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SCHEDULE D.6—PERMANENT WAIVER FROM INTERIM CONTROLS TEST—Continued

[Smelter identification]

	Line	1984	1985	1986	1987	1988	1989	1990	Total
7. Discount factors	10	.....	.....	.....	.....	.....	.....	.....	XXXX
8. Present value of future cash flows	11	.....	.....	.....	.....	.....	.....	.....	XXXX
B. Net present value:									
1. Horizon value	12	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
2. Discount factor	13	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
3. Present value of horizon value	14	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
4. Present value of future cash flows	15	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
5. Total present value	16	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
6. Current salvage value	17	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
7. Net present value	18	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....

SCHEDULE D.7—HORIZON VALUE OF CASH FLOWS

[Smelter identification]

	Line	Final forecast years		Horizon years					Total
		1989	1990	1991	1992	1993	1994	1995	
A. Depreciation-free horizon value:									
1. Net cash flow projections	01	.....	.....	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
2. Depreciation tax savings:									
a. Depreciation and amortization	02	.....	.....	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
b. Marginal tax rate	03	.....	.....	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
c. Tax savings	04	.....	.....	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
3. Depreciation-free net cash flows:									
a. Nominal dollar values	05	.....	.....	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
b. 1990 dollar values	06	.....	.....	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
c. Average	07	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
4. Horizon factor	08	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
5. Depreciation-free horizon value	09	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
B. Depreciation tax savings over the horizon period:									
1. Depreciation and amortization	10	XXXX	XXXX	.....	.....	.....	.....	.....	XXXX
2. Marginal tax rate	11	XXXX	XXXX	.....	.....	.....	.....	.....	XXXX
3. Tax savings	12	XXXX	XXXX	.....	.....	.....	.....	.....	XXXX
4. Discount factors	13	XXXX	XXXX	.....	.....	.....	.....	.....	XXXX
5. Present value of tax savings	14	XXXX	XXXX	.....	.....	.....	.....	.....	XXXX
6. Total present value of tax savings	15	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....
C. Horizon Value	16	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	.....

PART 58—AMBIENT AIR QUALITY SURVEILLANCE

Subpart A—General Provisions

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APPENDIX A TO PART 58—QUALITY ASSURANCE REQUIREMENTS FOR STATE AND LOCAL AIR MONITORING STATIONS (SLAMS)
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APPENDIX F TO PART 58 [RESERVED]
APPENDIX G TO PART 58—UNIFORM AIR QUALITY INDEX (AQI) AND DAILY REPORTING

AUTHORITY: 42 U.S.C. 7403, 7410, 7601(a), 7611, and 7619.

SOURCE: 44 FR 27571, May 10, 1979; 59 FR 41628, Aug. 12, 1994, unless otherwise noted.

Subpart A—General Provisions

SOURCE: 71 FR 61296, Oct. 17, 2006, unless otherwise noted.

§ 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.

AQCR means air quality control region.

CO means carbon monoxide.

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 (CBSA) 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*).

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.

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 Statistical Areas (MSAs) and micropolitan statistical areas 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 CBSAs are combined, these larger areas are referred to as combined statistical areas (CSAs) (*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.

Federal equivalent method (FEM) 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 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.

Federal reference method (FRM) 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.

HNO_3 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/or precipitation.

Metropolitan Statistical Area (MSA) means a CBSA associated with at least one urbanized area of 50,000 population or greater. 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 quality assurance 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 CBSA, county or State, having a common area that is used for planning monitoring locations for

$PM_{2.5}$. An MPA may cross State boundaries, such as the Philadelphia PA–NJ MSA, and be further subdivided into community monitoring zones. MPAs are generally oriented toward CBSAs or CSAs with populations greater than 200,000, but for convenience, those portions of a State that are not associated with CBSAs 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 multipollutant monitoring stations. Monitors at these sites are required to measure particles ($PM_{2.5}$, speciated $PM_{2.5}$, $PM_{10-2.5}$), O_3, SO_2, CO, nitrogen oxides ($NO/NO_2/NO_y$), Pb, and basic meteorology.

Network means all stations of a given type or types.

NH_3 means ammonia.

NO_2 means nitrogen dioxide. NO means nitrogen oxide. NO_X means oxides of nitrogen and is defined as the sum of the concentrations of NO_2 and NO.

NO_y means the sum of all total reactive nitrogen oxides, including NO, NO_2, and other nitrogen oxides referred to as NO_Z.

O_3 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 an implementation plan approved or promulgated pursuant to section 110 of the Act.

PM means PM_{10}, $PM1_{10C}$, $PM_{2.5}$, $PM_{10-2.5}$, or particulate matter of unspecified size range.

$PM_{2.5}$ 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.

PM_{10} 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 monitor 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.

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 exclude special purpose monitor (SPM) stations and include NCore, PAMS, and all other State or locally operated stations that have not been designated as SPM stations.

SO_2 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.

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.

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.

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.

Urbanized area means an area with a minimum residential population of at least 50,000 people and which generally includes core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile. The Census Bureau notes that under certain conditions, less densely settled territory may be part of each Urbanized Area.

VOC means volatile organic compounds.

§ 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:

(1) Quality assurance procedures for monitor operation and data handling.

(2) Methodology used in monitoring stations.

(3) Operating schedule.

(4) Siting parameters for instruments or instrument probes.

(5) Minimum ambient air quality monitoring network requirements used to provide support to the State implementation plans (SIP), national air quality assessments, and 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.

(b) The requirements pertaining to provisions for an air quality surveillance system in the SIP are contained in this part.

(c) This part also acts to establish a national ambient air quality monitoring network for the purpose of providing timely air quality data upon which to base national assessments and policy decisions.

§ 58.3 Applicability.

This part applies to:

(a) State air pollution control agencies.

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

(c) Owners or operators of proposed sources.

Subpart B—Monitoring Network

SOURCE: 71 FR 61298, Oct. 17, 2006, unless otherwise noted.

§ 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 SLAMS monitoring stations including FRM, FEM, and ARM monitors that are part of SLAMS, NCore stations, STN stations, State speciation stations, SPM stations, and/or, in serious, severe and extreme ozone nonattainment areas, PAMS stations, and SPM monitoring stations. The plan shall include a statement of purposes for each monitor and 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. If the State or local agency has already provided a public comment opportunity on its plan and has made no changes subsequent to that comment opportunity, and has submitted the received comments together with the plan, the Regional Administrator is not required to provide a separate opportunity for comment.

(3) The plan for establishing required NCore multipollutant stations shall be submitted to the Administrator not later than 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 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 as described in § 58.30.

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

(c) 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 to part 50 of this chapter. The affected State or local agency must document the process for obtaining public comment and include any comments received through the public notification process within their submitted plan.

(d) 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 to 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. The network assessment 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. 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, 2010.

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

[71 FR 61298, Oct. 17, 2006, as amended at 72 FR 32210, June 12, 2007]

§ 58.11 Network technical requirements.

(a)(1) State and local governments shall follow the applicable quality assurance criteria contained in appendix A to this part when operating the SLAMS networks.

(2) Beginning January 1, 2009, State and local governments shall follow the quality assurance criteria contained in appendix A to this part that apply to SPM sites when operating any SPM site which uses a FRM, FEM, or ARM and meets the requirements of appendix E to this part, unless the Regional Administrator approves an alternative to the requirements of appendix A with respect to such SPM sites because meeting those requirements would be physically and/or financially impractical due to physical conditions at the monitoring site and the requirements are not essential to achieving the intended data objectives of the SPM site. Alternatives to the requirements of appendix A may be approved for an SPM site as part of the approval of the annual monitoring plan, or separately.

(3) 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.

§ 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 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)(i) Manual $PM_{2.5}$ samplers at required SLAMS stations without a collocated continuously operating $PM_{2.5}$ monitor must operate on at least a 1-in-3 day schedule.

(ii) For SLAMS $PM_{2.5}$ sites with both manual and continuous $PM_{2.5}$ monitors operating, the monitoring agency may request approval for a reduction to 1-in-6 day $PM_{2.5}$ sampling or for seasonal sampling from the EPA Regional Administrator. The EPA Regional Administrator may grant sampling frequency reductions after consideration of factors, including but not limited to the historical $PM_{2.5}$ data quality assessments, the location of current $PM_{2.5}$ design value sites, and their regulatory data needs. Required SLAMS stations whose measurements determine the design value for their area and that are within plus or minus 10 percent of the NAAQS; and all required sites where one or more 24-hour values have exceeded the NAAQS each year for a consecutive period of at least 3 years are required to maintain at least a 1-in-3 day sampling frequency. A continuously operating FEM or ARM $PM_{2.5}$ monitor satisfies this requirement.

(iii) Required SLAMS stations whose measurements determine the design value for their area and that are within plus or minus 5 percent of the daily $PM_{2.5}$ NAAQS must have an FRM or FEM operate on a daily schedule. A continuously operating FEM or ARM $PM_{2.5}$ monitor satisfies this requirement.

(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 at least a 1-in-3 day sampling frequency.

(e) For PM_{10} samplers, a 24-hour sample must be taken from midnight to midnight (local standard time) to ensure national consistency. The minimum monitoring schedule for the site in the area of expected maximum concentration shall be based on the relative level of that monitoring site concentration with respect to the 24-hour standard as illustrated in Figure 1. If the operating agency demonstrates by monitoring data that during certain periods of the year conditions preclude violation of the PM_{10} 24-hour standard, the increased sampling frequency for those periods or seasons may be exempted by the Regional Administrator and permitted to revert back to once in six days. The minimum sampling schedule for all other sites in the area remains once every six days. No less frequently than as part of each 5-year network assessment, the most recent year of data must be considered to estimate the air quality status at the site near the area of maximum concentration. Statistical models such as analysis of concentration frequency distributions as described in ''Guideline for the Interpretation of Ozone Air Quality Standards,'' EPA–450/479–003,

U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1979, should be used. Adjustments to the monitoring schedule must be made on the basis of the 5-year network assessment. The site having the highest concentration in the most current year must be given first consideration when selecting the site for the more frequent sampling schedule. Other factors such as major change in sources of PM_{10} emissions or in sampling site characteristics could influence the location of the expected maximum concentration site. Also, the use of the most recent 3 years of data might, in some cases, be justified in order to provide a more representative database from which to estimate current air quality status and to provide stability to the network. This multiyear consideration reduces the possibility of an anomalous year biasing a site selected for accelerated sampling. If the maximum concentration site based on the most current year is not selected for the more frequent operating schedule, documentation of the justification for selection of an alternative site must be submitted to the Regional Office for approval during the 5-year network assessment process. Minimum data completeness criteria, number of years of data and sampling frequency for judging attainment of the NAAQS are discussed in appendix K of part 50 of this chapter.

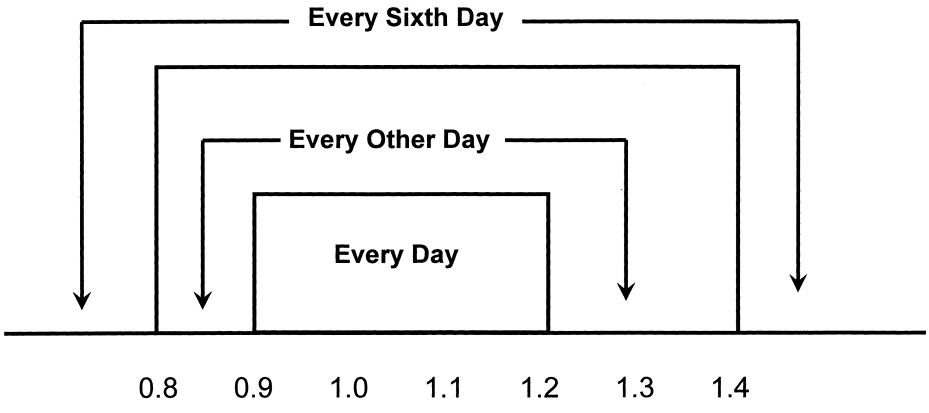

Figure 1 – Ratio to Standard

(f) For manual $PM_{10-2.5}$ samplers:

(1) Manual $PM_{10-2.5}$ samplers at NCore stations must operate on at least a 1-in-3 day schedule at sites without a collocated continuously operating federal equivalent $PM_{10-2.5}$ method that has been designated in accordance with part 53 of this chapter.

(2) Manual $PM_{10-2.5}$ speciation samplers at NCore stations must operate on at least a 1-in-3 day sampling frequency.

[71 FR 61298, Oct. 17, 2006, as amended at 72 FR 32210, June 12, 2007]

§ 58.13 Monitoring network completion.

(a) 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.

(b) Where existing networks are not in conformance with required numbers of monitors specified in this part, additional required monitors must be operated by January 1, 2008.

§ 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(e). 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 with respect to the SLAMS network are subject to the approval of the EPA Regional Administrator. Plans containing modifications to NCore Stations or PAMS Stations shall be submitted to the Administrator. The Regional Administrator shall provide opportunity for public comment and shall approve or disapprove submitted plans and schedules 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. These modifications must address changes invoked by a new census and changes due to changing air quality levels. 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 SLAMS monitor station discontinuation, subject to the review of the Regional Administrator, will be approved if any of the following criteria are met and if the requirements of appendix D to this part, if any, continue to be 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 and if the requirements of appendix D to this part, if any, continue to be met.

(1) Any $PM_{2.5}$, O_3, CO, PM_{10}, SO_2, Pb, or NO_2 SLAMS 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. In a nonattainment or maintenance area, if the most recent attainment or maintenance plan adopted by the State and approved by EPA contains a contingency measure to be triggered by an air quality concentration and the monitor to be discontinued is the only SLAMS monitor operating in the nonattainment or maintenance area, the monitor may not be discontinued.

(2) Any SLAMS 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 (or portion of a county within a distinct attainment area, nonattainment area, or maintenance area, as applicable) 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, any SLAMS monitor in a county (or portion of a county within a distinct attainment, nonattainment, or maintenance area, as applicable) provided the monitor has not measured violations of the applicable NAAQS in the previous five years, 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 $PM_{2.5}$ SLAMS 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 SLAMS 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.

(6) A SLAMS monitor not eligible for removal under any of the criteria in paragraphs (c)(1) through (c)(5) of this section may be moved to a nearby location with the same scale of representation if logistical problems beyond the State's control make it impossible to continue operation at its current site.

§ 58.15 Annual air monitoring data certification.

(a) 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 FRM, FEM, and ARM SPM stations that meet criteria in appendix A to this part from January 1 to December 31 of the previous year. The senior air pollution control officer in each agency, or his or her 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.

(1) Through 2009, the annual data certification letter is due by July 1 of each year.

(2) Beginning in 2010, the annual data certification letter is due by May 1 of each year.

(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 collected at all SLAMS and at SPM stations using FRM, FEM, or ARMs. 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 must be submitted on the same schedule as the certification letter, 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.

(c) Along with each certification letter, the State shall submit to the Administrator (through the appropriate Regional Office) a summary of the precision and accuracy data for all ambient air quality data collected at all SLAMS and at SPM stations using FRM, FEM, or ARMs. The summary of precision and accuracy shall be submitted for data collected from January 1 to December 31 of the previous year. The summary of precision and accuracy must be submitted on the same schedule as the certification letter, unless an approved alternative date is included in the plan.

§ 58.16 Data submittal and archiving requirements.

(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 SO_2; CO; O_3; NO_2; NO; NO_Y; NO_X; Pb; PM_{10} mass concentration; $PM_{2.5}$ mass concentration; for filter-based $PM_{2.5}$ FRM/FEM the field blank mass, sampler-generated average daily temperature, and sampler-generated average daily pressure; chemically speciated $PM_{2.5}$ mass concentration data; $PM_{10-2.5}$ mass concentration; chemically speciated $PM_{10-2.5}$ mass concentration data; meteorological data from NCore and PAMS sites; and metadata records and information specified by the AQS Data Coding Manual (*http://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 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.

(f) The State, or where applicable, local agency shall archive all $PM_{2.5}$, PM_{10}, and $PM_{10-2.5}$ filters from manual low-volume samplers (samplers having flow rates less than 200 liters/minute) from all SLAMS sites for a minimum period of 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 particulate matter 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. The 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.

Subpart C—Special Purpose Monitors

SOURCE: 71 FR 61302, Oct. 17, 2006, unless otherwise noted.

§ 58.20 Special purpose monitors (SPM).

(a) An 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 purposes for each SPM monitor and evidence that operation of each monitor meets the requirements of appendix A or an approved alternative as provided by § 58.11(a)(2) where applicable. The monitoring agency may designate a monitor as an SPM after January 1, 2007 only if it is a new monitor, i.e., a SLAMS monitor that is not included in the currently applicable monitoring plan or, for a monitor included in the monitoring plan prior to January 1, 2007, if the Regional Administrator has approved the discontinuation of the monitor as a SLAMS site.

(b) Any SPM data collected by an air monitoring agency using a Federal reference method (FRM), Federal equivalent method (FEM), or approved regional method (ARM) must meet the requirements of § 58.11, § 58.12, and appendix A to this part or an approved alternative to appendix A 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 using a FRM, FEM, or ARM meeting the requirements of appendix A must be submitted to AQS according to the requirements of § 58.16. Data collected by other SPMs may be submitted. The monitoring agency must also submit to AQS an indication of whether each SPM reporting data to AQS monitor

meets the requirements of appendices A and E to this part.

(c) All data from an SPM using an FRM, FEM, or ARM 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 that the data came from a particular period during which the requirements of appendix A, appendix C, or appendix E to this part were not met in practice.

(d) If an SPM using an FRM, FEM, or ARM is discontinued within 24 months of start-up, the Administrator will not base a NAAQS violation determination for the $PM_{2.5}$ or ozone NAAQS solely on data from the SPM.

(e) If an SPM using an FRM, FEM, or ARM is discontinued within 24 months of start-up, the Administrator will not designate an area as nonattainment for the CO, SO_2, NO_2, Pb, or 24-hour PM_{10} NAAQS solely on the basis of data from the SPM. Such data are 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.

[71 FR 61298, Oct. 17, 2006, as amended at 72 FR 32210, June 12, 2007]

Subpart D—National Air Monitoring Stations (NAMS)

SOURCE: 71 FR 61302, Oct. 17, 2006, unless otherwise noted.

§ 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 (see appendix D to this part, section 4.7.1) 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) [Reserved]

Subpart E [Reserved]

Subpart F—Air Quality Index Reporting

§ 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.

[71 FR 61302, Oct. 17, 2006]

Subpart G—Federal Monitoring

SOURCE: 44 FR 27571, May 10, 1979, unless otherwise noted. Redesignated at 58 FR 8467, Feb. 12, 1993.

§ 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 in § 58.10, a SLAMS station at a site which is necessary in

the judgment of the Regional Administrator to meet the objectives defined in appendix D to this part.

[71 FR 61303, Oct. 17, 2006]

§ 58.61 Monitoring other pollutants.

The Administrator may promulgate criteria similar to that referenced in subpart B of this part for monitoring a pollutant for which an NAAQS does not exist. Such an action would be taken whenever the Administrator determines that a nationwide monitoring program is necessary to monitor such a pollutant.

[71 FR 61303, Oct. 17, 2006]

APPENDIX A TO PART 58—QUALITY ASSURANCE REQUIREMENTS FOR SLAMS, SPMS AND PSD AIR MONITORING

1. General Information
2. Quality System Requirements
3. Measurement Quality Check Requirements
4. Calculations for Data Quality Assessments
5. Reporting Requirements
6. References

1. GENERAL INFORMATION

This appendix specifies the minimum quality system requirements applicable to SLAMS air monitoring data and PSD data for the pollutants SO_2, NO_2, O_3, CO, $PM_{2.5}$, PM_{10} and $PM_{10-2.5}$ submitted to EPA. This appendix also applies to all SPM stations using FRM, FEM, or ARM methods which also meet the requirements of Appendix E of this part. 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, 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, 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, SPMs if applicable, and PSD are the same. Affected SPMs are subject to all the SLAMS requirements, even where not specifically stated in each section. 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. The requirements of this appendix do not apply to a SPM that does not use a FRM, FEM, or ARM;

(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 annual performance evaluations (described in section 3.2.2 of this appendix) 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. Monitoring for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) 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), by primary quality assurance organization, or nationally, depending on the pollutant. SLAMS data are required to be reported to the AQS, PSD data are required to be reported to the permit-granting authority. Requirements in this appendix, with the exception of 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 objectives for which the data are collected. The process by which one determines the quality of data needed to meet the monitoring objective is sometimes referred to the Data Quality Objectives Process. 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 quality assurance project plans (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 his or her representative. 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 his or her representative, may allow delegation of the authority to review and approve the 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 environmental data operation (EDO) to have a 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 organization's 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 plus or minus 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 90 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 90 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 the 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 NPAP Coordinator at the Air Quality Assessment Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency in Research Triangle Park, North Carolina.

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 (SO_2), nitrogen oxide (NO), and nitrogen dioxide (NO_2) 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 primary quality assurance organizations (PQAOs) to perform the measurement quality checks that can be used to assess data quality. With the exception of the flow rate verifications (sections 3.2.3 and 3.3.2 of this appendix), data from these checks are required to be submitted to the AQS within the same time frame as routine ambient concentration 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. A primary quality assurance organization is defined as a monitoring organization or a coordinated aggregation of such organizations that is responsible for a set of stations that monitors the same pollutant and for which data quality assessments can logically 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 Data quality 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 SO_2, NO_2, O_3, 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 SO_2, NO_2, O_3 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 SO_2, NO_2, and O_3, 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). 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 Annual performance evaluation for SO_2, NO_2, O_3, or CO. Each calendar quarter (during which analyzers are operated), evaluate at least 25 percent of the SLAMS analyzers that monitor for SO_2, NO_2, O_3, 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. The evaluation should be conducted by a trained experienced technician other than the routine site operator.

3.2.2.1 (a) 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 audit levels. The audit levels selected should represent or bracket 80 percent of ambient concentrations measured by 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

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

3.2.2.2 (a) NO_2 audit gas for chemiluminescence-type NO_2 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 NO_2 audit gas to levels closer to typical ambient NO concentrations at the site.

(b) To evaluate SLAMS analyzers operating on ranges higher than 0 to 1.0 ppm for SO_2, NO_2, and O_3 or 0 to 50 ppm for CO, use audit gases of appropriately higher concentration as approved by the appropriate EPA Regional Administrator or the Administrator'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, if the open path instrument is not installed in a permanent manner, the monitoring path length must be reverified to within plus or minus 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 Matter. Every 6 months, audit the flow rate of the PM_{10}, $PM_{10-2.5}$ and $PM_{2.5}$ particulate analyzers. Where possible, EPA strongly encourages more frequent auditing. The audit should (preferably) 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 Sampling Procedures for $PM_{2.5}$. 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 0.5 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 model designated as an EPA FEM used by the PQAO, 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, FEM or ARM 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 about 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 Collocated Sampling Procedures for $PM_{10-2.5}$. For the $PM_{10-2.5}$ network, all automated methods must be designated as Federal equivalent methods (FEMs). 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.

3.2.6.1 The EPA shall ensure that each EPA designated FEM within the national $PM_{10-2.5}$ monitoring network must:

(a) Have 15 percent of the monitors collocated (values of 0.5 and greater round up); and

(b) Have at least 2 collocated monitors (if the total number of monitors is less than 10). The first collocated monitor must be a designated FRM monitor and the second must be a monitor of the same method designation. Both collocated FRM and FEM monitors can be located at the same site.

3.2.6.2 The Regional Administrator for the EPA Regions where the FEMs are implemented will select the sites for collocated monitoring. The site selection process shall consider giving priority to sites at primary quality assurance organizations or States with more than one $PM_{10-2.5}$ site, sites considered important from a regional perspective, and sites needed for an appropriate distribution among rural and urban NCore sites. Depending on the speed at which the $PM_{10-2.5}$ network is deployed, the first sites implementing FEMs shall be required to perform collocation until there is a larger distribution of FEM monitors implemented in the network.

3.2.6.3 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.

3.2.6.4 Sample the collocated audit monitor for SLAMS sites on a 12-day schedule. 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.

3.2.7 $PM_{2.5}$ Performance Evaluation Program (PEP) Procedures. The PEP 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 $\mu g/m^3$. Additionally, each year, every designated FRM or FEM within a primary quality assurance organization must:

(1) Have each method designation evaluated each year; and,

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

(b) 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.

3.2.8 $PM_{10-2.5}$ Performance Evaluation Program. For the $PM_{10-2.5}$ network, all automated methods will be designated as federal equivalent methods (FEMs). One performance evaluation audit, as described in section 3.2.7 must be performed at one $PM_{10-2.5}$ site in each primary quality assurance organization each year. 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 Sampling 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. However, PM_{10} samplers used in the $PM_{10-2.5}$ network, may be counted along with the PM_{10} samplers in the PM_{10} network as long as the PM_{10} samplers in both networks are the same method designation. 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 approximately 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} (low-volume instruments), and $PM_{10-2.5}$. High-volume PM_{10} and TSP instruments can also follow the procedure in section 3.2.3 but the audits are required to be conducted quarterly. 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 (¾ 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, µg/strip	Equivalent ambient Pb concentration, µg/m³ [1]
1	100–300	0.5–1.5
2	400–1,000	3.0–5.0

[1] Equivalent ambient Pb concentration in µ/m³ is based on sampling at 1.7 m³/min for 24 hours on a 20.3 cm × 25.4 cm (8 inch × 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 Sampling Procedures for $PM_{2.5}$. Follow the same procedure as described in section 3.2.5 of this appendix. $PM_{2.5}$ samplers used in the $PM_{10-2.5}$ network, may be counted along with the $PM_{2.5}$ samplers in the $PM_{2.5}$ network as long as the $PM_{2.5}$ samplers in both networks are the same method designation.

3.3.6 Collocated Sampling Procedures for $PM_{10-2.5}$. All designated FRMs within the $PM_{10-2.5}$ monitoring network must have 15

percent of the monitors collocated (values of 0.5 and greater round up) at the $PM_{10-2.5}$ sites. All FRM method designations can be aggregated.

3.3.6.1 The EPA shall ensure that each designated FEM within the $PM_{10-2.5}$ monitoring network must:

(a) Have 15 percent of the monitors collocated (values of 0.5 and greater round up); and

(b) Have at least 2 collocated monitors (if the total number of monitors is less than 10). The first collocated monitor must be a designated FRM monitor and the second must be a monitor of the same method designation. Both collocated FRM and FEM monitors can be located at the same site.

3.3.6.2 The Regional Administrator for the EPA Region where the FRM or FEMs are implemented will select the sites for collocated monitoring. The collocation site selection process shall consider sites at primary quality assurance organizations or States with more than one $PM_{10-2.5}$ site; primary quality assurance organizations already monitoring for PM_{10} and $PM_{2.5}$ using FRMs or FEMs; and an appropriate distribution among rural and urban NCore sites. Monitoring organizations implementing PM_{10} samplers and $PM_{2.5}$ FRM samplers of the same method designation as the $PM_{10-2.5}$ FRM can include the $PM_{10-2.5}$ monitors in their respective PM_{10} and $PM_{2.5}$ count. Follow the same procedures as described in sections 3.2.6.2 and 3.2.6.3 of this appendix.

3.3.7 $PM_{2.5}$ Performance Evaluation Program (PEP) Procedures. Follow the same procedure as described in section 3.2.7 of this appendix.

3.3.8 $PM_{10-2.5}$ Performance Evaluation Program (PEP) Procedures. One performance evaluation audit, as described in section 3.2.7 of this appendix must be performed at one $PM_{10-2.5}$ site in each primary quality assurance organization each year. Monitoring organizations implementing $PM_{2.5}$ FRM samplers of the same method designation in both the $PM_{2.5}$ and the $PM_{10-2.5}$ networks can include the $PM_{10-2.5}$ performance evaluation audit in their respective $PM_{2.5}$ performance evaluation count as long as the performance evaluation is conducted at the $PM_{10-2.5}$ site. 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.

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

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

$$d_i = \frac{meas - audit}{audit} \times 100$$

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 SO_2, NO_2, O_3, 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, $X^2_{0.1,n-1}$ 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 SO_2, NO_2, O_3, or CO described in section 3.2.1

of this appendix and the performance evaluation program for $PM_{10-2.5}$ described in sections 3.2.8 and 3.3.8 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

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

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 the one-point QC Checks. The annual performance evaluations for SO_2, NO_2, O_3, 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

$$\text{Upper Probability Limit} = m + 1.96 \cdot S$$

Equation 7

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

where, m is the mean (equation 8 of this appendix):

Equation 8

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

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 PM_{10}.

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

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

where, n is the number of valid data pairs being aggregated, and $X^2_{0.1,n-1}$ 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 if the d_i's and is calculated using equation 5 of this

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 of 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

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

where, n_j is the number of pairs and d_1, d_2, * * *, d_{nj} are the 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

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

Equation 14

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

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 PM_{10} 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

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

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

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

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

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

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 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. The 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 relevant data for the calendar year, EPA will calculate and report the measurement uncertainty for the entire calendar year.

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/240/B–06/001. February, 2006. Office of Environmental Information, Washington DC 20460. *http://www.epa.gov/quality/qs-docs/g4-final.pdf*.

(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 Information (CERI), 26 W. Martin Luther King Drive, Cincinnati, OH 45268. *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	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, and verifications. Prefer different personnel.	Personnel, standards and equipment different from those used for spanning, calibration, and 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	Parameters reported
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 concentration [1] and measured concentration [2].
Annual performance evaluation for SO_2, NO_2, O_3, CO.	See section 3.2.2 of this appendix.	Each analyzer	Once per year	Audit concentration [1] and measured concentration [2] for each level.
Flow rate verification PM_{10}, $PM_{2.5}$, $PM_{10-2.5}$.	Check of sampler flow rate.	Each sampler	Once every month	Audit flow rate and measured flow rate indicated by the sampler.
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	Audit flow rate and measured flow rate indicated by the sampler.
Collocated sampling $PM_{2.5}$, $PM_{10-2.5}$.	Collocated samplers	15%	Every 12 days	Primary sampler concentration and duplicate sampler concentration.
Performance evaluation program $PM_{2.5}$, $PM_{10-2.5}$.	Collocated samplers	1. 5 valid audits for primary QA orgs, with ≤ 5 sites. 2. 8 valid audits for primary QA orgs, with > 5 sites. 3. All samplers in 6 years.	Over all 4 quarters	Primary sampler concentration and performance evaluation sampler concentration.
Manual Methods				
Collocated sampling PM_{10}, TSP, $PM_{10-2.5}$, $PM_{2.5}$.	Collocated samplers	15%	Every 12 days PSD—every 6 days.	Primary sampler concentration and duplicate sampler concentration.
Flow rate verification PM_{10} (low Vol), $PM_{10-2.5}$, $PM_{2.5}$.	Check of sampler flow rate.	Each sampler	Once every month	Audit flow rate and measured flow rate indicated by the sampler.
Flow rate verification PM_{10} (High-Vol), TSP.	Check of sampler flow rate.	Each sampler	Once every quarter	Audit flow rate and measured flow rate indicated by the sampler.
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 flow rate and measured flow rate indicated by the sampler.
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	1. Include with TSP 2. Each quarter	1. Same as for TSP. 2. Actual concentration.
Performance evaluation program $PM_{2.5}$, $PM_{10-2.5}$.	Collocated samplers	1. 5 valid audits for primary QA orgs, with ≤ 5 sites. 2. 8 valid audits for primary QA orgs, with ≥ 5 sites. 3. All samplers in 6 years.	Over all 4 quarters	Primary sampler concentration and performance evaluation sampler concentration.

[1] Effective concentration for open path analyzers.
[2] Corrected concentration, if applicable, for open path analyzers.

TABLE A–3 OF APPENDIX A TO PART 58—SUMMARY OF $PM_{2.5}$ 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

[71 FR 61303, Oct. 17, 2006, as amended at 72 FR 32211, June 12, 2007]

EDITORIAL NOTE: At 72 FR 32211, June 13, 2007, the last sentence in section 4.2.2.2, was amended in Appendix A to Part 58; however, the amendment could not be incorporated due to inaccurate amendatory instruction.

APPENDIX B TO PART 58 [RESERVED]

APPENDIX C TO PART 58—AMBIENT AIR QUALITY MONITORING METHODOLOGY

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

1.0 PURPOSE

This appendix specifies the criteria pollutant monitoring methods (manual methods or automated analyzers) which must be used in SLAMS and NCore stations that are a subset of SLAMS.

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 Reserved

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 an FRM or 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 or primary quality assurance organization, 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/CSA 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.

2.4.1.3 No PM_{10} samplers shall be required for the test, as determination of the $PM_{2.5}/PM_{10}$ ratio at the test site shall not be required.

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 ($\mu g/m^3$) may be excluded. Exclusion of data does not result in failure of sample completeness specified in this section.

2.4.1.7 Data transformations are allowed to be used to demonstrate meeting the comparability requirements specified in subpart C of part 53 of this chapter. Data transformation may be linear or non-linear, but must be applied in the same way to all sites used in the testing.

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.

2.4.2.5 If data transformations are used, they must be described in the monitoring agencies Quality Assurance Project plan (or addendum to QAPP). The QAPP shall describe how often (e.g., quarterly, yearly) and under what provisions the data transformation will be updated. For example, not meeting the data quality objectives for a site over a season or year may be cause for recalculating a data transformation, but by itself would not be cause for invalidating the data. Data transformations must be applied prospectively, i.e., in real-time or near real-time, to the data output from the $PM_{2.5}$ continuous method. See reference 7 of this appendix.

2.4.3 The monitoring agency wishing to use the method must develop and implement appropriate procedures for assessing and reporting the precision and accuracy of the method comparable to the procedures set forth in appendix A of this part for designated reference and equivalent methods.

2.4.4 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 ARM with FRM/FEM samplers must be maintained at a minimum of 30 percent of the required SLAMS sites with a minimum of 1 per network;

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 an 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 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.

2.4.5.2 A detailed description of the method and the nature of the sampler or analyzer upon which it is based.

2.4.5.3 A brief statement of the reason or rationale for requesting the approval.

2.4.5.4 A detailed description of the quality assurance procedures that have been developed and that will be implemented for the method.

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.

2.4.5.6 Test results from the comparability tests as required in section 2.4.1 through 2.4.1.4 of this appendix.

2.4.5.7 Such further supplemental information as may be necessary or helpful to support the required statements and test results.

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 decision.

2.5 [Reserved]

2.6 Use of Methods With Higher, Nonconforming Ranges in Certain Geographical Areas.

2.6.1 [Reserved]

2.6.2 An analyzer may be used (indefinitely) on a range which extends to concentrations higher than two times the upper limit specified in table B–1 of part 53 of this chapter if:

2.6.2.1 The analyzer has more than one selectable range and has been designated as a reference or equivalent method on at least one of its ranges, or has been approved for use under section 2.5 (which applies to analyzers purchased before February 18, 1975);

2.6.2.2 The pollutant intended to be measured with the analyzer is likely to occur in concentrations more than two times the upper range limit specified in table B–1 of part 53 of this chapter in the geographical area in which use of the analyzer is proposed; and

2.6.2.3 The Administrator determines that the resolution of the range or ranges for which approval is sought is adequate for its intended use. For purposes of this section (2.6), ''resolution'' means the ability of the analyzer to detect small changes in concentration.

2.6.3 Requests for approval under section 2.6.2 of this appendix must meet the submittal requirements of section 2.7. Except as provided in section 2.7.3 of this appendix, each request must contain the information specified in section 2.7.2 in addition to the following:

2.6.3.1 The range or ranges proposed to be used;

2.6.3.2 Test data, records, calculations, and test results as specified in section 2.7.2.2 of this appendix for each range proposed to be used;

2.6.3.3 An identification and description of the geographical area in which use of the analyzer is proposed;

2.6.3.4 Data or other information demonstrating that the pollutant intended to be measured with the analyzer is likely to occur in concentrations more than two times the upper range limit specified in table B–1 of part 53 of this chapter in the geographical area in which use of the analyzer is proposed; and

2.6.3.5 Test data or other information demonstrating the resolution of each proposed range that is broader than that permitted by section 2.5 of this appendix.

2.6.4 Any person who has obtained approval of a request under this section (2.6.2) shall assure that the analyzer for which approval was obtained is used only in the geographical area identified in the request and only while operated in the range or ranges specified in the request.

2.7 Requests for Approval; Withdrawal of Approval.

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 ARM 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.

2.7.2 Except as provided in section 2.7.3 of this appendix, each request must contain:

2.7.2.1 A statement identifying the analyzer (e.g., by serial number) and the method of which the analyzer is representative (e.g., by manufacturer and model number); and

2.7.2.2 Test data, records, calculations, and test results for the analyzer (or the method of which the analyzer is representative) as specified in subpart B, subpart C, or both (as applicable) of part 53 of this chapter.

2.7.3 A request may concern more than one analyzer or geographical area and may incorporate by reference any data or other information known to EPA from one or more of the following:

2.7.3.1 An application for a reference or equivalent method determination submitted to EPA for the method of which the analyzer is representative, or testing conducted by the applicant or by EPA in connection with such an application;

2.7.3.2 Testing of the method of which the analyzer is representative at the initiative of the Administrator under §53.7 of this chapter; or

2.7.3.3 A previous or concurrent request for approval submitted to EPA under this section (2.7).

2.7.4 To the extent that such incorporation by reference provides data or information required by this section (2.7) or by sections 2.4, 2.5, or 2.6 of this appendix, independent data or duplicative information need not be submitted.

2.7.5 After receiving a request under this section (2.7), the Administrator may request such additional testing or information or conduct such tests as may be necessary in his judgment for a decision on the request.

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 Modifications of Methods by Users.

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.

2.8.2 Requests for approval under this section (2.8) must meet the submittal requirements of sections 2.7.1 and 2.7.2.1 of this appendix.

2.8.3 Each request submitted under this section (2.8) must include:

2.8.3.1 A description, in such detail as may be appropriate, of the desired modification;

2.8.3.2 A brief statement of the purpose(s) of the modification, including any reasons for considering it necessary or advantageous;

2.8.3.3 A brief statement of belief concerning the extent to which the modification will or may affect the performance characteristics of the method; and

2.8.3.4 Such further information as may be necessary to explain and support the statements required by sections 2.8.3.2 and 2.8.3.3.

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 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.

3.0 NCore Ambient Air Monitoring Stations

3.1 Methods employed in NCore multipollutant sites used to measure SO_2, CO, NO_2, O_3, $PM_{2.5}$, 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 SO_2, CO, NO_2, O_3, $PM_{2.5}$, 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. Examples of locations that are not intended to be compared to the NAAQS may be rural background and transport sites or areas where the concentration of the pollutant is so low that it would be more useful to operate a higher sensitivity method that is not an FRM or FEM.

4.0 PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

4.1 Methods used for O_3 monitoring at PAMS must be automated reference or equivalent methods as defined in §50.1 of this chapter.

4.2 Methods used for NO, NO_2 and NO_X monitoring at PAMS should be automated reference or equivalent methods as defined for NO_2 in §50.1 of this chapter. If alternative NO, NO_2 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.

5.0 PARTICULATE MATTER EPISODE MONITORING

5.1 For short-term measurements of PM_{10} during air pollution episodes (see §51.152 of this chapter) the measurement method must be:

5.1.1 Either the ''Staggered PM_{10}'' method or the ''PM_{10} Sampling Over Short Sampling Times'' method, both of which are based on the reference method for PM_{10} and are described in reference 1: or

5.1.2 Any other method for measuring PM_{10}:

5.1.2.1 Which has a measurement range or ranges appropriate to accurately measure air pollution episode concentration of PM_{10},

5.1.2.2 Which has a sample period appropriate for short-term PM_{10} measurements, and

5.1.2.3 For which a quantitative relationship to a reference or equivalent method for PM_{10} has been established at the use site. Procedures for establishing a quantitative site-specific relationship are contained in reference 1.

5.2 PM_{10} methods other than the reference method are not covered under the quality assessment requirements of appendix to this part. Therefore, States must develop and implement their own quality assessment procedures for those methods allowed under this section 4. These quality assessment procedures should be similar or analogous to those described in section 3 of appendix A to this part for the PM_{10} reference method.

6.0 REFERENCES

1. Pelton, D. J. Guideline for Particulate Episode Monitoring Methods, GEOMET Technologies, Inc., Rockville, MD. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68–02–3584. EPA 450/4–83–005. February 1983.

2. Technical Assistance Document For Sampling and Analysis of Ozone Precursors. Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. EPA 600/8–91–215. October 1991.

3. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements. Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. EPA 600/4–90–0003. August 1989.

4. Eldred, R.A., Cahill, T.A., Wilkenson, L.K., *et al.,* Measurements of fine particles and their chemical components in the IMPROVE/NPS networks, in Transactions of the International Specialty Conference on Visibility and Fine Particles, Air and Waste Management Association: Pittsburgh, PA, 1990; pp. 187–196.

5. Sisler, J.F., Huffman, D., and Latimer, D.A.; Spatial and temporal patterns and the chemical composition of the haze in the United States: An analysis of data from the IMPROVE network, 1988–1991, ISSN No. 0737–5253–26, National Park Service, Ft. Collins, CO, 1993.

6. Eldred, R.A., Cahill, T.A., Pitchford, M., and Malm, W.C.; IMPROVE—a new remote area particulate monitoring system for visibility studies, Proceedings of the 81st Annual Meeting of the Air Pollution Control Association, Dallas, Paper 88–54.3, 1988.

7. Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and Continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI). Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. EPA 454/B–02–2002. November 2002.

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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)
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} mass sites, $PM_{2.5}$ mass sites, chemically-speciated $PM_{2.5}$ sites, and O_3 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.

(a) Provide air pollution data to the general public in a timely manner. Data can be presented to the public in a number of attractive ways including through air quality maps, newspapers, Internet sites, and as part of weather forecasts and public advisories.

(b) Support compliance with ambient air quality standards and emissions strategy development. Data from FRM, FEM, and ARM monitors for NAAQS pollutants will be used for comparing an area's air pollution levels against the 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.

(c) 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.

1.1.1 In order to support the air quality management work 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:

(a) Sites located to determine the highest concentrations expected to occur in the area covered by the network.

(b) Sites located to measure typical concentrations in areas of high population density.

(c) Sites located to determine the impact of significant sources or source categories on air quality.

(d) Sites located to determine general background concentration levels.

(e) Sites located to determine the extent of regional pollutant transport among populated areas; and in support of secondary standards.

(f) Sites located to measure air pollution impacts on visibility, vegetation damage, or other welfare-based impacts.

1.1.2 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. The EPA, State, and local agencies will periodically collaborate on network design issues through the network assessment process outlined in §58.10.

1.1.3 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.

1.2 Spatial Scales. (a) 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.

(b) 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:

(1) *Microscale*—Defines the concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.

(2) *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.

(3) *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.

(4) *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.

(5) *Regional scale*—Defines usually a rural area of reasonably homogeneous geography without large sources, and extends from tens to hundreds of kilometers.

(6) *National and global scales*—These measurement scales represent concentrations characterizing the nation and the globe as a whole.

(c) 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.

(d) 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.

(e) 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).

(f) 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

(a) 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.

(b) 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 included here due to their important role in supporting the air quality management program.

(c) The NCore multipollutant sites are sites that measure multiple pollutants in order to provide support to integrated air quality management data needs. NCore sites include both neighborhood and 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 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. The Administrator must approve the NCore sites.

(d) 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.

(e) 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 50,000 population or greater is termed a Metropolitan Statistical Area (MSA). A CBSA associated with at least one urbanized cluster of at least 10,000 population or greater is termed a Micropolitan Statistical Area. CSA consist of two or more adjacent CBSA. In this appendix, the term MSA is used to refer to a Metropolitan Statistical Area. By definition, both MSA and CSA have a high degree of integration; however, many such areas cross State or other political boundaries. MSA and CSA may also cross more than one air shed. The 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. The 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

(a) Each State (i.e. the fifty States, District of Columbia, Puerto Rico, and the Virgin Islands) is required to operate at least 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. These additional sites shall be located to avoid proximity to large emission sources. 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 multipollutant air monitoring sites including PAMS sites, National Air Toxics Trends Stations (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.

(b) 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, speciated $PM_{10-2.5}$, O_3, SO_2, CO, NO/NO_y, wind speed, wind direction, relative humidity, and ambient temperature.

(1) Although the measurement of NO_y is required in support of a number of monitoring objectives, available commercial instruments may indicate little difference in their measurement of NO_y compared to the conventional measurement of NO_X, particularly in areas with relatively fresh sources of nitrogen emissions. Therefore, in areas with negligible expected difference between NO_y and NO_X measured concentrations, the Administrator may allow for waivers that permit NO_X monitoring to be substituted for the required NO_y monitoring at applicable NCore sites.

(2) 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.

(c) In addition to the continuous measurements listed above, 10 of the NCore locations must also measure lead (Pb) either at the same sites or elsewhere within the MSA/CSA boundary. These ten Pb sites are included within the NCore networks because they are intended to be long-term in operation, and not impacted directly from a single Pb source. These locations for Pb monitoring must be located in the most populated MSA/CSA in each of the 10 EPA Regions. Alternatively, it is also acceptable to use the Pb 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.

(d) Siting criteria are provided for urban and rural locations. Sites with significant historical records that do not meet siting

criteria may be approved as NCore by the Administrator. Sites with the suite of NCore measurements that are explicitly designed for other monitoring objectives are exempt from these siting criteria (e.g., a near-roadway site).

(1) Urban NCore stations are to be generally located at urban or neighborhood scale to provide representative concentrations of exposure expected throughout the metropolitan area; however, a middle-scale site may be acceptable in cases where the site can represent many such locations throughout a metropolitan area.

(2) Rural NCore stations are to be located to the maximum extent practicable at a regional or larger scale away from any large local emission source, so that they represent ambient concentrations over an extensive area.

4. Pollutant-Specific Design Criteria for SLAMS Sites

4.1 Ozone (O_3) Design Criteria. (a) State, and where appropriate, local agencies must operate O_3 sites for various locations depending upon area size (in terms of population and geographic characteristics) and typical peak concentrations (expressed in percentages below, or near the O_3 NAAQS). Specific SLAMS O_3 site minimum requirements are included in Table D–2 of this appendix. The NCore sites are expected to complement the O_3 data collection that takes place at single-pollutant SLAMS sites, and both types of sites can be used to meet the network minimum requirements. The total number of O_3 sites needed to support the basic monitoring objectives of public data reporting, air quality mapping, compliance, and understanding O_3-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 O_3 network to service the variety of data needs in an area.

Table D–2 of Appendix D to Part 58—SLAMS Minimum O_3 Monitoring Requirements

MSA population[1, 2]	Most recent 3-year design value concentrations ≥85% of any O_3 NAAQS[3]	Most recent 3-year design value concentrations <85% of any O_3 NAAQS[3, 4]
>10 million	4	2
4–10 million	3	1
350,000–<4 million	2	1
50,000–<350,000[5]	1	0

[1] Minimum monitoring requirements apply to the Metropolitan statistical area (MSA).

[2] Population based on latest available census figures.

[3] The ozone (O_3) National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.

[4] These minimum monitoring requirements apply in the absence of a design value.

[5] Metropolitan statistical areas (MSA) must contain an urbanized area of 50,000 or more population.

(b) Within an O_3 network, at least one O_3 site for each MSA, or CSA if multiple MSAs are involved, 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 O_3 monitoring program for an area. Some of these additional factors include geographic size, population density, complexity of terrain and meteorology, adjacent O_3 monitoring programs, air pollution transport from neighboring areas, and measured air quality in comparison to all forms of the O_3 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 O_3 requirements are allowed if approved by the EPA Regional Administrator.

(c) The appropriate spatial scales for O_3 sites are neighborhood, urban, and regional. Since O_3 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.

(1) *Neighborhood scale*—Measurements in this category represent conditions throughout some reasonably homogeneous urban sub-region, 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.

(2) *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.

(3) *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 O_3

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.

(d) EPA's technical guidance documents on O_3 monitoring network design should be used to evaluate the adequacy of each existing O_3 monitor, to relocate an existing site, or to locate any new O_3 sites.

(e) 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 O_3 air quality days. Trajectory analyses, an evaluation of wind and emission patterns on high O_3 days, can also be useful in evaluating an O_3 monitoring network. In areas without any previous O_3 air quality measurements, meteorological and O_3 precursor emissions information would be useful.

(f) 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 O_3 concentrations, more specifically, downwind during periods of photochemical activity. In many cases, these maximum concentration O_3 sites will be located 10 to 30 miles or more downwind from the urban area where maximum O_3 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 O_3 levels. Monitoring agencies are to consult with their EPA Regional Office when considering siting a maximum O_3 concentration site.

(g) 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 located closer to the areas bordering on the center city or slightly further downwind in an area of high density population.

(h) 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 O_3 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.

(i) Since O_3 levels decrease significantly in the colder parts of the year in many areas, O_3 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 O_3 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 O_3 data to support a change to the O_3 season in support of the 8-hour standard for a specific State can be found in reference 8 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
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

TABLE D–3 TO APPENDIX D OF PART 58—OZONE MONITORING SEASON BY STATE—Continued

State	Begin month	End month
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. (a) There are no minimum requirements for the number of CO monitoring sites. Continued operation of existing SLAMS CO sites using FRM or FEM is required until discontinuation is approved by the EPA Regional Administrator. Where SLAMS CO monitoring is ongoing, at least one site must be a maximum concentration site for that area under investigation.

(b) 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.

(1) *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.

(2) *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.

(c) After the spatial scale and type of site has been determined to meet the monitoring objective for each location, the technical guidance in reference 2 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 (NO_2) Design Criteria. (a) There are no minimum requirements for the number of NO_2 monitoring sites. Continued operation of existing SLAMS NO_2 sites using FRM or FEM is required until discontinuation is approved by the EPA Regional Administrator. Where SLAMS NO_2 monitoring is ongoing, at least one NO_2 site in the area must be located to measure the maximum concentration of NO_2.

(b) 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 NO_2 that can be used to ensure tracking continued compliance with the NO_2 NAAQS. NO/NO_y monitors are used at these sites because it is important to collect data on total reactive nitrogen species for understanding O_3 photochemistry.

4.4 Sulfur Dioxide (SO_2) Design Criteria. (a) There are no minimum requirements for the number of SO_2 monitoring sites. Continued operation of existing SLAMS SO_2 sites using FRM or FEM is required until discontinuation is approved by the EPA Regional Administrator. Where SLAMS SO_2 monitoring is ongoing, at least one of the SLAMS SO_2 sites must be a maximum concentration site for that specific area.

(b) The appropriate spatial scales for SO_2 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 SO_2.

(1) *Micro and middle scale*—Some data uses associated with microscale and middle scale measurements for SO_2 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.

(2) *Neighborhood scale*—This scale applies where there is a need to collect air quality data as part of an ongoing SO_2 stationary source impact investigation. Typical locations might include suburban areas adjacent to SO_2 stationary sources for example, or for determining background concentrations as part of these studies of population responses to exposure to SO_2.

(c) Technical guidance in reference 1 of this appendix should be used to evaluate the adequacy of each existing SO_2 site, to relocate an existing site, or to locate new sites.

4.5 Lead (Pb) Design Criteria. (a) 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.

(b) The most important spatial scales to effectively characterize the emissions from point sources are the micro, middle, and neighborhood scales.

(1) *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.

(2) *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 3 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.

(3) *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.

(c) Technical guidance is found in references 4 and 5 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 (PM_{10}) Design Criteria. ≤(a) Table D–4 indicates the approximate number of permanent stations required in MSAs to characterize national and regional PM_{10} air quality trends and geographical patterns. The number of PM_{10} stations in areas where MSA populations exceed 1,000,000 must be in the range from 2 to 10 stations, while in low population urban areas, no more than two stations are required. A range of monitoring stations is specified in Table D–4 because sources of pollutants and local control efforts can vary from one part of the country to another and therefore, some flexibility is allowed in selecting the actual number of stations in any one locale. Modifications from these PM_{10} monitoring requirements must be approved by the Regional Administrator.

TABLE D–4 OF APPENDIX D TO PART 58—PM_{10} MINIMUM MONITORING REQUIREMENTS (APPROXIMATE NUMBER OF STATIONS PER MSA) [1]

Population category	High concentration [2]	Medium concentration [3]	Low concentration [4,5]
>1,000,000	6–10	4–8	2–4
500,000–1,000,000	4–8	2–4	1–2
250,000–500,000	3–4	1–2	0–1
100,000–250,000	1–2	0–1	0

[1] Selection of urban areas and actual numbers of stations per area will be jointly determined by EPA and the State agency.
[2] High concentration areas are those for which ambient PM10 data show ambient concentrations exceeding the PM_{10} NAAQS by 20 percent or more.
[3] Medium concentration areas are those for which ambient PM10 data show ambient concentrations exceeding 80 percent of the PM_{10} NAAQS.
[4] Low concentration areas are those for which ambient PM10 data show ambient concentrations less than 80 percent of the PM_{10} NAAQS.
[5] These minimum monitoring requirements apply in the absence of a design value.

(b) Although microscale monitoring may be appropriate in some circumstances, the most important spatial scales to effectively characterize the emissions of PM_{10} from both mobile and stationary sources are the middle scales and neighborhood scales.

(1) *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 PM_{10} 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.

(2) *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.

(3) *Neighborhood scale*—Measurements in this category represent conditions throughout some reasonably homogeneous urban sub-region 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.

4.7 Fine Particulate Matter ($PM_{2.5}$) Design Criteria.

4.7.1 General Requirements. (a) State, and where applicable local, agencies must operate the minimum number of required $PM_{2.5}$ SLAMS sites listed in Table D–5 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–5 OF APPENDIX D TO PART 58—$PM_{2.5}$ MINIMUM MONITORING REQUIREMENTS

MSA population [1,2]	Most recent 3-year design value ≥85% of any $PM_{2.5}$ NAAQS [3]	Most recent 3-year design value <85% of any $PM_{2.5}$ NAAQS [3,4]
>1,000,000	3	2
500,000–1,000,000	2	1
50,000–<500,000 [5]	1	0

[1] Minimum monitoring requirements apply to the Metropolitan statistical area (MSA).
[2] Population based on latest available census figures.
[3] The $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] Metropolitan statistical areas (MSA) must contain an urbanized area of 50,000 or more population.

(b) Specific Design Criteria for $PM_{2.5}$. The required monitoring stations or sites must be sited to represent community-wide air quality. These sites can include sites collocated at PAMS. These monitoring stations will typically be at neighborhood or urban-scale; however, in certain instances where population-oriented micro-or middle-scale $PM_{2.5}$ monitoring are determined by the Regional Administrator to represent many such locations throughout a metropolitan area, these smaller scales can be considered to represent community-wide air quality.

(1) At least one monitoring station is to be sited in a population-oriented area of expected maximum concentration.

(2) For areas with more than one required SLAMS, a monitoring station is to be sited in an area of poor air quality.

(3) Additional technical guidance for siting $PM_{2.5}$ monitors is provided in references 6 and 7 of this appendix.

(c) 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.

(1) *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. 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 SPM.

(2) *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.

(3) *Neighborhood scale*—Measurements in this category would represent conditions throughout some reasonably homogeneous urban sub-region 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.

(4) *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.

(5) *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 O_3 and regional haze.

4.7.2 Requirement for Continuous $PM_{2.5}$ Monitoring. The State, or where appropriate, local agencies must operate continuous $PM_{2.5}$ analyzers equal to at least one-half (round up) the minimum required sites listed in Table D–5 of this appendix. At least one required continuous analyzer in each MSA must be collocated with one of the required FRM/FEM/ARM monitors, unless at least one of the required FRM/FEM/ARM monitors is itself a continuous FEM or ARM monitor in which case no collocation requirement applies. 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 required continuous analyzers.

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. 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. (a) The $PM_{2.5}$ NAAQS, specified in 40 CFR part 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.

(b) 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 to 40 CFR part 50.

4.8 Coarse Particulate Matter ($PM_{10-2.5}$) Design Criteria.

4.8.1 General Monitoring Requirements. (a) The only required monitors for $PM_{10-2.5}$ are those required at NCore Stations.

(b) Although microscale monitoring may be appropriate in some circumstances, 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.

(1) *Microscale*—This scale would typify relatively small areas immediately adjacent to: Industrial sources; locations experiencing ongoing construction, redevelopment, and soil disturbance; and 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.

(2) *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.

(3) *Neighborhood scale*—Measurements in this category would represent conditions throughout some reasonably homogeneous urban sub-region 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 $PM_{10-2.5}$ Chemical Speciation Site Requirements. $PM_{10-2.5}$ chemical speciation monitoring and analyses is required at NCore sites. The selection and modification of these sites must be approved by the Administrator. Samples must be collected using the monitoring methods and the sampling schedules approved by the Administrator.

5. Network Design for Photochemical Assessment Monitoring Stations (PAMS)

The PAMS program provides more comprehensive data on O_3 air pollution in areas classified as serious, severe, or extreme nonattainment for O_3 than would otherwise be achieved through the NCore and SLAMS sites. More specifically, the PAMS program includes measurements for O_3, oxides of nitrogen, VOC, and meteorology.

5.1 PAMS Monitoring Objectives. PAMS design criteria are site specific. Concurrent measurements of O_3, 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 O_3 precursor source areas and predominant wind directions associated with high O_3 events. Specific monitoring objectives are associated with each location. The overall design should enable characterization of precursor emission sources within the area, transport of O_3 and its precursors, and the photochemical processes related to O_3 nonattainment. Specific objectives that must be addressed include assessing ambient trends in O_3, oxides of nitrogen, VOC species, and determining spatial and diurnal variability of O_3, 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 9 of this appendix.

(a) Type 1 sites are established to characterize upwind background and transported O_3 and its precursor concentrations entering the area and will identify those areas which are subjected to transport.

(b) 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.

(c) Type 3 sites are intended to monitor maximum O_3 concentrations occurring downwind from the area of maximum precursor emissions.

(d) Type 4 sites are established to characterize the downwind transported O_3 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 O_3 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 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.

TABLE D–6 OF APPENDIX D TO PART 58—MINIMUM REQUIRED PAMS MONITORING LOCATIONS AND FREQUENCIES—Continued

Measurement	Where required	Sampling frequency (all daily except for upper air meteorology) [1]
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 annual monitoring network plan required in 40 CFR 58.10.

[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 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 O_3 nonattainment area to serious, severe, or extreme, or the designation of a new area and classification to serious, severe, or extreme O_3 nonattainment, a State is allowed 1 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.

6. REFERENCES

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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.
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

(a) 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.

(b) 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 10 of this appendix.

(c) 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, PM_{10}, $PM_{10-2.5}$, $PM_{2.5}$, 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, PM_{10}, $PM_{10-2.5}$ 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

(a) 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 SO_2, 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.

(b) Similarly, local sources of nitric oxide (NO) and ozone-reactive hydrocarbons can have a scavenging effect causing unrepresentatively low concentrations of O_3 in the vicinity of probes and monitoring paths for O_3. 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 SO_2 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

(a) 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.

(b) 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.

(c) Special consideration must be given 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

(a) Trees can provide surfaces for SO_2, O_3, or NO_2 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.

(b) The scavenging effect of trees is greater for O_3 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.

(c) 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 O_3 analyzer, it is important to minimize destructive interferences from sources of NO, since NO readily reacts with O_3. In siting NO_2 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 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 (O_3) AND OXIDES OF NITROGEN (NO, NO_2, NO_X, NO_y)

Roadway average daily traffic, vehicles per day	Minimum distance [1] (meters)	Minimum distance [1, 2] (meters)
≤1,000	10	10

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 (O_3) AND OXIDES OF NITROGEN (NO, NO_2, NO_X, NO_y)—Continued

Roadway average daily traffic, vehicles per day	Minimum distance [1] (meters)	Minimum distance [1,2] (meters)
10,000	10	20
15,000	20	30
20,000	30	40
40,000	50	60
70,000	100	100
≥110,000	250	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.

[2] Applicable for ozone monitors whose placement has not already been approved as of December 18, 2006.

6.2 Spacing for Carbon Monoxide Probes and Monitoring Paths. (a) 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.

(b) 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.

(c) 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. (a) 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.

(b) The intent is to locate localized hotspot 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. 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.

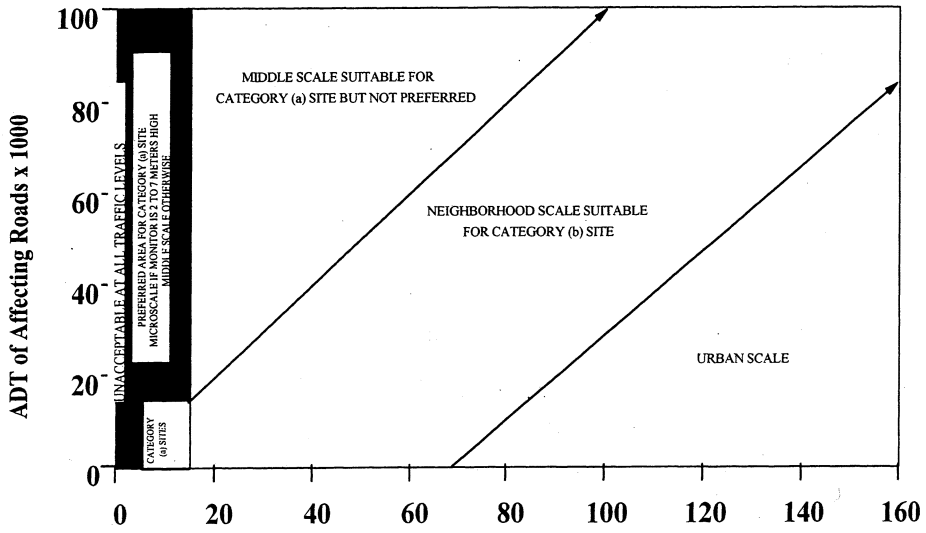

Figure E-1. Distance of PM samplers to nearest traffic lane (meters)

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

(a) For the reactive gases, SO_2, NO_2, and O_3, 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 EPA[25] 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 the only material in the sampling train (from inlet probe to the back of the analyzer) that can be in contact with the ambient air sample for existing and new SLAMs.

(b) 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.

(c) 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 studies [27–28] 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 still produce useful data for some purposes. The 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:

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_2, O_3 [3,4,5]	Middle (300 m) Neighborhood, Urban, and Regional (1 km).	2–15	> 1	> 10	See Table E–1 of this appendix for all scales.

TABLE E–4 OF APPENDIX E TO PART 58—SUMMARY OF PROBE AND MONITORING PATH SITING CRITERIA—Continued

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)
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 SO_2,O_3, O_3 precursors, and NO_2.

[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.

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APPENDIX F TO PART 58 [RESERVED]

APPENDIX G TO PART 58—UNIFORM AIR QUALITY INDEX (AQI) AND DAILY REPORTING

GENERAL REQUIREMENTS

1. What is the AQI?

2. Why report the AQI?
3. Must I report the AQI?
4. What goes into my AQI report?
5. Is my AQI report for my MSA only?
6. How do I get my AQI report to the public?
7. How often must I report the AQI?
8. May I make exceptions to these reporting requirements?

CALCULATION

9. How Does the AQI Relate to Air Pollution Levels?
10. What Monitors Should I Use To Get the Pollutant Concentrations for Calculating the AQI?
11. Do I have to forecast the AQI?
12. How Do I Calculate the AQI?

BACKGROUND AND REFERENCE MATERIALS

13. What Additional Information Should I Know?

GENERAL REQUIREMENTS

1. What Is the AQI?

The AQI is a tool that simplifies reporting air quality to the general public. The AQI incorporates into a single index concentrations of 5 criteria pollutants: ozone (O_3), particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). The scale of the index is divided into general categories that are associated with health messages.

2. Why Report the AQI?

The AQI offers various advantages:

a. It is simple to create and understand.

b. It conveys the health implications of air quality.

c. It promotes uniform use throughout the country.

3. Must I Report the AQI?

You must report the AQI daily if yours is a metropolitan statistical area (MSA) with a population over 350,000.

4. What Goes Into My AQI Report?

i. Your AQI report must contain the following:

a. The reporting area(s) (the MSA or subdivision of the MSA).

b. The reporting period (the day for which the AQI is reported).

c. The critical pollutant (the pollutant with the highest index value).

d. The AQI (the highest index value).

e. The category descriptor and index value associated with the AQI and, if you choose to report in a color format, the associated color. Use only the following descriptors and colors for the six AQI categories:

TABLE 1—AQI CATEGORIES

For this AQI	Use this descriptor	And this color [1]
0 to 50	"Good"	Green.
51 to 100	"Moderate"	Yellow.
101 to 150	"Unhealthy for Sensitive Groups".	Orange.
151 to 200	"Unhealthy"	Red.
201 to 300	"Very Unhealthy"	Purple.
301 and above	"Hazardous"	Maroon.[1]

[1] Specific colors can be found in the most recent reporting guidance (Guideline for Public Reporting of Daily Air Quality—Air Quality Index (AQI)).

f. The pollutant specific sensitive groups for any reported index value greater than 100. Use the following sensitive groups for each pollutant:

When this pollutant has an index value above 100 * * *	Report these sensitive groups * * *
Ozone	Children and people with asthma are the groups most at risk.
$PM_{2.5}$	People with respiratory or heart disease, the elderly and children are the groups most at risk.
PM_{10}	People with respiratory disease are the group most at risk.
CO	People with heart disease are the group most at risk.
SO_2	People with asthma are the group most at risk.
NO_2	Children and people with respiratory disease are the groups most at risk.

ii. When appropriate, your AQI report may also contain the following:

a. Appropriate health and cautionary statements.

b. The name and index value for other pollutants, particularly those with an index value greater than 100.

c. The index values for sub-areas of your MSA.

d. Causes for unusual AQI values.

e. Actual pollutant concentrations.

5. Is My AQI Report for My MSA Only?

Generally, your AQI report applies to your MSA only. However, if a significant air quality problem exists (AQI greater than 100) in areas significantly impacted by your MSA but not in it (for example, O_3 concentrations are often highest downwind and outside an urban area), you should identify these areas and report the AQI for these areas as well.

6. How Do I Get My AQI Report to the Public?

You must furnish the daily report to the appropriate news media (radio, television, and newspapers). You must make the daily report publicly available at one or more places of public access, or by any other means, including a recorded phone message, a public Internet site, or facsimile transmission. When the AQI value is greater than 100, it is particularly critical that the reporting to the various news media be as extensive as possible. At a minimum, it should include notification to the media with the largest market coverages for the area in question.

7. How Often Must I Report the AQI?

You must report the AQI at least 5 days per week. Exceptions to this requirement are in section 8 of this appendix.

8. May I Make Exceptions to These Reporting Requirements?

i. If the index value for a particular pollutant remains below 50 for a season or year, then you may exclude the pollutant from your calculation of the AQI in section 12.

ii. If all index values remain below 50 for a year, then you may report the AQI at your discretion. In subsequent years, if pollutant levels rise to where the AQI would be above 50, then the AQI must be reported as required in sections 3, 4, 6, and 7 of this appendix.

CALCULATION

9. How Does the AQI Relate to Air Pollution Levels?

For each pollutant, the AQI transforms ambient concentrations to a scale from 0 to 500. The AQI is keyed as appropriate to the national ambient air quality standards (NAAQS) for each pollutant. In most cases, the index value of 100 is associated with the numerical level of the short-term standard (i.e., averaging time of 24-hours or less) for each pollutant. A different approach is taken for NO_2, for which no short-term standard has been established. The index value of 50 is associated with the numerical level of the annual standard for a pollutant, if there is one, at one-half the level of the short-term standard for the pollutant, or at the level at which it is appropriate to begin to provide guidance on cautionary language. Higher categories of the index are based on increasingly serious health effects and increasing proportions of the population that are likely to be affected. The index is related to other air pollution concentrations through linear interpolation based on these levels. The AQI is equal to the highest of the numbers corresponding to each pollutant. For the purposes of reporting the AQI, the sub-indexes for PM_{10} and $PM_{2.5}$ are to be considered separately. The pollutant responsible for the highest index value (the reported AQI) is called the ''critical'' pollutant.

10. What Monitors Should I Use To Get the Pollutant Concentrations for Calculating the AQI?

You must use concentration data from population-oriented State/Local Air Monitoring Station (SLAMS) or parts of the SLAMS required by 40 CFR 58.10 for each pollutant except PM. For PM, calculate and report the AQI on days for which you have measured air quality data (e.g., from continuous $PM_{2.5}$ monitors required in Appendix D to this part). You may use PM measurements from monitors that are not reference or equivalent methods (for example, continuous PM_{10} or $PM_{2.5}$ monitors). Detailed guidance for relating non-approved measurements to approved methods by statistical linear regression is referenced in section 13 below.

11. Do I Have to Forecast the AQI?

You should forecast the AQI to provide timely air quality information to the public, but this is not required. If you choose to forecast the AQI, then you may consider both long-term and short-term forecasts. You can forecast the AQI at least 24-hours in advance using the most accurate and reasonable procedures considering meteorology, topography, availability of data, and forecasting expertise. The document ''Guideline for Developing an Ozone Forecasting Program'' (the Forecasting Guidance) will help you start a forecasting program. You can also issue short-term forecasts by predicting 8-hour ozone values from 1-hour ozone values using methods suggested in the Reporting Guidance, ''Guideline for Public Reporting of Daily Air Quality.''

12. How Do I Calculate the AQI?

i. The AQI is the highest value calculated for each pollutant as follows:

a. Identify the highest concentration among all of the monitors within each reporting area and truncate the pollutant concentration to one more than the significant digits used to express the level of the NAAQS for that pollutant. This is equivalent to the rounding conventions used in the NAAQS.

b. Using Table 2, find the two breakpoints that contain the concentration.

c. Using Equation 1, calculate the index.

d. Round the index to the nearest integer.

TABLE 2—BREAKPOINTS FOR THE AQI

These breakpoints							Equal these AQI's	
O_3 (ppm) 8-hour	O_3 (ppm) 1-hour [1]	$PM_{2.5}$ (μg/m³)	PM_{10} (μg/m³)	CO (ppm)	SO_2 (ppm)	NO_2 (ppm)	AQI	Category
0.000–0.059 ..	0.0–15.4	0–54	0.0–4.4	0.000–0.034	([3])	0–50	Good.	
0.060–0.075 ..	15.5–40.4	55–154	4.5–9.4	0.035–0.144	([3])	51–100	Moderate.	
0.076–0.095 ..	0.125–0.164	40.5–65.4	155–254	9.5–12.4	0.145–0.224	([3])	101–150	Unhealthy for Sensitive Groups.
0.096–0.115 ..	0.165–0.204	[4] 65.5–150.4	255–354	12.5–15.4	0.225–0.304	([3])	151–200	Unhealthy.
0.116–0.374 ..	0.205–0.404	[4] 150.5–250.4	355–424	15.5–30.4	0.305–0.604	0.65–1.24	201–300	Very Unhealthy.
([2])	0.405–0.504	[4] 250.5–350.4	425–504	30.5–40.4	0.605–0.804	1.25–1.64	301–400	
([2])	0.505–0.604	[4] 350.5–500.4	505–604	40.5–50.4	0.805–1.004	1.65–2.04	401–500	Hazardous.

[1] Areas are generally required to report the AQI based on 8-hour ozone values. However, there are a small number of areas where an AQI based on 1-hour ozone values would be more precautionary. In these cases, in addition to calculating the 8-hour ozone index value, the 1-hour ozone index value may be calculated, and the maximum of the two values reported.

[2] 8-hour O_3 values do not define higher AQI values (≥ 301). AQI values of 301 or greater are calculated with 1-hour O_3 concentrations.

[3] NO_2 has no short-term NAAQS, and can generate an AQI only above the value of 200.

[4] If a different SHL for $PM_{2.5}$ is promulgated, these numbers will change accordingly.

ii. If the concentration is equal to a breakpoint, then the index is equal to the corresponding index value in Table 2. However, Equation 1 can still be used. The results will be equal. If the concentration is between two breakpoints, then calculate the index of that pollutant with Equation 1. You must also note that in some areas, the AQI based on 1-hour O_3 will be more precautionary than using 8-hour values (see footnote 1 to Table 2). In these cases, you may use 1-hour values as well as 8-hour values to calculate index values and then use the maximum index value as the AQI for O_3.

$$I_p = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}}\left(C_p - BP_{Lo}\right) + I_{Lo} \qquad \text{(Equation 1)}$$

Where:

I_p = the index value for pollutant$_p$

C_p = the truncated concentration of pollutant$_p$

BP_{Hi} = the breakpoint that is greater than or equal to C_p

BP_{Lo} = the breakpoint that is less than or equal to C_p

I_{Hi} = the AQI value corresponding to BP_{Hi}

I_{lo} = the AQI value corresponding to BP_{Lo}.

iii. If the concentration is larger than the highest breakpoint in Table 2 then you may use the last two breakpoints in Table 2 when you apply Equation 1.

Example

iv. Using Table 2 and Equation 1, calculate the index value for each of the pollutants measured and select the one that produces the highest index value for the AQI. For example, if you observe a PM_{10} value of 210 μg/m³, a 1-hour O_3 value of 0.156 ppm, and an 8-hour O_3 value of 0.130 ppm, then do this:

a. Find the breakpoints for PM_{10} at 210 μg/m³ as 155 μg/m³ and 254 μg/m³, corresponding to index values 101 and 150;

b. Find the breakpoints for 1-hour O_3 at 0.156 ppm as 0.125 ppm and 0.164 ppm, corresponding to index values 101 and 150;

c. Find the breakpoints for 8-hour O_3 at 0.130 ppm as 0.116 ppm and 0.374 ppm, corresponding to index values 201 and 300;

d. Apply Equation 1 for 210 μg/m³, PM_{10}:

$$\frac{150 - 101}{254 - 155}\left(210 - 155\right) + 101 = 128$$

e. Apply Equation 1 for 0.156 ppm, 1-hour O_3:

$$\frac{150 - 101}{0.164 - 0.125}\left(0.156 - 0.125\right) + 101 = 140$$

f. Apply Equation 1 for 0.130 ppm, 8-hour O_3:

$$\frac{300 - 201}{0.374 - 0.116}(0.130 - 0.116) + 201 = 206$$

g. Find the maximum, 206. This is the AQI. The minimal AQI report would read:

v. Today, the AQI for my city is 206 which is Very Unhealthy, due to ozone. Children and people with asthma are the groups most at risk.

13. What Additional Information Should I Know?

The EPA has developed a computer program to calculate the AQI for you. The program prompts for inputs, and it displays all the pertinent information for the AQI (the index value, color, category, sensitive group, health effects, and cautionary language). The EPA has also prepared a brochure on the AQI that explains the index in detail (The Air Quality Index), Reporting Guidance (Guideline for Public Reporting of Daily Air Quality) that provides associated health effects and cautionary statements, and Forecasting Guidance (Guideline for Developing an Ozone Forecasting Program) that explains the steps necessary to start an air pollution forecasting program. You can download the program and the guidance documents at *www.airnow.gov*. Reference for relating non-approved PM measurements to approved methods (Eberly, S., T. Fitz-Simons, T. Hanley, L. Weinstock., T. Tamanini, G. Denniston, B. Lambeth, E. Michel, S. Bortnick. Data Quality Objectives (DQOs) For Relating Federal Reference Method (FRM) and Continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI). U.S. Environmental Protection Agency, research Triangle Park, NC. EPA–454/B–02–002, November 2002) can be found on the Ambient Monitoring Technology Information Center (AMTIC) Web site, *http://www.epa.gov/ttnamti1/*.

[64 FR 42547, Aug. 4, 1999, as amended at 73 FR 16513, Mar. 27, 2008]

PART 59—NATIONAL VOLATILE ORGANIC COMPOUND EMISSION STANDARDS FOR CONSUMER AND COMMERCIAL PRODUCTS

Sec.

Subpart A—General

59.1 Final determinations under section 183(e)(3)(C) of the Clean Air Act.

Subpart B—National Volatile Organic Compound Emission Standards for Automobile Refinish Coatings

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TABLE 1 TO SUBPART B—VOLATILE ORGANIC COMPOUND (VOC) CONTENT LIMITS FOR AUTOMOBILE REFINISH COATINGS

Subpart C—National Volatile Organic Compound Emission Standards for Consumer Products

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