute value of the percent differences as described in equation 3 of this section:

Equation 3

$$|bias| = AB + t_{0.95, n-1} \cdot \frac{AS}{\sqrt{n}}$$

where, n is the number of single point checks being aggregated; $t_{0.95, n-1}$ is the 95th quantile of a t-distribution with $n-1$ degrees of freedom; the quantity AB is the mean of the absolute values of the d_i 's and is calculated using equation 4 of this section:

Equation 4

$$AB = \frac{1}{n} \cdot \sum_{i=1}^n |d_i|$$

and the quantity AS is the standard deviation of the absolute value of the d_i 's and is calculated using equation 5 of this section:

Equation 5

$$AS = \sqrt{\frac{n \cdot \sum_{i=1}^n |d_i|^2 - \left(\sum_{i=1}^n |d_i| \right)^2}{n(n-1)}}$$

4.1.3.1 Assigning a sign (positive/negative) to the bias estimate. Since the bias statistic as calculated in equation 3 of this appendix uses absolute values, it does not have a tendency (negative or positive bias) associated with it. A sign will be designated by rank ordering the percent differences of the QC check samples from a given site for a particular assessment interval.

4.1.3.2 Calculate the 25th and 75th percentiles of the percent differences for each site. The absolute bias upper bound should be flagged as positive if both percentiles are positive and negative if both percentiles are negative. The absolute bias upper bound would not be flagged if the 25th and 75th percentiles are of different signs.

4.1.4 Validation of Bias Using Performance Evaluations. The annual performance evaluations for SO₂, NO₂, O₃, or CO described in section 3.2.2 of this appendix are used to verify the results obtained from the one-point

QC checks and to validate those results across a range of concentration levels. To quantify this annually at the site level and at the 3-year primary quality assurance organization level, probability limits will be calculated from the one-point QC checks using equations 6 and 7 of this appendix:

Equation 6

$$\textit{Upper probability Limit} = m + 1.96 \cdot S$$

Equation 7

$$\text{Lower probability Limit} = \bar{m} - 1.96 \cdot S$$

where, \bar{m} is the mean (equation 8 of this appendix):

Equation 8

$$\bar{m} = \frac{1}{k} \sum_{i=1}^k d_i$$

where, k is the total number of one point QC checks for the interval being evaluated and S is the standard deviation of the percent differences (equation 9 of this appendix) as follows:

Equation 9

$$S = \sqrt{\frac{k \cdot \sum_{i=1}^k d_i^2 - \left(\sum_{i=1}^k d_i \right)^2}{k(k-1)}}$$

4.1.5 Percent Difference. Percent differences for the performance evaluations, calculated using equation 1 of this appendix can be compared to the probability intervals for the respective site or at the primary quality assurance organization level. Ninety-five percent of the individual

percent differences (all audit concentration levels) for the performance evaluations should be captured within the probability intervals for the primary quality assurance organization.

4.2 Statistics for the Assessment of PM₁₀.

4.2.1 Precision Estimate from Collocated Samplers.

Precision is estimated via duplicate measurements from collocated samplers of the same type. It is recommended that the precision be aggregated at the primary quality assurance organization level quarterly, annually, and at the 3-year level. The data pair would only be considered valid if both concentrations are greater than the minimum values specified in section 4(c) of this appendix. For each collocated data pair, calculate the relative percent difference, d_i , using equation 10 of this appendix:

Equation 10

$$d_i = \frac{X_i - Y_i}{(X_i + Y_i)/2} \cdot 100$$

where, X_i is the concentration from the primary sampler and Y_i is the concentration value from the audit sampler.

The coefficient of variation upper bound is calculated using the equation 11 of this appendix:

Equation 11

$$CV = \sqrt{\frac{n \cdot \sum_{i=1}^n d_i^2 - \left(\sum_{i=1}^n d_i \right)^2}{2n(n-1)}} \cdot \sqrt{\frac{n-1}{X_{0.1, n-1}^2}}$$

where, n is the number of valid data pairs being aggregated, and $X_{0.1, n-1}$ is the 10th percentile of a chi-squared distribution with $n-1$ degrees of freedom. The factor of 2 in the denominator adjusts for the fact that each d_i is calculated from two values with error.

4.2.2 Bias Estimate Using One-Point Flow Rate

Verifications. For each one-point flow rate verification described in sections 3.2.3 and 3.3.2 of this appendix, calculate the percent difference in volume using equation 1 of this appendix where meas is the value indicated by the sampler's volume measurement and audit is the actual volume indicated by the auditing flow meter. The absolute volume bias upper bound is then calculated using equation 3, where n is the number of flow rate audits being aggregated; $t_{0.95, n-1}$ is the 95th quantile of a t-distribution with $n-1$ degrees of

freedom, the quantity AB is the mean of the absolute values of the d_i 's and is calculated using equation 4 of this appendix, and the quantity AS in equation 3 of this appendix is the standard deviation of the absolute values of the d_i 's and is calculated using equation 5.

4.2.3 Assessment Semi-Annual Flow Rate Audits. The flow rate audits described in sections 3.2.4 and 3.3.3 of this appendix are used to assess the results obtained from the one-point flow rate verifications and to provide an estimate of flow rate acceptability. For each flow rate audit, calculate the percent difference in volume using equation 1 of this appendix where $meas$ is the value indicated by the sampler's volume measurement and $audit$ is the actual volume indicated by the auditing flow meter. To quantify this annually and at the 3-year primary quality assurance organization level, probability limits are calculated from the percent differences using equations 6 and 7 of this appendix where m is the mean described in equation 8 of this appendix and k is the total number of one point flow rate verifications for the year and S is the standard deviation of the percent differences as described in equation 9 of this appendix.

4.2.4 Percent Difference. Percent differences for the annual flow rate audit concentration, calculated using equation 1 of this appendix, can be compared to the probability intervals for the one-point flow rate verifications for the respective primary quality assurance organization. Ninety-five percent of the individual percent differences (all audit concentration levels) for the performance evaluations should be captured within the probability intervals for primary quality assurance organization.

4.3 Statistics for the Assessment of $PM_{2.5}$ and $PM_{10-2.5}$.

4.3.1 Precision Estimate. Precision for collocated instruments for $PM_{2.5}$ and $PM_{10-2.5}$ may be estimated where both the primary and collocated instruments are the same method designation and when the method designations are not similar. Follow the procedure described in section 4.2.1 of this appendix. In addition, one may want to perform an estimate bias when the primary monitor is an FEM and the collocated monitor is an FRM. Follow the procedure described in section 4.1.3 of this appendix in order to provide an estimate of bias using the collocated data.

4.3.2 Bias Estimate. Follow the procedure described in section 4.1.3 of this appendix for the bias estimate of

PM_{10-2.5}. The PM_{2.5} bias estimate is calculated using the paired routine and the PEP monitor data described in section 3.2.6 of this appendix. Calculate the percent difference, d_i , using equation 1 of this appendix, where *meas* is the measured concentration from agency's primary monitor and *audit* is the concentration from the PEP monitor. The data pair would only be considered valid if both concentrations are greater than the minimum values specified in section 4(c) of this appendix. Estimates of bias are presented for various levels of aggregation, sometimes aggregating over time, sometimes aggregating over samplers, and sometimes aggregating over both time and samplers. These various levels of aggregation are achieved using the same basic statistic.

4.3.2.1 This statistic averages the individual biases described in equation 1 of this appendix to the desired level of aggregation using equation 12 of this appendix:

Equation 12

$$D = \frac{1}{n_j} \times \sum_{i=1}^{n_j} d_i$$

where, n_j is the number of pairs and d_1, d_2, \dots, d_{n_j} are the

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biases for each of the pairs to be averaged.

4.3.2.2 Confidence intervals can be constructed for these average bias estimates in equation 12 of this appendix using equations 13 and 14 of this appendix:

Equation 13

$$\text{Lower 90\% Confidence Interval} = D - t_{0.95,df} \times \frac{s}{\sqrt{n_j}}$$

Equation 14

$$\text{Upper 90\% Confidence Interval} = D + t_{0.95,df} \times \frac{s}{\sqrt{n_j}}$$

Where, $t_{0.95,df}$ is the 95th quantile of a t-distribution with degrees of freedom $df=n_j-1$ and s is an estimate of the variability of the average bias calculated using equation 15 of this appendix:

Equation 15

$$s = \sqrt{\frac{\sum_{i=1}^{n_j} (d_i - D)^2}{n_j - 1}}$$

4.4 Statistics for the Assessment of Pb.

4.4.1 Precision Estimate. Follow the same procedures

as described for PM₁₀ in section 4.2.1 of this appendix using the data from the collocated instruments. The data pair would only be considered valid if both concentrations are greater than the minimum values specified in section 4(c) of this appendix.

4.4.2 Bias Estimate. In order to estimate bias, the information from the flow rate audits and the Pb strip audits needs to be combined as described below. To be consistent with the formulas for the gases, the recommended procedures are to work with relative errors of the lead measurements. The relative error in the concentration is related to the relative error in the volume and the relative error in the mass measurements using equation 16 of this appendix:

Equation 16

$$\begin{aligned} \text{rel. error} &= \frac{(\text{measured concentration} - \text{audit concentration})}{\text{audit concentration}} \\ &= \left(\frac{1}{1 + \text{rel. error}} \right) (\text{rel. mass error} - \text{rel. volume error}) \end{aligned}$$

As with the gases, an upper bound for the absolute bias is desired. Using equation 16 above, the absolute value of the relative (concentration) error is bounded by equation 17 of this appendix:

Equation 17

$$|rel. error| \leq \frac{|relative\ mass\ error| + |relative\ volume\ error|}{1 - |relative\ volume\ error|}$$

The quality indicator data collected are then used to bound each part of equation 17 separately.

4.4.2.1 Flow rate calculations. For each flow rate audit, calculate the percent difference in volume by equation 1 of this appendix where *meas* is the value indicated by the sampler's volume measurement and *audit* is the actual volume indicated by the auditing flow meter. The absolute volume bias upper bound is then calculated using equation 3 of this appendix where *n* is the number of flow rate audits being aggregated; $t_{0.95, n-1}$ is the 95th quantile of a t-distribution with *n*-1 degrees of freedom; the quantity *AB* is the mean of the absolute values of the d_i 's and is calculated using equation 4, and the quantity *AS* in equation 3 of this appendix is the standard deviation of the absolute values of the d_i 's and is calculated using equation 5 of this appendix.

4.4.2.2 Lead strip calculations. Similarly for each lead strip audit, calculate the percent difference in mass by equation 1 where *meas* is the value indicated by the mass

measurement and *audit* is the actual lead mass on the audit strip. The absolute mass bias upper bound is then calculated using equation 3 of this appendix where n is the number of lead strip audits being aggregated; $t_{0.95,n-1}$ is the 95th quantile of a t-distribution with $n-1$ degrees of freedom; the quantity AB is the mean of the absolute values of the d_i 's and is calculated using equation 4 of this appendix and the quantity AS in equation 3 of this appendix is the standard deviation of the absolute values of the d_i 's and is calculated using equation 5 of this appendix.

4.4.2.3 Final bias calculation. Finally, the absolute bias upper bound is given by combining the absolute bias estimates of the flow rate and Pb strips using equation 18 of this appendix:

Equation 18

$$|bias| = \frac{|mass\ bias| + |vol.\ bias|}{100 - |vol.\ bias|} \cdot 100$$

where the numerator and denominator have been multiplied by 100 since everything is expressed as a percentage.

4.5 Time Period for Audits. The statistics in this section assume that the mass and flow rate audits represent the same time period. Since the two types of audits are not performed at the same time, the audits need to be grouped by

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common time periods. Consequently, the absolute bias estimates should be done on annual and 3-year levels. The flow rate audits are site specific, so the absolute bias upper bound estimate can be done and treated as a site level statistic.

5. Reporting Requirements.

5.1 SLAMS Reporting Requirements. For each pollutant, prepare a list of all monitoring sites and their AQS site identification codes in each primary quality assurance organization and submit the list to the appropriate EPA Regional Office, with a copy to AQS. Whenever there is a change in this list of monitoring sites in a primary quality assurance organization, report this change to the EPA Regional Office and to AQS.

5.1.1 Quarterly Reports. For each quarter, each primary quality assurance organization shall report to AQS directly (or via the appropriate EPA Regional Office for organizations not direct users of AQS) the results of all valid measurement quality checks it has carried out during the quarter. The quarterly reports must be submitted consistent with the data reporting requirements specified for air quality data as set forth in §58.16 of this part. EPA strongly encourages early submission of the quality

assurance data in order to assist the monitoring organizations control and evaluate the quality of the ambient air data.

5.1.2 Annual Reports.

5.1.2.1 When the monitoring organization has certified their data for the calendar year, EPA will calculate and report the measurement uncertainty for the entire calendar year. These limits will then be associated with the data submitted in the annual report required by §58.15 of this part.

5.1.2.2 Each primary quality assurance organization shall submit, along with its annual report, a listing by pollutant of all monitoring sites in the primary quality assurance organization.

5.2 PSD Reporting Requirements. At the end of each sampling quarter, the organization must report the appropriate statistical assessments in section 4 of this appendix for the pollutants measured. All data used to calculate reported estimates of precision and bias including span checks, collocated sampler and audit results must be made available to the permit granting authority upon request.

6.0 References.

(1) American National Standard--Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs. ANSI/ASQC E4-2004. February 2004. Available from American Society for Quality Control, 611 East Wisconsin Avenue, Milwaukee, WI 53202.

(2) EPA Requirements for Quality Management Plans. EPA QA/R-2. EPA/240/B-01/002. March 2001. Office of Environmental Information, Washington DC 20460.
<http://www.epa.gov/quality/qs-docs/r2-final.pdf>.

(3) EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations. EPA QA/R-5. EPA/240/B-01/003. March 2001. Office of Environmental Information, Washington DC 20460.
<http://www.epa.gov/quality/qs-docs/r5-final.pdf>.

(4) EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards. EPA-600/R-97/121. September 1997. Available from U.S. Environmental Protection Agency, ORD Publications Office, Center for Environmental Research Information (CERI), 26 W. Martin Luther King Drive, Cincinnati, OH 45268.

(5) Guidance for the Data Quality Objectives Process. EPA QA/G-4. EPA/600/R-96/055. August 2000. Office of

Environmental Information, Washington DC 20460.

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(6) List of Designated Reference and Equivalent Methods. Available from U.S. Environmental Protection Agency, National Exposure Research Laboratory, Human Exposure and Atmospheric Sciences Division, MD-D205-03, Research Triangle Park, NC 27711.

<http://www.epa.gov/ttn/amtic/criteria.html>.

(7) McElroy, F.F. Transfer Standards for the Calibration of Ambient Air Monitoring Analyzers for Ozone. EPA-600/4-79-056. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, September, 1979.

<http://www.epa.gov/ttn/amtic/cpreldoc.html>.

(8) Paur, R.J. and F.F. McElroy. Technical Assistance Document for the Calibration of Ambient Ozone Monitors. EPA-600/4-79-057. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, September, 1979.

<http://www.epa.gov/ttn/amtic/cpreldoc.html>.

(9) Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 1 - A Field Guide to Environmental Quality Assurance. EPA-600/R-94/038a. April 1994. Available from U.S. Environmental Protection Agency, ORD Publications Office, Center for Environmental Research

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Information (CERI), 26 W. Martin Luther King Drive,
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<http://www.epa.gov/ttn/amtic/qabook.html>.

(10) Quality Assurance Handbook for Air Pollution
Measurement Systems, Volume II: Part 1 - Ambient Air Quality
Monitoring Program Quality System Development. EPA-454/R-
98-004. <http://www.epa.gov/ttn/amtic/qabook.html>.

Table A-1 of Appendix A to Part 58. Difference and Similarities Between SLAMS and PSD Requirements.

Topic	SLAMS	PSD
Requirements	<ol style="list-style-type: none"> 1. the development, documentation, and implementation of an approved quality system. 2. the assessment of data quality 3. the use of reference, equivalent, or approved methods. 4. the use of calibration standards traceable to NIST or other primary standard. 5. the participation in EPA performance evaluations and the permission for EPA to conduct system audits. 	
Monitoring and QA Responsibility	State/local agency via the "primary quality assurance organization"	Source owner/operator.
Monitoring Duration	Indefinitely	Usually up to 12 months.
Annual Performance Evaluation (PE)	Standards and equipment different from those used for spanning/calibration/verifications. Prefer different personnel.	Personnel, standards and equipment different from those used for spanning/calibration/verifications.
PE audit rate		
-Automated	100% per year.	100% per quarter.

-Manual	Varies depending on pollutant. See Table A-2 of this appendix.	100% per quarter.
Precision Assessment		
-Automated	One-point QC check biweekly but data quality dependent.	One point QC check biweekly.
-Manual	Varies depending on pollutant. See Table A-2 of this appendix.	One site: 1 every 6 days or every third day for daily monitoring (TSP and Pb).
Reporting		
-Automated	By site - EPA performs calculations annually.	By site - source owner/operator performs calculations each sampling quarter.
-Manual	By reporting organization - EPA performs calculations annually.	By site - source owner/operator performs calculations each sampling quarter.

Table A-2 of Appendix A to Part 58. Minimum Data Assessment Requirements for SLAMS Sites

Method	Assessment method	Coverage	Minimum frequency	Part
Automated Methods				
1-Point QC: for SO ₂ , NO ₂ , O ₃ , CO	Response check at concentration 0.01 -0.1 ppm SO ₂ , NO ₂ , O ₃ , and 1-10 ppm CO	Each analyzer	Once per 2 weeks	Audit measur
Performance Evaluation for SO ₂ , NO ₂ , O ₃ , CO	See section 3.2.2 of this appendix	Each analyzer	Once per year	Audit meas for
Flow rate verification PM ₁₀ , PM _{2.5} , PM _{10-2.5}	Check of sampler flow rate	Each sampler	Once every month	Audit meas indi samp
Semi-annual flow rate audit PM ₁₀ , PM _{2.5} , PM _{10-2.5}	Check of sampler flow rate using independent standard	Each sampler	Once every 6 months	Audit meas indi samp
Collocated Sampling PM _{2.5} , PM _{10-2.5}	Collocated samplers	15%	Every twelve days	Primary conce dupl conce

Performance Evaluation $PM_{2.5}$, $PM_{10-2.5}$	Collocated samplers	1. 5 valid audits for primary QA orgs, with \leq 5 sites 2. 8 valid audits for primary QA orgs, with $>$ 5 sites 3. All samplers in 6 years	over all 4 quarters	Primary concn perf samp.
Manual Methods				
Collocated Sampling PM_{10} , TSP, $PM_{10-2.5}$, $PM_{2.5}$	Collocated samplers	15%	Every 12 days TSP-every 6 days	Primary concn dupl concn
Flow rate verification PM_{10} , TSP, $PM_{10-2.5}$, $PM_{2.5}$	Check of sampler flow rate	Each sampler	Once every month	Audit meas indi samp
Semi-annual flow rate audit PM_{10} , TSP, $PM_{10-2.5}$, $PM_{2.5}$	Check of sampler flow rate using independent standard	Each sampler, all locations	Once every 6 months	Audit meas indi samp
Manual Methods Lead	1. Check of sample flow rate as for TSP 2. Check of analytical system with Pb audit strips	1. Each sampler 2. Analytical system	1. Include with TSP 2. Each quarter	1. Sam 2. Act and r (ind concn samp)

<p>Performance Evaluation PM_{2.5}, PM_{10-2.5}</p>	<p>Collocated samplers</p>	<p>1. 5 valid audits for primary QA orgs, with \leq 5 sites 2. 8 valid audits for primary QA orgs, with \geq 5 sites 3. All samplers in 6 years</p>	<p>Over all 4 quarters</p>	<p>Primary concentration performance sampling</p>
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¹ Effective concentration for open path analyzers.

² Corrected concentration, if applicable, for open path analyzers.

Table A-3 to Appendix A of Part 58. Summary of PM_{2.5} or PM_{10-2.5}. Number and Type of Collocation (15% Collocation Requirement) Needed as an Example of a Primary Quality Assurance Organization that has 54 Monitors and Procured FRMs and Three Other Equivalent Method Types.

Primary sampler method designation	Total no. of monitors	Total no. collocated	No. of collocated FRM	No. of collocated monitors of same method designation as primary
FRM	20	3	3	n/a
FEM (A)	20	3	2	1
FEM (C)	2	1	1	0
FEM (D)	12	2	1	1

* * * * *

Appendix C to Part 58-- [Amended]

50. Appendix C is revised by adding a table of contents to read as follows:

- 1.0 Purpose.
- 2.0 SLAMS Ambient Air Monitoring Stations
- 3.0 NCore Ambient Air Monitoring Stations
- 4.0 Photochemical Assessment Monitoring Stations (PAMS)
- 5.0 Particulate Matter Episode Monitoring
- 6.0 References

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51. Section 1.0 is revised to read as follows:

1.0 Purpose

This appendix specifies the criteria pollutant monitoring methods (manual methods or automated analyzers) which must be used in the SLAMS ambient air monitoring stations and the NCore stations that are a subset of SLAMS.

52. Section 2 is amended as follows:

- a. By revising the heading for section 2.0.
- b. By revising section 2.1.
- c. By deleting the heading of section 2.2 and adding introductory text, revising sections 2.2.1 and 2.2.2, and adding section 2.2.3.
- d. By revising sections 2.4, 2.4.1, 2.4.1.1, 2.4.1.2, and 2.4.1.4; adding sections 2.4.1.5 and 2.4.1.6; revising section 2.4.2; adding sections 2.4.2.1 through 2.4.2.4; revising section 2.4.4; and adding sections 2.4.4.1 through 2.4.4.6.
- e. By revising sections 2.4.5, 2.4.5.1, 2.4.5.5, and 2.4.6.
- f. By removing and reserving section 2.5.
- g. By revising sections 2.7.1 and 2.7.6.
- h. By revising sections 2.8.1, 2.8.4, and 2.8.5.
- i. By revising section 2.9 to read as follows:

2.0 SLAMS Ambient Air Monitoring Network

2.1 Except as otherwise provided in this appendix, a criteria pollutant monitoring method used for making NAAQS decisions at a SLAMS site must be a reference or equivalent method as defined in §50.1 of this chapter.

2.2 Through December 31, 2012, data produced from any PM_{10} method approved under Part 53 of this chapter may be used in lieu of a required $PM_{10-2.5}$ monitor to determine attainment of the $PM_{10-2.5}$ NAAQS according to the following stipulations.

2.2.1 At any sites proposed for monitoring in lieu of $PM_{10-2.5}$ monitoring, the 98th percentile value for the most recent complete calendar year of PM_{10} monitoring data must be less than the $PM_{10-2.5}$ NAAQS, based on a sample frequency of at least 1 in 3 sample days, and reported at local conditions of temperature and pressure.

2.2.2 PM_{10} data used in lieu of required $PM_{10-2.5}$ monitoring must be based on a daily sampling frequency.

2.2.3 During any calendar year of sampling in lieu of a required $PM_{10-2.5}$ sampler, if more than seven 24-hour average PM_{10} concentrations exceed the numerical value of the $PM_{10-2.5}$ NAAQS, as reported at local conditions of temperature and pressure, the State must deploy a FRM or FEM

PM_{10-2.5} monitor within a one year period.

2.3 Any manual method or analyzer purchased prior to cancellation of its reference or equivalent method designation under §53.11 or §53.16 of this chapter may be used at a SLAMS site following cancellation for a reasonable period of time to be determined by the Administrator.

2.4 Approval of non-designated continuous PM_{2.5} methods as approved regional methods (ARMs) operated within a network of sites. A method for PM_{2.5} that has not been designated as a federal reference method (FRM) or federal equivalent method (FEM) as defined in §50.1 of this chapter may be approved as an ARM for purposes of section 2.1 of this appendix at a particular site or network of sites under the following stipulations.

2.4.1 The candidate ARM must be demonstrated to meet the requirements for PM_{2.5} Class III equivalent methods as defined in subpart C of part 53 of this chapter. Specifically the requirements for precision, correlation, and additive and multiplicative bias apply. For purposes of this section 2.4, the following requirements shall apply:

2.4.1.1 The candidate ARM shall be tested at the site(s) in which it is intended to be used. For a network of sites operated by one reporting agency, the testing shall

occur at a subset of sites to include one site in each MSA/CSA, up to the first 2 highest population MSA/CSAs and at least one rural area or Micropolitan Statistical Area site. If the candidate ARM for a network is already approved for purposes of this section in another agency's network, subsequent testing shall minimally occur at one site in a MSA/CSA and one rural area or Micropolitan Statistical Area. There shall be no requirement for tests at any other sites.

2.4.1.2 For purposes of this section, a full year of testing may begin and end in any season, so long as all seasons are covered.

* * * * *

2.4.1.4 The test specification for $PM_{2.5}$ Class III equivalent method precision defined in subpart C of part 53 of this chapter applies; however, there is no specific requirement that collocated continuous monitors be operated for purposes of generating a statistic for coefficient of variation (CV). To provide an estimate of precision that meets the requirement identified in subpart C of part 53 of this chapter, agencies may cite peer reviewed published data or data in AQS that can be presented demonstrating the

candidate ARM operated will produce data that meets the specification for precision of Class III PM_{2.5} methods.

2.4.1.5 A minimum of 90 valid sample pairs per site for the year with no less than 20 valid sample pairs per season must be generated for use in demonstrating that additive bias, multiplicative bias and correlation meet the comparability requirements specified in subpart C of part 53 of this chapter. A valid sample pair may be generated with as little as one valid FRM and one valid candidate ARM measurement per day.

2.4.1.6 For purposes of determining bias, FRM data with concentrations less than 3 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) may be excluded. Exclusion of data does not result in failure of sample completeness specified in this section.

2.4.2 The monitoring agency wishing to use an ARM must develop and implement appropriate quality assurance procedures for the method. Additionally, the following procedures are required for the method:

2.4.2.1 The ARM must be consistently operated throughout the network. Exceptions to a consistent operation must be approved according to section 2.8 of this appendix;

2.4.2.2 The ARM must be operated on an hourly sampling

frequency capable of providing data suitable for aggregation into daily 24-hour average measurements ;

2.4.2.3 The ARM must use an inlet and separation device, as needed, that are already approved in either the reference method identified in appendix L to part 50 of this chapter or under part 53 of this chapter as approved for use on a PM_{2.5} reference or equivalent method. The only exceptions to this requirement are those methods that by their inherent measurement principle may not need an inlet or separation device that segregates the aerosol; and

2.4.2.4 The ARM must be capable of providing for flow audits, unless by its inherent measurement principle, measured flow is not required. These flow audits are to be performed on the frequency identified in appendix A to this part.

* * * * *

2.4.4 Data Quality Assessment Requirements. Assessments of data quality shall follow the same frequencies and calculations as required under section 3 of appendix A to this part with the following exceptions:

2.4.4.1 Collocation of ARMs with FRM/FEM samplers must be maintained at a minimum of 30 percent of the SLAMS sites with a minimum of 1 per network;

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2.4.4.2 All collocated FRM/FEM samplers must maintain a sample frequency of at least 1 in 6 sample days;

2.4.4.3 Collocated FRM/FEM samplers shall be located at the design value site, with the required FRM/FEM samplers deployed among the largest MSA/CSA in the network, until all required FRM/FEM are deployed; and

2.4.4.4 Data from collocated FRM/FEM are to be substituted for any calendar quarter that an ARM method has incomplete data.

2.4.4.5 Collocation with an ARM under this part for purposes of determining the coefficient of variation of the method shall be conducted at a minimum of 7.5 percent of the sites with a minimum of 1 per network. This is consistent with the requirements in appendix A to this part for one-half of the required collocation of FRM/FEM (15 percent) to be collocated with the same method.

2.4.4.6 Assessments of bias with an independent audit of the total measurement system shall be conducted with the same frequency as a FEM as identified in appendix A to this part.

2.4.5 Request for approval of a candidate ARM, that is not already approved in another agency's network under this section, must meet the general submittal requirements of

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section 2.7 of this appendix. Requests for approval under this section when an ARM is already approved in another agency's network are to be submitted to the EPA Regional Administrator. Requests for approval under section 2.4 of this appendix must include the following requirements:

2.4.5.1 A clear and unique description of the site(s) at which the candidate ARM will be used and tested, and a description of the nature or character of the site and the particulate matter that is expected to occur there.

* * * * *

2.4.5.5 A detailed description of the procedures for assessing the precision and accuracy of the method that will be implemented for reporting to AQS.

* * * * *

2.4.6 Within 120 days after receiving a request for approval of the use of an ARM at a particular site or network of sites under section 2.4 of this appendix, the Administrator will approve or disapprove the method by letter to the person or agency requesting such approval. When appropriate for methods that are already approved in another SLAMS network, the EPA Regional Administrator has approval/disapproval authority. In either instance, additional information may be requested to assist with the

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decision.

2.5 [Reserved]

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2.7 * * *

2.7.1 Requests for approval under sections 2.4, 2.6.2, or 2.8 of this appendix must be submitted to: Director, National Exposure Research Laboratory, (MD-D205-03), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. For ARMs that are already approved in another agency's network, subsequent requests for approval under section 2.4 are to be submitted to the applicable EPA Regional Administrator.

* * * * *

2.7.6 If the Administrator determines, on the basis of any available information, that any of the determinations or statements on which approval of a request under this section was based are invalid or no longer valid, or that the requirements of section 2.4, 2.5, or 2.6, as applicable, have not been met, he/she may withdraw the approval after affording the person who obtained the approval an opportunity to submit information and arguments opposing such action.

2.8 * * *

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2.8.1 Except as otherwise provided in this section, no reference method, equivalent method, or ARM may be used in a SLAMS network if it has been modified in a manner that could significantly alter the performance characteristics of the method without prior approval by the Administrator. For purposes of this section, "alternative method" means an analyzer, the use of which has been approved under section 2.4, 2.5, or 2.6 of this appendix or some combination thereof.

* * * * *

2.8.4 The Administrator will approve or disapprove the modification by letter to the person or agency requesting such approval within 75 days after receiving a request for approval under this section and any further information that the applicant may be asked to provide.

2.8.5 A temporary modification that could alter the performance characteristics of a reference, equivalent, or ARM may be made without prior approval under this section if the method is not functioning or is malfunctioning, provided that parts necessary for repair in accordance with the applicable operation manual cannot be obtained within 45 days. Unless such temporary modification is later approved under section 2.8.4 of this appendix, the temporarily

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modified method shall be repaired in accordance with the applicable operation manual as quickly as practicable but in no event later than 4 months after the temporary modification was made, unless an extension of time is granted by the Administrator. Unless and until the temporary modification is approved, air quality data obtained with the method as temporarily modified must be clearly identified as such when submitted in accordance with §58.16 and must be accompanied by a report containing the information specified in section 2.8.3 of this appendix. A request that the Administrator approve a temporary modification may be submitted in accordance with sections 2.8.1 through 2.8.4 of this appendix. In such cases the request will be considered as if a request for prior approval had been made.

2.9 Use of IMPROVE Samplers at a SLAMS Site.

"IMPROVE" samplers may be used in SLAMS for monitoring of regional background and regional transport concentrations of fine particulate matter. The IMPROVE samplers were developed for use in the Interagency Monitoring of Protected Visual Environments (IMPROVE) network to characterize all of the major components and many trace constituents of the particulate matter that impair visibility in Federal Class I

Areas. Descriptions of the IMPROVE samplers and the data they collect are available in references 4, 5, and 6 of this appendix.

53. Section 3 is amended by revising the heading of section 3.0, revising section 3.1, and adding section 3.2 to read as follows:

3.0 NCore Ambient Air Monitoring Stations

3.1 Methods employed in NCore multipollutant sites used to measure SO₂, CO, NO₂, O₃, PM_{2.5}, or PM_{10-2.5} must be reference or equivalent methods as defined in §50.1 of this chapter, or an ARM as defined in section 2.4 of this appendix, for any monitors intended for comparison with applicable NAAQS.

3.2 If alternative SO₂, CO, NO₂, O₃, PM_{2.5}, or PM_{10-2.5} monitoring methodologies are proposed for monitors not intended for NAAQS comparison, such techniques must be detailed in the network description required by §58.10 and subsequently approved by the Administrator.

54. Sections 4.2 and 4.3 are revised to read as follows:

4.0 * * *

* * * * *

4.2 Methods used for NO, NO₂ and NO_x monitoring at

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PAMS should be automated reference or equivalent methods as defined for NO₂ in §50.1 of this chapter. If alternative NO, NO₂ or NO_x monitoring methodologies are proposed, such techniques must be detailed in the network description required by §58.10 and subsequently approved by the Administrator.

4.3 Methods for meteorological measurements and speciated VOC monitoring are included in the guidance provided in references 2 and 3 of this appendix. If alternative VOC monitoring methodology (including the use of new or innovative technologies), which is not included in the guidance, is proposed, it must be detailed in the network description required by §58.10 and subsequently approved by the Administrator.

* * * * *

55. Appendix D to part 58 is revised to read as follows:

**Appendix D to Part 58--Network Design Criteria for
Ambient Air Quality Monitoring**

1. Monitoring Objectives and Spatial Scales
2. General Monitoring Requirements
3. Design Criteria for NCore Sites
4. Pollutant-Specific Design Criteria for SLAMS Sites
5. Design Criteria for Photochemical Assessment Monitoring Stations (PAMS)

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6. References

1. Monitoring Objectives and Spatial Scales.

The purpose of this appendix is to describe monitoring objectives and general criteria to be applied in establishing the required SLAMS ambient air quality monitoring stations and for choosing general locations for additional monitoring sites. This appendix also describes specific requirements for the number and location of FRM, FEM, and ARM sites for specific pollutants, NCore multipollutant sites, PM_{10-2.5} mass sites, chemically speciated PM_{10-2.5} sites, continuous PM_{2.5} mass sites, chemically speciated PM_{2.5} sites, and ozone precursor measurements sites (PAMS). These criteria will be used by EPA in evaluating the adequacy of the air pollutant monitoring networks.

1.1 Monitoring Objectives. The ambient air monitoring networks must be designed to meet three basic monitoring objectives. These basic objectives are listed below. The appearance of any one objective in the order of this list is not based upon a prioritized scheme. Each objective is important and must be considered individually.

- Provide air pollution data to the general public in a timely manner. Data can be presented to the public in a

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number of attractive ways including through air quality maps, newspapers, Internet sites, and as part of weather forecasts and public advisories.

- Support compliance with ambient air quality standards and emissions strategy development. Data from FRM, FEM, and ARM monitors will be used for comparing an area's air pollution levels against the National Ambient Air Quality Standards (NAAQS). Data from monitors of various types can be used in the development of attainment and maintenance plans. SLAMS, and especially NCore station data, will be used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality. In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions.

1.1.3 Support for air pollution research studies. Air pollution data from the NCore network can be used to supplement data collected by researchers working on health effects assessments and atmospheric processes, or for monitoring methods development work.

In order to support the air quality management work

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indicated in the three basic air monitoring objectives, a network must be designed with a variety of types of monitoring sites. Monitoring sites must be capable of informing managers about many things including the peak air pollution levels, typical levels in populated areas, air pollution transported into and outside of a city or region, and air pollution levels near specific sources. To summarize some of these sites, here is a listing of six general site types:

(1) Sites located to determine the highest concentrations expected to occur in the area covered by the network.

(2) Sites located to measure typical concentrations in areas of high population density.

(3) Sites located to determine the impact of significant sources or source categories on air quality.

(4) Sites located to determine general background concentration levels.

(5) Sites located to determine the extent of Regional pollutant transport among populated areas; and in support of secondary standards.

(6) Sites located to measure air pollution impacts on visibility, vegetation damage, or other welfare-based

impacts.

This appendix contains criteria for the basic air monitoring requirements. The total number of monitoring sites that will serve the variety of data needs will be substantially higher than these minimum requirements provide. The optimum size of a particular network involves trade-offs among data needs and available resources. This regulation intends to provide for national air monitoring needs, and to lend support for the flexibility necessary to meet data collection needs of area air quality managers. EPA, State, and local agencies will periodically collaborate on network design issues through the network assessment process outlined in §58.10.

This appendix focuses on the relationship between monitoring objectives, site types, and the geographic location of monitoring sites. Included are a rationale and set of general criteria for identifying candidate site locations in terms of physical characteristics which most closely match a specific monitoring objective. The criteria for more specifically locating the monitoring site, including spacing from roadways and vertical and horizontal probe and path placement, are described in appendix E to this part.

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1.2 Spatial Scales. To clarify the nature of the link between general monitoring objectives, site types, and the physical location of a particular monitor, the concept of spatial scale of representativeness is defined. The goal in locating monitors is to correctly match the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for the monitoring site type, air pollutant to be measured, and the monitoring objective.

Thus, spatial scale of representativeness is described in terms of the physical dimensions of the air parcel nearest to a monitoring site throughout which actual pollutant concentrations are reasonably similar. The scales of representativeness of most interest for the monitoring site types described above are as follows:

Microscale--defines the concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.

Middle scale--defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometer.

Neighborhood scale--defines concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range. The

neighborhood and urban scales listed below have the potential to overlap in applications that concern secondarily formed or homogeneously distributed air pollutants.

Urban scale--defines concentrations within an area of city-like dimensions, on the order of 4 to 50 kilometers. Within a city, the geographic placement of sources may result in there being no single site that can be said to represent air quality on an urban scale.

Regional scale--defines usually a rural area of reasonably homogeneous geography without large sources, and extends from tens to hundreds of kilometers.

National and global scales--these measurement scales represent concentrations characterizing the nation and the globe as a whole.

Proper siting of a monitor requires specification of the monitoring objective, the types of sites necessary to meet the objective, and then the desired spatial scale of representativeness. For example, consider the case where the objective is to determine NAAQS compliance by understanding the maximum ozone concentrations for an area. Such areas would most likely be located downwind of a metropolitan area, quite likely in a suburban residential

area where children and other susceptible individuals are likely to be outdoors. Sites located in these areas are most likely to represent an urban scale of measurement. In this example, physical location was determined by considering ozone precursor emission patterns, public activity, and meteorological characteristics affecting ozone formation and dispersion. Thus, spatial scale of representativeness was not used in the selection process but was a result of site location.

In some cases, the physical location of a site is determined from joint consideration of both the basic monitoring objective and the type of monitoring site desired, or required by this appendix. For example, to determine $PM_{2.5}$ concentrations which are typical over a geographic area having relatively high $PM_{2.5}$ concentrations, a neighborhood scale site is more appropriate. Such a site would likely be located in a residential or commercial area having a high overall $PM_{2.5}$ emission density but not in the immediate vicinity of any single dominant source. Note that in this example, the desired scale of representativeness was an important factor in determining the physical location of the monitoring site.

In either case, classification of the monitor by its

type and spatial scale of representativeness is necessary and will aid in interpretation of the monitoring data for a particular monitoring objective (e.g., public reporting, NAAQS compliance, or research support).

Table D-1 of this appendix illustrates the relationship between the various site types that can be used to support the three basic monitoring objectives, and the scales of representativeness that are generally most appropriate for that type of site.

Table D-1 of Appendix D to Part 58. Relationship Between Site Types and Scales of Representativeness.

Site type	Appropriate siting scales
1. Highest concentration .	Micro, middle, neighborhood (sometimes urban or regional for secondarily formed pollutants).
2. Population oriented . .	Neighborhood, urban.
3. Source impact	Micro, middle, neighborhood.
4. General/background & regional transport . .	Urban, regional.
5. Welfare-related impacts	Urban, regional.

2. General Monitoring Requirements.

The National ambient air monitoring system includes several types of monitoring stations, each targeting a key data collection need and each varying in technical

sophistication.

Research grade sites are platforms for scientific studies, either involved with health or welfare impacts, measurement methods development, or other atmospheric studies. These sites may be collaborative efforts between regulatory agencies and researchers with specific scientific objectives for each. Data from these sites might be collected with both traditional and experimental techniques, and data collection might involve specific laboratory analyses not common in routine measurement programs. The research grade sites are not required by regulation; however, they are mentioned here due to their important role in supporting the air quality management program.

The National Core multipollutant (NCore) sites are sites that measure multiple pollutants in order to provide support to integrated air quality management data needs. NCore sites include urban scale measurements in general, in a selection of metropolitan areas and a limited number of more rural locations. Continuous monitoring methods are to be used at the NCore sites when available for a pollutant to be measured, as it is important to have data collected over common time periods for integrated analyses. NCore multipollutant sites are intended to be long-term sites

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useful for a variety of applications including air quality trends analyses, model evaluation, and tracking metropolitan area statistics. As such, the NCore sites should be placed away from direct emission sources that could substantially impact the ability to detect area-wide concentrations. NCore sites will also supplement other SLAMS sites in reporting to the public in major metropolitan areas. It is not the intent of the NCore sites to monitor in every area where the NAAQS are violated, rather they provide only a subset of the total monitoring effort necessary to accomplish air quality management goals. The total number of monitoring sites that will serve the variety of national, State, and local governmental needs will be substantially higher than these NCore requirements. The Administrator must approve the NCore sites.

Monitoring sites designated as SLAMS sites, but not as NCore sites, are intended to address specific air quality management interests, and as such, are frequently single-pollutant measurement sites. The EPA Regional Administrator must approve the SLAMS sites.

This appendix uses the statistical-based definitions for metropolitan areas provided by the Office of Management and Budget and the Census Bureau. These areas are referred

to as metropolitan statistical areas (MSA), micropolitan statistical areas, core-based statistical areas (CBSA), and combined statistical areas (CSA). A CBSA associated with at least one urbanized area of at least 50,000 population is termed a Metropolitan Statistical Area. A CBSA associated with at least one urbanized cluster of at least 10,000 population is termed a Micropolitan Statistical Area. CSAs consist of two or more adjacent CBSAs. In this appendix, the term MSA will be used to refer to a Metropolitan Statistical Area. By definition, both MSAs and CSAs have a high degree of integration; however, many such areas cross State or other political boundaries. MSAs and CSAs may also cross more than one air shed. EPA recognizes that State or local agencies must consider MSA/CSA boundaries and their own political boundaries and geographical characteristics in designing their air monitoring networks. EPA recognizes that there may be situations where the EPA Regional Administrator and the affected State or local agencies may need to augment or to divide the overall MSA/CSA monitoring responsibilities and requirements among these various agencies to achieve an effective network design. Full monitoring requirements apply separately to each affected State or local agency in the absence of an agreement between

the affected agencies and the EPA Regional Administrator.

3. Design Criteria for NCore Sites.

Each State is required to operate one NCore site. States may delegate this requirement to a local agency. States with many MSAs often also have multiple air sheds with unique characteristics and, often, elevated air pollution. These States include, at a minimum, California, Florida, Illinois, Michigan, New York, North Carolina, Ohio, Pennsylvania, and Texas. These States are required to identify one to two additional NCore sites in order to account for their unique situations. Any State or local agency can propose additional candidate NCore sites or modifications to these requirements for approval by the Administrator. The NCore locations should be leveraged with other multi-pollutant air monitoring sites including PAMS sites, NATTS sites, CASTNET sites, and STN sites. Site leveraging includes using the same monitoring platform and equipment to meet the objectives of the variety of programs where possible and advantageous.

The NCore sites must measure, at a minimum, $PM_{2.5}$ particle mass using continuous and integrated/filter-based samplers, speciated $PM_{2.5}$, $PM_{10-2.5}$ particle mass using continuous samplers, O_3 , SO_2 , CO , NO/NO_y wind speed, wind

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direction, relative humidity, and ambient temperature. EPA recognizes that, in some cases, the physical location of the NCore site may not be suitable for representative meteorological measurements due to the site's physical surroundings. It is also possible that nearby meteorological measurements may be able to fulfill this data need. In these cases, the requirement for meteorological monitoring can be waived by the Administrator.

In addition to the continuous measurements listed above, ten of the NCore locations (either at the same sites or elsewhere within the MSA/CSA boundary) must also measure lead. These ten lead sites are included within the NCore networks because they are intended to be long-term in operation, and not impacted directly from a single lead source. These locations for lead monitoring must be located in the most populated MSA/CSA in each of the ten EPA Regions. Alternatively, it is also acceptable to use the lead concentration data provided at urban air toxics sites. In approving any substitutions, the Administrator must consider whether these alternative sites are suitable for collecting long-term lead trends data for the broader area.

4. Pollutant-Specific Design Criteria for SLAMS Sites.

4.1 Ozone (O₃) Design Criteria. State, and where

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appropriate, local Agencies must operate ozone sites for various locations depending upon area size (in terms of population and geographic characteristics) and typical peak concentrations (expressed in percentages above, below, or near the ozone NAAQS). Specific SLAMS O₃ site minimum requirements are included in Table D-2 of this appendix. Typically, most of these required ozone sites will be SLAMS. The NCore sites are expected to compliment the O₃ data collection that takes place at SLAMS sites, and both types of sites can be used to meet the network minimum requirements. The total number of O₃ sites needed to support the basic monitoring objectives of public data reporting, air quality mapping, compliance, and understanding O₃-related atmospheric processes will include more sites than these minimum numbers required in Table D-2 of this appendix. The EPA Regional Administrator and the responsible State or local air monitoring agency must work together to design and/or maintain the most appropriate O₃ network to service the variety of data needs in an area.

Table D-2 of Appendix D to Part 58. SLAMS Minimum O₃ Monitoring Requirements.

MSA or CSA population ³	Most recent 3-year design value concentrations >115% of any O ₃ NAAQS ¹	Most recent 3-year design value concentrations ±15% of any O ₃ NAAQS ¹	Most recent 3-year design value concentrations <85% of any O ₃ NAAQS ^{1, 2}
>10 million	3	4	2
4-10 million	2	3	1
1-4 million	2	2	1
350,000-1 million	2	2	1
200,000-350,000	1	1	0
50,000-<200,000 ⁴	1	1	0

¹ The O₃ NAAQS levels and forms are defined in 40 CFR part 50.

² These minimum monitoring requirements apply in the absence of a design value.

³ Minimum monitoring requirements apply to the CSA as a whole, if applicable.

⁴ MSAs must contain an urbanized area of 50,000 or more population.

At least one O₃ site in each MSA/CSA's ozone network must be designed to record the maximum concentration for that particular metropolitan area. More than one maximum concentration site may be necessary in some areas. Table D-2 of this appendix does not account for the full breadth of additional factors that would be considered in designing a complete ozone monitoring program for an area. Some of these additional factors include geographic size, population density, complexity of terrain and meteorology, adjacent ozone monitoring programs, air pollution transport from neighboring areas, and measured air quality in comparison to all forms of the O₃ NAAQS (i.e., 8-hour and 1-hour forms). Networks must be designed to account for all of these area characteristics. Network designs must be re-examined in periodic network assessments. Deviations from the above O₃ requirements are allowed if approved by the EPA Regional Administrator.

The appropriate spatial scales for ozone sites are neighborhood, urban, and regional. Since ozone requires appreciable formation time, the mixing of reactants and products occurs over large volumes of air, and this reduces the importance of monitoring small scale spatial variability.

Neighborhood scale--Measurements in this category represent conditions throughout some reasonably homogeneous urban subregion, with dimensions of a few kilometers. Homogeneity refers to pollutant concentrations. Neighborhood scale data will provide valuable information for developing, testing, and revising concepts and models that describe urban/regional concentration patterns. These data will be useful to the understanding and definition of processes that take periods of hours to occur and hence involve considerable mixing and transport. Under stagnation conditions, a site located in the neighborhood scale may also experience peak concentration levels within a metropolitan area.

Urban scale--Measurement in this scale will be used to estimate concentrations over large portions of an urban area with dimensions of several kilometers to 50 or more kilometers. Such measurements will be used for determining trends, and designing area-wide control strategies. The urban scale sites would also be used to measure high concentrations downwind of the area having the highest precursor emissions.

Regional scale--This scale of measurement will be used to typify concentrations over large portions of a

metropolitan area and even larger areas with dimensions of as much as hundreds of kilometers. Such measurements will be useful for assessing the ozone that is transported to and from a metropolitan area, as well as background concentrations. In some situations, particularly when considering very large metropolitan areas with complex source mixtures, regional scale sites can be the maximum concentration location.

EPA's technical guidance documents on ozone monitoring network design should be used to evaluate the adequacy of each existing O₃ monitor, to relocate an existing site, or to locate any new O₃ sites.

For locating a neighborhood scale site to measure typical city concentrations, a reasonably homogeneous geographical area near the center of the region should be selected which is also removed from the influence of major NO_x sources. For an urban scale site to measure the high concentration areas, the emission inventories should be used to define the extent of the area of important nonmethane hydrocarbons and NO_x emissions. The meteorological conditions that occur during periods of maximum photochemical activity should be determined. These periods can be identified by examining the meteorological conditions

that occur on the highest ozone air quality days. Trajectory analyses, an evaluation of wind and emission patterns on high ozone days, can also be useful in evaluating an ozone monitoring network. In areas without any previous ozone air quality measurements, meteorological and ozone precursor emissions information would be useful.

Once the meteorological and air quality data are reviewed, the prospective maximum concentration monitor site should be selected in a direction from the city that is most likely to observe the highest ozone concentrations, more specifically, downwind during periods of photochemical activity. In many cases, these maximum concentration ozone sites will be located 10 to 30 miles or more downwind from the urban area where maximum ozone precursor emissions originate. The downwind direction and appropriate distance should be determined from historical meteorological data collected on days which show the potential for producing high ozone levels. Monitoring agencies are to consult with their EPA Regional Office when considering siting a maximum ozone concentration site.

In locating a neighborhood scale site which is to measure high concentrations, the same procedures used for the urban scale are followed except that the site should be

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located closer to the areas bordering on the center city or slightly further downwind in an area of high density population.

For regional scale background monitoring sites, similar meteorological analysis as for the maximum concentration sites may also inform the decisions for locating regional scale sites. Regional scale sites may be located to provide data on ozone transport between cities, as background sites, or for other data collection purposes. Consideration of both area characteristics, such as meteorology, and the data collection objectives, such as transport, must be jointly considered for a regional scale site to be useful.

Since ozone levels decrease significantly in the colder parts of the year in many areas, ozone is required to be monitored at SLAMS monitoring sites only during the "ozone season" as designated in the AQS files on a State-by-State basis and described below in Table D-3 of this appendix. Deviations from the ozone monitoring season must be approved by the EPA Regional Administrator, documented within the annual monitoring network plan, and updated in AQS. Information on how to analyze ozone data to support a change to the ozone season in support of the 8-hour standard for a specific State can be found in reference 20 to this

appendix.

Table D-3 to Appendix D of Part 58. Ozone Monitoring Season
by State

State	Begin Month	End Month
Alabama	March	October
Alaska	April	October
Arizona	January	December
Arkansas	March	November
California	January	December
Colorado	March	September
Connecticut	April	September
Delaware	April	October
District of Columbia	April	October
Florida	March	October
Georgia	March	October
Hawaii	January	December
Idaho	May	September
Illinois	April	October
Indiana	April	September
Iowa	April	October
Kansas	April	October
Kentucky	March	October
Louisiana AQCR 019,022	March	October
Louisiana AQCR 106	January	December
Maine	April	September
Maryland	April	October
Massachusetts	April	September

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Michigan	April	September
Minnesota	April	October
Mississippi	March	October
Missouri	April	October
Montana	June	September
Nebraska	April	October
Nevada	January	December
New Hampshire	April	September
New Jersey	April	October
New Mexico	January	December
New York	April	October
North Carolina	April	October
North Dakota	May	September
Ohio	April	October
Oklahoma	March	November
Oregon	May	September
Pennsylvania	April	October
Puerto Rico	January	December
Rhode Island	April	September
South Carolina	April	October
South Dakota	June	September
Tennessee	March	October
Texas AQCR 106, 153, 213, 214, 216	January	December
Texas AQCR 022, 210, 211, 212, 215, 217, 218	March	October

Utah	May	September
Vermont	April	September
Virginia	April	October
Washington	May	September
West Virginia	April	October
Wisconsin	April 15	October 15
Wyoming	April	October
American Samoa	January	December
Guam	January	December
Virgin Islands	January	December

4.2 Carbon Monoxide (CO) Design Criteria. There are no minimum requirements for the number of CO monitoring sites. Continued operation of existing SLAMS CO sites using FRM or FEM methods is required until discontinuation is approved by the EPA Regional Administrator. Where SLAMS CO monitoring is required, at least one site must be a maximum concentration site for that area under investigation.

Microscale and middle scale measurements are useful site classifications for SLAMS sites since most people have the potential for exposure on these scales. Carbon monoxide maxima occur primarily in areas near major roadways and intersections with high traffic density and often poor atmospheric ventilation.

Microscale--This scale applies when air quality measurements are to be used to represent distributions within street canyons, over sidewalks, and near major roadways. In the case with carbon monoxide, microscale measurements in one location can often be considered as representative of other similar locations in a city.

Middle scale--Middle scale measurements are intended to represent areas with dimensions from 100 meters to 0.5 kilometer. In certain cases, middle scale measurements may apply to areas that have a total length of several

kilometers, such as "line" emission source areas. This type of emission sources areas would include air quality along a commercially developed street or shopping plaza, freeway corridors, parking lots and feeder streets.

After the spatial scale and type of site has been determined to meet the monitoring objective for each location, the technical guidance in reference 3 of this appendix should be used to evaluate the adequacy of each existing CO site and must be used to relocate an existing site or to locate any new sites.

4.3 Nitrogen Dioxide (NO₂) Design Criteria. There are no minimum requirements for the number of NO₂ monitoring sites. Continued operation of existing SLAMS NO₂ sites using FRM or FEM methods is required until discontinuation is approved by the EPA Regional Administrator. Where SLAMS NO₂ monitoring is required, at least one NO₂ site in the area must be located to measure the maximum concentration of NO₂.

NO/NO_y measurements are included within the NCore multipollutant site requirements and the PAMS program. These NO/NO_y measurements will produce conservative estimates for NO₂ that can be used to track continued compliance with the NO₂ NAAQS. NO/NO_y monitors are used at

these sites because it is important to collect data on total reactive nitrogen species for understanding ozone photochemistry.

4.4 Sulfur Dioxide (SO₂) Design Criteria. There are no minimum requirements for the number of SO₂ monitoring sites. Continued operation of existing SLAMS SO₂ sites using FRM or FEM methods is required until discontinuation is approved by the EPA Regional Administrator. Where SLAMS SO₂ monitoring is required, at least one of the SLAMS SO₂ sites must be a maximum concentration site for that specific area.

The appropriate spatial scales for SO₂ SLAMS monitoring are the microscale, middle, and possibly neighborhood scales. The multi-pollutant NCore sites can provide for metropolitan area trends analyses and general control strategy progress tracking. Other SLAMS sites are expected to provide data that are useful in specific compliance actions, for maintenance plan agreements, or for measuring near specific stationary sources of SO₂.

Micro and middle scale--Some data uses associated with microscale and middle scale measurements for SO₂ include assessing the effects of control strategies to reduce concentrations (especially for the 3-hour and 24-hour

averaging times) and monitoring air pollution episodes.

Neighborhood scale--This scale applies where there is a need to collect air quality data as part of an ongoing SO₂ stationary source impact investigation. Typical locations might include suburban areas adjacent to SO₂ stationary sources for example, or for determining background concentrations as part of these studies of population responses to exposure to SO₂.

Technical guidance in reference 2 of this appendix should be used to evaluate the adequacy of each existing SO₂ site, to relocate an existing site, or to locate new sites.

4.5 Lead (Pb) Design Criteria. State, and where appropriate, local agencies are required to conduct Pb monitoring for all areas where Pb levels have been shown or are expected to be of concern over the most recent 2 years. As a minimum, there must be two SLAMS sites in any area where Pb concentrations currently exceed or have exceeded the Pb NAAQS in the most recent 2 years, and at least one of these two required sites must be a maximum concentration site. Where the Pb air quality violations are widespread or the emissions density, topography, or population locations are complex and varied, the EPA Regional Administrator may require more than two Pb ambient air monitoring sites.

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The most important spatial scales to effectively characterize the emissions from point sources are the micro, middle, and neighborhood scales.

Microscale--This scale would typify areas in close proximity to lead point sources. Emissions from point sources such as primary and secondary lead smelters, and primary copper smelters may under fumigation conditions likewise result in high ground level concentrations at the microscale. In the latter case, the microscale would represent an area impacted by the plume with dimensions extending up to approximately 100 meters. Data collected at microscale sites provide information for evaluating and developing "hot-spot" control measures.

Middle scale--This scale generally represents Pb air quality levels in areas up to several city blocks in size with dimensions on the order of approximately 100 meters to 500 meters. The middle scale may for example, include schools and playgrounds in center city areas which are close to major Pb point sources. Pb monitors in such areas are desirable because of the higher sensitivity of children to exposures of elevated Pb concentrations (reference 7 of this appendix). Emissions from point sources frequently impact on areas at which single sites may be located to measure

concentrations representing middle spatial scales.

Neighborhood scale--The neighborhood scale would characterize air quality conditions throughout some relatively uniform land use areas with dimensions in the 0.5 to 4.0 kilometer range. Sites of this scale would provide monitoring data in areas representing conditions where children live and play. Monitoring in such areas is important since this segment of the population is more susceptible to the effects of Pb. Where a neighborhood site is located away from immediate Pb sources, the site may be very useful in representing typical air quality values for a larger residential area, and therefore suitable for population exposure and trends analyses.

Technical guidance is found in references 9 and 10 of this appendix. These documents provide additional guidance on locating sites to meet specific urban area monitoring objectives and should be used in locating new sites or evaluating the adequacy of existing sites.

4.6 Particulate Matter (PM₁₀) Design Criteria. There are no minimum requirements for the number of PM₁₀ monitoring sites. In areas where the PM₁₀ NAAQS has not been revoked, continued operation of existing SLAMS PM₁₀ sites using FRM or FEM methods is required until

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discontinuation is approved by the EPA Regional Administrator. In areas for where the PM₁₀ NAAQS has been revoked, there is no requirement for continued operation of existing sites.

The most important spatial scales to effectively characterize the emissions of PM₁₀ from both mobile and stationary sources are the middle scales and neighborhood scales. For purposes of establishing monitoring sites to represent large homogenous areas other than the above scales of representativeness and to characterize regional transport, urban or regional scale sites would also be needed.

Microscale--This scale would typify areas such as downtown street canyons, traffic corridors, and fence line stationary source monitoring locations where the general public could be exposed to maximum PM₁₀ concentrations. Microscale particulate matter sites should be located near inhabited buildings or locations where the general public can be expected to be exposed to the concentration measured. Emissions from stationary sources such as primary and secondary smelters, power plants, and other large industrial processes may, under certain plume conditions, likewise result in high ground level concentrations at the

microscale. In the latter case, the microscale would represent an area impacted by the plume with dimensions extending up to approximately 100 meters. Data collected at microscale sites provide information for evaluating and developing hot spot control measures.

Middle scale--Much of the short-term public exposure to coarse fraction particles (PM_{10}) is on this scale and on the neighborhood scale. People moving through downtown areas or living near major roadways or stationary sources, may encounter particulate pollution that would be adequately characterized by measurements of this spatial scale. Middle scale PM_{10} measurements can be appropriate for the evaluation of possible short-term exposure public health effects. In many situations, monitoring sites that are representative of micro-scale or middle-scale impacts are not unique and are representative of many similar situations. This can occur along traffic corridors or other locations in a residential district. In this case, one location is representative of a neighborhood of small scale sites and is appropriate for evaluation of long-term or chronic effects. This scale also includes the characteristic concentrations for other areas with dimensions of a few hundred meters such as the parking lot

and feeder streets associated with shopping centers, stadia, and office buildings. In the case of PM_{10} , unpaved or seldomly swept parking lots associated with these sources could be an important source in addition to the vehicular emissions themselves.

Neighborhood scale--Measurements in this category represent conditions throughout some reasonably homogeneous urban subregion with dimensions of a few kilometers and of generally more regular shape than the middle scale. Homogeneity refers to the particulate matter concentrations, as well as the land use and land surface characteristics. In some cases, a location carefully chosen to provide neighborhood scale data would represent not only the immediate neighborhood but also neighborhoods of the same type in other parts of the city. Neighborhood scale PM_{10} sites provide information about trends and compliance with standards because they often represent conditions in areas where people commonly live and work for extended periods. Neighborhood scale data could provide valuable information for developing, testing, and revising models that describe the larger-scale concentration patterns, especially those models relying on spatially smoothed emission fields for inputs. The neighborhood scale measurements could also be

used for neighborhood comparisons within or between cities.

Urban scale--This class of measurement would be made to characterize the particulate matter concentration over an entire metropolitan or rural area ranging in size from 4 to 50 kilometers. Such measurements would be useful for assessing trends in area-wide air quality, and hence, the effectiveness of large scale air pollution control strategies.

Regional scale--These measurements would characterize conditions over areas with dimensions of as much as hundreds of kilometers. As noted earlier, using representative conditions for an area implies some degree of homogeneity in that area. For this reason, regional scale measurements would be most applicable to sparsely populated areas. Data characteristics of this scale would provide information about larger scale processes of particulate matter emissions, losses and transport.

4.7 Fine Particulate Matter (PM_{2.5}) Design Criteria.

4.7.1 General Requirements. State, and where applicable local, agencies must operate the minimum number of required PM_{2.5} SLAMS sites listed in Table D-4 of this appendix. The NCore sites are expected to complement the PM_{2.5} data collection that takes place at non-NCore SLAMS

sites, and both types of sites can be used to meet the minimum PM_{2.5} network requirements. Deviations from these PM_{2.5} monitoring requirements must be approved by the EPA Regional Administrator.

Table D-4 of Appendix D to Part 58. PM_{2.5} Minimum Monitoring Requirements

MSA or CSA population ³	Most recent 3-year design value $\geq 115\%$ of any PM _{2.5} NAAQS ¹	Most recent 3-year design value $\pm 15\%$ of any PM _{2.5} NAAQS ¹	Most recent 3-year design value $\leq 85\%$ of any PM _{2.5} NAAQS ^{1, 2}
> 1,000,000	2	3	2
500,000 - 1,000,000 . .	1	2	1
250,000 - 500,000 . . .	1	1	0
100,000-250,000 . . .	1	1	0
50,000- <100,000 ⁴	1	1	0

¹ The PM_{2.5} National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.

² These minimum monitoring requirements apply in the absence of a design value.

³ Minimum monitoring requirements apply to the CSA as a whole, where applicable.

⁴ MSAs must contain an urbanized area of 50,000 or more population.

The technical guidance in references 17 and 18 of this appendix should be used for siting PM_{2.5} monitors.

The most important spatial scale to effectively characterize the emissions of particulate matter from both mobile and stationary sources is the neighborhood scale for PM_{2.5}. For purposes of establishing monitoring sites to represent large homogenous areas other than the above scales of representativeness and to characterize regional transport, urban or regional scale sites would also be needed. Most PM_{2.5} monitoring in urban areas should be representative of a neighborhood scale.

Microscale--This scale would typify areas such as downtown street canyons and traffic corridors where the general public would be exposed to maximum concentrations from mobile sources. In some circumstances, the microscale is appropriate for particulate sites; community-oriented SLAMS sites measured at the microscale level should, however, be limited to urban sites that are representative of long-term human exposure and of many such microenvironments in the area. In general, microscale particulate matter sites should be located near inhabited buildings or locations where the general public can be expected to be exposed to the concentration measured.

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Emissions from stationary sources such as primary and secondary smelters, power plants, and other large industrial processes may, under certain plume conditions, likewise result in high ground level concentrations at the microscale. In the latter case, the microscale would represent an area impacted by the plume with dimensions extending up to approximately 100 meters. Data collected at microscale sites provide information for evaluating and developing hot spot control measures. Unless these sites are indicative of population-oriented monitoring, they may be more appropriately classified as special purpose monitors (SPMs).

Middle scale--People moving through downtown areas, or living near major roadways, encounter particle concentrations that would be adequately characterized by this spatial scale. Thus, measurements of this type would be appropriate for the evaluation of possible short-term exposure public health effects of particulate matter pollution. In many situations, monitoring sites that are representative of microscale or middle-scale impacts are not unique and are representative of many similar situations. This can occur along traffic corridors or other locations in a residential district. In this case, one location is

representative of a number of small scale sites and is appropriate for evaluation of long-term or chronic effects. This scale also includes the characteristic concentrations for other areas with dimensions of a few hundred meters such as the parking lot and feeder streets associated with shopping centers, stadia, and office buildings.

Neighborhood scale--Measurements in this category would represent conditions throughout some reasonably homogeneous urban subregion with dimensions of a few kilometers and of generally more regular shape than the middle scale. Homogeneity refers to the particulate matter concentrations, as well as the land use and land surface characteristics. Much of the $PM_{2.5}$ exposures are expected to be associated with this scale of measurement. In some cases, a location carefully chosen to provide neighborhood scale data would represent the immediate neighborhood as well as neighborhoods of the same type in other parts of the city. $PM_{2.5}$ sites of this kind provide good information about trends and compliance with standards because they often represent conditions in areas where people commonly live and work for periods comparable to those specified in the NAAQS. In general, most $PM_{2.5}$ monitoring in urban areas should have this scale.

Urban scale--This class of measurement would be used to characterize the particulate matter concentration over an entire metropolitan or rural area ranging in size from 4 to 50 kilometers. Such measurements would be useful for assessing trends in area-wide air quality, and hence, the effectiveness of large scale air pollution control strategies. Community-oriented PM_{2.5} sites may have this scale.

Regional scale--These measurements would characterize conditions over areas with dimensions of as much as hundreds of kilometers. As noted earlier, using representative conditions for an area implies some degree of homogeneity in that area. For this reason, regional scale measurements would be most applicable to sparsely populated areas. Data characteristics of this scale would provide information about larger scale processes of particulate matter emissions, losses and transport. PM_{2.5} transport contributes to elevated particulate concentrations and may affect multiple urban and State entities with large populations such as in the eastern United States. Development of effective pollution control strategies requires an understanding at regional geographical scales of the emission sources and atmospheric processes that are

responsible for elevated PM_{2.5} levels and may also be associated with elevated ozone and regional haze.

4.7.2 Requirement for Continuous PM_{2.5} Monitoring. State, or where appropriate, local agencies must operate continuous fine particulate analyzers at one-half (round up) of the minimum required sites listed in Table D-4 of this appendix. State and local air monitoring agencies must use methodologies and quality assurance/quality control (QA/QC) procedures approved by the EPA Regional Administrator for these sites.

4.7.3 Requirement for PM_{2.5} Background and Transport Sites. Each State shall install and operate at least one PM_{2.5} site to monitor for regional background and at least one PM_{2.5} site to monitor regional transport. These monitoring sites may be at community-oriented sites and this requirement may be satisfied by a corresponding monitor in an area having similar air quality in another State. State and local air monitoring agencies must use methodologies and QA/QC procedures approved by the EPA Regional Administrator for these sites. Methods used at these sites may include non-federal reference method samplers such as IMPROVE or continuous PM_{2.5} monitors.

4.7.4 PM_{2.5} Chemical Speciation Site Requirements.

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Each State shall continue to conduct chemical speciation monitoring and analyses at sites designated to be part of the PM_{2.5} Speciation Trends Network (STN). The selection and modification of these STN sites must be approved by the Administrator. The PM_{2.5} chemical speciation urban trends sites shall include analysis for elements, selected anions and cations, and carbon. Samples must be collected using the monitoring methods and the sampling schedules approved by the Administrator. Chemical speciation is encouraged at additional sites where the chemically resolved data would be useful in developing State implementation plans and supporting atmospheric or health effects related studies.

4.7.5 Special Network Considerations Required When Using PM_{2.5} Spatial Averaging Approaches. The PM_{2.5} NAAQS, specified in 40 CFR 50, provides State and local air monitoring agencies with an option for spatially averaging PM_{2.5} air quality data. More specifically, two or more community-oriented (i.e., sites in populated areas) PM_{2.5} monitors may be averaged for comparison with the annual PM_{2.5} NAAQS. This averaging approach is directly related to epidemiological studies used as the basis for the PM_{2.5} annual NAAQS. Spatial averaging does not apply to comparisons with the daily PM_{2.5} NAAQS.

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State and local agencies must carefully consider their approach for $PM_{2.5}$ network design when they intend to spatially average the data for compliance purposes. These State and local air monitoring agencies must define the area over which they intend to average $PM_{2.5}$ air quality concentrations. This area is defined as a Community Monitoring Zone (CMZ), which characterizes an area of relatively similar annual average air quality. State and local agencies can define a CMZ in a number of ways, including as part or all of a metropolitan area. These CMZ must be defined within a State or local agencies network description, as required in §58.10 of this part and approved by the EPA Regional Administrator. When more than one CMZ is described within an agency's network design plan, CMZs must not overlap in their geographical coverage. The criteria that must be used for evaluating the acceptability of spatial averaging are defined in Appendix N of 40 CFR Part 50.

4.8 Coarse Particulate Matter ($PM_{10-2.5}$) Design Criteria.

4.8.1 General Monitoring Requirements. Consistent with the indicator for the proposed new $PM_{10-2.5}$ NAAQS, required $PM_{10-2.5}$ monitoring will address areas where the mix of $PM_{10-2.5}$

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is dominated by coarse fraction particulate matter generated by high density traffic on paved roads, industrial sources, and construction activities, and will not address areas where the mix is dominated by rural windblown dust and soils and agricultural and mining sources.

State, and where applicable, local Agencies must operate, at a minimum, the number of required $PM_{10-2.5}$ SLAMS sites listed in Table D-5 of this appendix. NCore sites are expected to complement the $PM_{10-2.5}$ data collection that takes place at SLAMS Sites. Data from urban NCore sites can be used to meet minimum $PM_{10-2.5}$ network requirements if those sites meet the NAAQS comparability criteria in §58.30 (b). Modifications from the $PM_{10-2.5}$ monitoring requirements must be approved by the Regional Administrator.

Table D-5 of Appendix D to Part 58. $PM_{10-2.5}$ Minimum

Monitoring Requirements

MSA population ¹	Most recent 3-year design value ² $\geq 80\%$ of $PM_{10-2.5}$ NAAQS ³	Most recent 3-year design value 50%-80% of $PM_{10-2.5}$ NAAQS ^{3,4}	Most recent 3-year design value $< 50\%$ of $PM_{10-2.5}$ NAAQS ³
$\geq 5,000,000$	5	3	2
1,000,000 - $< 5,000,000$	4	2	1
500,000 - $< 1,000,000$	3	1	0
100,000 - $< 500,000$. .	2	1	0
50,000 - $< 100,000$ ⁵ . .	1	0	0

¹ Metropolitan Statistical Area (MSA) as defined by the Office of Management of Budget. Multiple MSAs in a CSA are separately subject to these requirements based on their population and design value.

² A database of estimated $PM_{10-2.5}$ design values will be provided by EPA until the network is fully deployed for three years. States may propose alternate estimates for EPA Regional Administrator approval.

³ The $PM_{10-2.5}$ National Ambient Air Quality Standards (NAAQS) levels and forms are defined in part 50 of this chapter.

⁴ These minimum monitoring requirements apply in the absence of a design value.

⁵ An MSA must contain an urbanized area of at least 50,000. The smallest MSA's population is greater than 50,000 because of population outside the urbanized area.

Middle and neighborhood scale measurements are the most important station classifications for $PM_{10-2.5}$ to assess the variation in coarse particle concentrations that would be expected across populated areas that are in proximity to large emissions sources. Sites that represent larger spatial scales would characterize concentrations in the suburban, highly populated areas of larger MSA's that are more distant from the zones of most concentrated industrial activity.

Microscale--This scale would typify relatively small areas immediately adjacent to: (1) industrial sources; (2) locations experiencing ongoing construction, redevelopment, and soil disturbance; and (3) heavily traveled roadways. Data collected at microscale stations would characterize exposure over areas of limited spatial extent and population exposure, and may provide information useful for evaluating and developing source-oriented control measures. Microscale sites would be excluded from NAAQS comparison in accordance with §58.30(b)(4), and may be more appropriately classified as SPMs.

Middle scale--People living or working near major roadways or industrial districts encounter particle concentrations that would be adequately characterized by

this spatial scale. Thus, measurements of this type would be appropriate for the evaluation of public health effects of coarse particle exposure. Monitors located in populated areas that are nearly adjacent to large industrial point sources of coarse particles provide suitable locations for assessing maximum population exposure levels and identifying areas of potentially poor air quality. Similarly, monitors located in populated areas that border dense networks of heavily-traveled traffic are appropriate for assessing the impacts of resuspended road dust. This scale also includes the characteristic concentrations for other areas with dimensions of a few hundred meters such as school grounds and parks that are nearly adjacent to major roadways and industrial point sources, locations exhibiting mixed residential and commercial development, and downtown areas featuring office buildings, shopping centers, and stadiums.

Neighborhood scale--Measurements in this category would represent conditions throughout some reasonably homogeneous urban subregion with dimensions of a few kilometers and of generally more regular shape than the middle scale.

Homogeneity refers to the particulate matter concentrations, as well as the land use and land surface characteristics.

This category includes suburban neighborhoods dominated by

residences that are somewhat distant from major roadways and industrial districts but still impacted by urban sources, and areas of diverse land use where residences are interspersed with commercial and industrial neighborhoods. In some cases, a location carefully chosen to provide neighborhood scale data would represent the immediate neighborhood as well as neighborhoods of the same type in other parts of the city. The comparison of data from middle scale and neighborhood scale sites would provide valuable information for determining the variation of $PM_{10-2.5}$ levels across urban areas and assessing the spatial extent of elevated concentrations caused by major industrial point sources and heavily traveled roadways. Neighborhood scale sites would provide concentration data that are relevant to informing a large segment of the population of their exposure levels on a given day.

4.8.2 $PM_{10-2.5}$ Specific Siting Requirements.

4.8.2.1 A minimum of 50 percent of the $PM_{10-2.5}$ sites required in Table D-5 of this appendix must characterize middle scale-sized areas (values of 0.5 monitors and greater round up). Middle-scale sites must be situated in areas of expected maximum concentration among sites eligible for comparison to the NAAQS.

4.8.2.2 For those areas with monitoring requirements greater than one required monitor, at least one of the required monitors must be at a population-oriented site in a neighborhood scale-sized area that is highly populated and which may be somewhat further away from emission sources than the required middle-scale sites, subject to the requirement that the site must meet the comparability criteria in §58.30 (b). Among such sites, the State should select a site characterized by a large number of people subject to exposure; typically, this population number would be higher than the population at middle-scale sites expected to record maximum concentrations.

4.8.2.3 For MSA's with a requirement for four or five monitors, the siting of the remaining unspecified monitor is left to the discretion of the State or local monitoring agency, subject to the requirement that the site must meet the comparability criteria in §58.30 (b). This site could be placed in middle-scale or neighborhood scale locations similar to those that would be eligible as monitoring sites for the other required monitors. A State may also choose to place the site in a location that is somewhat more distant from downtown areas, main industrial source regions, or areas of highest traffic density, such as in a suburban

residential community.

4.8.3 PM_{10-2.5} Chemical Speciation Site Requirements.

One chemical speciation monitoring site is required in each MSA with total population over 500,000 people that also has an estimated PM_{10-2.5} design value greater than 80% of the NAAQS. These sites will gather data in areas that have a higher probability of exceeding the proposed NAAQS and also have larger exposed populations at risk, and will support the characterization of coarse particles concentrations that control the attainment/nonattainment status of the area. Samples must be collected using monitoring methods and the sampling schedules approved by the EPA Regional Administrator. Chemical speciation is encouraged at additional sites to support development of State implementation plans and atmospheric or health effects related studies. These additional locations may include STN, NCore, CASTNET, and IMPROVE sites to provide coverage of sources typical of urban core locations, suburban regions typified by predominantly residential districts, and less densely-settled rural locations that may be characterized by naturally occurring geologic materials. The selection and modification of PM_{10-2.5} chemical speciation sites must be approved by the EPA Regional Administrator.

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4.9 Filter Archive Requirements for PM_{2.5}, PM₁₀, and PM_{10-2.5}

Air pollution control agencies shall archive PM_{2.5}, PM₁₀, and PM_{10-2.5} filters from all SLAMS sites for 1 year after collection. These filters shall be made available during the course of that year for supplemental analyses at the request of EPA or to provide information to State and local agencies on PM_{2.5} composition. Other Federal Agencies may request access to filters for purposes of supporting air quality management or community health - such as biological assay - through the applicable EPA Regional Administrator. The filters shall be archived according to procedures approved by the Administrator. EPA recommends that particulate matter filters be archived for longer periods, especially for key sites in making NAAQS related decisions or for supporting health-related air pollution studies.

5. Network Design for Photochemical Assessment Monitoring Stations (PAMS)

The PAMS program provides more comprehensive data on O₃ air pollution in areas classified as serious, severe, or extreme nonattainment for ozone than would otherwise be achieved through the NCore and SLAMS sites. More specifically, the PAMS program includes measurements for

ozone, oxides of nitrogen, volatile organic compounds, and meteorology.

5.1 PAMS Monitoring Objectives. PAMS design criteria are site specific. Concurrent measurements of O₃, oxides of nitrogen, speciated VOC, CO, and meteorology are obtained at PAMS sites. Design criteria for the PAMS network are based on locations relative to O₃ precursor source areas and predominant wind directions associated with high O₃ events. Specific monitoring objectives are associated with each location. The overall design should enable characterization of precursor emission sources within the area, transport of O₃ and its precursors, and the photochemical processes related to O₃ nonattainment. Specific objectives that must be addressed include assessing ambient trends in O₃, oxides of nitrogen, VOC species, and determining spatial and diurnal variability of O₃, oxides of nitrogen, and VOC species. Specific monitoring objectives associated with each of these sites may result in four distinct site types. Detailed guidance for the locating of these sites may be found in reference 21 of this appendix.

Type 1 sites are established to characterize upwind background and transported O₃ and its precursor concentrations entering the area and will identify those

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areas which are subjected to transport.

Type 2 sites are established to monitor the magnitude and type of precursor emissions in the area where maximum precursor emissions are expected to impact and are suited for the monitoring of urban air toxic pollutants.

Type 3 sites are intended to monitor maximum O₃ concentrations occurring downwind from the area of maximum precursor emissions.

Type 4 sites are established to characterize the downwind transported O₃ and its precursor concentrations exiting the area and will identify those areas which are potentially contributing to overwhelming transport in other areas.

5.2 Monitoring Period. PAMS precursor monitoring must be conducted annually throughout the months of June, July and August (as a minimum) when peak O₃ values are expected in each area. Alternate precursor monitoring periods may be submitted for approval to the Administrator as a part of the annual monitoring network plan required by §58.10.

5.3 Minimum Monitoring Network Requirements. A Type 2 site is required for each area. Overall, only two sites are required for each area, providing all chemical measurements are made. For example, if a design includes two Type 2

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sites, then a third site will be necessary to capture the NO_y measurement. The minimum required number and type of monitoring sites and sampling requirements are listed in Table D-6 of this appendix. Any alternative plans may be put in place in lieu of these requirements, if approved by the Administrator.

Table D-6 of Appendix D to Part 58. Minimum Required PAMS

Monitoring Locations and Frequencies.

Measurement	Where required	Sampling frequency (all daily except for upper air meteorology) ¹
Speciated VOC ²	Two sites per area, one of which must be a Type 2 site.	During the PAMS monitoring period: (1) Hourly auto GC, or (2) Eight 3-hour canisters, or (3) 1 morning and 1 afternoon canister with a 3-hour or less averaging time plus Continuous Total Non-methane Hydrocarbon measurement.
Carbonyl Sampling	Type 2 site in areas classified as serious or above for the 8-hour ozone standard.	3-hour samples every day during the PAMS monitoring period.
NO _x	All Type 2 sites.	Hourly during the ozone monitoring season. ³
NO _y	One site per area at the Type 3 or Type 1 site.	Hourly during the ozone monitoring season.
CO (ppb level)	One site per area at a Type 2 site.	Hourly during the ozone monitoring season.
Ozone	All sites.	Hourly during the ozone monitoring season.
Surface met	All sites.	Hourly during the ozone monitoring season.
Upper air meteorology	One representative location within PAMS area.	Sampling frequency must be approved as part of the PAMS Network Description described in 40 CFR 58.41.

¹ Daily or with an approved alternative plan.² Speciated VOC is defined in the Technical Assistance Document for Sampling and Analysis of Ozone Precursors, EPA/600-R-98/161, September 1998.

³ Approved ozone monitoring season as stipulated in 40 CFR part 58, Table D-3 of this appendix.

5.4 Transition Period. A transition period is allowed for phasing in the operation of newly required PAMS programs (due generally to reclassification of an area into serious, severe, or extreme nonattainment for ozone). Following the date of redesignation or reclassification of any existing O₃ nonattainment area to serious, severe, or extreme, or the designation of a new area and classification to serious, severe, or extreme O₃ nonattainment, a State is allowed one year to develop plans for its PAMS implementation strategy. Subsequently, a minimum of one Type 2 site must be operating by the first month of the following approved PAMS season. Operation of the remaining site(s) must, at a minimum, be phased in at the rate of one site per year during subsequent years as outlined in the approved PAMS network description provided by the State.

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Appendix E to Part 58--[Amended]

54. Appendix E to part 58 is amended by:

- a. Revising the table of contents.
- b. Revising sections 1 through 10.
- c. Removing section 11.
- d. Redesignating section 12 as section 11 and

revising newly redesignated section 11.

- e. Redesignating section 13 as section 12 to read as follows:

**Appendix E to Part 58--Probe and Monitoring Path Siting
Criteria for Ambient Air Quality Monitoring**

1. Introduction
2. Horizontal and Vertical Placement
3. Spacing from Minor Sources
4. Spacing From Obstructions
5. Spacing From Trees and Other Considerations
6. Spacing From Roadways
7. Cumulative Interferences on a Monitoring Path
8. Maximum Monitoring Path Length
9. Probe Material and Pollutant Sample Residence Time
10. Waiver Provisions
11. Summary
12. References

1. Introduction.

This appendix contains specific location criteria applicable to SLAMS, NCore, and PAMS ambient air quality monitoring probes, inlets, and optical paths after the general location has been selected based on the monitoring objectives and spatial scale of representation discussed in appendix D to this part. Adherence to these siting criteria is necessary to ensure the uniform collection of compatible and comparable air quality data.

The probe and monitoring path siting criteria discussed in this appendix must be followed to the maximum extent

possible. It is recognized that there may be situations where some deviation from the siting criteria may be necessary. In any such case, the reasons must be thoroughly documented in a written request for a waiver that describes how and why the proposed siting deviates from the criteria. This documentation should help to avoid later questions about the validity of the resulting monitoring data. Conditions under which the EPA would consider an application for waiver from these siting criteria are discussed in section 11 of this appendix.

The pollutant-specific probe and monitoring path siting criteria generally apply to all spatial scales except where noted otherwise. Specific siting criteria that are phrased with a "must" are defined as requirements and exceptions must be approved through the waiver provisions. However, siting criteria that are phrased with a "should" are defined as goals to meet for consistency but are not requirements.

2. Horizontal and Vertical Placement.

The probe or at least 80 percent of the monitoring path must be located between 2 and 15 meters above ground level for all ozone, sulfur dioxide and nitrogen dioxide monitoring sites, and for neighborhood scale Pb, PM₁₀, PM_{10-2.5}, PM_{2.5}, and carbon monoxide sites. Middle scale PM_{10-2.5}

sites are required to have sampler inlets between 2 and 7 meters above ground level. Microscale Pb, PM₁₀, and PM_{2.5} sites are required to have sampler inlets between 2 and 7 meters above ground level. The inlet probes for microscale carbon monoxide monitors that are being used to measure concentrations near roadways must be 3±½ meters above ground level. The probe or at least 90 percent of the monitoring path must be at least 1 meter vertically or horizontally away from any supporting structure, walls, parapets, penthouses, etc., and away from dusty or dirty areas. If the probe or a significant portion of the monitoring path is located near the side of a building, then it should be located on the windward side of the building relative to the prevailing wind direction during the season of highest concentration potential for the pollutant being measured.

3. Spacing from Minor Sources.

It is important to understand the monitoring objective for a particular location in order to interpret this particular requirement. Local minor sources of a primary pollutant, such as SO₂, lead, or particles, can cause high concentrations of that particular pollutant at a monitoring site. If the objective for that monitoring site is to investigate these local primary pollutant emissions, then

the site is likely to be properly located nearby. This type of monitoring site would in all likelihood be a microscale type of monitoring site. If a monitoring site is to be used to determine air quality over a much larger area, such as a neighborhood or city, a monitoring agency should avoid placing a monitor probe, path, or inlet near local, minor sources. The plume from the local minor sources should not be allowed to inappropriately impact the air quality data collected at a site. Particulate matter sites should not be located in an unpaved area unless there is vegetative ground cover year round, so that the impact of wind blown dusts will be kept to a minimum.

Similarly, local sources of nitric oxide (NO) and ozone-reactive hydrocarbons can have a scavenging effect causing unrepresentatively low concentrations of O₃ in the vicinity of probes and monitoring paths for O₃. To minimize these potential interferences, the probe or at least 90 percent of the monitoring path must be away from furnace or incineration flues or other minor sources of SO₂ or NO. The separation distance should take into account the heights of the flues, type of waste or fuel burned, and the sulfur content of the fuel.

4. Spacing From Obstructions.

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Buildings and other obstacles may possibly scavenge SO_2 , O_3 , or NO_2 , and can act to restrict airflow for any pollutant. To avoid this interference, the probe, inlet, or at least 90 percent of the monitoring path must have unrestricted airflow and be located away from obstacles. The distance from the obstacle to the probe, inlet, or monitoring path must be at least twice the height that the obstacle protrudes above the probe, inlet, or monitoring path. An exception to this requirement can be made for measurements taken in street canyons or at source-oriented sites where buildings and other structures are unavoidable.

Generally, a probe or monitoring path located near or along a vertical wall is undesirable because air moving along the wall may be subject to possible removal mechanisms. A probe, inlet, or monitoring path must have unrestricted airflow in an arc of at least 180 degrees. This arc must include the predominant wind direction for the season of greatest pollutant concentration potential. For particle sampling, a minimum of 2 meters of separation from walls, parapets, and structures is required for rooftop site placement.

Special consideration must be devoted to the use of open path analyzers due to their inherent potential

sensitivity to certain types of interferences, or optical obstructions. A monitoring path must be clear of all trees, brush, buildings, plumes, dust, or other optical obstructions, including potential obstructions that may move due to wind, human activity, growth of vegetation, etc. Temporary optical obstructions, such as rain, particles, fog, or snow, should be considered when siting an open path analyzer. Any of these temporary obstructions that are of sufficient density to obscure the light beam will affect the ability of the open path analyzer to continuously measure pollutant concentrations. Transient, but significant obscuration of especially longer measurement paths could occur as a result of certain meteorological conditions (e.g., heavy fog, rain, snow) and/or aerosol levels that are of a sufficient density to prevent the open path analyzer's light transmission. If certain compensating measures are not otherwise implemented at the onset of monitoring (e.g., shorter path lengths, higher light source intensity), data recovery during periods of greatest primary pollutant potential could be compromised. For instance, if heavy fog or high particulate levels are coincident with periods of projected NAAQS-threatening pollutant potential, the representativeness of the resulting data record in

reflecting maximum pollutant concentrations may be substantially impaired despite the fact that the site may otherwise exhibit an acceptable, even exceedingly high overall valid data capture rate.

5. Spacing From Trees.

Trees can provide surfaces for SO₂, O₃, or NO₂ adsorption or reactions, and surfaces for particle deposition. Trees can also act as obstructions in cases where they are located between the air pollutant sources or source areas and the monitoring site, and where the trees are of a sufficient height and leaf canopy density to interfere with the normal airflow around the probe, inlet, or monitoring path. To reduce this possible interference/obstruction, the probe, inlet, or at least 90 percent of the monitoring path must be at least 10 meters or further from the drip line of trees.

The scavenging effect of trees is greater for O₃ than for other criteria pollutants. Monitoring agencies must take steps to consider the impact of trees on ozone monitoring sites and take steps to avoid this problem.

For microscale sites of any air pollutant, no trees or shrubs should be located between the probe and the source under investigation, such as a roadway or a stationary

source.

6. Spacing From Roadways.

6.1 Spacing for Ozone and Oxide of Nitrogen Probes and Monitoring Paths. In siting an O₃ analyzer, it is important to minimize destructive interferences from sources of NO, since NO readily reacts with O₃. In siting NO₂ analyzers for neighborhood and urban scale monitoring, it is important to minimize interferences from automotive sources. Table E-1 of this appendix provides the required minimum separation distances between a roadway and a probe or, where applicable, at least 90 percent of a monitoring path for various ranges of daily roadway traffic. A sampling site having a point analyzer probe located closer to a roadway than allowed by the Table E-1 requirements should be classified as middle scale rather than neighborhood or urban scale, since the measurements from such a site would more closely represent the middle scale. If an open path analyzer is used at a site, the monitoring path(s) must not cross over a roadway with an average daily traffic count of 10,000 vehicles per day or more. For those situations where a monitoring path crosses a roadway with fewer than 10,000 vehicles per day, one must consider the entire segment of the monitoring path in the area of potential atmospheric

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interference from automobile emissions. Therefore, this calculation must include the length of the monitoring path over the roadway plus any segments of the monitoring path that lie in the area between the roadway and the minimum separation distance, as determined from Table E-1 of this appendix. The sum of these distances must not be greater than 10 percent of the total monitoring path length.

Table E-1 to Appendix E of Part 58. Minimum Separation Distance Between Roadways and Probes or Monitoring Paths for Monitoring Neighborhood and Urban Scale Ozone (O₃) and Oxides of Nitrogen (NO, NO₂, NO_x, NO_y)

Roadway average daily traffic, vehicles per day	Minimum distance ¹ (meters)
≤1,000	10
10,000	20
15,000	30
20,000	40
40,000	60
70,000	100
110,000	250

¹ Distance from the edge of the nearest traffic lane. The distance for intermediate traffic counts should be interpolated from the table values based on the actual traffic count.

6.2 Spacing for Carbon Monoxide Probes and Monitoring Paths. Street canyon and traffic corridor sites (microscale) are intended to provide a measurement of the influence of the immediate source on the pollution exposure of the population. In order to provide some reasonable consistency and comparability in the air quality data from microscale sites, a minimum distance of 2 meters and a maximum distance of 10 meters from the edge of the nearest traffic lane must be maintained for these CO monitoring inlet probes. This should give consistency to the data, yet still allow flexibility of finding suitable locations.

Street canyon/corridor (microscale) inlet probes must be located at least 10 meters from an intersection and preferably at a midblock location. Midblock locations are preferable to intersection locations because intersections represent a much smaller portion of downtown space than do the streets between them. Pedestrian exposure is probably also greater in street canyon/corridors than at intersections.

In determining the minimum separation between a neighborhood scale monitoring site and a specific roadway, the presumption is made that measurements should not be substantially influenced by any one roadway. Computations

were made to determine the separation distance, and Table E-2 of this appendix provides the required minimum separation distance between roadways and a probe or 90 percent of a monitoring path. Probes or monitoring paths that are located closer to roads than this criterion allows should not be classified as a neighborhood scale, since the measurements from such a site would closely represent the middle scale. Therefore, sites not meeting this criterion should be classified as middle scale.

Table E-2 to Appendix E of Part 58. Minimum Separation Distance Between Roadways and Probes or Monitoring Paths for Monitoring Neighborhood Scale Carbon Monoxide

Roadway average daily traffic, vehicles per day	Minimum distance ¹ (meters)
≤ 10,000	10
15,000	25
20,000	45
30,000	80
40,000	115
50,000	135
≥60,000	150

¹ Distance from the edge of the nearest traffic lane. The distance for intermediate traffic counts should be interpolated from the table values based on the actual traffic count.

6.3 Spacing for Particulate Matter ($PM_{2.5}$, PM_{10} , Pb)

Inlets. Since emissions associated with the operation of motor vehicles contribute to urban area particulate matter ambient levels, spacing from roadway criteria are necessary for ensuring national consistency in PM sampler siting.

The intent is to locate localize hot-spot sites in areas of highest concentrations whether it be from mobile or multiple stationary sources. If the area is primarily affected by mobile sources and the maximum concentration area(s) is judged to be a traffic corridor or street canyon location, then the monitors should be located near roadways with the highest traffic volume and at separation distances most likely to produce the highest concentrations. For the microscale traffic corridor site, the location must be between 5 and 15 meters from the major roadway. For the microscale street canyon site the location must be between 2 and 10 meters from the roadway. For the middle scale site, a range of acceptable distances from the roadway is shown in figure E-1 of this appendix. This figure also includes separation distances between a roadway and neighborhood or larger scale sites by default. Any site, 2 to 15 meters high, and further back than the middle scale requirements will generally be neighborhood, urban or regional scale.

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For example, according to Figure E-1 of this appendix, if a PM sampler is primarily influenced by roadway emissions and that sampler is set back 10 meters from a 30,000 ADT (average daily traffic) road, the site should be classified as microscale, if the sampler height is between 2 and 7 meters. If the sampler height is between 7 and 15 meters, the site should be classified as middle scale. If the sample is 20 meters from the same road, it will be classified as middle scale; if 40 meters, neighborhood scale; and if 110 meters, an urban scale.

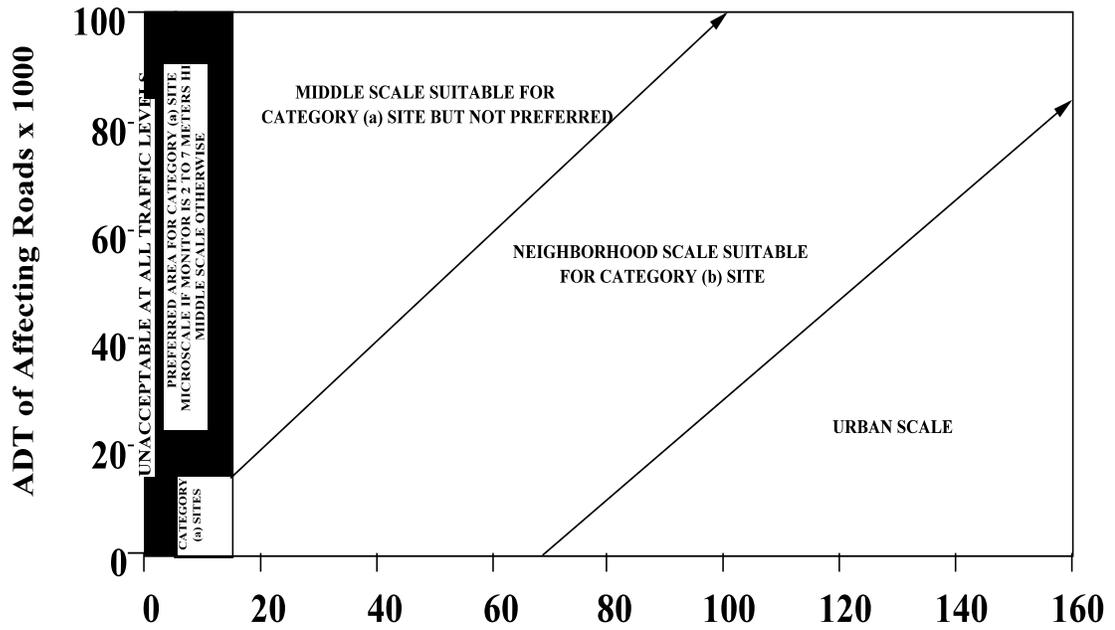


Figure E-1. Distance of PM samplers to nearest traffic lane (meters)

7. Cumulative Interferences on a Monitoring Path.

(This paragraph applies only to open path analyzers.)
The cumulative length or portion of a monitoring path that is affected by minor sources, trees, or roadways must not exceed 10 percent of the total monitoring path length.

8. Maximum Monitoring Path Length.

(This paragraph applies only to open path analyzers.)
The monitoring path length must not exceed 1 kilometer for analyzers in neighborhood, urban, or regional scale. For middle scale monitoring sites, the monitoring path length must not exceed 300 meters. In areas subject to frequent periods of dust, fog, rain, or snow, consideration should be given to a shortened monitoring path length to minimize loss of monitoring data due to these temporary optical obstructions. For certain ambient air monitoring scenarios using open path analyzers, shorter path lengths may be needed in order to ensure that the monitoring site meets the objectives and spatial scales defined in appendix D to this part. The Regional Administrator may require shorter path lengths, as needed on an individual basis, to ensure that the SLAMS sites meet the appendix D requirements. Likewise, the Administrator may specify the maximum path length used at NCore monitoring sites.

9. Probe Material and Pollutant Sample Residence Time.

For the reactive gases, SO₂, NO₂, and O₃, special probe material must be used for point analyzers. Studies ²⁰⁻²⁴ have been conducted to determine the suitability of materials such as polypropylene, polyethylene, polyvinyl chloride, Tygon®, aluminum, brass, stainless steel, copper, Pyrex® glass and Teflon® for use as intake sampling lines. Of the above materials, only Pyrex® glass and Teflon® have been found to be acceptable for use as intake sampling lines for all the reactive gaseous pollutants. Furthermore, the EPA²⁵ has specified borosilicate glass or FEP Teflon® as the only acceptable probe materials for delivering test atmospheres in the determination of reference or equivalent methods. Therefore, borosilicate glass, FEP Teflon®, or their equivalent must be used for existing and new NCore monitors.

For volatile organic compound (VOC) monitoring at PAMS, FEP Teflon® is unacceptable as the probe material because of VOC adsorption and desorption reactions on the FEP Teflon®. Borosilicate glass, stainless steel, or its equivalent are the acceptable probe materials for VOC and carbonyl sampling. Care must be taken to ensure that the sample residence time is kept to 20 seconds or less.

No matter how nonreactive the sampling probe material

is initially, after a period of use reactive particulate matter is deposited on the probe walls. Therefore, the time it takes the gas to transfer from the probe inlet to the sampling device is also critical. Ozone in the presence of nitrogen oxide (NO) will show significant losses even in the most inert probe material when the residence time exceeds 20 seconds.²⁶ Other studies²⁷⁻²⁸ indicate that a 10-second or less residence time is easily achievable. Therefore, sampling probes for reactive gas monitors at NCore must have a sample residence time less than 20 seconds.

10. Waiver Provisions.

Most sampling probes or monitors can be located so that they meet the requirements of this appendix. New sites with rare exceptions, can be located within the limits of this appendix. However, some existing sites may not meet these requirements and yet still produce useful data for some purposes. EPA will consider a written request from the State agency to waive one or more siting criteria for some monitoring sites providing that the State can adequately demonstrate the need (purpose) for monitoring or establishing a monitoring site at that location.

10.1 For establishing a new site, a waiver may be granted only if both of the following criteria are met:

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10.1.1 The site can be demonstrated to be as representative of the monitoring area as it would be if the siting criteria were being met.

10.1.2 The monitor or probe cannot reasonably be located so as to meet the siting criteria because of physical constraints (e.g., inability to locate the required type of site the necessary distance from roadways or obstructions).

10.2 However, for an existing site, a waiver may be granted if either of the criteria in sections 10.1.1 and 10.1.2 of this appendix are met.

10.3 Cost benefits, historical trends, and other factors may be used to add support to the criteria in sections 10.1.1 and 10.1.2 of this appendix, however, they in themselves, will not be acceptable reasons for granting a waiver. Written requests for waivers must be submitted to the Regional Administrator.

11. Summary.

Table E-4 of this appendix presents a summary of the general requirements for probe and monitoring path siting criteria with respect to distances and heights. It is apparent from Table E-4 that different elevation distances above the ground are shown for the various pollutants. The

discussion in this appendix for each of the pollutants describes reasons for elevating the monitor, probe, or monitoring path. The differences in the specified range of heights are based on the vertical concentration gradients. For CO, the gradients in the vertical direction are very large for the microscale, so a small range of heights are used. The upper limit of 15 meters is specified for consistency between pollutants and to allow the use of a single manifold or monitoring path for monitoring more than one pollutant.

Table E-4 of Appendix E to Part 58. Summary of Probe and Monitoring Path Siting Criteria

Pollutant	Scale (maximum monitoring path length, meters)	Height from ground to probe, inlet or 80% of monitoring path ¹	Horizontal and vertical distance from supporting structures ² to probe, inlet or 90% of monitoring path ¹ (meters)	Distance from trees to probe, inlet or 90% of monitoring path ¹ (meters)	Distance from roadways to probe, inlet or monitoring path ¹ (meters)
SO ₂ ^{3,4,5,6}	Middle (300 m) Neighborhood Urban, and Regional (1 km)	2-15	> 1	> 10	N/A
CO ^{4,5,7}	Micro, middle (300 m), Neighborhood (1 km)	3±½: 2-15	> 1	> 10	2-10; see Table E-2 of this appendix for middle and neighborhood scales.
NO _x , O ₃ ^{3,4,5,8}	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	2-15	> 1	> 10	See Table E-1 of this appendix for all scales.
Ozone precursors (for PAMS) ^{3,4,5}	Neighborhood and Urban (1 km)	2-15	> 1	> 10	See Table E-4 of this appendix for all scales.
PM, Pb ^{3,4,5,6,8}	Micro: Middle, Neighborhood, Urban and Regional	2-7 (micro); 2-7 (middle PM _{10-2.5}); 2-15 (all other scales)	> 2 (all scales, horizontal distance only)	> 10 (all scales)	2-10 (micro); see Figure E-1 of this appendix for all other scales.

N/A--Not applicable.

¹ Monitoring path for open path analyzers is applicable only to middle or neighborhood scale CO monitoring and all

applicable scales for monitoring SO₂, O₃, O₃ precursors, and NO₂.

² When probe is located on a rooftop, this separation distance is in reference to walls, parapets, or penthouses located on roof.

³ Should be >20 meters from the dripline of tree(s) and must be 10 meters from the dripline when the tree(s) act as an obstruction.

⁴ Distance from sampler, probe, or 90% of monitoring path to obstacle, such as a building, must be at least twice the height the obstacle protrudes above the sampler, probe, or monitoring path. Sites not meeting this criterion may be classified as middle scale (see text).

⁵ Must have unrestricted airflow 270 degrees around the probe or sampler; 180 degrees if the probe is on the side of a building.

⁶ The probe, sampler, or monitoring path should be away from minor sources, such as furnace or incineration flues. The separation distance is dependent on the height of the minor source's emission point (such as a flue), the type of fuel or waste burned, and the quality of the fuel (sulfur, ash, or lead content). This criterion is designed to avoid undue influences from minor sources.

⁷ For microscale CO monitoring sites, the probe must be >10 meters from a street intersection and preferably at a midblock location.

⁸ Collocated monitors must be within 4 meters of each other and at least 2 meters apart for flow rates greater than 200 liters/min or at least 1 meter apart for samplers having flow rates less than 200 liters/min to preclude airflow interference.

12. References.

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