

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 58

[FRL-4842-4]

Ambient Air Quality Surveillance Siting Criteria for Open Path Analyzers

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The EPA proposes to amend provisions of part 58 of chapter 1 of title 40 of the Code of Federal Regulations to define the appropriate ambient air monitoring criteria for open path (long-path) analyzers. The proposed revisions to the Ambient Air Quality Surveillance regulations would define the siting requirements for open path analyzers used as State and Local Air Monitoring Stations (SLAMS), which includes both National Air Monitoring Stations (NAMS) and Photochemical Assessment Monitoring Stations (PAMS), as well as the quality assurance procedures for this technology. These changes will allow the ambient air monitoring community to effectively use open path monitoring data for regulatory purposes.

DATES: Comments must be received on or before [please insert date 30 days after publication]. Requests for public hearing must be received by [please insert date 15 days after publication]. If a hearing is held, comments must be received on or before 30 days from the conclusion of the hearing.

ADDRESSES: Comments should be submitted (in duplicate, if possible) to: Air Docket (LE-131), Attention: Docket Number A-93-44, U.S. Environmental Protection Agency, room M-1500, 401 M Street, SW., Washington, DC 20460.

Public hearing: A public hearing will be held, if requested, in accordance with information provided in the "DATES" section of this proposal, to provide interested parties an opportunity for oral presentation of data, views, or arguments concerning the proposed revisions. If anyone contacts EPA requesting a public hearing, it will be held at the EPA's Environmental Research Center, Research Triangle Park, North Carolina. Persons interested in attending the hearing or wishing to present oral testimony should notify Ms. Lee Ann B. Byrd, Monitoring and Reports Branch (MD-14), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-5367. Specific dates and other pertinent details of this public hearing will be published in a separate Federal Register notice.

Docket: Docket Number A-93-44, containing supporting information used in developing these revised regulations, is available for public inspection and copying between 8:30 a.m. and 12 noon, and between 1:30 p.m. and 3:30 p.m., Monday through Friday, at EPA's Air Docket Section at the address noted above. As provided in 40 CFR Part 2, a reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Ms. Lee Ann B. Byrd at telephone (919) 541-5367 concerning this action. The address is Monitoring and Reports Branch (MD-14), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

SUPPLEMENTARY INFORMATION:

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I. Authority

Authority: sections 110, 301(a), 313, and 319 of the Clean Air Act as amended 42 U.S.C. 7410, 7601(a), 7613, 7619.

II. Background of Proposed Rule

The Clean Air Act, as amended in 1990, requires, in sections 181(b)(2), 185A, and 186(b)(2)(A), ambient air quality monitoring for purposes of defining areas of nonattainment with the National Ambient Air Quality Standards (NAAQS), evaluating progress toward achievement of the NAAQS pursuant to State implementation plans (SIP's), and reporting air quality data to the EPA to document the status and trends of the Nation's air quality. These are nontrivial activities, and to achieve the aforementioned objectives, the EPA must ensure that the ambient air monitoring networks consist of high quality instruments that produce accurate concentration measurements. As new monitoring techniques are developed, the EPA evaluates the new methodology and, as appropriate, determines how to effectively incorporate it into the existing air quality monitoring program. To assess new ambient air monitoring instruments for those pollutants with established NAAQS, the EPA currently uses the Ambient Air Monitoring Reference and Equivalent Method regulatory procedures detailed in title 40, chapter 1, part 53. The EPA does not formally regulate the performance testing of ambient air monitoring instruments, which measure pollutants without established NAAQS. Methodology for collected ozone (O₃) precursor data (specified in the Photochemical Assessment Monitoring program as volatile organic compounds and oxides of nitrogen) is reviewed in the "Technical Assistance Document for Sampling and Analysis of Ozone Precursors," and any subsequent revisions, EPA/600-8-91/215, October 1991. Supplementing the Part 53 performance requirements and the aforementioned "Technical Assistance Document," the Part 58 Ambient Air Quality Surveillance regulation specifies how to most appropriately conduct routine ambient air monitoring through pollutant-specific monitor siting criteria, operation schedules, monitoring network design, and data reporting. Under the part 58 provisions, each SLAMS must employ reference or equivalent methods, as determined according to part 53, and meet all applicable siting requirements as contained in part 58, before its data can be used for regulatory purposes. Specifically, these regulatory actions include comparison with the NAAQS and other SIP-related activities. It is important to note that the NAMS and the PAMS are subsets of the SLAMS networks; therefore, provisions for the SLAMS also apply to both the NAMS and PAMS, as included in this proposal.

A new technique for monitoring pollutants in ambient air has been developed and introduced to the EPA. Instruments based on this new technique, called open path (or long-path) analyzers, use ultraviolet, visible, or infrared light to measure nitrogen dioxide (NO₂), O₃, carbon monoxide (CO), sulfur dioxide (SO₂), and other gaseous pollutant concentrations over a path of several meters up to several kilometers. The concentration measurements obtained by these open path analyzers are path-integrated, or path-averaged, values. Traditional fixed point analyzers measure pollutant concentrations at one specific point by extracting an air sample from the atmosphere through an inlet probe. A list of all EPA-approved reference and equivalent ambient air monitoring methods is available through the docket. Due to the fundamental difference in the measurement principles of open path and point analyzers, there may be trade-offs in using each type of instrument for certain applications. Because of the ability of open path analyzers to measure pollutant concentrations over a path, these new techniques are expected to provide better spatial coverage, and thereby a better assessment of a general population's exposure to air pollutants for certain applications. However, due to this same path-averaging characteristic, open path analyzers could underestimate high pollutant concentrations at specific points within the measurement path for other ambient air monitoring situations. The applicability of either technique to a particular monitoring scenario is dependent on a number of factors including plume dispersion characteristics, monitoring location, pollutant of interest, population density, site topography, and monitoring objective. The EPA has considered these factors in evaluating the advantages and disadvantages of using open path analyzers for the various ambient air monitoring applications detailed in 40 CFR part 58. Additionally, several studies of the comparability of data collected with point and open path analyzers have been conducted by the EPA and by other organizations. The most recent EPA study of these two methodologies was completed during the summer of 1993 in Baytown, Texas. Results from this study and others are available in the docket for public review. The EPA solicits comment on these studies and on the comparability of using path-averaged and point measurements in the Nation's ambient air monitoring programs.

The EPA is currently assessing the performance of an open path analyzer as a candidate method under part 53 to determine if it should be designated as an equivalent method for one or more of those pollutants. In parallel with this effort, the EPA has developed the appropriate part 58 siting and quality assurance criteria for open path analyzers, which are contained in this proposal.

The existing part 58 monitoring network design criteria define the monitoring objectives for a particular site in terms of measurement scale. More specifically, each ambient air monitoring station is located in such a way that it represents a particular air parcel or volume. The regulation uses six measurement scales to describe the size of these air parcels. These six scales are: microscale (dimensions of several meters to approximately 100 meters), middle scale (100 to 500 meters), neighborhood scale (500 meters to 4 kilometers), urban scale (4 to 50 kilometers), regional scale (tens to hundreds of kilometers), and national or global scales. (National and global scales are generally not applicable for a single air monitoring station. National and global averages are more appropriately determined by networks of various monitoring stations.) Within each of these measurement scales, it is assumed that the pollutant concentrations are relatively homogeneous; therefore, a monitor placed at any point in the area, within the tolerances of this siting regulation, measures a concentration representative of that area.

Depending on the objective for a particular SLAMS, each pollutant can be monitored on a particular measurement scale as defined in Table 5 of appendix D in part 58. The applicability of the first five scales to monitoring the four pollutants referenced in this proposal, CO, NO₂, O₃, and SO₂, follows:

Summary of Spatial Scales for Selected SLAMS

Measurement Scale	CO	NO ₂	O ₃	SO ₂	OZONE PRECURSORS*
Microscale	Yes	No	No	No	No
Middle scale	Yes	Yes	Yes	Yes	No
Neighborhood scale	Yes	Yes	Yes	Yes	Yes
Urban scale	No	Yes	Yes	Yes	Yes
Regional	No	No	Yes	Yes	No

* Ozone precursors, as defined in the PAMS program, include volatile organic compounds, oxides of nitrogen, and selected carbonyls.

Existing regulations in part 58 state that the pollutant concentration within a particular measurement scale is nearly homogeneous, and that a point measurement collected in this same scale generally represents any other point within that scale. This basic provision defines how ambient air monitoring data can be used to represent the air quality in a neighborhood, city, or other geographic region. Based on these current provisions, it is reasonable to accept that a path-averaged measurement taken within the dimensions and other siting specifications of that measurement scale would provide a value descriptive of that same geographic region. In order to maintain data comparability between open path and point analyzers, the revisions contained in this proposal are based on the siting criteria currently being used with conventional fixed point ambient air monitoring networks. The most obvious difference between the proposed and existing siting criteria is that the new requirements are defined in terms of a "probe" (applicable to point analyzers), a "monitoring path" (applicable to open path analyzers), or both. Some minor flexibility in siting criteria was added for open path analyzers to compensate for the additional difficulties in locating suitable sites for the various equipment used with an open path analyzer, such as retroreflectors, receivers, and transmitters. Nonetheless, these criteria should still provide a concentration representative of the area to be monitored.

It is important to note that criteria for open path measurement of CO in a street canyon scenario, typically defined in terms of microscale dimensions (up to 100 meters), is not included in this proposal. The siting criteria currently used for microscale CO monitoring is unique and narrow in scope in comparison to other monitoring scenarios. Adapting the

existing siting criteria to accommodate path measurement techniques, as this proposal does for other types of monitoring scales, would unduly restrict the usage of open path analyzers for this particular application. In order to fully address more appropriate siting criteria for microscale CO monitoring using open path analyzers, the EPA must more fully evaluate the effects of measuring path-averaged CO concentrations across roadways, intersections, and at locations other than those currently defined in the part 58 regulation. The EPA specifically solicits comments from the public regarding the use of open path analyzers for measuring CO in microscale applications.

III. Discussion of Proposed Revisions to Regulations

A. Section 58.1 Definitions.

Today's proposal would amend the definitions section of part 58 by adding several new definitions that are necessary to clearly define the proposed new requirements for open path analyzers. Definitions for "point analyzer" and "open path analyzer" would be added to define these two types of automated instruments and to clarify the distinction between them, since the various new and existing requirements may apply to one or the other or both types of analyzers. A new definition for "probe" is proposed to specify the inlet where an air sample is extracted from the atmosphere for delivery to a sampler or point analyzer. This definition would clarify that location requirements applicable to point analyzers apply to the analyzer's probe and not to the analyzer (or sampler) itself, which could be located some distance from the probe. Similarly, a new definition is proposed for "monitoring path" to describe the path in the atmosphere over which an open path analyzer measures and averages a pollutant concentration. Closely associated with the term "monitoring path" are new definitions for "monitoring path length," to describe the scalar length of the monitoring path, and "optical measurement path length," to describe the actual length of the optical beam of an open path instrument. The length of the optical beam may be two or more times the length of the monitoring path when one or more mirrors are used to cause the optical beam to pass through the monitoring path more than once.

To help describe the new requirements for data quality assessment procedures, the term "effective concentration" is proposed. It would refer to the ambient concentration of a pollutant over the monitoring path that would be equivalent to a much higher concentration of the pollutant contained in a short calibration cell inserted into the optical beam of an open path analyzer during a precision test or accuracy audit. Specifically, effective concentration is proposed to be defined as the actual concentration of the pollutant in the test cell multiplied by the ratio of the optical measurement path length of the test cell to the optical measurement path length of the atmospheric monitoring path. Also, when a calibration cell is inserted into the actual atmospheric measurement beam of an open path analyzer for a precision or accuracy test, the

resulting measurement reading would be the sum of the pollutant concentration in the calibration cell and the pollutant concentration in the atmosphere. The atmospheric pollutant concentration must be measured separately and subtracted from the test measurement to produce a "corrected concentration," which would be the true test result. Thus, the term "corrected concentration" is proposed to define the result of such a precision or accuracy assessment test after correction of the test measurement by subtracting the atmospheric pollutant concentration.

Finally, a formal definition of "monitor" is proposed to clarify its use in the regulations as a generic term to refer to any type of ambient air analyzer or sampler that is acceptable for use in a SLAMS monitoring network under Appendix C of this part. A monitor could thus be a point analyzer, an open path analyzer, or a sampler.

B. Appendix A--Quality Assurance Requirements for State and Local Air Monitoring Stations (SLAMS).

Appendix A sets forth both general quality assurance requirements applicable to SLAMS air monitoring as well as specific procedures for assessing the quality of the monitoring data obtained in SLAMS monitoring networks. While the general quality assurance requirements (in section 2) would be directly applicable to open path analyzers without change, the more specific data quality assessment procedures (in section 3) must be modified somewhat to apply to open path analyzers. Accordingly, changes to these procedures are proposed to incorporate appropriate data quality assessment tests applicable to open path monitoring instruments. To the extent possible, the new requirements are similar or parallel to the existing requirements for point analyzers.

For both the precision test (section 3.1) and the accuracy audit (section 3.2), the proposed new requirements specify that an optical calibration or test cell containing a pollutant concentration standard must be inserted into the optical measurement beam of the open path analyzer. Both theory and testing indicate that the use of such a calibration or test cell is equivalent in accuracy to measurement of the equivalent pollutant concentration in air over the entire monitoring path of an open path analyzer. Each concentration standard must be selected such that it produces an "effective concentration" equivalent to a specified ambient concentration over the monitoring path. As noted previously, effective concentration is defined as the actual concentration of the pollutant in the test cell multiplied by the ratio of the optical measurement path length of the test cell to the optical measurement path length of the atmospheric monitoring path. The effective concentrations specified for the precision and accuracy tests for open path analyzers would be the same as the test concentrations currently specified in these procedures for point analyzers.

Ideally, precision and accuracy assessments should test a monitoring instrument in its normal monitoring configuration. Therefore, the proposed test procedures require that the test or calibration cell containing the test pollutant concentration standard be inserted into the actual atmospheric measurement beam of the open path analyzer. The resulting test measurement of the pollutant concentration would thus be the sum of the test concentration in the cell and the pollutant concentration in the atmosphere, because the measurement beam would pass through both the test cell and the atmospheric monitoring path. Accordingly, a correction for the atmospheric concentration is required to obtain the true test result.

In the proposed procedures, the atmospheric pollutant concentration would be measured immediately before and again immediately after the precision or accuracy test, and the average of these two measurements would be subtracted from the test concentration measurement to produce a "corrected concentration," which would be reported as the test result.

The corrected concentration reported for a precision or accuracy test may not be accurate if the atmospheric pollutant concentration changes during the test. When the ambient concentration is variable, the average of the pre- and post-test measurements may not be an accurate representation of the ambient pollutant concentration during the test. The proposed test procedures recommend that these tests should be carried out, if possible, during periods when the atmospheric pollutant concentration is low and steady. The lower the atmospheric pollutant concentration, the steadier the concentration is likely to be and the better the pre- and post-test measurements will represent the actual atmospheric concentration during the test measurement. Further, the procedures propose that if the pre- and post-test measurements of the atmospheric concentration differ by more than 20 percent of the effective concentration of the test standard, the test result would be discarded and the test repeated.

It is recognized that the proposed tests for precision and accuracy for open path analyzers, as well as the existing tests for point analyzers, are described in very general terms, and that additional, more detailed information and guidance is usually necessary for an analyzer operator to carry out these tests properly. Accordingly, section 3 of Appendix A is proposed to be amended by adding an explicit indication that supplemental information and guidance to assist the analyst in conducting these tests may be available in the publication, "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II" (EPA-600/4-77-027a, identified as Reference 3 at the end of Appendix A), or in the operation or instruction manual associated with the particular monitor being used.

The proposed techniques for precision and accuracy assessment of open path analyzers are based largely on consultations with the manufacturer, along with EPA tests, of the differential optical absorption spectrometer that is currently under consideration by EPA for possible designation as equivalent methods under 40 CFR part 53. However, it is desirable that the techniques be generic in nature, if possible, so that they would be applicable to other types of open path monitoring instruments as well. In addition, for some types of open path instruments or for some installations or configurations, there may be technical reasons why the proposed techniques for precision and accuracy assessment may not be feasible,

appropriate, or advisable. The procedures, as currently proposed, allow for the use of an alternate local light source or an alternate optical path that does not include the normal atmospheric monitoring path, if such alternate configuration is permitted by the operation or instruction manual associated with the analyzer. Since the analyzer operation or instruction manual would be subject to approval as part of the requirements for EPA designation of an open path analyzer as an equivalent method, EPA would thereby have control over the alternate configurations that would be allowable for the precision and accuracy assessment tests.

In view of these issues regarding the precision and accuracy assessment techniques, EPA specifically solicits comments on (1) the suitability of the proposed techniques; (2) the advisability of a technique that requires correction of the test result for the atmospheric pollutant concentration versus a technique that does not require that correction but does not test the normal atmospheric measurement components and configuration; (3) the proposed technique for correcting test measurements for the atmospheric pollutant concentration, if required, and the 20 percent limit on the difference between the pre- and post-test measurements of the atmospheric concentration; and (4) whether the proposed techniques are sufficiently generic in nature to apply to various other types of open path analyzers that might be applicable to SLAMS monitoring, or how the techniques could be made more generic.

C. Appendix B--Quality Assurance Requirements for Prevention of Significant Deterioration (PSD) Air Monitoring

Appendix B sets forth both general quality assurance requirements for PSD monitoring as well as specific procedures for assessing the quality of the monitoring data obtained in PSD monitoring networks. The amendments and procedures proposed for Appendix B to extend the existing requirements to open path analyzers are essentially identical to the changes proposed for Appendix A.

D. Appendix E--Probe and Path Siting Criteria for Ambient Air Quality Monitoring

This proposal would amend Appendix E by adding new siting criteria applicable to open path analyzers for monitoring of SO₂, O₃, NO₂, CO, and O₃ precursors (defined in the PAMS program as volatile organic compounds, oxides of nitrogen, and selected carbonyls). Because of the substantial similarity in the siting criteria for SO₂, O₃, and NO₂ (both the existing criteria for point monitors and proposed new criteria for open path analyzers), the siting requirements for these three pollutants are proposed to be combined, consolidated, and set forth in section 2 of Appendix E. The existing criteria for SO₂, O₃, and NO₂ in sections 3, 5, and 6 would be deleted, and those sections would be reserved. As noted below, the criteria for CO monitoring are somewhat different, so they would be retained in a separate section 4. Siting criteria for measuring O₃ and its precursors as part of a PAMS network are included in section 10. In all cases, the new open path provisions would be incorporated into the existing provisions, as appropriate.

The proposed new open path siting requirements largely parallel the existing requirements for point analyzers, with the revised provisions applicable to either a "probe" (for point analyzers), a "monitoring path" (for open path analyzers), or both, as appropriate. Accordingly, criteria for the monitoring path of an open path analyzer are proposed for horizontal and vertical placement, spacing from minor sources, spacing from obstructions, spacing from trees, and spacing from roadways. The open path requirements would apply to most of the monitoring path—generally 80 or 90 percent—but not to the entire monitoring path, to allow some needed flexibility in siting open path analyzers. For example, using the proposed 80 percent requirement, a monitoring path may be sited across uneven terrain, where up to 20 percent of the monitoring path may not fall within the proposed 3 to 15 meter specification for height above ground.

In addition to the criteria common to both point and open path analyzers mentioned above, two new provisions, applicable only to open path analyzers, would limit the maximum length of the monitoring path and the cumulative interferences on the path. The maximum monitoring path length limit would help to ensure that open path monitoring data represent the air volume that they are intended to measure according to the monitoring objectives of the spatial scale identified for the site. Similarly, the limit for the cumulative interferences on the monitoring path would control the total amount of interferences from minor sources, roadways, obstructions, and other factors that might unduly influence the monitoring

data collected by an open path analyzer. This limit is necessary because a long monitoring path presents a much greater opportunity to be affected by multiple interferences. It is also recognized that State or local air monitoring agencies may encounter difficulties in locating atmospheric monitoring equipment due to vandalism, scarcity of available sites, and other considerations; therefore, certain provisions are included in both the existing and the proposed new provisions of the regulation to accommodate these difficulties.

In the consolidation of current sections 3, 5, and 6 to section 2, Tables 2 and 3, which list the minimum separation distance between O_3 and NO_2 stations and nearby roadways, would be combined and redesignated as Table 1. As a result, Table 1 (in section 3), Table 4 (in section 7), Table 5 (in section 10), and Table 6 (in section 12) would be renumbered as tables 2, 3, 4, and 5, respectively. Finally, the summary of all the general siting requirements in renumbered Table 5 would be modified to include the new criteria for monitoring paths.

IV. Comments and the Public Docket

The EPA welcomes comments on all aspects of this proposed rulemaking, specifically (a) the appropriateness of using open path (long-path) analyzers to measure CO, O₃, SO₂, NO₂, and/or O₃ precursors (defined in the PAMS program as volatile organic compounds, oxides of nitrogen, and selected carbonyls); (b) the ability of a monitoring agency to use an open path analyzer in a manner consistent with these siting criteria; (c) using open path analyzers to measure CO in microscale scenarios; (d) the precision and accuracy assessment techniques as described in the proposed Appendix A and Appendix B regulations; (e) using open path analyzers to measure SO₂ in source-oriented ambient air monitoring networks, particularly in micro- and middle-scale applications; and (f) all available and relevant study information on the comparability of open path and point ambient air monitoring. All comments, with the exception of proprietary information, should be directed to the EPA Air Docket Section, Docket No. A-93-44.

Those who wish to submit proprietary information for consideration should clearly separate such information from other comments by:

- ◆ labeling proprietary information "Confidential Business Information," and;
- ◆ sending proprietary information directly to the contact person listed (see "FOR FURTHER INFORMATION CONTACT") and not to the public docket.

This will help ensure that proprietary information is not inadvertently placed in the docket. If a commenter wants the EPA to use a submission labeled as confidential business information as part of the basis for the final rule, then a nonconfidential version of the document, which summarizes the key data or information, should be sent to the docket.

Information covered by a claim of confidentiality will be disclosed by the EPA only to the extent allowed and by the procedures set forth in 40 CFR part 2. If no claim of confidentiality accompanies the submission when it is received by the EPA, the submission may be made available to the public without notifying the commenters.

V. Administrative Requirements

A. Administrative Designation

Executive Order 12866

Under Executive Order 12866 (58 FR 51735 (October 4, 1993)) the Agency must determine whether the regulatory action is "significant" and therefore subject to Office of Management and Budget (OMB) review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another Agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations or recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

It has been determined that this rule is not a "significant regulatory action" under the terms of Executive Order 12866 and is therefore not subject to OMB review.

B. Reporting and Recordkeeping Requirements

All of the information collection requirements contained in part 58 have been approved by the OMB under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 et seq., and have been assigned OMB Control Number 2060-0084. This proposed amendment to Part 58 does not add any new information collection requirements.

C. Regulatory Flexibility Act

Pursuant to section 605(b) of the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Administrator certifies that this rule will not have a significant economic impact on a substantial number of small entities. This rulemaking package does not impose any additional requirements on small entities, rather, it is this proposal's intent to provide all entities with the option to choose the most suitable ambient air method for their particular application. This proposal provides the appropriate siting and quality assurance criteria for a new ambient air monitoring technology (open path analyzers) as they are used in various applications. All of the criteria listed in this rulemaking package parallel existing requirements and vary only as necessary due to technological differences between measurement techniques. It is possible that a beneficial impact may be encountered by some small entities that use this new technology in certain scenarios.

List of Subjects in 40 CFR Part 58

Air pollution control, Ambient air monitoring, Ambient air monitoring networks and siting criteria, Intergovernmental relations, National ambient air monitoring program, Quality assurance requirements, Reporting and recordkeeping requirements, State and local agency ambient air monitoring programs.

Dated: August 4, 1994.

Carol M. Browner,
Administrator.

For reasons set forth in the preamble, title 40, chapter I, part 58 of the Code of Federal Regulations is proposed to be amended as follows:

1. The authority citation for part 58 continues to read as follows:
Authority: 42 U.S.C. 7410, 7601(a), 7613, and 7619.
2. In §58.1, the following definitions are added:
§58.1 Definitions.

(z) Point analyzer is 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.

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

(bb) Open path analyzer is 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.

(cc) Monitoring path for an open path analyzer is the actual path in space over which the pollutant concentration is measured and averaged.

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

(ee) Optical measurement path length is the actual length of the optical beam over which measurement of the pollutant is determined. Generally, the optical measurement path length is: (1) Equal to the monitoring path length for a (bistatic) system having transmitter and 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.

(ff) 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.

(gg) 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.

(hh) Monitor is a generic term for an instrument, sampler, analyzer, or other device that measures or assists in the measurement of atmospheric air pollutants and is acceptable for use in ambient air surveillance under the provisions of appendix C to this part, including both point and open path analyzers that have been designated as reference or equivalent methods under part 53 of this chapter and air samplers that are specified as part of a manual method that has been designated as a reference or equivalent method under part 53 of this chapter.

3. Appendix A is amended as follows:

a. The fourth paragraph of section 3 introductory text is revised.

b. Section 3.1 is revised.

c. The text preceding the table in the second paragraph, and the seventh, and eighth paragraphs of section 3.2 are amended; and a new paragraph is added between the seventh and eighth paragraphs.

d. Table A-1 is revised.

Appendix A - Quality Assurance Requirements for State and Local Air Monitoring Stations (SLAMS)

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3. Data Quality Assessment Requirements

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Assessment results shall be reported as specified in section 4. Concentration and flow standards must be as specified in sections 2.3 or 3.4. In addition, working standards and equipment used for accuracy audits must not be the same standards and equipment used for routine calibration. Additional information and guidance in the technical aspects of conducting these tests may be found in Reference 3 or in the operation or instruction manual associated with the analyzer or sampler. Concentration measurements

reported from analyzers or analytical systems (indicated concentrations) should be based on stable readings and must be derived by means of the same calibration curve and data processing system used to obtain the routine air monitoring data [see Reference 1 and Reference 3, section 2.0.9.1.3(d)]. Table A-1 provides a summary of the minimum data quality assessment requirements, which are described in more detail in the following sections.

3.1 Precision of Automated Methods. A one-point precision check must be carried out at least once every 2 weeks on each automated analyzer used to measure SO₂, NO₂, O₃, and CO. The precision check is made by challenging the analyzer with a precision check gas of known concentration (effective concentration for open path analyzers) between 0.08 and 0.10 ppm for SO₂, NO₂, and O₃ analyzers, and between 8 and 10 ppm for CO analyzers. To check the precision of SLAMS analyzers operating on ranges higher than 0 to 1.0 ppm SO₂, NO₂, and O₃, or 0 to 100 ppm for CO, use precision check gases of appropriately higher concentration as approved by the appropriate Regional Administrator or the Regional Administrator's designee. However, the results of precision checks at concentration levels other than those specified above need not be reported to the EPA. The standards from which precision check test concentrations are obtained must meet the specifications of section 2.3.

Except for certain CO analyzers described below, point analyzers must operate in their normal sampling mode during the precision 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 precision 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 precision check is made in conjunction with a zero or span adjustment, it must be made prior to such zero or span adjustments. Randomization of the precision check with respect to time of day, day of week, and routine service and adjustments is encouraged where possible.

Open path analyzers are tested by inserting a test cell containing a precision 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 precision check gas in the test cell must be selected to produce an "effective concentration" in the range specified above. Generally, the precision test concentration measurement will be the sum of the atmospheric pollutant concentration and the precision 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 instrument immediately before and immediately after the precision check test from the precision test 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.

Report the actual concentration (effective concentration for open path analyzers) of the precision check gas and the corresponding concentration measurement (corrected concentration, if applicable, for open path analyzers) indicated by the analyzer. The percent differences between these concentrations are used to assess the precision of the monitoring data as described in section 5.1.

3.2 Accuracy of Automated Methods

The audit is made by challenging the analyzer with at least one audit gas of known concentration (effective concentration for open path analyzers) from each of the following ranges that fall within the measurement range of the analyzer being audited: ***

* * * * *

For point analyzers, the audit shall be carried out by allowing the analyzer to analyze the audit 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 given in section 3.1 for certain CO analyzers does not apply for audits.

Open path analyzers are audited 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 audit, and the normal monitoring configuration of the instrument should be modified as little as possible to accommodate the test cell for the audit. 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 ranges specified in this section 3.2. Generally, each audit concentration measurement result will be the sum of the atmospheric pollutant concentration and the audit 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 concentration measured by the instrument immediately before and immediately after the audit test (or preferably before and after each audit concentration level) from the audit 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 audited during periods when the atmospheric pollutant concentrations are relatively low and steady.

Report both the audit test concentrations (effective concentrations for open path analyzers) and the corresponding concentration measurements (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 accuracy of the monitoring data as described in section 5.2.

* * * * *

TABLE A-1 MINIMUM DATA ASSESSMENT REQUIREMENTS

Method	Assessment Method	Coverage	Minimum Frequency	Parameters Reported
<p>Precision:</p> <p>Automated Methods for SO₂, NO₂, O₃, and CO.</p> <p>Manual methods including lead.</p>	<p>Response check at concentration between .08 & .10 ppm (8 & 10 ppm for CO).²</p> <p>Collocated samplers</p>	<p>Each analyzer</p> <p>1 site for 1-5 sites; 2 sites for 6-20 sites; 3 sites > 20 sites; (sites with highest conc.).</p>	<p>Once per 2 weeks</p> <p>Once per week</p>	<p>Actual concentration² & measured concentration.³</p> <p>Two concentration measurements</p>
<p>Accuracy:</p> <p>Automated Methods for SO₂, NO₂, O₃, and CO.</p> <p>Manual methods for SO₂ and NO₂</p> <p>TSP, PM-10</p> <p>Lead</p>	<p>Response check at: .03-.08 ppm;^{1,2} .15-.20 ppm;^{1,2} .35-.45 ppm;^{1,2} .80-.90 ppm;^{1,2} (if applicable).</p> <p>Check of analytical procedure with audit standard solutions.</p> <p>Check of sampler flow rate.</p> <p>1. Check sample flow rate as for TSP. 2. Check analytical system with Pb audit strips.</p>	<p>1. Each analyzer. 2. 25% of analyzers (at least 1).</p> <p>Analytical system.</p> <p>1. Each sampler. 2. 25% of samplers (at least 1).</p> <p>1. Each sampler. 2. Analytical system.</p>	<p>1. Once per year. 2. Each calendar quarter.</p> <p>Each day samples are analyzed, at least twice per quarter.</p> <p>1. Once per year. 2. Each calendar quarter.</p> <p>1. Include with TSP. 2. Each quarter.</p>	<p>Actual concentration² & measured (indicated) concentration³ for each level.</p> <p>Actual concentration & measured (indicated) concentration for each audit solution.</p> <p>Actual flow rate and flow rate indicated by the sampler.</p> <p>1. Same as for TSP. 2. Actual concentration & measured (indicated) concentration of audit samples (µg Pb/strip).</p>

¹ Concentration times 100 for CO.

² Effective concentration for open path analyzers.

³ Corrected concentration, if applicable, for open path analyzers.

* * * * *

4. Appendix B is amended as follows:

a. The first paragraph of section is revised.

b. Section 3.1 is revised.

c. The text preceding the table in the first paragraph, and the third, and fourth paragraphs of section 3.2 are revised; and a new paragraph is added between the third and fourth paragraphs.

d. Table B-1 is revised.

Appendix B - Quality Assurance Requirements for Prevention of Significant Deterioration (PSD) Air Monitoring

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3. Data Quality Assessment Requirements

All ambient monitoring methods or analyzers used in PSD monitoring shall be tested periodically, as described in this section 3, to quantitatively assess the quality of the data being routinely collected. The results of these tests shall be reported as specified in section 6. Concentration standards used for the tests must be as specified in section 2.3. Additional information and guidance in the technical aspects of conducting these tests may be found in Reference 3 or in the operation or instruction manual associated with the analyzer or sampler. Concentration measurements reported from analyzers or analytical systems must be derived by means of the same calibration curve and data processing system used to obtain the routine air monitoring data. Table B-1 provides a summary of the minimum data quality assessment requirements, which are described in more detail in the following sections.

3.1 Precision of Automated Methods

A one-point precision check must be carried out at least once every 2 weeks on each automated analyzer used to measure SO₂, NO₂, O₃, and CO. The precision check is made by challenging the analyzer with a precision check gas of known concentration (effective concentration for open path analyzers) between 0.08 and 0.10 ppm for SO₂, NO₂, and O₃ analyzers, and between 8 and 10 ppm for CO analyzers. The standards from which precision check test concentrations are obtained must meet the specifications of section 2.3. Except for certain CO analyzers described below, point analyzers must operate in their normal sampling mode during the precision 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 precision 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.

Open path analyzers are tested by inserting a test cell containing a precision 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 precision check gas in the test cell must be selected to produce an "effective concentration" in the range specified above. Generally, the precision test concentration measurement will be the sum of the atmospheric pollutant concentration and the precision 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 instrument immediately before and immediately after the precision check test from the precision test 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.

If a precision check is made in conjunction with a zero or span adjustment, it must be made prior to such zero or span adjustment. The difference between the actual concentration (effective concentration for open path analyzers) of the precision check gas and the corresponding concentration measurement (corrected concentration, if applicable, for open path analyzers) indicated by the analyzer is used to assess the precision of the monitoring data as described in section 4.1. Report data only from automated analyzers that are approved for use in the PSD network.

3.2 Accuracy of Automated Methods

Each sampling quarter audit each analyzer that monitors for SO₂, NO₂, O₃, or CO at least once. The audit is made by challenging the analyzer with at least one audit gas of known concentration (effective concentration for open path analyzers) from each of the following ranges that fall within the measurement range of the analyzer being audited: ***

For point analyzers, the audit shall be carried out by allowing the analyzer to analyze the audit test atmosphere in the same manner as described for precision checks in section 3.1. The exception given in section 3.1 for certain CO analyzers does not apply for audits.

Open path analyzers are audited by inserting a test cell containing an audit 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 audit, and the normal monitoring configuration of the instrument should be modified as little as possible to accommodate the test cell for the audit. 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 range specified in this section 3.2. Generally, each audit concentration measurement result will be the sum of the atmospheric pollutant concentration and the audit 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 instrument immediately before and immediately after the audit test (or preferably before and after each audit concentration level) from the audit concentration measurement. If the difference between these before and after measurements is greater than 20 percent of the effective concentration of the test gas standards, discard the test result for that concentration level and repeat the test for that level. If possible, open path analyzers should be audited during periods when the atmospheric pollutant concentrations are relatively low and steady.

The differences between the actual concentrations (effective concentrations for open path analyzers) of the audit test gas and the corresponding concentration measurements (corrected concentrations, if applicable, for open path analyzers) indicated by the analyzer are used to assess the accuracy of the monitoring data as described in section 4.2. Report data only from automated analyzers that are approved for use in the PSD network.

* * * * *

TABLE B-1 MINIMUM PSD DATA ASSESSMENT REQUIREMENTS

Method	Assessment Method	Coverage	Frequency	Parameters Reported
<p>Precision: Automated Methods for SO₂, NO₂, O₃, and CO. TSP, PM₁₀, Lead.</p>	<p>Response check at concentration between .08 & .10 ppm (8 & 10 ppm for CO).² Collocated samplers</p>	<p>Each analyzer Highest concentration site in monitoring network.</p>	<p>Once per 2 weeks Once per week or every 3rd day for continuous sampling.</p>	<p>Actual concentration² & measured concentration.³ Two concentration measurements.</p>
<p>Accuracy: Automated Methods for SO₂, NO₂, O₃, and CO. TSP, PM₁₀ Lead</p>	<p>Response check at: .03-.08 ppm;^{1,2} .15-.20 ppm;^{1,2} .35-.45 ppm;^{1,2} .80-.90 ppm;^{1,2} (if applicable). Sampler flow check. 1. Sample flow rate check. 2. Check analytical system with Pb audit strips.</p>	<p>Each analyzer. Each sampler. 1. Each sampler. 2. Analytical system.</p>	<p>Once per sampling quarter. Once per sampling quarter. 1. Once/quarter. 2. Each quarter Pb samples are analyzed.</p>	<p>Actual concentration² & measured (indicated) concentration³ for each level. Actual flow rate and flow rate indicated by the sampler. 1. Same as for TSP. 2. Actual concentration & measured concentration of audit samples (µg Pb/strip).</p>

¹ Concentration shown times 100 for CO.

² Effective concentration for open path analyzers.

³ Corrected concentration, if applicable, for open path analyzers.

* * * * *

5. Appendix E is amended as follows:

- a. The title of appendix E is revised.
- b. Section 1 is revised.
- c. Section 2 is added and sections 3, 5, and 6 are removed and reserved.
- d. Section 4 is revised.
- e. In section 7 table 3 is removed and table 4 is redesignated as table 3.
- f. The first paragraph of section 9 is revised.

- g. Section 10 is revised.
- h. Section 12 is revised.

Appendix E--Probe and Monitoring Path Siting Criteria
for Ambient Air Quality Monitoring

1. Introduction

This appendix contains specific location criteria applicable to ambient air quality monitoring probes and monitoring paths after the general station siting has been selected based on the monitoring objectives and spatial scale of representation discussed in Appendix D of this part. Adherence to these siting criteria is necessary to ensure the uniform collection of compatible and comparable air quality data.

The probe and monitoring path siting criteria discussed below 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 EPA would consider an application for waiver from these siting criteria are discussed in section 11 of this appendix.

The spatial scales of representation used in this appendix, i.e., micro, middle, neighborhood, urban, and regional, are defined and discussed in Appendix D of this part. 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. Sulfur dioxide (SO₂), Ozone (O₃), and Nitrogen Dioxide (NO₂)

Additional information on SO₂, NO₂, and O₃ monitor siting criteria may be found in references 11 and 13.

2.1 Horizontal and Vertical Placement. The probe or at least 80 percent of the monitoring path must be located between 3 and 15 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.

2.2 Spacing from Minor Sources (applicable to SO₂ and O₃ monitoring only). Local minor sources of SO₂ can cause inappropriately high concentrations of SO₂ in the vicinity of probes and monitoring paths for SO₂. Similarly, local sources of nitric oxide (NO) and ozone-reactive hydrocarbons can have a scavenging effect causing unrepresentatively low concentrations of O₃ in the vicinity of probes and monitoring paths for O₃. To minimize these potential interferences, the probe or at least 90 percent of the monitoring path must be away from furnace or incineration flues or other minor sources of SO₂ or NO, particularly for open path analyzers because of their potential for greater exposure over the area covered by the monitoring path. The separation distance should take into account the height of the flues, type of waste or fuel burned, and the sulfur content of the fuel. It is acceptable, however, to monitor for SO₂ near a point source of SO₂ when the objective is to assess the effect of this source on the represented population.

2.3 Spacing from Obstructions. Buildings and other obstacles may possibly scavenge SO₂, O₃, or NO₂. To avoid this interference, the probe or at least 90 percent of the monitoring path must have unrestricted airflow and be located away from obstacles so that the distance from the probe or monitoring path is at least twice the height that the obstacle protrudes above the probe or monitoring path. 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 must have unrestricted airflow in an arc of at least 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building. This arc must include the predominant wind direction for the season of greatest pollutant concentration potential. A sampling station having a probe located closer to an obstacle than this criterion allows should be classified as middle scale rather than neighborhood or urban scale, since the measurements from such a station would more closely represent the middle scale. 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.

2.4 Spacing from Trees. Trees can provide surfaces for SO_2 , O_3 , or NO_2 adsorption or reactions and obstruct wind flow. To reduce this possible interference, the probe or at least 90 percent of the monitoring path should be 20 meters or more from the drip line of trees. If a tree or trees could be considered an obstacle, the probe or 90 percent of the monitoring path must meet the distance requirements of 2.3 and be at least 10 meters from the drip line of the tree or trees. Since the scavenging effect of trees is greater for O_3 than for other criteria pollutants, strong consideration of this effect must be given to locating an O_3 probe or monitoring path to avoid this problem.

2.5 Spacing from Roadways (applicable to O_3 and NO_2 only). 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 1 provides the required minimum separation distances between a roadway and a probe and between a roadway and at least 90 percent of a monitoring path for various ranges of daily roadway traffic. A sampling station having a point analyzer probe located closer to a roadway than allowed by the Table 1 requirements should be classified as middle scale rather than neighborhood or urban scale, since the measurements from such a station would more closely represent the middle scale. The monitoring path of an open path analyzer must not cross over a roadway with an average daily traffic count of 10,000 vehicles per day or more. In calculating the percentage of a monitoring path over or near a roadway, 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 1. The sum of these distances must not be greater than 10 percent of the total monitoring path length.

TABLE 1--MINIMUM SEPARATION DISTANCE BETWEEN ROADWAYS
AND PROBES OR MONITORING PATHS FOR MONITORING
NEIGHBORHOOD- AND URBAN-SCALE OZONE and NITROGEN DIOXIDE

Roadway average daily traffic, vehicles per day	Minimum separation distance ¹ , meters
≤10,000	10
15,000	20
20,000	30
40,000	50
70,000	100
≥110,000	250

¹ Distance from the edge of the nearest traffic lane. The distance for intermediate traffic counts should be interpolated from the table values based on the actual traffic count.

2.6 Cumulative Interferences on a Monitoring Path. The cumulative length or portion of a monitoring path that is affected by minor sources, obstructions, trees, or roadways must not exceed 10 percent of the total monitoring path length.

2.7 Maximum Monitoring Path Length. 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 station meets the objectives and spatial scales defined for SLAMS in Appendix D. Therefore, the Regional Administrator or the Regional Administrator's designee may require shorter path lengths, as needed on an individual basis, to ensure that the SLAMS meet the Appendix D requirements. Likewise, the Administrator or the Administrator's designee may specify the maximum path length used at monitoring stations designated as NAMS or PAMS as needed on an individual basis.

* * * * *

4. Carbon Monoxide (CO)

Open path analyzers may be used to measure CO for only middle or neighborhood scale measurement applications if the open path analyzer is designated as a SLAMS. Additional information on CO monitor siting criteria may be found in reference 12.

4.1 Horizontal and Vertical Placement. Because of the importance of measuring population exposure to CO concentrations, air should be sampled at average breathing heights. However, practical factors require that the inlet probe be higher. The required height of the inlet probe for CO monitoring is therefore $3\pm\frac{1}{2}$ meter for a microscale site, which is a compromise between representative breathing height and prevention of vandalism. The recommended 1 meter range of heights is also a compromise to some extent. For consistency and comparability, it would be desirable to have all inlets at exactly the same height, but practical considerations often prevent this. Some reasonable range must be specified and 1 meter provides adequate leeway to meet most requirements.

For the middle and neighborhood scale stations, the vertical concentration gradients are not as great as for the microscale station. This is because the diffusion from roads is greater and the concentrations would represent larger areas than for the microscale. Therefore, the probe or at least 80 percent of the monitoring path must be located between 3 and 15 meters above ground level for middle and neighborhood scale stations. 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 both the prevailing wind direction during the season of highest concentration potential and the location of sources of interest, i.e., roadways.

4.2 Spacing from Obstructions. Buildings and other obstacles may restrict airflow around a probe or monitoring path. To avoid this interference, the probe or at least 90 percent of the monitoring path must have unrestricted airflow and be located away from obstacles so that the distance from the probe or monitoring path is at least twice the height that the obstacle protrudes above the probe or monitoring path. 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 must have unrestricted airflow in an arc of at least 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building. This arc must include the predominant wind direction for the season of greatest pollutant concentration potential. 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.

4.3 Spacing from Roadways. Street canyon and traffic corridor stations (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 stations, a minimum distance of 2 meters and a maximum distance of 10 meters from the edge of the nearest traffic lane must be maintained for these CO monitoring inlet probes. This should give consistency to the data, yet still allow flexibility of finding suitable locations.

Street canyon/corridor (microscale) inlet probes must be located at least 10 meters from an intersection and preferably at a midblock location. Midblock locations are preferable to intersection locations because intersections represent a much smaller portion of downtown space than do the streets between them. Pedestrian exposure is probably also greater in street canyon/corridors than at intersections. Also, the practical difficulty of positioning sampling inlets is less at midblock locations than at the intersection. However, the final siting of the monitor must meet the objectives and intent of appendix D, sections 2.4, 3, 3.3, and appendix E, section 4.

In determining the minimum separation between a neighborhood scale monitoring station and a specific line source, the presumption is made that measurements should not be unduly influenced by any one roadway. Computations were made to determine the separation distance, and table 2 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 station would closely represent the middle scale. Therefore, stations not meeting this criterion should be classified as middle scale.

TABLE 2--MINIMUM SEPARATION DISTANCE BETWEEN ROADWAYS
AND PROBES OR MONITORING PATHS FOR MONITORING
NEIGHBORHOOD SCALE CARBON MONOXIDE

Roadway average daily traffic, vehicles per day	Minimum separation distance ¹ for probes or 90% of a monitoring path, 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.

4.4 Spacing from Trees and Other Considerations. Since CO is relatively nonreactive, the major factor concerning trees is as obstructions to normal wind flow patterns. For middle and neighborhood scale stations, trees should not be located between the major sources of CO, usually vehicles on a heavily traveled road, and the monitor. The probe or at least 90 percent of the monitoring path must be 10 meters or more from the drip line of trees which are between the probe or monitoring path and the road and which extend at least 5 meters above the probe or monitoring path. For microscale stations, no trees or shrubs should be located between the probe and the roadway.

4.5 Cumulative Interferences on a Monitoring Path. The cumulative length or portion of a monitoring path that is affected by obstructions, trees, or roadways must not exceed 10 percent of the total monitoring path length.

4.6 Maximum Monitoring Path Length. The monitoring path length must not exceed 1 kilometer for analyzers used for neighborhood scale monitoring applications, or 300 meters for middle scale monitoring applications. 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 station meets the objectives and spatial scales defined for

SLAMS in Appendix D. Therefore, the Regional Administrator or the Regional Administrator's designee may require shorter path lengths, as needed on an individual basis, to ensure that the SLAMS meet the Appendix D requirements. Likewise, the Administrator or the Administrator's designee may specify the maximum path length used at monitoring stations designated as NAMS or PAMS as needed on an individual basis. * * * * *

Table 3--Separation Distance Between Pb Stations and Roadways (Edge of Nearest Traffic Lane)

9. Probe Material and Pollutant Sample Residence Time

For the reactive gases, SO₂, NO₂, and O₃, special probe material must be used for point analyzers. Studies²⁰⁻²⁴ have been conducted to determine the suitability of materials such as polypropylene, polyethylene, polyvinylchloride, 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, EPA²⁵ has specified borosilicate glass or FEP teflon as the only acceptable probe materials for delivering test atmospheres in the determination of reference or equivalent methods. Therefore, borosilicate glass, FEP teflon, or their equivalent must be used for existing and new NAMS or SLAMS. *****

10. Photochemical Assessment Monitoring Stations (PAMS)

10.1 Horizontal and Vertical Placement. The probe or at least 80 percent of the monitoring path must be located 3 to 15 meters above ground level. This range provides a practical compromise for finding suitable sites for the multi-pollutant PAMS. 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.

10.2 Spacing from Obstructions. The probe or at least 90 percent of the monitoring path must be located away from obstacles and buildings such that the distance between the obstacles and the probe or monitoring path is at least twice the height that the obstacle protrudes above the probe or monitoring path. There must be unrestricted airflow in an arc of at least 270° around the probe inlet. Additionally, the predominant wind direction for the period of greatest pollutant concentration (as described for each site in section 4.2 of Appendix D) must be included in the 270° arc. If the

probe is located on the side of the building, 180° clearance is required. 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.

10.3 Spacing from Roadways. It is important in the probe and monitoring path siting process to minimize destructive interferences from sources of NO since NO readily reacts with O₃. Table 4 below provides the required minimum separation distances between roadways and PAMS (excluding upper air measuring stations):

Table 4 - SEPARATION DISTANCE BETWEEN
PAMS AND ROADWAYS
[Edge of Nearest Traffic Lane]

Roadway average daily traffic, vehicles per day	Minimum separation distance between roadways and stations in meters ¹
<10,000	>10
15,000	20
20,000	30
40,000	50
70,000	100
>110,000	250

¹Distance from the edge of the nearest traffic lane. The distance for intermediate traffic counts should be interpolated from the table based on the actual traffic flow.

10.4 Spacing from Trees. Trees can provide surfaces for adsorption and/or reactions to occur and can obstruct normal wind flow patterns. To minimize these effects at PAMS, the probe or at least 90 percent of the monitoring path should be placed at least 20 meters from the drip line of trees. Since the scavenging effect of trees is greater for O₃ than for the other criteria pollutants, strong consideration of this effect must be given in locating the PAMS probe or monitoring path to avoid this problem. Therefore, the probe or at least 90 percent of the monitoring path must be at least 10 meters from the drip line of trees that are located between the urban city core area and the probe or monitoring path along the appropriate wind direction.

12. Summary

Table 5 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 5 that different elevation distances above the ground are shown for the various pollutants. The discussion in the text for each of the pollutants described 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 has been used. The upper limit of 15 meters was specified for consistency between pollutants and to allow the use of a single manifold or monitoring path for monitoring more than one pollutant.

TABLE 5 - SUMMARY OF PROBE AND MONITORING PATH SITING CRITERIA

Pollutant	Scale [maximum monitoring path length, meters]	Height from ground to probe or 80% of monitoring path ^A (meters)	Horizontal & vertical distance from supporting structures ^B to probe or 90% of monitoring path ^A (meters)	Distance from trees to probe or 90% of monitoring path ^A (meters)	Distance from roadways to probe or monitoring path ^A (meters)
SO ₂ ^{C,D,E,F}	Middle [300m] Neighborhood, Urban, & Regional [1km]	3-15	>1	>10	N/A
CO ^{D,E,G}	Micro Middle [300m] Neighborhood [1km]	3±0.5 3-15	>1	>10	2-10 See Table 1 for middle & neighborhood scales
O ₃ ^{C,D,E}	Middle [300m] Neighborhood, Urban, & Regional [1km]	3-15	>1	>10	See Table 2 for all scales
Ozone precursors (for PAMS) ^{C,D,E}	Neighborhood & Urban [1 km]	3-15	>1	>10	See Table 4 for all scales
NO ₂ ^{C,D,E}	Middle [300m] Neighborhood & Urban [1km]	3-15	>1	>10	See Table 2 for all scales
Pb ^{C,D,E,F,H}	Micro; Middle, Neighborhood, Urban & Regional	2-7 (Micro) 2-15 (All other scales)	>2 (All scales, horizontal distance only)	>10 (All scales)	5-15 (Micro) See Table 3 for all other scales
PM-10 ^{C,D,E,F,H}	Micro; Middle, Neighborhood, Urban & Regional	2-7 (Micro) 2-15 (All other scales)	>2 (All scales, horizontal distance only)	>10 (All scales)	2-10 (Micro) See Figure 2 for all other scales

^A Monitoring path for open path analyzers is applicable only to middle or neighborhood scale CO monitoring and all applicable scales for monitoring SO₂, O₃, O₃ precursors, and NO₂.

^B When probe is located on a rooftop, this separation distance is in reference to walls, parapets, or penthouses located on roof.

N/A - Not applicable.

^C 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.

^D 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).

^E Must have unrestricted airflow 270° around the probe or sampler; 180° if the probe is on the side of a building.

^F 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.

^G For microscale CO monitoring sites, the probe must be >10 meters from a street intersection and preferably at a midblock location.

^H For collocated Pb and PM-10 samplers, a 2-4 meter separation distance between collocated samplers must be met.
