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AMBIENT MONITORING GUIDELINES FOR PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

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Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)

by

Monitoring and Data Analysis Division
Office of Air Quality Planning and Standards

and

Environmental Monitoring Systems Laboratory
Office of Research and Development

U.S. Environmental Protection Agency
Research Triangle Park NC 27711

FOREWORD

Many individuals were involved in the preparation of this document and should be contacted if any questions arise in the application of the guideline.

Subject Area	Contact	Phone Number (Area Code 919)	FTS Number
Ambient Air Quality Monitoring	Stan Sleva David Lutz	541-5652 541-5476	629-5652 629-5476
Meteorological Monitoring	James Dicke	541-5682	629-5682
Quality Assurance (Ambient Air Quality)	Larry Purdue Jack Puzak	541-2665 541-2106	629-2665 629-2106
PSD Policy and Interpretation of Regulations	Gary McCutchen	541-5592	629-5592
Acceptable Methods Non-Criteria Pollutants	Larry Purdue Ken Rehme	541-2665 541-2666	629-2665 629-2666

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1. INTRODUCTION

The Clean Air Act Amendments of 1977, Part D, Prevention of Significant Deterioration, require that certain new major stationary sources and major modifications be subject to a preconstruction review which includes an ambient air quality analysis. Furthermore, the Act requires that an analysis be conducted in accordance with regulations promulgated by the EPA. In this regard, the Agency promulgated PSD regulations [1] on June 19, 1978, which included ambient monitoring requirements. Guidelines were published in May 1978 [2] to discuss monitoring for PSD purposes. However, in response to the June 18, 1979 preliminary Court Decision (Alabama Power Company v. Costle, 13 ERC 1225), EPA proposed revised PSD regulations [3] on September 5, 1979. The final court decision was rendered December 14, 1979 [4]. Based on the public comments to the September 5, 1979 proposed PSD regulations and the December 14, 1979 court decision, EPA promulgated new PSD regulations on August 7, 1980. Some of the pertinent provisions of the 1980 PSD regulations that affect PSD monitoring are discussed below:

(a) Potential to emit.

The PSD regulations retain the requirement that new major stationary sources would be subject to a new source review on the basis of potential to emit. However, the annual emission potential of a source will be determined after the application of air pollution controls rather than before controls as was generally done under the 1978 regulations [1].

(b) *De minimis* cutoffs.

The PSD regulations will exempt on a pollutant specific basis major modifications and new major stationary sources from all monitoring requirements when emissions of a particular pollutant are below a specific significant emission rate, unless the source is near a Class I area. Also included are significant air quality levels which may be used to exempt sources or modifications from PSD monitoring when the air quality impacts from the sources or modifications are below specified values.

(c) Noncriteria pollutants.

The 1978 PSD regulations [1] required monitoring only for those pollutants for which national ambient air quality standards exist. However, there are a number of pollutants for which no ambient standards exist (noncriteria pollutants) but which are regulated under new source performance standards and national emission standards for hazardous pollutants. The 1980 regulations [5] require an ambient air quality analysis for all regulated pollutants emitted in significant amounts. This analysis will generally be based on modeling the impact of the pollutants in lieu of collecting monitoring data.

(d) Preconstruction monitoring.

A list of air quality concentrations is included in the PSD regulations as criteria for generally exempting proposed sources or modifications from collecting monitoring data. Basically, monitoring data will be required if the existing air quality and the impact of the proposed source or modification is equal to or greater than these concentrations. In certain cases, even though the air quality impact or background air quality may be less than these concentrations, monitoring data may be required if the proposed source or modification will impact a Class I area, nonattainment area, or area where the PSD increment is violated.

(e) Postconstruction monitoring.

The PSD regulations include authority to require postconstruction monitoring. In general, EPA may require postconstruction monitoring from large sources or sources whose impacts will threaten standards or PSD increments. The permit granting authority will make this decision on a case-by-case basis.

In 1987 [6] EPA promulgated revisions to the National Ambient Air Quality Stardards (NAAQS) for Particulate Matter. Also, revisions were promulgated to revise the PSD regulations to account for the NAAQS changes. The PM_{10} amendments will not require any new data gathering requirements beyond the 1980 PSD requirements for PSD applications submitted not later than 10 months after the effective date of the 1987 PSD amendments. New monitoring requirements for PM_{10} will be phased in for PSD applications submitted greater than 10 and and less than 24 months after the effective date of the 1987 PSD amendments. In addition, all new monitoring requirements for PM_{10} will be in effect 24 months after the effective date of the PSD amendments.

Because of the revisions to the PSD regulations, this guideline has been modified to reflect such revisions. The purpose of this guideline is to address those items or activities which are considered essential in conducting an ambient air quality monitoring program. Guidance is given for designing a PSD air quality monitoring network as well as the operational details such as sampling procedures and methods, duration of sampling, quality assurance procedures, etc. Guidance is also given for a meteorological monitoring program as well as the specifications for meteorological instrumentation and quality assurance procedures.

An appendix is included to show how the ambient air quality analysis fits in the overall PSD requirements. Flow diagrams are presented to aid a proposed source or modification in assessing if monitoring data may be required.

General adherence to the guidance contained in this document should ensure consistency in implementing the PSD monitoring regulations.

2. GENERAL REQUIREMENTS AND CONSIDERATIONS

2.1 Monitoring Data Rationale

The court decision [4] has affirmed the Congressional intent in the Clean Air Act as it relates to PSD monitoring requirements. The court ruled that section 165(e)(1) of the Clean Air Act requires that an air quality analysis be conducted for each pollutant subject to regulation under the Act before a major stationary source or major modification could construct. This analysis may be accomplished by the use of modeling and/or monitoring the air quality. EPA has discretion in specifying the choice of either monitoring or modeling, consistent with the provisions in section 165(e)(2). As will be discussed later, modeling will be used in most cases for the analysis for the noncriteria pollutants.

The court ruled that section 165(e)(2) of the Clean Air Act requires that continuous preconstruction air quality monitoring data must be collected to determine whether emissions from a source will result in exceeding the National Ambient Air Quality Standards (NAAQS). Further, the data could be used to verify the accuracy of the modeling estimates since modeling will be the principal mechanism to determine whether emissions from the proposed source or modification will result in exceeding allowable increments. In regard to monitoring requirements, the court stated that EPA had the authority to exempt de minimis situations.

Postconstruction monitoring data requirements are addressed in section 165(a)(7) of the Clean Air Act. Sources may have to conduct such monitoring to determine the air quality effect its emissions may have on the area it impacts. EPA has the discretion of requiring monitoring data and the court stated that guidelines could be prepared to show the circumstances that may require postconstruction monitoring data.

In view of the provisions of sections 165(e)(1), 165(e)(2), and 165(a)(7) of the Clean Air Act, the de minimis concept, and sections of the final PSD regulations, Sections 2.1.1, 2.1.2 and 2.1.3 present the basic rationale which generally will be followed to determine when monitoring data will or will not be required. It should be noted that the subsequent use of "monitoring data" refers to either the use of existing representative air quality data or monitoring the existing air quality.

Additional discussion and flow diagrams are presented in Appendix A of this guideline which show various decision points leading to a determination as to when monitoring data will or will not be required. Also, these procedures indicate at what points a modeling analysis must be performed.

2.1.1 Criteria Pollutants - Preconstruction Phase

For the criteria pollutants (SO_2, CO, and NO_2) continuous air quality monitoring data must, in general, be used to establish existing air quality concentrations in the vicinity of the proposed source or modification. For VOC emissions, continuous ozone monitoring data must be used to establish existing air quality concentrations in the vicinity of the proposed source or modification. For PM_{10} and lead, the 24-hour manual method will be used to establish the existing air quality concentrations. However, no preconstruction monitoring data will generally be required if the ambient air quality concentration before construction is less than the significant monitoring concentrations. (The significant monitoring concentrations for each pollutant are shown in Table A-2 in the appendix to this guideline.) To require monitoring data where the air quality concentration of a pollutant is less than these values would be questionable because these low level concentrations cannot reasonably be determined because of measurement errors. These measurement errors may consist of errors in sample collection, analytical measurement, calibration, and interferences.

Cases where the projected impact of the source or modification is less than the significant monitoring concentrations would also generally be exempt from preconstruction monitoring data, consistent with the *de minimis* concept. [40 CFR 51.24(i)(8) and 40 CFR 52.21(i)(8)].

The one exception to the *de minimis* exemption occurs when a proposed source or modification would adversely impact on a Class I area or would pose a threat to the remaining allowable increment or NAAQS. For those situations where the air quality concentration before construction is near the significant monitoring concentration, and there are uncertainties associated with this air quality situation, then preconstruction air quality monitoring data may be required. These situations must be evaluated on a case-by-case basis by the permit granting authority before a final decision is made.

2.1.2 Criteria Pollutants - Postconstruction Phase

EPA has discretion in requiring postconstruction monitoring data under section 165(a)(7) of the Clean Air Act and in general will not require postconstruction monitoring data. However, to require air quality monitoring data implies that the permit granting authority will have valid reasons for the data and, in fact, will use the data after it is collected. Generally, this will be applied to large sources or sources whose impact will threaten the standards or PSD increments. Examples of when a permit granting authority may require postconstruction monitoring data may include:

a. NAAQS are threatened - The postconstruction air quality is projected to be so close to the NAAQS that monitoring is needed to certify attainment or to trigger appropriate SIP related actions if nonattainment results.

b. Source impact is uncertain or unknown - Factors such as complex terrain, fugitive emissions, and other uncertainties in source or emission characteristics result in significant uncertainties about the projected impact of the source or modification. Postconstruction data is justified as a permit condition on the basis that model refinement is necessary to assess the impact of future sources of a similar type and configuration.

2.1.3 Noncriteria Pollutants - Preconstruction and Postconstruction Phase

Consistent with section 165(e)(1) of the Clean Air Act, EPA believes that an analysis based on modeling of the impact of noncriteria pollutants (including TSP) on the air quality should generally be used in lieu of monitoring data. The permit granting authority, however, does have the discretion of requiring preconstruction and postconstruction monitoring data. Before a permit granting authority exercises its discretion in requiring monitoring data, there should be an acceptable measurement method approved by EPA (see Section 2.6) and the concentrations would generally be equal to or greater than the significant monitoring concentrations (shown in Table A-2 of the appendix).

A permit granting authority may require monitoring data in cases such as (a) where a State or other jurisdiction has a standard for a noncriteria pollutant and the emissions from the proposed source or modification pose a threat to the standard, (b) where the reliability of emission data used as input to modeling existing sources is highly questionable, especially for the pollutants regulated under the national emission standards for hazardous pollutants, and (c) where available models or complex terrain make it difficult to estimate air quality or impact of the proposed source or modification.

2.2 Monitoring Objective and Data Uses

The basic objective of PSD monitoring is to determine the effect emissions from a source are having or may have on the air quality in any area that may be affected by the emission. Principal uses of the data are as follows:

(a) To establish background air quality concentrations in the vicinity of the proposed source or modification. These background levels are important in determining whether the air quality before or after construction are or will be approaching or exceeding the NAAQS or PSD increment.

(b) To validate and refine models. The data will be helpful in verifying the accuracy of the modeling estimates.

2.3 VOC and O_3 Monitoring Requirements

The previous 0.24 ppm nonmethane organic compound (NMOC) standard, which was used as a guide for developing State Implementation Plans to attain the O_3 ambient standard, has been rescinded. However, VOC emissions are the precursors in the formation of ozone. Consequently, any new source or modified existing source located in an unclassified or attainment area for ozone that is equal to or greater than 100 tons per year of VOC emissions will be required to monitor ozone. VOC monitoring will not be required.

2.4 Use of Representative Air Quality Data

The use of existing representative air quality data was one of the options discussed in Section 2.1 for monitoring data. In determining whether the data are representative, three major items which need to be considered are monitor location, quality of the data, and currentness of the data.

2.4.1 Monitor Location

The existing monitoring data should be representative of three types of areas: (1) the location(s) of maximum concentration increase from the proposed source or modification, (2) the location(s) of the maximum air pollutant concentration from existing sources, and (3) the location(s) of the maximum impact area, i.e., where the maximum pollutant concentration would hypothetically occur based on the combined effect of existing sources and the proposed new source or modification. Basically, the locations and size of the three types of areas are determined through the application of air quality models. The areas of maximum concentration or maximum combined impact vary in size and are influenced by factors such as the size and relative distribution of ground level and elevated sources, the averaging times of concern, and the distances between impact areas and contributing sources.

In situations where there is no existing monitor in the modeled areas, monitors located outside these three types of areas may or may not be used. Each determination must be made on a case-by-case basis. In order to clarify EPA's intent regarding the use of existing monitoring data, some examples are included to demonstrate the overall intent.

(a) Case I - If the proposed source or modification will be constructed in an area that is generally free from the impact of other point sources and area sources associated with human activities, then monitoring data from a "regional" site may be used as representative data. Such a site could be out of the maximum impact area, but must be similar in nature to the impact area. This site would be characteristic of air quality across a broad region including that in which the proposed source or modification is located. The intent of EPA is to limit the use of these "regional" sites to relatively remote areas, and not to use them in areas of multisource emissions or areas of complex terrain.

(b) Case II - If the proposed construction will be in an area of multisource emissions and basically flat terrain, then the proposed source or modification may propose the use of existing data at nearby monitoring sites if either of the following criteria are met.

1. The existing monitor is within 10 km of the points of proposed emissions, or

2. The existing monitor is within or not farther than 1 km away from either the area(s) of the maximum air pollutant concentration from existing sources or the area(s) of the combined maximum impact from existing and proposed sources.

If the existing monitor(s) meets either of the above two conditions, the data could be used together with the model estimates to determine the concentrations at all three types of areas discussed earlier in this section.

As an example of the first criterion, if an existing monitor is located within 10 km from the points of proposed emissions but not within the boundaries of the modeled areas of either of the three locations noted above, the data could be used together with model estimates to determine the concentrations at the three types of required area.

The next example applies to the second criterion. In evaluating the adequacy of the location of existing monitors, the applicant must first, through modeling, determine the significant ambient impact area of the proposed source. In general, except for impact on Class I areas, the application of air quality models for the purpose of determining significant ambient impact would be limited to 50 km downwind of the source or to that point where the concentration from the source falls below the levels shown in Table A-3 of the Appendix. For Class I areas, a significant impact is 1 ug/m^3 (24-hr) for PM_{10} and SO_2. The applicant would then identify within this significant impact area the area(s) of the maximum air pollutant concentration from existing sources and the area(s) of the combined maximum impact from existing and proposed sources. The area(s) of estimated maximum concentration from existing sources or the estimated maximum combined impact area(s) are determined as follows: First, within the modeled significant ambient impact area, estimate the point of maximum concentration from existing sources, and the point of combined maximum impact (existing and proposed source). Using these concentration values, determine the areas enclosed by air quality concentration isopleths equal to or greater than one half of the respective estimated maximum concentration. An existing monitor located within or not farther than 1 km away from of any of these areas can yield representative data.

The rationale for considering the use of existing data collected from monitors satisfying the above criteria is that modelers have a reasonable degree of confidence in the modeling results within the 10 km distance and the maximum concentrations from most sources are likely to occur within this distance. Generally, the modeling results in this flat terrain case may under or over predict by a factor of two, and thus the actual maximum impact from the source(s) could occur at points where the model predicts one half of this impact. Data collected within or not farther than 1 km from areas may be considered as representative.

(c) Case III - If the proposed construction will be in an area of multisource emissions and in areas of complex terrain, aerodynamic downwash complications, or land/water interface situations, existing data could only be used for PSD purposes if it were collected (1) at the modeled location(s) of the maximum air pollution concentration from existing sources, (2) at the location(s) of the maximum concentration increase from the proposed construction, and (3) at the location(s) of the maximum impact area. If a monitor is located at only one of the locations mentioned above and the locations do not coincide, the source would have to monitor at the other locations.

It must be emphasized that the permit granting authority may choose not to accept data proposed under the cases discussed above. This may occur because of additional factors, especially in Case II which were not discussed but must be considered, such as uncertainties in data bases for modeling and high estimates of existing air quality resulting in possible threats to the applicable standards. Because of such situations, the permit granting authority must review each proposal on a case-by-case basis to determine if the use of existing data will be acceptable. It is important for the proposed source or modification to meet with the permit granting authority to discuss any proposed use of existing data. If the data are not acceptable, then a monitoring program would have to be started to collect the necessary data.

2.4.2 Data Quality

The monitoring data should be of similar quality as would be obtained if the applicant monitored according to the PSD requirements. As a minimum, this would mean:

1. The monitoring data were collected with continuous instrumentation. No bubbler data should be included. See Section 2.7 for frequency of particulate pollutant sampling.

2. The applicant should be able to produce records of the quality control performed during the time period at which the data were collected. Such quality control records should include calibration, zero and span checks, and control checks. In addition, quality control procedures should be a minimum specified in the instrument manufacturer's operation and instruction manual.

3. Historical data that were gathered from monitors which were operated in conformance with Appendix A or B of the Part 58 regulations [7] would satisfy the quality assurance requirements.

4. The calibration and span gases (for CO, SO_2 and NO_2) should be working standards certified by comparison to a National Bureau of Standards gaseous Standard Reference Material.

5. The data recovery should be 80 percent of the data possible during the information effort.

2.4.3 Currentness of Data

The air quality monitoring data should be current. Generally, this would mean for the preconstruction phase that the data must have been collected in the 3-year period preceding the permit application, provided the data are still representative of current conditions. When such data are required, the noncriteria pollutant data must also have been collected in the 3-year period preceding the permit application provided that an acceptable measurement method was used. For the postconstruction phase, the data must be collected after the source or modification becomes operational.

2.4.4 Provisions for PM_{10} and TSP in Transition Period of 1987 PSD Amendments

Section 2.5.2 discusses the use of existing representative air quality data for P_{10} and TSP during the phasing in of the 1987 PSD amendments for particulate matter. References are cited for using existing nonreference PM_{10} and/or PM_{15} data where available, or TSP data. Existing representative air quality data for PM_{10} collected more than 12 months after the effective date of the 1987 PSD amendments must have been collected using reference or equivalent PM_{10} method samplers.

2.5 Duration of Monitoring

2.5.1 Normal Conditions

If a source must monitor because representative air quality data are not available for the preconstruction monitoring data requirement, then monitoring generally must be conducted for at least 1 year prior to submission of the application to construct. Also, if a source decides to monitor because representative air quality data are not available for the postconstruction monitoring data requirement, then monitoring must also be conducted for at least 1 year after the source or modification becomes operational. However, under some circumstances, less than 1 year of air quality data may be acceptable for the preconstruction and postconstruction phases. This will vary according to the pollutant being studied. For all pollutants, less than a full year will be acceptable if the applicant demonstrates through historical data or dispersion modeling that the data are obtained during a time period when maximum air quality levels can be expected. However, a minimum of 4 months of air quality data will be required. As discussed in Section 2.1.3, monitoring for noncriteria pollutants will generally not be required.

Special attention needs to be given to the duration of monitoring for ozone. Ozone monitoring will still be required during the time period when maximum ozone concentrations will be expected. Temperature is one of the factors that affect ozone concentrations, and the maximum ozone concentrations will generally occur during the warmest 4 months of the year, i.e., June-September. However, historical monitoring data have shown that the maximum yearly ozone concentration for some areas may not occur from June-September. Therefore, ozone monitoring will also be required for those months when historical ozone data have shown that the yearly maximum ozone concentrations have occurred during months other than the warmest 4 months of the year. This requirement is in addition to monitoring during the warmest 4 months of the year. If there is an interval of time between the warmest 4 months of the year and month where historical monitoring data have shown that the maximum yearly ozone concentration has occurred, then monitoring must also be conducted during that interval. For example, suppose historical data have shown the maximum yearly ozone concentration for at least 1 year occurred in April. Also, suppose the warmest 4 months for that particular area occurred June-September. In such cases, ozone monitoring would be required for April (previous maximum concentration month), May (interval month), and June-September (warmest 4 months).

Some situations may occur where a source owner or operator may not operate a new source or modification at the rated capacity applied for in the PSD permit. Generally, the postconstruction monitoring should not begin until the source is operating at a rate equal to or greater than 50 percent of its design capacity. However, in no case should the postconstruction monitoring be started later than 2 years after the start-up of the new source or modification.

If the permit granting authority has determined that less than 1 year of monitoring data is permissible, the source must agree to use the maximum values collected over this short period for comparison to all applicable short-term standards, and the average value for the short period as the equivalent of the annual standard.

It should also be noted that the above discussion of less than 1 year of data pertains to air quality data, not meteorological data. When the air quality impact must be determined using a dispersion model, the preferred meteorological data base is at least 1 year of on-site data. Although less than 1 year of data may be sufficient to determine the acceptability for a model, once the model has been accepted, a full year of meteorological data must be used in the PSD analysis.

2.5.2 Transition Period for PM_{10} and TSP

The 1987 PSD regulatory changes for particulate matter [6] provide for a transition period for phasing in the PM_{10} monitoring data requirements. The term "monitoring data" was previously defined in Section 2.1 as the use of existing representative air quality data or monitoring to determine the existing air quality.

2.5.2.1 Transition Within 10 Months After Effective Date of PM_{10} Amendments - The first provision of the regulations concerning a transition period is in section 52.21(i)(11)(i) and relates to applications for a PSD permit submitted not later than 10 months after the effective date of the 1987 PSD amendments. During this 10-month period, the permit granting authority has the discretion of waiving the preconstruction monitoring data requirements for the ambient air quality analysis discussed in Appendix A of this guideline. In all cases no applicant would be required to initiate monitoring during this period. However, the requirement to use existing air quality data would be discretionary. The discretion would be based in part on the availability of existing air quality data which could include total suspended particulate matter data, PM_{10} data, as well as inhalable particulate matter (PM_{15}) data. The PM_{15} data would be from samplers with inlets designed for a 50 percent collective efficiency at 15 um. The PM_{15} data could be from dichotomous samplers or high volume samplers with a size selective inlet of 15 um.

(a) Comparing Representative Air Quality Data to PM_{10} NAAQS. In situations where existing PM_{10} and/or PM_{15} data are available, the data may be used for describing the existing air quality levels for comparison with the PM_{10} NAAQS. Reference [8] describes procedures for estimating ambient PM_{10} concentrations from PM_{15} ambient air measurements. The PM_{15} data multiplied by a correction factor of 0.8 may be assumed to be equivalent to PM_{10}. Existing TSP data may only be used as a "one-for-one" substitute for comparison to the PM_{10} NAAQS.

Concerning the priorities for using existing air quality data, the first preference is to use ambient PM_{10} data. The second preference is to use inhalable particulate (PM_{15}) measurements obtained with a dichotomous sampler or a size selective high volume sampler. The third preference is to use total suspended particulte (TSP) data. Also, combinations of the above data may be used.

2.5.2.2 Transition During 10-16 Months After Effective Date of PM_{10} Amendments - The second provision of the regulations concerning a transition period is in section 52.21(i)(11)(ii) and relates to applications for a PSD permit submitted more than 10 months and no later than 16 months after the effective date of the 1987 PSD amendments. If preconstruction monitoring data are required in the ambient air quality analysis during this 10 to 16-month period, the applicant must use representative air quality data or collect monitoring data.

(a) Comparing Preconstruction Air Quality Data to PM_{10} NAAQS. Existing representative PM_{10} and/or PM_{15} air quality data may be used if available. The priorities and calculations for using these data were described in Section 2.5.2.1. Existing TSP data cannot be used during during this transition period.

If the applicant collects new PM_{10} and/or PM_{15} monitoring data, the data should have been collected from the date 6 months after the effective date of the 1987 PSD amendments to the time the PSD application becomes otherwise complete. The preferences for PM_{10} and PM_{15} data were previously discussed.

(b) Other Considerations and Explanations. As discussed in Section 2.5.1, less than the maximum amount of data (10 months in this case) monitoring data will be acceptable if the applicant demonstrates, through historical data or dispersion modeling, that the data would be obtained during a time period when the maximum air quality can be expected. The minimum of 4 months of air quality data would still be required. The assumptions for the 10-month figure were derived by assuming that 5 months are needed for instrument and equipment procurement, 1 month to install the equipment, calibrate and ensure satisfactory operation, and a minimum of 4 months of monitoring data. The upper range of 16 months after the effective date for use of non-reference PM_{10} monitoring is based on the assumption that within 11 months after the effective date, reference or equivalent method samplers for PM_{10} would be designated by EPA and would be commercially available. Furthermore, 1 month would be needed to install the equipment, calibrate, and ensure satisfactory operation, and a minimum of 4 months would be needed for gathering monitoring data.

2.5.2.3 <u>Transition During 16-24 Months After Effective Date of PM_{10} Amendments</u> - The third transition period provision of the amendments is in section 52.21(m)(1)(vii) and relates to applications for a PSD permit submitted more than 16 months and not later than 24 months after the effective date of the 1987 PSD amendments. If preconstruction monitoring data are required in the ambient air quality analysis during this 16 to 24-month period, the applicant must use representative air quality data or collect monitoring data.

(a) <u>Comparing Preconstruction Air Quality Data to PM_{10} NAAQS</u>. If existing representative PM_{10} and/or PM_{15} air quality data are available they may be used. The priorities and calculations for using these data were described in Section 2.5.2.1. Existing TSP data cannot be used during this transition period. If no PM_{10} or PM_{15} representative air quality data are available, the applicant will have to collect monitoring data using only reference or equivalent PM_{10} method samplers. The sampling must be conducted for at least 12 months during the period from 12 months after the effective date to the time when the application is completed, except if the permit granting authority determines that a complete and adequate analysis can be accomplished with monitoring data over a shorter period (but in no case less than 4 months).

2.5.2.4 <u>Period Following 24 Months After Effective Date of PM_{10} Amendments</u> - For applications for a PSD permit submitted later than 24 months after the effective date, the transition period would no longer be in effect. If preconstruction monitoring data are required in the ambient air quality analysis, the applicant must use representative air quality data or collect monitoring data.

(a) <u>Comparing Preconstruction Air Quality Data to PM_{10} NAAQS</u>. If existing representative PM_{10} air quality data are available, they may be used. However, existing PM_{10} representative air quality data collected later than 24 months after the effective date of the 1987 PSD amendments must have been collected using reference or equivalent PM_{10} method samplers. If no PM_{10} representative air quality data are available, the applicant will have to collect monitoring data using only reference or equivalent PM_{10} method samplers.

2.6 Sampling Methods and Procedures

(a) Criteria pollutants.

All ambient air quality monitoring must be done with continuous Reference or Equivalent Methods, with the exception of particulate matter and lead for which continuous Reference or Equivalent Methods do not exist. For particulate matter and lead, samples must be taken in accordance with the Reference Method. The Reference Methods are described in 40 CFR 50. A list of designated continuous Reference or Equivalent Methods can be obtained by writing Environmental Monitoring Systems Laboratory, Department E (MD-76), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

(b) PM_{10} Transition for Non-reference Methods

As discussed in Section 2.5.2, non-reference monitors for PM_{10} may be used for applications submitted not later than 16 months after the effective date of the 1987 PSD amendments. These could include PM_{10} monitors as well as inhalable particulate matter (PM_{15}) monitors. The PM_{15} monitors could be dichotomous monitors or high volume monitors with a size selective inlet of 15 um.

(c) Noncriteria pollutants.

For noncriteria pollutants, a list of acceptable measurement methods is available upon request by writing Environmental Monitoring Systems Laboratory, Quality Assurance Division (MD-77), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. This list of acceptable methods will be reviewed at least annually and are available from the above address. Measurement methods considered candidates for the noncriteria pollutant list should be brought to the attention of EPA at the address given above.

2.7 Frequency of Sampling

For all gaseous pollutants and for all meteorological parameters, continuous analyzers must be used. Thus, continuous sampling (over the time period determined necessary) is required. For particulate pollutants, except for PM_{10}, daily sampling (i.e., one sample every 24 hours) is required except in areas where the applicant can demonstrate that significant pollutant variability is not expected. In these situations, a sampling schedule less frequent than every day would be permitted. However, a minimum of one sample every 6 days will be required for these areas. The sampling frequency would apply to both preconstruction and postconstruction monitoring.

The sampling frequency for PM_{10} samplers is determined by the PM_{10}, PM_{15}, or TSP concentrations relative to the PM_{10} NAAQS. The philosophy is to use existing data where possible to determine the PM_{10} sampling frequency.

The frequencies discussed below are consistent with the Part 58 sampling frequencies [6]. If PM_{10} data are available but not from the locations as specified in Section 2.4.1, then modeling could be used in conjunction with the data to estimate the PM_{10} concentrations in the appropriate sampling area(s) to determine the PM_{10} sampling frequency. If these estimated concentrations were < 80 percent of the PM_{10} NAAQS, then a minimum of one sample every 6 days would be required for PM_{10} monitors; for $\geq$80 - <90 percent of the PM_{10} NAAQS, a minimum of one sample every other day would be required; and for $\geq$90 percent of the PM_{10} NAAQS every day sampling would be required. PM_{15} data would be treated the same way except the data must be multiplied by a correction factor of 0.8 to be equivalent to PM_{10}.

Reference [8] describes how TSP data may also be used to estimate the probability of exceeding the PM_{10} NAAQS in the appropriate sampling area(s) for purposes of determining the PM_{10} sampling frequency. If the probabilities are < .20 of the PM_{10} NAAQS, then a minimum of one sample every 6 days would be required for PM_{10} monitors; for $\geq$.20 - <.50 probabilities, a minimum of one sample every other day would be required; and for $\geq$.50 probabilities, every day sampling would be required. These probability intervals are in line with the percent of the NAAQS intervals specified when using PM_{10} data.

In those cases where no PM_{10}, PM_{15}, or TSP data are available to determine the PM_{10} sampling frequency, the PM_{10} expected concentrations could be estimated by modeling. These estimated concentrations would be used to calculate the percentage of the PM_{10} NAAQS and the resulting PM_{10} sampling frequency as discussed above for the cases where PM_{10} data were available.

2.8 Monitoring Plan

A monitoring plan prepared by the source should be submitted to and approved by the permit granting authority before any PSD monitoring begins. Note that approval of the monitoring plan before a monitoring program is started is not a requirement. However, since the network size and station locations are determined on a case-by-case basis, it would be prudent for the owner or operator to seek review of the network and the overall monitoring plan from the permit granting authority prior to collecting data. This review could avoid delays in the processing of the permit application and could also result in the elimination of any unnecessary monitoring. Delays may result from insufficient, inadequate, poor, or unknown quality data. Table 1 lists the types of information that should be included in the monitoring plan.

2.9 Meteorological Parameters and Measurement Methods

Meteorological data will be required for input to dispersion models used in analyzing the impact of the proposed new source or modification on ambient air quality and the analyses of effects on soil, vegetation, and visibility in the vicinity of the proposed source. In some cases, representative data are available from sources such as the National

Weather Service. However, in some situations, on-site data collection will be required. The meteorological monitoring and instrumentation considerations are discussed in Sections 5 and 6.

TABLE 1. MINIMUM CONTENTS OF A MONITORING PLAN

I. <u>SOURCE ENVIRONMENT DESCRIPTION</u> (within 2 km of source)

- o topographical description
- o land-use description
- o topographical map of source and environs (including location of existing stationary sources, roadways, and monitoring sites)
- o climatological description
- o quarterly wind roses (from meteorological data collected at the source or other representative meteorological data)

II. <u>SAMPLING PROGRAM DESCRIPTION</u>

- o time period for which the pollutant(s) will be measured
- o rationale for location of monitors (include modeling results and analysis of existing soures in the area)
- o rationale for joint utilization of monitoring network by other PSD sources

III. <u>MONITOR SITE DESCRIPTION</u>

- o Universal Transverse Mercator (UTM) coordinates
- o height of sampler (air intake) above ground
- o distance from obstructions and heights of obstructions
- o distance from other sources (stationary and mobile)
- o photographs of each site (five photos: one in each cardinal direction looking out from each existing sampler or where a future sampler will be located, and one closeup of each existing sampler or where a future sampler will be located. Ground cover should be included in the closeup photograph.)

IV. <u>MONITOR DESCRIPTION</u>

- o name of manufacturer
- o description of calibration system to be used
- o type of flow control and flow recorder

V. <u>DATA REPORTING</u>

- o format of data submission
- o frequency of data reporting

VI. <u>QUALITY ASSURANCE PROGRAM</u>

- o calibration frequency
- o independent audit program
- o internal quality control procedures
- o data precision and accuracy calculation procedures

3. NETWORK DESIGN AND PROBE SITING CRITERIA

A source subject to PSD should proceed with designing a PSD monitoring network only after going through the procedure in Appendix A to determine if monitoring data will be required. To fulfill that requirement, a source may use representative air quality data which was discussed in Section 2.4 or monitor. This section presents guidance to be used if an applicant decides to monitor in lieu of using representative air quality data.

3.1 Network Design

The design of a network for criteria and noncriteria pollutants will be affected by many factors, such as topography, climatology, population, and existing emission sources. Therefore, the ultimate design of a network for PSD purposes must be decided on a case-by-case basis by the permit granting authority. Section 3.2 discusses the number and location of monitors for a PSD network. Additional guidance on the general siting of the monitors may be found in references 9-13 which discuss highest concentration stations, isolated point sources, effects of topography, etc. Probe siting criteria for the monitors are discussed in Section 3.3. The guidelines presented here should be followed to the maximum extent practical in developing the final PSD monitoring network.

3.2 Number and Location of Monitors

The number and location of monitoring sites will be determined on a case-by-case basis by the source owner or operator and reviewed by the permit granting authority. Consideration should be given to the effects of existing sources, terrain, meteorological conditions, existence of fugitive or reentrained dusts, averaging time for the pollutant, etc. Generally, the number of monitors will be higher where the expected spatial variability of the pollutant in the area(s) of study is higher.

3.2.1 Preconstruction Phase

Information obtained in the ambient air quality analysis in Appendix A will be used to assist in determining the number and location of monitors for the preconstruction phase. The air quality levels before construction were determined by modeling or in conjunction with monitoring data. The screening procedure (or more refined model) estimates were determined in Appendix A.

The source should first use the screening procedure or refined model estimates to determine the general location(s) for the maximum air quality concentrations from the proposed source or modification. Secondly, the source should determine by modeling techniques the general location(s) for the maximum air quality levels from existing sources. Thirdly, the modeled pollutant contribution of the proposed source or modification should be analyzed in conjunction with the modeled results for existing sources to determine the maximum impact area. Application of these models must be consistent with EPA's "Guideline on Air Quality Models" [14]. This would provide sufficient information for the applicant to place a monitor at (a) the location(s) of the maximum concentration increase expected from the proposed source or modification, (b) the location(s) of the maximum air pollutant concentration from existing sources of emissions, and (c) the location(s) of the maximum impact area, i.e., where the maximum pollutant concentration would hypothetically occur based on the combination effect of existing sources and the proposed new source or modification. In some cases, two or more of these locations may coincide and thereby reduce the number of monitoring stations.

Monitoring should then be conducted in or as close to these areas as possible (also see discussion in Section 3.2.3). Generally, one to four sites would cover most situations in multisource settings. For remote areas in which the permit granting authority has determined that there are no significant existing sources, a minimum number of monitors would be needed, i.e., one or probably two at the most. For new sources, in these remote areas, as opposed to modifications, some concessions will be made on the locations of these monitors. Since the maximum impact from these new sources would be in remote areas, the monitors may be located, based on convenience or accessibility, near the proposed new source rather than near the maximum impact area since the existing air quality would be essentially the same in both areas. However, the maximum impact area is still the preferred location.

When industrial process fugitive particulate emissions are involved, the applicant should locate a monitor at the proposed source site (also see Section 3.2.3). If stack emissions are also involved, a downwind location should also be selected. For fugitive hydrocarbon emissions, the applicant should locate a monitor downwind of the source at the point of expected maximum ozone concentration contribution. This location will be found downwind during conditions that are most conducive to ozone formation, such as temperature above 20°C (68°F) and high solar radiation intensity. For hydrocarbon emissions from a stack, the applicant should also locate the monitor in the area of expected maximum ozone concentration. For both fugitive and stack emissions, the selection of areas of highest ozone concentrations will require wind speed and direction data for periods of photochemical activity. Monitoring for ozone will only be necessary during the seasons when high concentrations occur.

Since ozone is the result of a complex photochemical process, the rate of movement across an area of the air mass containing precursors should be considered. The distance from the proposed source to the monitor for an urban situation should be about equal to the distance traveled by the air moving for 5 to 7 hours at wind speeds occurring during periods of photochemical activity. In an urban situation, ozone formation over the initial few hours may be supressed by nitric oxide (NO) emissions. For a point source, the NO interactions may be minimal, and the travel time to the expected maximum ozone concentration may be 3 to 4 hours downwind. In general, the downwind distance for the maximum ozone site should generally not be more than 15 to 20 miles from the source because a lower wind speed (2-3 miles per hour) with less dilution would be a more critical case. Additionally, the frequency that the wind would blow from the source over the site diminishes with increasing distances.

3.2.2 Postconstruction Phase

As discussed above for preconstruction monitoring, appropriate dispersion modeling techniques are used to estimate the location of the air quality impact of the new source or modification. Monitors should then be placed at (a) the expected area of the maximum concentration from the new source or modification, and (b) the maximum impact area(s), i.e., where the maximum pollutant concentration will occur based on the combined effect of existing sources and the new source or modification. It should be noted that locations for these monitors may be different from those sites for the preconstruction phase due to other new sources or modifications in the area since the preconstruction monitoring.

Generally, two or three sites would be sufficient for most situations in multisource areas. In remote areas where there are no significant existing sources, one or two sites would be sufficient. These sites would be placed at the locations indicated from the model results. The same concerns discussed in Section 3.2.1 regarding industrial process fugitive particulate emissions, fugitive hydrocarbon emissions, and ozone monitoring would also be applicable for the postconstruction phase.

3.2.3 Special Concerns for Location of Monitors

For the preconstruction and postconstruction phases, modeling is used to determine the general area where monitors would be located. Some of the modeled locations may be within the confines of the source's boundary. However, monitors should be placed in those locations satisfying the definition of ambient air. Ambient air is defined in 40 CFR 50.1(e) as "that portion of the atmosphere, external to buildings, to which the general public has access." Therefore, if the modeled locations are within an area excluded from ambient air, the monitors should be located downwind at the boundary of that area.

In some cases, it is simply not practical to place monitors at the indicated modeled locations. Some examples may include over open bodies of water, on rivers, swamps, cliffs, etc. The source and the permit granting authority should determine on a case-by-case basis alternative locations.

3.3 Probe Siting Criteria

The desire for comparability in monitoring data requires adherence to some consistent set of guidelines. Therefore, the probe siting criteria discussed below must be followed to the maximum extent possible to ensure uniform collection of air quality data that are comparable and compatible.

Before proceeding with the discussion of pollutant specific probe siting criteria, it is important to expand on the discussion in Section 3.2 of the location of monitors. In particular, reference is made to two monitoring objectives.

- <u>Case 1</u>: Locating monitors to determine the maximum concentration from the proposed source and/or existing sources.
- <u>Case 2</u>: Locating monitors to determine where the combined impact of the proposed source and existing sources would be expected to exhibit the highest concentrations.

For Case 1, the driving force for locating the siting area of the monitor as well as the specific location of the probe or instrument shelter is the objective of measuring the maximum impact from the proposed source. Two Case 1 examples are given. Consider the first situation in which a proposed source would be emitting pollutants from an elevated stack. Under these circumstances, sufficient mixing generally occurs during the transport of the emissions from the stack to the ground resulting in small vertical gradients near ground level, thus, a wide range of probe heights, 3-15 meters for gases and 2-15 meters for particulates is acceptable. For the same objective (maximum concentration from proposed source), consider the second example in which pollutants would be emitted from a ground level source. In this case, the concentration gradient near the ground can be large, thereby requiring a much tighter range of acceptable probe heights. For ground level sources emitting pollutants with steep vertical concentration gradients, efforts should be made to locate the inlet probe for gaseous pollutant monitors as close to 3 meters (a reasonable practical representation of the breathing zone) as possible and for particulate monitors using the hi-volume sampler 2 to 7 meters above ground level. The rationale for the 3 meters is that for gaseous pollutant measurements, the inlet probe can be adjusted for various heights even though the monitor is located in a building or trailer. On the contrary, the 2-3 meter height for the hi-volume sampler placement is not practical in certain areas. The 7 meter height allows for placement on a one story building and is reasonably close to representing the breathing zone.

Turn now to the second monitoring objective, Case 2, which is locating monitors to determine the maximum impact area taking into consideration the proposed source as well as existing sources. The critical element to keep in mind in locating a monitor to satisfy this objective is that the intent is to maximize the combined effect. Thus, in one circumstance, the existing source might contribute the largest impact. The importance of the above discussion to the topic of probe siting criteria is that in attempting to locate a monitor to achieve this objective, the placement of the probe or instrument shelter can vary depending upon which source is the predominant influence on the maximum impact area. As an extreme example, consider the situation where a proposed elevated source would emit CO into an urban area and have maximum combined CO impact coincident to an area adjacent to a heavily traveled traffic corridor. It is known that traffic along corridors emit CO in fairly steep concentration gradients so the placement of the probe to measure the areas of highest CO concentration can vary significantly with probe height as well as distance from the corridor. In this example, the traffic corridor has the major influence on the combined impact and therefore controls the probe placement. As noted in the CO probe siting criteria in Section 3.3.3 as well as Appendix E of the May 10, 1979 Federal Register promulgation of the Ambient Air Monitoring Regulations [7] and revised and updated on March 19, 1986 [15], the required probe height in such microscale cases is given as 3 ± 1/2 meters while the distance of the probe from the roadway would be between 2 and 10 meters.

As another example, consider the case where the same proposed CO source would emit CO at elevated heights and have a combined maximum CO impact in an urban area that is only slightly affected by CO emissions from a roadway. The combined impact area in this case is far enough away from the two sources to provide adequate mixing and only small vertical concentration gradients at the impact area. In this case, the acceptable probe height would be in the range of 3-15 meters.

It is recognized that there may be other situations occurring which prevent the probe siting criteria from being followed. If so, the differences must be thoroughly documented. This documentation should minimize future questions about the data.

The desire for comparability in monitoring data requires adherence to some consistent set of guidelines. Therefore, the probe siting criteria discussed below must be followed to the maximum extent possible to ensure uniform collection of air quality data that are comparable and compatible. To achieve this goal, the specific siting criteria that are prefaced with a "must" are defined as a requirement and exceptions must be approved by the permit granting authority. However, siting criteria that are prefaced with a "should" are defined as a goal to meet for consistency, but are not a requirement.

3.3.1 Total Suspended Particulates (TSP)

Section 3.3.1 is applicable only for the following cases. PSD applications submitted not later than 6 months after the effective date of the 1987 PSD amendments would use this siting criteria when collecting TSP monitoring data. Also, representative air quality data for TSP collected not later than 6 months after the effective date of the 1987 PSD amendments would use this siting criteria.

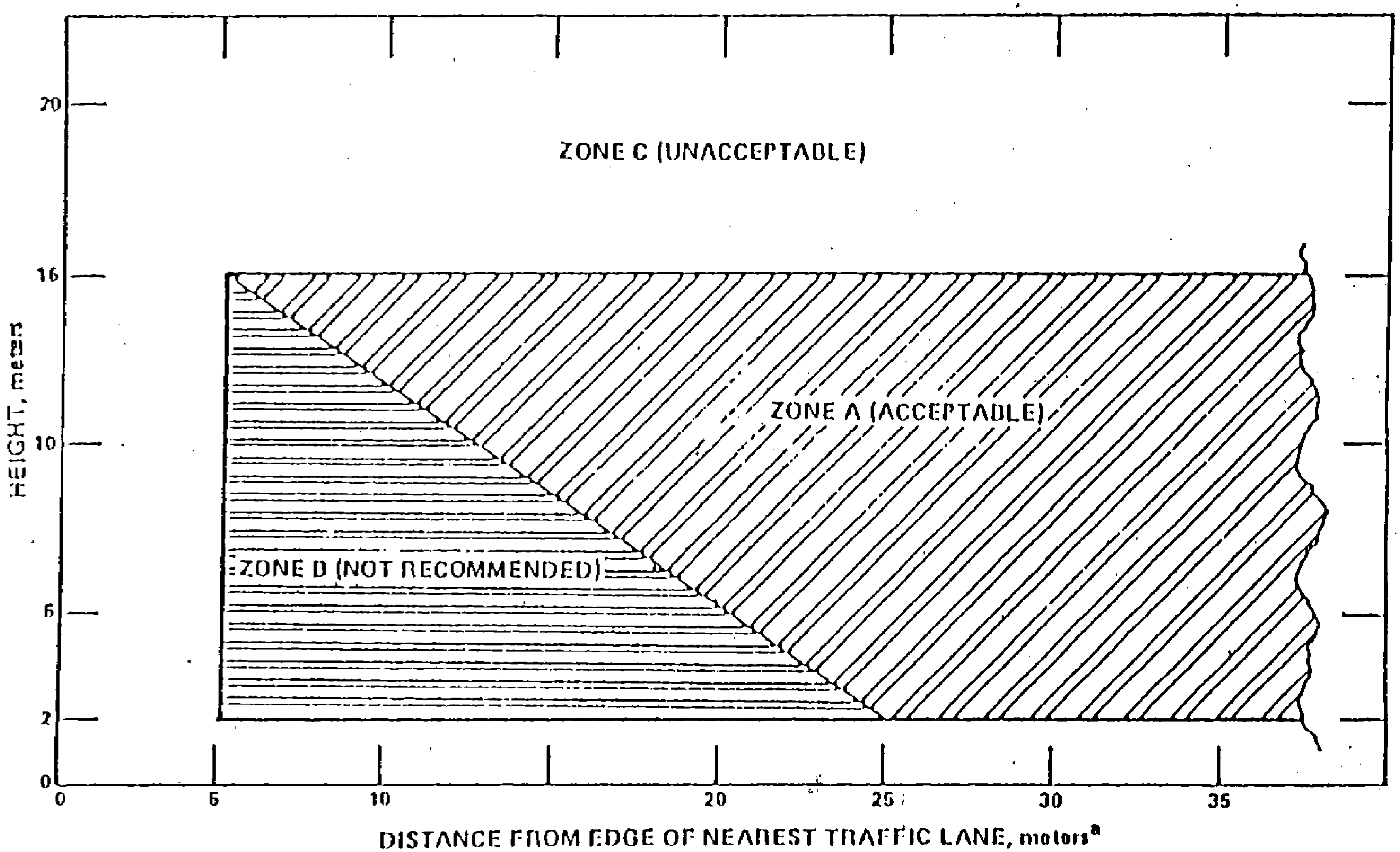
3.3.1.1 Vertical Placement - The most desirable height for a TSP monitor is near the breathing zone. However, practical considerations such as prevention of vandalism, security, accessibility, availability of electricity, etc., generally require that the sampler be elevated. Therefore, a range of acceptable heights needs to be used. In addition, the type of source, i.e., elevated or ground level, predominantly influencing the area of impact must be considered when locating the monitor. For purposes of determining elevated source impact, the sampler air intake must be located 2-15 meters above ground level. The lower limit was based on a compromise between ease of servicing the sampler and the desire to avoid reentrainment from dusty surfaces. The upper limit represents a compromise between the desire to have measurements which are most representative of population exposures, and the considerations noted earlier. For ground level sources with steep vertical concentration gradients, the air intake must be as close to the breathing zone as practical.

3.3.1.2 Spacing from Obstructions - If the sampler is located on a roof or other structure, then there must be a minimum of 2 meters separation from walls, parapets, penthouses, etc. Furthermore, no furnace or incineration flues should be nearby. The separation distance from flues is dependent on the height of the flues, type of waste or fuel burned, and quality of the fuel (ash content). For example, if the emissions from the chimney are the result of natural gas combustion, no special precautions are necessary except for the avoidance of obstructions, i.e., at least 2 meters separation. On the other hand, if fuel oil, coal, or solid waste is burned and the stack is sufficiently short so that the plume could reasonably be expected to impact on the sampler intake a significant part of the time, other buildings/locations in the area that are free from these types of sources should be considered for sampling. Trees provide surfaces for particulate deposition and also restrict airflow. Therefore, the sampler should be placed at least 20 meters from the dripline of trees and must be 10 meters from the dripline when trees act as an obstruction [15].

Obstacles such as buildings must also be avoided so that the distance between obstacles and the sampler is at least twice the height that the obstacle protrudes above the sampler. In addition, there must be unrestricted airflow in an arc of at least 270° around the sampler, and the predominant direction for the season of greatest pollutant concentration potential must be included in the 270° arc.

3.3.1.3 Spacing from Roads - A number of studies [16-23] support the conclusion that particulate concentrations decrease with increasing height of the monitor and distance from the road. Quite high concentrations have been reported at monitors located at a low elevation close to heavily traveled roads. Moreover, monitors located close to streets are within the concentrated plume of particulate matter emitted and generated by vehicle traffic. Therefore, ambient monitors for TSP should be located beyond the concentrated particulate plume generated by traffic, and not so close that the heavier reentrained roadway particles totally dominate the measured ambient concentration.

An analysis of various monitoring studies [24] shows that a linear relationship between sampler height and distance from roadways defines a zone where the plume generated by traffic greater than approximately 3,000 vehicles per day is diminished. Figure 1 illustrates this relationship by showing two zones where TSP monitors could be located. Zone A represents locations which are recommended and Zone B represents locations which



[a]APPLIES WHERE ADT >3 000

Figure 1. Acceptable zone for siting TSP monitors

should be avoided in order to minimize undesirable roadway influences. Roads with lower traffic (less than approximately 3,000 vehicles per day) are generally not considered to be a major source or vehicularrelated pollutants, and so as noted in Figure 1 do not preclude the use of monitors in Zone B for those situations. However, note that for those cases where the traffic is less than approximately 3,000 vehicles per day, the monitor must be located greater than 5 meters from the edge of the nearest traffic lane and 2 to 15 meters above ground level.

In the case of elevated roadways where the monitor must be placed below the level of the roadway, the monitor should be located no closer than approximately 25 meters from the edge of the nearest traffic lane. This separation distance applies for those situations where the road is elevated greater than 5 meters above the ground level, and applies to all traffic volumes.

3.3.1.4 Other Considerations - Stations should not be located in an unpaved area unless there is vegetative ground cover year round so that the impact of reentrained or fugitive dusts will be kept to a minimum. Additional information on TSP probe siting may be found in reference 9.

3.3.2 PM_{10}

3.3.2.1. Vertical Placement - Although there are limited studies on the PM_{10} concentration gradients around roadways or other ground level sources, references 16, 17, 19, 25, and 26 show a distinct variation in the distribution of TSP and Pb levels near roadways. TSP, which is greatly affected by gravity, has large concentration gradients, both horizontal and vertical, immediately adjacent to roads. Pb, being predominantly submicron in size, behaves more like a gas and does not exhibit steep vertical and horizontal gradients as does TSP. PM_{10}, being intermediate in size between these two extremes exhibits dispersion properties of both gas and settleable particulates and does show vertical and horizontal gradients [27]. Similar to monitoring for other pollutants, optimal placement of the sampler inlet for PM_{10} monitoring should be at breathing height level. However, practical factors such as prevention of vandalism, security, and safety precautions must also be considered when siting a PM_{10} monitor. Given these considerations, the sampler inlet for ground level source monitoring must be 2-7 meters above ground level. For PM_{10} samplers, the acceptable range for monitoring emissions from elevated sources is 2-15 meters above ground level.

3.3.2.2 Spacing from Obstructions - If the sampler is located on a roof or other structure, then there must be a minimum of 2 meters separation from walls, parapets, penthouses, etc. No furnace or incineration flues should be nearby. This separation distance from flues is dependent on the height of the flues, type of waste or fuel burned, and quality of the fuel (ash content). In the case of emissions from a chimney resulting from natural gas combustion, the sampler should be placed, as a precautionary measure, at least 5 meters from the chimney.

On the other hand, if fuel oil, coal, or solid waste is burned and the stack is sufficiently short so that the plume could reasonably be expected to impact on the sampler intake a significant part of the time, other buildings/locations in the area that are free from these types of sources should be considered for sampling. Trees provide surfaces for particulate deposition and also restrict airflow. Therefore, the sampler should be placed at least 20 meters from the dripline of trees and must be 10 meters from the dripline when trees act as an obstruction [15].

The sampler must also be located away from obstacles such as buildings, so that the distance between obstacles and the sampler is at least twice the height that the obstacle protrudes above the sampler. There must also be unrestricted airflow in an arc of at least 270° around the sampler, and the predominant wind direction for the season of greatest pollutant concentration potential must be included in the 270° arc.

3.3.2.3 Spacing from Roads - For these situations where the emissions from a proposed source would impact close to a roadway, the air intake for the monitor must be located between 5-15 meters from the edge of the nearest traffic lane. Monitors located in this area would thus measure the combined impact from the proposed source and the roadway. The sampler air intake must be 2-7 meters above ground level.

3.3.2.4 Other Considerations - Stations should not be located in an unpaved area unless there is vegetative ground cover year round so that the impact of reentrained or fugitive dusts will be kept to a minimum. Additional information on PM_{10} siting may be found in reference 28.

3.3.3 Sulfur Dioxide (SO_2)

3.3.3.1. Horizontal and Vertical Probe Placement - As with TSP monitoring, the most desirable height for an SO_2 inlet probe is near the breathing height. Various factors enumerated before may require that the inlet probe be elevated. consideration must also be given to the type of source predominantly influencing the impact area. For elevated sources, the inlet probe must be located 3 to 15 meters above ground level. For ground level sources, locate as close to the breathing zone as possible. If the inlet probe is located on the side of the building, then it should be located on the windward side of the building relative to the prevailing winter wind direction. The inlet probe must also be located more than 1 meter vertically or horizontally away from any supporting structure and also away from dirty, dusty areas.

3.3.3.2 Spacing from Obstructions - No furnace or incineration flues, or other minor sources of SO_2 should be nearby. The separation distance is dependent on the height of the flues, type of waste or fuel burned, and the quality of the fuel (sulfur content). If the inlet probe is located on a roof or other structure, it must be at least 1 meter from walls, parapets, penthouses, etc.

The inlet probe should be placed at least 20 meters from the dripline of trees and must be 10 meters from the dripline when trees act as an obstruction [15]. Additionally, the probe must be located away from obstacles and buildings. The distance between the obstacles and the inlet probe must be at least twice the height that the obstacle protrudes above the inlet probe. Airflow must also be unrestricted in an arc of at least 270° around the inlet probe, and the predominant direction for the season of greatest pollutant concentration potential must be included in the 270° arc. If the probe is located on the side of a building, 180° clearance is required. Additional information on SO_2 probe siting criteria may be found in reference 10.

3.3.4 Carbon Monoxide (CO)

3.3.4.1 Horizontal and Vertical Probe Placement - Because of the importance of measuring population exposure to CO concentrations, optimum CO sampling should be done at average breathing heights. However, practical factors require that the inlet probe be higher. In general, for CO emitted at elevated heights, the inlet probe for CO monitoring should be 3-15 meters above ground level. For those situations where the emissions from a proposed source would impact a street canyon or corridor type area in an urban area, and the area is prodominantly influenced by the traffic from the street canyon or traffic corridor, the inlet probe should be positioned 3 $\pm$ 1/2 meters above ground level which coincides with the vertical probe placement criteria for a street canyon/corridor type site [7]. The criteria is more stringent than the 3 to 15 meter range specified earlier because CO concentration gradients resulting from motor vehicles traveling along street canyon or corridors are rather steep and show wide variations in CO levels at different heights. The 3 meter height is a compromise between breathing height representation and such factors as the prevention of obstructions to pedestrians, vandalism, etc.

In addition to the vertical probe criteria, the inlet probe must also be located more than 1 meter in the vertical or horizontal direction from any supporting structure.

3.3.4.2 Spacing from Obstructions - Airflow must also be unrestricted in an arc of at least 270° around the inlet probe, and the predominant direction for the season of greatest pollutant concentration potential must be included in the 270° arc. If the probe is located on the side of a building, 180° clearance is required [7, 15]. Additionally, trees should not be located between the major sources of CO and the sampler. The sampler must be at least 10 meters form the dripline of a tree which is between the sampler and the source if the tree extends at least 5 meters above the sampler [15].

3.3.4.3 Spacing from Roads - For those situations discussed above where the emissions from a proposed source would impact a street canyon/corridor type area, the inlet probe must be located at least 10 meters from an intersection and preferably at a midblock location. The inlet probe must also be placed 2-10 meters from the edge of the nearest traffic lane.

Also no trees or shrubs should be located between the sampling inlet probe and the road [15]. Additional information on CO probe siting may be found in reference 11.

3.3.5 Ozone (O_3)

3.3.5.1 Vertical and Horizontal Probe Placement - The inlet probe for ozone monitors should be as close as possible to the breathing zone. The complicating factors discussed previously, however, require that the probe be elevated. The height of the inlet probe must be located 3 to 15 meters above ground level. The probe must also be located more than 1 meter vertically or horizontally away from any supporting structure.

3.3.5.2 Spacing from Obstructions - The probe must be located away from obstacles and buildings such that the distance between the obstacles and the inlet probe is at least twice the height that the obstacle protrudes above the sampler. The probe should also be located at least 20 meters from the dripline of trees. Since the scavenging effect of trees is greater for ozone than for some of the other pollutants, strong consideration should be used in locating the inlet probe to avoid this effect. Therefore, the sampler must be at least 10 meters from the dripline of trees that are located between the source of the ozone precursors and the sampler along the predominant summer daytime wind direction [15]. Airflow must be unrestricted in an arc of at least 270° around the inlet probe, and the predominant direction for the season of greatest pollutant concentration potential must be included in the 270° arc. If the probe is located on the side of a building, 180° clearance is required.

3.3.5.3 Spacing from Roads - It is important in the probe siting process to minimize destructive interferences from sources of nitric oxide (NO) since NO readily reacts with ozone. Regarding NO from motor vehicles, Table 2 provides the required minimum separation distances between roadways and ozone monitoring stations. These distances were based on recalculations using the methodology in reference 12 and validated using more recent ambient data collected near a major roadway. The minimum separation distance must also be maintained between an ozone station and other similar volumes of automotive traffic, such as parking lots. Additional information on ozone probe siting criteria may be found in reference 12.

Table 2. MINIMUM SEPARATION DISTANCE BETWEEN OZONE MONITORS AND ROADWAYS (EDGE OF NEAREST TRAFFIC LANE)

Roadway Average Daily Traffic, Vehicles Per Day	Minimum Separation Distance Between Roadways and Monitors, Meters
≤ 10,000	≥ 10[a]
15,000	20
20,000	30
40,000	50
70,000	100
≥110,000	≥250

[a]Distances should be interpolated based on traffic flow.

3.3.6 Nitrogen Dioxide (NO_2)

3.3.6.1 Vertical and Horizontal Probe Placement - As discussed for previous pollutants, the acceptable ranges for a monitor/probe inlet for monitoring NO_2 emissions in an area principally influenced by an elevated source is 3-15 meters. For areas influenced primarily by a ground level source, the height should be as close to 3 meters as possible. Regarding the distance of the probe from the supporting structure, a vertical or horizontal distance of 1 meter must be maintained.

3.3.6.2 Spacing from Obstructions - Buildings, trees, and other obstacles can serve as scavengers of NO_2. In order to avoid this kind of interference, the station must be located well away from such obstacles so that the distance between obstacles and the inlet probe is at least twice the height that the obstacle protrudes above the probe. Also, a probe inlet along a vertical wall is undesirable because air moving along that wall may be subject to possible removal mechanisms. Similarly, the inlet probe should also be at least 20 meters from the dripline of trees and must be at least 10 meters from the dripline of trees which protrude above the height of the probe by 5 of more meters [15]. There must be unrestricted airflow in an arc of at least 270° around the inlet probe, and the predominant direction for the season of greatest pollutant concentration potential must be included in the 270° arc. If the probe is located on the side of the building, 180° clearance is required. Additional information on NO_2 probe siting criteria may be found in reference 12.

3.3.7 Lead (Pb)

3.3.7.1 Vertical Placement - Breathing height is the most desirable location for the vertical placement of the Pb monitor. However, practical factors previously mentioned require that the monitor be elevated. In elevating the sampler, consideration must be given to ground level emissions (whether they be stationary or mobile sources) with steep vertical concentration gradients. Placing the shelter too high could result in measured values significantly lower than the level breathed by the general public. Accordingly, the sampler for ground level source monitoring must be located 2 to 7 meters above ground level. In contrast, samplers to monitor for elevated sources, as noted in previous discussion, are allowed a wider range of heights for locating the sampler/inlet probe. For Pb samplers, the acceptable range for monitoring emissions from elevated sources is 2-15 meters above ground level.

3.3.7.2 Spacing from Obstructions - A minimum of 2 meters of separation from walls, parapets, and penthouses is required for samplers located on a roof or other structure. No furnace or incineration flues should be nearby. The height of the flues and the type, quality, and quantity of waste or fuel burned determine the separation distances from flues. For example, if the emissions from the chimney have a high lead content and there is a high probability that the plume would impact on the sampler during most of the sampling period, then other buildings/locations in the area that are free from the described sources should be chosen for the monitoring site. The sampler should be placed at least 20 meters from the dripline of trees and must be at least 10 meters from the dripline of trees when the tree(s) could be classified as an obstruction [15], since trees absorb particles as well as restrict airflow.

The sampler must be located away from obstacles such as buildings, so that the distance between obstacles and the sampler is at least twice the height that the obstacle protrudes above the sampler. There must also be unrestricted airflow in an arc of at least 270° around the sampler, and the predominant direction for the season of greatest pollution concentration potential must be included in the 270° arc.

3.3.7.3 Spacing from Roads - For those situations discussed in Section 3.3.7.1 where the emissions from a proposed source would impact close to a major roadway (greater than approximately 30,000 ADT), the air intake for the monitor must be located within 15-30 meters from the edge of the nearest traffic lane. Monitors located in this area would thus measure the combined impact from the proposed source and the roadway. The sampler air intake must be 2 to 7 meters above ground level.

3.3.7.4 Other Considerations - Stations should not be located in an unpaved area unless there is vegetative ground cover year round so that the impact of reentrained or fugitive dusts will be kept to a minimum. Additional information on Pb siting criteria may be found in reference 13.

3.3.8 Noncriteria Pollutants

3.3.8.1 Vertical Placement - Similar to the discussion on criteria pollutants, the most desirable height for monitors/inlet probes for noncriteria pollutants is near the breathing zone. Again, practical factors require that the monitor/ inlet probe be elevated. Furthermore, consideration must be given to the type of source, i.e., elevated, ground level, stationary, or mobile. As the case may be, for noncriteria particulate pollutant monitors, the following monitor/inlet probe ranges are acceptable: for impact areas predominantly influenced by elevated sources, 2-15 meters; for ground level sources 2 to 7 meters. Regarding noncriteria gaseous pollutants, acceptable heights are as follows: areas impacted primarily by elevated sources, 3-15 meters; areas affected principally by ground level sources, as close to 3 meters as possible.

3.3.8.2 Spacing from Obstructions - If the sampler/inlet probe is located on a roof or other structure, then there must be a minimum of 2 meters separation from walls, parapets, penthouses, etc. No furnace or incineration flues should be nearby. This separation distance from flues is dependent on the height of the flues, type of waste or fuel burned, and quality of the fuel. For example, if the emissions from the chimney contain a high concentraton of the noncriteria pollutant that is being measured and there is a high probability that the plume would impact the sampler/inlet probe during most of the sampling period, then other buildings/locations in the area that are free from the described sources should be chosen for the monitoring site. The sampler/inlet probe should also be placed at least 20 meters from the dripline of trees and must be at least 10 meters from the dripline of tree(s) that could be classified as an obstruction [15].

The sampler/inlet probe must be located away from obstacles and buildings such that the distance between the obstacles and the sampler/inlet probe is at least twice the height that the obstacle protrudes above the sampler/inlet probe. Airflow must be unrestricted in an arc of at least 270° around the sampler/inlet probe, and the predominant direction for the season of greatest pollutant concentration potential must be included in the 270° arc. If the inlet probe is located on the side of a building, 180° clearance is required.

3.3.8.3 Other Considerations - Stations for measuring particulate noncriteria pollutants should not be located in an unpaved area unless there is vegetative ground cover year round so that the impact of reentrained or fugitive dusts will be kept to a minimum.

3.4 Probe Material and Pollutant Sample Residence Time

For reactive gases, special probe material must be used. Studies [29-33] 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, EPA [34] 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 inlet probes.

No matter how unreactive 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 NO will show significant losses even in the most inert probe material when the residence time exceeds 20 seconds [35]. Other studies [36-37] indicate that a 10-second or less residence time is easily achievable. Therefore, sampling probes for reactive gas monitors must have a sampler residence time less than 20 seconds.

3.5 Summary of Probe Siting Requirements

Table 3 presents a summary of the requirements for probe siting criteria with respect to distances and heights. These criteria are specified for consistency between pollutants and to allow the use of a single manifold for monitoring more than one pollutant at a site.

TABLE 3. SUMMARY OF PROBE SITING CRITERIA

Pollutant	Height Above Ground, Meters[a]	Distance from Supporting Structure, Meters: Vertical	Distance from Supporting Structure, Meters: Horizontal[b]	Other Spacing Criteria
TSP	2 - 15	--	>2	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° arc around the sampler. 4. No furnace or incineration flues should be nearby.[c] 5. Must have minimum spacing from roads. This varies with height of monitor (see Figure 1).
PM_{10} (impact near major roadway and/or ground level sources)	2 - 7	--	>2	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° arc around the sampler. 4. No furnace or incineration flues which emit particulate matter should be nearby.[c] 5. Must be 5-15 meters from roads.

TABLE 3. SUMMARY OF PROBE SITING CRITERIA
(continued)

		Distance from Supporting Structure, Meters		
Pollutant	Height Above Ground, Meters[a]	Vertical	Horizontal[b]	Other Spacing Criteria
PM_{10}	2 - 15	--	>2	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° arc around the sampler. 4. No furnace or incineration flues which emit particulate matter should be nearby.[3]
SO_2	3 - 15	>1	>1	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from inlet probe to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° arc around the inlet probe, or 180° if probe is on the side of a building. 4. No furnace or incineration flues should be nearby.[c]

TABLE 3. SUMMARY OF PROBE SITING CRITERIA
(continued)

Pollutant	Height Above Ground, Meters[a]	Distance from Supporting Structure, Meters: Vertical	Distance from Supporting Structure, Meters: Horizontal[b]	Other Spacing Criteria
CO (street/canyon)	3 ± 1/2	>1	>1	1. Must be >10 meters from intersection and should be at a midblock location. 2. Must be 2-10 meters from edge of nearest traffic lane. 3. Must have unrestricted airflow 180° around the inlet probe.
CO (non-street canyon/corridor)	3 - 15	>1	>1	1. Must have unrestricted airflow 270° around the inlet probe, or 180° if probe is on the side of a building.
O_3	3 - 15	>1	>1	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from inlet probe to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° arc around the inlet probe, or 180° if probe is on the side of a building. 4. Spacing from roads varies with traffic (see Table 2).

TABLE 3. SUMMARY OF PROBE SITING CRITERIA
(continued)

Pollutant	Height Above Ground, Meters[a]	Distance from Supporting Structure, Meters: Vertical	Distance from Supporting Structure, Meters: Horizontal[b]	Other Spacing Criteria
NO_2	3 - 15	>1	>1	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from inlet probe to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° arc around the inlet probe, or 180° if probe is on the side of a building.
Pb (impact near major roadway and/or ground level sources)	2 - 7	--	>2	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° arc around the sampler. 4. No furnace or incineration flues which emit lead should be nearby.[c] 5. Must be 15-30 meters from major roadways.

TABLE 3. SUMMARY OF PROBE SITING CRITERIA
(continued)

Pollutant	Height Above Ground, Meters[a]	Distance from Supporting Structure, Meters: Vertical	Distance from Supporting Structure, Meters: Horizontal[b]	Other Spacing Criteria
Pb	2 - 15	--	>2	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° arc around the sampler. 4. No furnace or incineration flues which emit lead should be nearby.[c]
Particulate Noncriteria Pollutants	2 - 7 for ground level sources; 2 - 15 for elevated sources	--	>2	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. 3. Must have unrestricted airflow 270° arc around the sampler. 4. No furnace or incineration flues which emit the noncriteria pollutant should be nearby.[c]

TABLE 3. SUMMARY OF PROBE SITING CRITERIA (continued)

Pollutant	Height Above Ground, Meters[a]	Distance from Supporting Structure, Meters		Other Spacing Criteria
		Vertical	Horizontal[b]	
Gaseous Noncriteria Pollutants	3 - 15	>1	>1	1. Should be >20 meters from the dripline and must be 10 meters from the dripline when the tree(s) act as an obstruction. 2. Distance from inlet probe to obstacle, such as buildings, must be at least twice the height obstacle protrudes above the inlet probe. 3. Must have unrestricted airflow 270° arc around the inlet probe, or 180° if the probe is on the side of a building. 4. No furnace or incineration flues which emit the noncriteria pollutant should be nearby.[b]

[a]For ground level sources, monitors/inlet probes should be placed as close to the breathing zone as possible.

[b]When probe is located on rooftop, this separation distance is in reference to walls, parapets, or penthouses located on the roof.

[c]Distance is dependent on height of furnace or incineration flue, type of fuel or waste burned, and quality of fuel. This is to avoid undue influences from minor pollutant sources.

4. QUALITY ASSURANCE FOR AIR QUALITY DATA

On May 10, 1979, EPA promulgated quality assurance requirements for PSD monitoring for SO_2, NO_2, O_3, CO, and TSP. These quality assurance requirements were revised and updated on March 19, 1986 [15]. These quality assurance requirements are Appendix B of 40 CFR 58 (reference 7). Section 4.1 describes minimum quality assurance requirements for PSD monitoring for all criteria air pollutants (SO_2, NO_2, O_3, CO, TSP, Pb and PM_{10}). Monitoring organizations are required to meet quality assurance requirements of Appendix B at the time the station is put into operation.

Currently, quality assurance for PSD monitoring for noncriteria air pollutants are EPA recommendations only. EPA promulgated requirements are not available for noncriteria air pollutants. Section 4.2 describes minimum quality assurance recommendations for noncriteria air pollutants.

4.1 Quality Assurance for Criteria Air Pollutants

4.1.1 General Information

The following specifies the minimum quality assurance requirements of an organization operating a network of PSD stations. These requirements are regarded as the minimum necessary for the control and assessment of the quality of the PSD ambient air monitoring data submitted to EPA. Organizations are encouraged to develop and implement quality assurance programs more extensive than the minimum required or to continue such programs where they already exist.

Quality assurance consists of two distinct and equally important functions. One function is the assessment of the quality of the monitoring data by estimating their precision and accuracy. The other function is the control, and improvement, of the quality of the monitoring data by implementation of quality control policies, procedures, and corrective actions. These two functions form a control loop; when the assessment function indicates that the data quality is inadequate, the control effort must be increased until the data quality is acceptable.

In order to provide uniformity in the assessment and reporting of data quality, the assessment procedures are specified explicitly in Sections 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

In contrast, the control and corrective action function encompasses a variety of policies, procedures, specifications, standards, and corrective measures which have varying effects on the resulting data quality. The selection and degree of specific control measures and corrective actions used depend on a number of factors such as the monitoring methods and equipment used, field and laboratory conditions, the objectives of the monitoring, the level of data quality needed, the expertise of personnel, the cost of control procedures, pollutant concentration levels, etc.

Accordingly, quality control requirements are specified in general terms, in Section 4.1.2 to allow each organization to develop a quality control system which is most effective for its own circumstances.

For purposes here, "organization" is defined as a source owner/operator, a government agency, or their contractor which operates an ambient air pollution monitoring network for PSD purposes.

4.1.2 Quality Control Requirements

4.1.2.1 Organizational Requirements - Each organization must develop and implement a quality control program consisting of policies, procedures, specifications, standards and documentation necessary to:

(a) meet the monitoring objectives and quality assurance requirements of the permit granting authority

(b) minimize loss of air quality data due to malfunctions or out-of-control conditions,

The quality control program must be described in detail, suitably documented, and approved by the permit granting authority.

4.1.2.2 Primary Guidance - Primary guidance for developing the quality control program is contained in references 38 and 39, which also contain many suggested procedures, checks, and control specifications. Section 2.0.9 of reference 39 describes the specific guidance for the development of a quality control program for PSD automated analyzers and manual methods. Many specific quality control checks and specifications for manual methods are included in the respective reference methods described in 40 CFR 50, or in the respective equivalent method descriptions available from EPA (see Section 2.6). Similarly, quality control procedures related to specifically designated reference and equivalent analyzers are contained in their respective operation and instruction manuals. This guidance, and any other pertinent information from appropriate sources, should be used by organizations in developing their quality control programs.

As a minimum each quality control program must have operational procedures for each of the following activities:

(a) selection of methods, analyzers, or samplers,
(b) installation of equipment,
(c) calibration,
(d) zero and span checks and adjustments of automated analyzers,
(e) control checks and their frequency,
(f) control limits for zero, span and other control checks, and respective corrective actions when such limits are surpassed,
(g) calibration and zero/span checks for multiple range analyzers
(h) preventive and remedial maintenance
(i) recording and validating data
(j) documentation of quality control information.

As previously mentioned, specific guidance for each activity listed above that must be a part of an organization's quality control program is described in Section 2.0.9 of reference 39.

4.1.2.3 Pollutant Standards - Gaseous standards (permeation tubes, permeation devices or cylinders of compressed gas) used to obtain test concentrations for CO, SO_2, and NO_2 must be working standards certified by comparison to a National Bureau of Standards (NBS) gaseous Standard Reference Material (SRM). A traceability protocol for certifying a working standard by direct comparison to an NBS SRM is given in reference 40. Direct use of an NBS SRM as a working standard is not prohibited but is discouraged because of the limited supply and expense of NBS SRM's. When available, gas manufacturers' cylinder gases Certified Reference Materials "CRM" may be substituted for NBS SRM cylinder gases in establishing traceability.

Test concentrations for ozone must be obtained in accordance with the UV photometric calibration procedure specified in Appendix D of 40 CFR 50, or by means of an ozone transfer standard which has been certified. Consult reference 41 for guidance on ozone transfer standards.

Flow measurements must be made by a flow measuring instrument which is traceable to an authoritative volume or other standard.

4.1.2.4 Performance and System Audit Programs - The organization operating a PSD monitoring network must participate in EPA's national performance audit program. The permit granting authority, or EPA, may conduct system audits of the ambient air monitoring programs of organizations operating PSD networks. See Section 1.4.16 of reference 38 and Sections 2.0.11 and 2.0.12 of reference 39 for additional information about these programs. Organizations should contact either the appropriate EPA Regional Quality Control Coordinator or the Quality Assurance Division, EMSL/RTP, at the address given in reference 40 for instructions for participation.

4.1.3 Data Quality Assessment Requirements

4.1.3.1 Precision of Automated Methods - A one-point precision check must be carried out at least once every two weeks on each automated analyzer used to measure SO_2, NO_2, O_3, and CO. The precision check is made by challenging the analyzer with a precision check gas of known concentration between 0.008 and 0.10 ppm for SO_2, NO_2, and O_3 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 4.1.2.3. Except for certain CO analyzers described below, 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 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 zero/span adjustment, it must be made prior to such zero and span adjustments. The difference between the actual concentration of the precision check gas and the concentration indicated by the analyzer is used to assess the precision of the monitoring data as described in Section 4.1.4.1. Report data only from automated analyzers that are approved for use in the PSD network.

4.1.3.2 Accuracy of Automated Methods - Each sampling quarter audit each analyzer that monitors for SO_2, NO_2, O_3, or CO at least once. The audit is made by challenging the analyzer with at least one audit gas of known concentration from each of the following ranges which fall within the measurement range of the analyzer being audited:

Audit Point	Concentration Range, ppm		
	SO_2, O_3	NO_2	CO
1	0.03 to 0.08	0.03 to 0.08	3 to 8
2	0.15 to 0.20	0.15 to 0.20	15 to 20
3	0.35 to 0.45	0.35 to 0.45	35 to 45
4	0.80 to 0.90		80 to 90

The standards from which audit gas test concentrations are obtained must meet the specifications of Section 4.1.2.3. Working and transfer standards and equipment used for auditing must be different from the standards and equipment used for calibration and spanning. The auditing standards and calibration standards may be referenced to the same NBS SRM or primary UV photometer. The auditor must not be the operator/analyst who conducts the routine monitoring, calibration, and analysis.

The audit shall be carried out by allowing the analyzer to analyze an audit test atmosphere in the same manner as described for precision checks in Section 4.1.3.1. The exception given in Section 4.1.3.1 for certain CO analyzers does not apply for audits.

The difference between the actual concentration of the audit test gas and the concentration indicated by the analyzer is used to assess the accuracy of the monitoring data as described in Section 4.1.4.2. Report data only from automated analyzers that are approved for use in the PSD network.

4.1.3.3 Precision of Manual Methods - (a) TSP and PM_{10} Methods. For a given organization's monitoring network, one sampling site must have collocated samplers. A site with the highest expected 24-hour pollutant concentration must be selected. The two samplers must be within 4 meters of each other but at least 2 meters apart to preclude airflow interference. Calibration, sampling, and analysis must be the same for both collocated samplers as well as for all other samplers in the network. The collocated samplers must be operated as a minimum every third day when continuous sampling is used. When a less frequent sample schedule is used, the collocated samplers must be operated at least once each week. For each pair of collocated samplers, designate one sampler as the sampler which will be used to report air quality for the site and designate the other as the duplicate sampler. The differences in measured concentration (g/m^3) between the two collocated samplers are used to calculate precision as described in Section 4.1.5.1.

(b) Pb Methods. The operation of collocated samplers at one sampling site must be used to assess the precision of the reference or an equivalent lead method. The procedure to be followed for lead methods is the same as described in 4.1.3.3(a) for the TSP and PM_{10} methods.

4.1.3.4 Accuracy of Manual Methods - (a) TSP and PM_{10} Methods. Each sampling quarter audit the flow rate of each sampler at least once. Audit the flow at the normal flow rate, using a certified flow transfer standard (see reference 39). The flow transfer standard used for the audit must not be the same one used to calibrate the flow of the sampler being audited, although both transfer standards may be referenced to the same primary flow or volume standard. The difference between the audit flow measurement and the flow indicated by the sampler's flow indicator is used to calculate accuracy, as described in Section 4.1.5.2

Great care must be used in auditing high-volume samplers having flow regulators because the introduction of resistance plates in the audit device can cause abnormal flow patterns at the point of flow sensing. For this reason, the orifice of the flow audit device should be used with a normal glass fiber 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.

(b) Pb Methods. For the reference method (Appendix G of 40 CFR 50) each sampling quarter audit the flow rate of each high-volume lead sampler at least once. Audit the flow rate at one flow rate using a reference flow device described in Section 2.2.8 of reference 39, or a similar flow transfer standard. The device used for auditing must be different from the one used to calibrate the flow of the high-volume sampler being audited. The auditing device and the calibration device may both be referenced to the same primary flow standard. With the audit device in place, operate the high-volume sampler at its normal flow rate. The difference in flow rate (in m^3/min) between the audit flow measurement and the flow indicated by the sampler's normal flow indicator are used to calculate accuracy as described in Section 4.1.5.3.

Great care must be used in auditing high-volume sampler having flow regulators because the introduction of resistance plates in the audit device can cause abnormal flow patterns at the point of flow sensing. For this reason, the orifice of the flow audit device should be used with a normal glass fiber filter in place without resistance plates to audit 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.

Each sampling quarter, audit the lead analysis using glass fiber filter strips containing a known quantity of lead. Audit samples are prepared by depositing a lead solution on 1.9 cm by 20.3 cm (3/4 inch by 8 inch) unexposed glass fiber filter strips and allowing to dry thoroughly. The audit samples must be prepared using reagents different from those used to calibrate the lead analytical equipment being audited. Prepare audit samples in the following concentration ranges:

Range	Conc. ug Pb/strip	Equivalent Ambient Conc. ug Pb/m^3*
1	100 to 300	0.5 to 1.5
2	600 to 1000	3.0 to 5.0

*Equivalent ambient lead concentration in ug/m^3 is based on sampling at 1.7 m^3/min for 24 hours on 20.3 cm x 25.4 (8 inch x 10 inch) glass fiber filter.

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

Analyze at least one audit sample in each of the two ranges each day that samples are analyzed. The difference between the audit concentration (in ug Pb/strip) and the analyst's measured concentration (in ug Pb/strip) are used to calculate analysis accuracy as described in Section 4.1.5.4.

The accuracy of an equivalent method is assessed in the same manner as the reference method. The flow auditing device and lead analysis audit samples must be compatible with the specific requirements of the equivalent method.

4.1.4 Calculations for Automated Methods

4.1.4.1 Single Analyzer Precision - Each organization, at the end of each sampling quarter, shall calculate and report a precision probability interval for each analyzer. Directions for calculations are given below and directions for reporting are given in Section 4.1.6. If monitoring data are invalidated during the period represented by a given precision check, the results of that precision check shall be excluded from the calculations. Calculate the percentage difference (d_i) for each precision check using equation 1.

$$d_i = \frac{Y_i - X_i}{X_i} \times 100 \qquad (1)$$

where: Y_i = analyzer's indicated concentration from the i-th precision check,

X_i = known concentration of the test gas used for the i-th precision check.

For each instrument, calculate the quarterly average (d_j), equation 2, and the standard deviation (S_j), equation 3.

$$\bar{d}_j = \frac{1}{n} \sum_{i=1}^{n} d_i \qquad (2)$$

$$S_j = \sqrt{\frac{1}{n-1} \left[\sum_{i=1}^{n} d_i^2 - \frac{1}{n} \left(\sum_{i=1}^{n} d_i \right)^2 \right]} \qquad (3)$$

Where n is the number of precision checks on the instrument made during the sampling quarter. For example, n should be 6 or 7 if span checks are made bi-weekly during a quarter.

Calculate the 95 percent probability limits for precision using equations 4 and 5.

Upper 95 Percent Probability Limit = $d_j + 1.96\ S_j$ (4)

Lower 95 Percent Probability Limit = $d_j - 1.96\ S_j$ (5)

4.1.4.2 Single Analyzer Accuracy - Each organization, at the end of each sampling quarter, shall calculate and report the percentage difference for each audit concentration for each analyzer audited during the quarter. Directions for calculations are given below (directions for reporting are given in Section 4.1.6).

Calculate and report the percentage difference (d_i) for each audit concentration using equation 1 where Y_i is the analyzer's indicated concentration from the i-th audit check and X_i is the known concentration of the audit gas used for the i-th audit check.

4.1.5 Calculations for Manual Methods

4.1.5.1 Single Instrument Precision for TSP, Pb, and PM_{10}. Estimates of precision for ambient air quality particulate measurements are calculated from results obtained from collocated samplers as described in section 4.1.2.3. At the end of each sampling quarter, calculate and report a precision probability interval, using weekly results from the collocated samplers. Directions for calculations are given below, and directions for reporting are given in Section 4.1.6.

For the paired measurements obtained as described in sections 4.1.2.3(a) and 4.1.2.3(b), calculate the percent difference (d_i) using equation 1a, where Y_i is the concentration of pollutant measured by the duplicate sampler, and X_i is the concentration measured by the sampler reporting air quality for

the site. Calculate the quarterly average percent difference (d_j), equation 2, standard deviation (S_j), equation 3, and upper and lower 95 percent probability limts for precision (equations 6 and 7).

$$d_i = \frac{Y_i - Y_i}{(Y_i + X_i)/2} \times 100 \qquad (1a)$$

$$\text{Upper 95 Percent Probability Limit} = d_j + 1.96\ S_j/\sqrt{2} \qquad (6)$$

$$\text{Lower 95 Percent Probability Limit} = d_j - 1.96\ S_j/\sqrt{2} \qquad (7)$$

4.1.5.2 Single Instrument Accuracy for TSP and PM_{10} - Each organization, at the end of each sampling quarter, shall calculate and report the percentage difference for each high-volume or PM_{10} sampler audited during the quarter. Directions for calculation are given below and directions for reporting are given in Section 4.1.6.

For the flow rate audit described in Section 4.1.3.4, let X_i represent the known flow rate and Y_i represent the indicated flow rate. Calculate the percentage difference (d_i) using equation 1.

4.1.5.3 Single Instrument Sampling Accuracy for Pb - Each organization, at the end of each sampling quarter, shall calculate and report the percentage difference for each high-volume lead sampler audited during the quarter. Directions for calculation are given in Section 4.1.5.2 and directions for reporting are given in Section 4.1.6.

4.1.5.4 Single-Analysis-Day Accuracy for Pb - Each organization, at the end of each sampling quarter, shall calculate and report the percentage difference for each Pb analysis audit during the quarter. Directions for calculations are given below and directions for reporting are given in Section 4.1.6.

For each analysis audit for Pb described in Section 4.1.3.4(b), let X_i represent the known value of the audit sample and Y_i the indicated value of Pb. Calculate the percentage difference (d_i) for each audit at each concentration level using equation 1.

4.1.6 Organization Reporting Requirements

At the end of each sampling quarter, the organization must report the following data assessment information: (a) for automated analyzers - precision probability limits from Section 4.1.4.1 and percentage differences from Section 4.1.4.2, and (b) for manual methods - precision probability limits from Section 4.1.5.1 and percentage differences from Sections 4.1.5.2, 4.1.5.3 and 4.1.5.4. The precision and accuracy information for the entire sampling quarter must be submitted with the air monitoring data. All data used to calculate reported estimates of precision and accuracy including span checks, collocated sampler and audit results must be made available to the permit granting authority upon request.

4.2 Quality Assurance for Noncriteria Air Pollutants

At the present time, there are no EPA regulations on quality assurance for PSD monitoring of noncriteria air pollutants. The following are EPA recommendations for a minimum quality assurance program for noncriteria pollutants.

4.2.1 Selection of Method

Selection of the measurement method for noncriteria air pollutants is extremely important. A list of acceptable measurement methods for noncriteria air pollutants is available and may be obtained by writing: U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Quality Assurance Division (MD-77), Research Triangle Park, North Carolina 27711. This list of acceptable methods will be revised at least annually and be available from the above address. Measurement methods considered candidates for the noncriteria pollutant list should be brought to the attention of EPA at the address given above.

4.2.2 Calibration

Calibration procedures described in the acceptable methods should be followed and a schedule for calibrations should be established. In addition, flow measurement devices used to measure sampling rate should be calibrated and a schedule established for recalibration. Calibration procedures for several flow measurement devices (rotameter, critical orifice, mass flow meter, and wet test meter) are described in Section 2.1.2 of reference 39. All calibration procedures should be written and maintained up-to-date by a document control system. A description of one document control system that has been found to be effective is discussed in Section 1.4.1 of reference 38.

4.2.3 Data Validation

Measurement data of poor quality may be worse than no data at all. Therefore, the monitoring organization should establish data validation procedures and implement these procedures to invalidate data of questionable quality. Examples of data validation procedures for criteria pollutants described in Section 2.0.9 of reference 39 may be useful as a guide in establishing data validation procedures for noncriteria pollutants.

4.2.4 Standard and Split Samples

Where possible, standard samples containing the pollutant of interest should be analyzed periodically during the analysis of collected samples. This practice is useful in helping to determine if the analytical system is in control. Splitting samples with another laboratory is quite useful in determining if there are unidentified biases in the analytical system.

5. METEOROLOGICAL MONITORING

5.1 Data Required

The preconstruction review of proposed major emitting facilities will require the use of meteorological data. It is essential that such data be representative of atmospheric dispersion conditions at the source and at locations where the source may have a significant impact on air quality. The representativeness of the data is dependent upon (a) the proximity of the meteorological monitoring site to the area under consideration, (b) the complexity of the topography of the area, (c) the exposure of the meteorological sensors, and (d) the period of time during which the data are collected. More guidance for determining representativeness is presented in reference 42.

A data base representative of the site should consist of at least the following data:

a. hourly average wind speed and direction

b. hourly average atmospheric stability based on Pasquill stability category or wind fluctuations (σ_θ), or vertical temperature gradient combined with wind speed

c. hourly surface temperature at standard height for climatological comparisons and plume rise calculations

d. hourly precipitation amounts for climatological comparisons.

In addition, hourly average mixing heights may be necessary for the air quality impact analysis. In most cases, this may be limited to an extrapolation of twice-daily radiosonde measurements routinely collected by the National Weather Service (NWS). Sections 5.2 and 6.1 contain specific information on instrument exposure and specifications.

Requirements for additional instrumentation and data will depend upon the availability of information needed to assess the effects of pollutant emissions on ambient air quality, soils, vegetation, and visibility in the vicinity of the proposed source. The type, quantity, and format of the required meteorological data will also be influenced by the input requirements of the dispersion modeling techniques used in the air quality analysis. Any application of dispersion modeling must be consistent with the EPA "Guideline on Air Quality Models" [14]. The guideline makes specific recommendations concerning air quality models and data bases. It also specifies those situations for which models, data, and techniques other than those recommended therein, may be applied.

Site-specific data are always preferable to data collected off-site. The availability of site-specific meteorological data permits relatively detailed meteorological analyses and subsequent improvement of dispersion model estimates. An important source of background information pertaining to on-site meteorological instrumentation is contained in an EPA workshop report [43]. Off-site meteorological data may be used in lieu of site-specific data only if it is agreed by source owner and permit granting authority that the off-site data are reasonably representative of atmospheric conditions in the area under consideration. The off-site meteorological data can sometimes be derived from routine measurements by NWS stations. The data are available as individual observations and in summarized form from the National Climatic Data Center, Federal Building, Asheville, NC 28801. On the other hand, if the nearest source of off-site data is considerably removed from the area under consideration, and especially if there are significant terrain features, urban areas, or large bodies of water nearby, it may be necessary that the required meteorological data be site-specific.

In some cases, it will be necessary that data be collected at more than one site in order to provide a reasonable representation of atmospheric conditions over the entire area of concern. Atmospheric conditions may vary considerably over the area. In some cases, (e.g., complex terrain) it will not be feasible to adequately monitor the entire meteorological field of concern. Then the only recourse is to site the stations in areas where characteristic and significant airflow patterns are likely to be encountered. In any event, one of the meteorological stations should be located so that it represents atmospheric conditions in the immediate vicinity of the source.

Although at least 1 year of meteorological data should be available, a shorter period of record that conforms to the air quality monitoring period of record discussed in Section 2.5 is acceptable when approved by the permit granting authority. If more than 1 year of data is available, it is recommended that such data be included in the analysis. Such a multiyear data base allows for more comprehensive consideration of variations in meteorological conditions that occur from year to year. A 5-year period of record will usually yield an adequate meteorological data base for considering such year-to-year variations.

In all cases, the meteorological data used must be of at least the quality of data collected by the National Weather Service. Desired features of instrumentation for collecting meteorological data are discussed in Section 6.1.

5.2 Exposure of Meteorological Instruments

Measurements of most meteorological parameters are affected by the exposure of the sensor. To obtain comparable observations at different sites, the exposures must be similar. Also, the exposure should be such that the measured parameters provide a good representation of pollutant transport and dispersion within the area that the monitoring site is supposed to represent. For example, if wind flow data over a fairly broad area are desired, the wind sensors should be away from the immediate influence of trees, buildings, steep slopes, ridges, cliffs, or hollows.

The standard exposure of wind instruments over level open terrain is 10 meters above the ground. Open terrain is defined as an area where the distance between the anemometer and any obstruction to the wind flow is at least five times the height of the obstruction. Where a standard exposure is unobtainable at this height, the anemometer should be installed at such a height that its indications are reasonably unaffected by local obstructions and represent as closely as possible what the wind at 10 meters would be in the absence of the obstructions. Detailed guidance on assessing adverse aerodynamic effects due to local obstructions is contained in reference 44. In locating wind sensors in rough terrain or valley situations, it will be necessary to determine if local effects such as channeling, slope and valley winds, etc., are important, or whether the flow outside those zones of influence is to be measured. If the analysis concerns emissions from a tall stack, it may be desirable to avoid the local influences. On the other hand, if pollution from low-level sources is the main concern, the local influences may be important.

If the source emission point is substantially above the standard 10-meter level for wind measurements, additional wind measurements at the height of the emission point and at plume height are desirable. Such measurements are used to determine the wind regime in which the effluent plume is transported away from the source. (The wind speed and direction 50 to 100 meters or more above the surface are often considerably different than at the 10-meter level.) An instrumented tower is the most common means of obtaining meteorological measurements at several elevations in the lower part of the atmospheric boundary layer. For wind instruments mounted on the side of a tower, precautions must be taken to ensure that the wind measurements are not unduly influenced by the tower. Turbulence in the immediate wake of a tower (even a latticetype tower) can be severe. Thus, depending on the supporting structure, wind measuring equipment should be mounted (e.g., on booms) at least two structure widths away from the structure, and two systems mounted on opposite sides of the structure will sometimes be necessary. A wind instrument mounted on top of a tower should be mounted at least one tower width above the top. If there is no alternative to mounting instruments on a stack, the increased turbulence problem [45], must be explicitly resolved to the satisfaction of the permit granting authority.

Atmospheric stability is another key factor in pollutant dispersion downwind of a source. The stability category is a function of static stability (related to temperature change with height), convective turbulence (caused by heating of the air at ground level), and mechanical turbulence (a function of wind speed and surface roughness). A procedure for estimating stability category is given by Turner [46] which requires information on solar elevation angle, cloud cover, ceiling height, and wind speed. The hourly observations at NWS stations include cloud cover, ceiling height, and wind speed. Alternative procedures for estimating stability category may be applied if representative data are available. For example, stability category estimates may be based upon horizontal wind direction fluctuations [47], or vertical gradients of temperature and wind speed [48]. To obtain a representative reading of the air temperature, the temperature sensor should be protected from thermal radiation from the sun, sky, earth, and any surrounding objects, and must be adequately ventilated. Aspirated radiation shields are designed to provide such protection. (Note that ambient temperature data are also commonly required for plume rise estimates used in dispersion model calculations.)

Mixing height is another parameter that can be important in some cases. Mixing height is the distance above the ground to which relatively free vertical mixing occurs in the atmosphere. For estimating long-term average concentrations, it is adequate to use a representative annual average mixing height [49]. However, in many cases, and especially for estimates of short-term concentrations, twice-daily or hourly mixing height data are necessary. Such data can sometimes be derived [49] from representative surface temperatures and twice-daily upper air soundings collected by selected NWS stations.

Precipitation collectors must be located so that obstructions do not prevent the precipitation from falling into the collector opening or force precipitation into the opening. Several collectors may be required for adequate spatial resolution in complex topographic regimes.

Final rule making entitled "Visibility Protection for Federal Class I Areas," was published in the Federal Register on December 2, 1980. The regulations are applicable to 36 States listed in the action. Although these States are not required to establish visibility monitoring networks, they should consult with the Federal Land Managers to determine monitoring needs. Paragraph 51.305 states that the SIP strategies "must take into account current and anticipated visibility monitoring research, the availability of appropriate monitoring techniques and such guidance as is provided by the Agency." Visibility definitions, monitoring methods, modeling considerations and impact assessment approaches are among the subjects of three EPA reports: (1) "Protecting Visibility: An EPA Report to Congress" [50], (2) "Interim Guidance for Visibility Monitoring" [51], and (3) "Workbook for Estimating Visibility Impairment" [52]. Also, since publication of the final rule, the National Park Service has established a visibility monitoring system. The States or permit granting authority should consider these resources when handling visibility new source review questions.

Additional information and guidance on siting and exposure of meteorological instruments is contained in reference 53.

6. METEOROLOGICAL INSTRUMENTATION

6.1 Specifications

Meteorological instrumentation used for PSD monitoring must yield reasonably accurate and precise data. Accuracies and allowable errors are expressed in this section as absolute values for digital systems; errors in analog systems may be 50 percent greater. For example, an allowable error expressed as 5 percent means the recorded value should be within ±5 percent of the true value for digital systems, and ±7.5 percent for analog systems. Records should be dated, and should be accurate to within 10 minutes. Wind speed and direction (or vector components) should be recorded on a digital data logging system at intervals not to exceed 60 seconds for a given variable; data recorded on continuous strip recorders at intervals not exceeding 60 seconds may be used as backup. These specifications apply to the meteorological instruments used to gather the site specific data that will accompany a PSD permit application. When the use of existing representative meteorological data is approved by the permit granting authority, the instrumentation should meet, as a minimum, NWS standards [54-55].

6.1.1 Wind Systems (horizontal wind)

Wind direction and wind speed systems should exhibit a starting threshold of less than 0.5 meter per second (m/s) wind speed (at 10 degrees deflection for direction vanes). Wind speed systems should be accurate above the starting threshold to within 0.25 m/s at speeds equal to or less than 5 m/s. At higher speeds, the error should not exceed 5 percent of the observed speed (maximum error not to exceed 2.5 m/s). The damping ratio of the wind vane should be between 0.4 and 0.65 and the distance constant should not exceed 5 m. Wind direction system errors should not exceed 5 degrees, including sensor orientation errors. Wind vane orientation procedures should be documented.

6.1.2 Wind Systems (vertical wind)

In complex terrain, downwash of plumes due to significant terrain relief may pose a problem. If such a problem potentially exists, it may be necessary to measure the vertical component of the wind at the proposed site, and as close as possible to stack height. The starting threshold for the vertical wind speed component should be less than 0.25 m/s. Required accuracy for the vertical wind speed component is as specified in Section 6.1.1 for horizontal speeds.

6.1.3 Wind Fluctuations

Determination of the on-site standard deviation of wind fluctuations, or derived standard deviations of cross-plume concentrations may be necessary if dispersion parameters are being developed for use at a specific site. Since the analytical framework within which such wind fluctuations measurements/

statistics are to be incorporated is expected to be unique or applied on a case-by-case basis, approval by the permit granting authority is required and no general requirements regarding specifications are outlined in this guideline. Considerable care is required in the selection of wind instruments and data logging systems, especially in the choice of sampling and averaging times. Thus, response characteristics of wind sensors are especially critical [56,57]. Owners or operators designing programs incorporating these capabilities should submit a statement from a qualified consultant identifying the adequacy of such wind system(s) within the context of the overall PSD ambient monitoring program.

6.1.4 Vertical Temperature Difference

Errors in measured temperature difference should not exceed 0.003 °C/m.

6.1.5 Temperature

Errors in temperatures should not exceed 0.5°C if fog formation, icing, etc., due to water spray or water vapor emitted from the facility may be a problem. Otherwise, errors should not exceed 1.0°C.

6.1.6 Humidity

Atmospheric humidity can be measured and expressed in several ways. If the permit granting authority determines that a significant potential exists for fog formation, icing, etc., due to effluents from the proposed facility, error in the selected measurement technique should not exceed an equivalent dewpoint temperature error of 0.5°C. Otherwise, errors in equivalent dewpoint temperature should not exceed 1.5°C over a dewpoint range of -30°C to +30°C.

6.1.7 Radiation - Solar and Terrestrial

The determination of Pasquill stability class may be based on whether the solar radiation is termed strong, moderate, or slight. Stability class can be determined from sun elevation and the presence, height, and amount of clouds [46], or by using a pyranometer and/or net radiometer during the daytime and a net radiometer at night. Such radiation-to-stability relationships are expected to be site-specific, and the responsibility for demonstrating their accuracy lies with the permit applicant. General accuracy for pyranometers and net radiometers used in a PSD monitoring network is expected to be ± 5 percent.

6.1.8 Mixing Height

Mixing height data may be derived from NWS upper air data. If available data are determined to be inappropriate by the permit granting authority, such data may be obtained on-site by the permit applicant [58]

The instrument system to be used is not specified in this guideline, but its precision and resolution should not exceed the limits associated with NWS radiosonde systems [54,55].

6.1.9 Precipitation

A recording precipitation collector should have a resolution of 0.25 mm (0.01 inches) liquid precipitation per hour at precipitation rates up to 7.6 cm/hour. Accuracy should be within 10 percent of the recorded value. A heated system should be used to assure proper measurement of frozen precipitation. A suitable windscreen should be used.

6.1.10 Visibility

Visibility can be measured within 5 percent of true over visual ranges of about 80 meters to 3 km with available transmissometers. Estimates can be based upon very short path lengths using other types of equipment such as nephelometers [59]. At this time, the combined use of a multi-wavelength telephotometer, integrating nephelometer and particulate monitor, together with color photography, should prove most helpful in documenting baseline visibility related parameters. These as well as other components of a visibility monitoring program, are discussed in reference 51. Reference 50 also contains much background information.

7. QUALITY ASSURANCE FOR METEOROLOGICAL DATA

All equipment should receive an appropriate examination and calibration prior to initial installation to assure the acquisition of the maximum amount of usable data within the error limits specified herein. Inspection, servicing, and calibration of equipment must be scheduled throughout the measurement program at appropriate intervals to assure at least 90 percent data retrieval for each variable measured at sites where continuous air quality monitors are being operated. At remote sites, data retrieval for measured variables should not fall below 80 percent. In addition, the joint frequency for the recovery of wind and stability data should not fall below 90 percent on an annual basis; missing data periods must not show marked correlation with the various meteorological cycles.

Calibration of systems should be accomplished no less frequently than once every 6 months. In corrosive or dusty areas, the interval should be reduced to assure adequate and valid data acquisition.

If satisfactory calibration of a measuring system can be provided only by the manufacturer or in special laboratories, such as wind-tunnel facilities, arrangements should be made for such calibrations prior to acquisition of the equipment. A parts inventory should be maintained at a readily accessible location to minimize delays in restoring operations after system failures.

An independent meteorological audit (by other than one who conducts the routine calibration and operation of the network) should be performed to provide an on-site calibration of instruments as well as an evaluation of (a) the network installation, (b) inspection, maintenance, and calibration procedures, and logging thereof, (c) data reduction procedures, including spot checking of data, and (d) data logging and tabulation procedures. The on-site visit (requiring as little as 1 day in many cases) should be made within 60 days after the network is first in full operation, and a written audit/evaluation should be provided to the owner. This report should be retained by the owner. Any problems should be corrected and duly noted as to action taken in an addendum to the audit report. A reproducible copy of the audit report and the addendum should be furnished with the source construction permit application.

Such independent meteorological audit-evaluations should be performed about each 6 months. The last such inspection should be made no more than 30 days prior to the termination of the measurement program, and while the measurement operation is in progress.

The 1983 publication "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements" [60] should be consulted for more information. Major sections in this volume address (1) quality assurance of the measurement process, (2) methods for judging the suitability of sensor siting, and (3) meteorological data validation.

8. DATA REPORTING

8.1 Air Quality Data Reporting

A summary of the air quality data, the raw air quality data, and the quality assurance data discussed in Section 4.1.6 must be submitted to the permit granting authority at the time of submittal of the PSD application. There should be a prior agreement between the source and the permit granting authority as to whether the raw data should be submitted in addition to a summary of the data. Some sources may also desire to submit data periodically to the permit granting authority for review to identify any problems in the data as they occur. Note that this is not a requirement. The applicant and the permit granting authority should have a prior agreement as to the format and procedure for the data submission. The air quality data should preferably be submitted in SAROAD format and in a machine readable form. A printout of the contents of the tape or cards should also be included. All raw data not previously submitted (i.e., calibration data, flow rates, etc.) should be retained for 3 years and submitted upon request to the permit granting authority.

For continuous analyzers, at least 80 percent of the individual hourly values should be reported by the source in any sampling period. For manual methods (TSP and particulate pollutants), 80 percent of the individual 24-hour values should be reported in any sampling period. This capture rate is important because of the short duration of a PSD monitoring program. In addition, there should not be a correlation between missing data periods and expected highest concentrations.

8.2 Meteorological Data Format and Reporting

Because of the different data requirements for different types of analyses that might be used to evaluate various facilities, there is no fixed format that applies to all data sets. However, a generalization can be made: all meteorological parameters must be collated in chronological order and tabulated according the observation time, and be furnished to the permit granting authority upon request. All meteorological variables that have a SAROAD parameter code should be submitted in SAROAD format. All units should be in the SI system (International System of Units) [61]. All input data (in the format required by the analytical procedures selected) used in, and all results of, the air quality analyses must be furnished to the permit granting authority upon request.

APPENDIX A

PROCEDURES TO DETERMINE IF MONITORING DATA WILL BE REQUIRED FOR A PSD APPLICATION

1. INTRODUCTION

This appendix has been included in this guideline to aid both the reviewing authorities and the source applicants in determining if monitoring data will or will not be required under PSD. The major considerations leading to a monitoring data decision have been simplified for presentation in this appendix. This discussion represents the Federal requirements and the minimum State program requirements. It is important to identify the reviewing authority, whether it be the local or State air pollution control agency, or the Regional Office of EPA for the final requirements. For a complete discussion on the complex PSD issues, the reader is referred to the PSD regulations and the preamble discussion [5,6].

2. PSD PERMIT APPLICATION PROCEDURES

Figure A-1 shows a simplified organizational overview of the procedures to be followed in the preparation of a PSD permit application. Figure A-1 shows that these procedures are divided into seven parts. This division is only for illustrative purposes within this appendix and is intended only to separate the complex procedures into distinct subparts. Within the Part 1-Source Applicability Determination, both candidate new and modified major sources are reviewed to see if PSD review will apply. The Part 2-Pollutant Applicability Determination shows those pollutants emitted from subject sources that may or may not be exempted from further analysis. The Part 3-BACT Analysis is to ensure the application of best available control technology (BACT) on subject pollutants. Air quality analysis covered in Part 4 includes both modeling and monitoring data considerations for certain BACT pollutants. The Part 5-Source Impact Analysis is to demonstrate that the proposed emissions would not cause or contribute to a violation of any NAAQS or PSD increment. The Part 6-Additional Impact Analysis is to ensure that the proposed emissions increases would not impair visibility, or impact on soils and vegetation. Finally, Part 7 represents the complete PSD application which transfers to the permit granting authority the results of all the analysis from the first six parts. Normally, the source applicant will supply all the information including the BACT and air quality analyses to make the necessary determinations. Each of these seven parts is discussed below in Sections 2.1-2.7. Section 3 contains flow diagrams and discussion of the first four parts that pertain to the decision whether monitoring data will or will not be required.

2.1 Part 1 - Source Applicability Determination

The first step in the PSD program is to determine if a proposed new or modified source is subject to the PSD regulations. The first test for PSD applicability is that the proposed construction must involve a major stationary source. Thus, the candidate construction must either be a proposed new major stationary source or involve the modification of an existing major stationary source. The criteria in determining whether

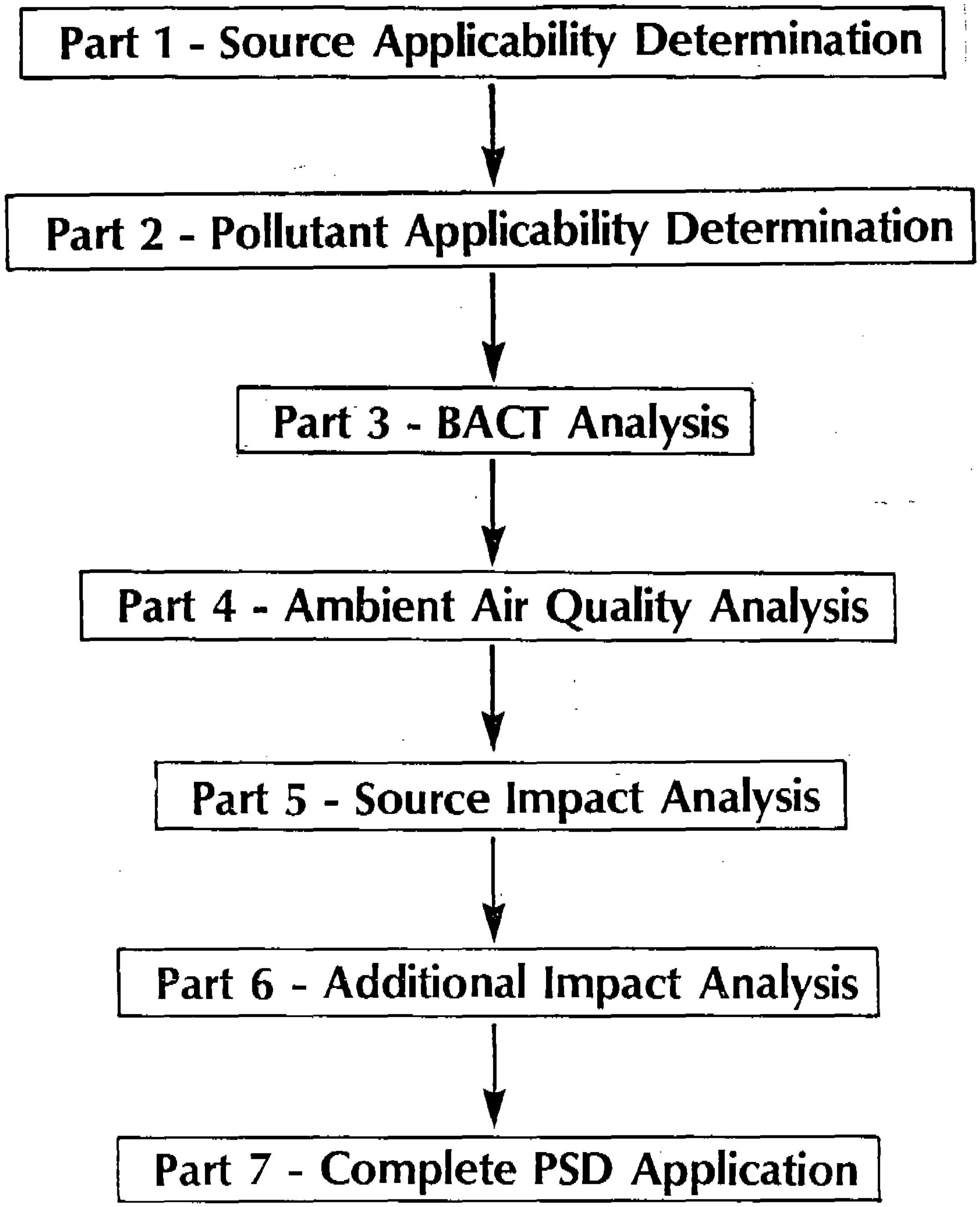


Figure A-1. Simplified procedures for the preparation of a PSD permit application.

the affected source is sufficiently large (in terms of emissions) to be a new major stationary source or major modification is based on consideration of its potential to emit at rates exceeding certain threshold values. Potential to emit is the capability at maximum design capacity to emit a pollutant after the application of all required air pollution control equipment, taking into account all federally enforceable requirements restricting the type or amount of source operation. A major modification is generally a physical change in or a change in the method of operation of a major stationary source which would result in a significant net emissions increase for any regulated pollutant. (There are several changes that are exempted from being considered a major modification.) Also, the proposed source or modification must locate in a PSD area--an area designated as "attainment" or "unclassifiable." If the proposed source or modification would meet certain tests and commence construction in a continuous fashion at the proposed site within a reasonable time, a PSD permit under the August 7, 1980 regulations would not be necessary. Lastly, there are specific new sources and modifications that are exempted from PSD review. All of the above considerations are explained in more detail in Section 3 of this appendix.

If it is determined that a new source or modification is subject to the PSD regulations, then one must proceed to the Part 2-Pollutant Applicability Determination in order to learn how the pollutant-specific requirements of PSD may apply.

2.2 Part 2 - Pollutant Applicability Determination

If a source applicant has determined that a proposed new source or modification would be subject to the PSD requirements, then the applicant must assess whether the pollutants the project would emit are subject to PSD. If a new major stationary source emits pollutants for which the area it locates in is designated nonattainment, then the source is exempt from PSD review for those pollutants. These sources must, however, meet the applicable requirements of new source review (NSR) for each nonattainment pollutant. If a major construction proposed for a PSD area involves only changes for nonattainment pollutants, then the source is not subject to PSD. These sources must meet the appropriate nonattainment NSR under the SIP for the pollutant. Once the question of NSR jurisdiction is resolved, then the PSD review applies to significant emissions increases of regulated air pollutants.

Specific numerical cutoffs which define what emissions increases are "significant" are shown in Table A-1. These emissions rates will be used for pollutants to be emitted from a PSD source unless the new source or modification is to be located within 10 km of a Class I area [1]. For these situations, the proposed source or modification must be prepared to demonstrate that it would not have a significant impact with respect to a Class I area. A Class I significant impact is defined as one microgram per cubic meter (ug/m^3 or more for a 24-hour average. Further details on how the significant emission rates in Table A-1 were derived may be found in the preamble discussion of the PSD regulations [5].

TABLE A-1. SIGNIFICANT EMISSIONS RATES

Pollutant	Emissions Rate (tons/year)
Carbon monoxide	100
Nitrogen oxides	40
Sulfur dioxide	40
Particulate Matter	25 (TSP)
Particulate Matter	15 (PM_{10})
Ozone (volatile organic compounds)	40
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl chloride	1.0
Fluorides	3
Sulfuric acid mist	7
Total reduced sulfur (including H_2S)	10
Reduced sulfur (including H_2S)	10
Hydrogen sulfide	10

If the emissions from a new source will be significant, or if the net emissions increase from a proposed modification will be significant, then one must proceed to the Part 3-BACT Analysis for these pollutants.

2.3 Part 3 - BACT Analysis

Any major stationary source or major modification subject to PSD must conduct an analysis to ensure application of best available control technology (BACT) for all applicable pollutants. During each analysis, which will be done on a case-by-case basis, the reviewing authority will evaluate the energy, environmental, economic, and other costs associated with each alternative technology. The reviewing authority will then specify an emissions limitation for the source that reflects the maximum degree of reduction achievable with all these concerns in mind for each pollutant regulated under the Act. In no event can an emission limitation be required which would be less stringent than any applicable standard of performance under 40 CFR Parts 60 and 61.

After the BACT determination, the source must then investigate the need for each pollutant subject to BACT (BACT pollutant) to also undergo the remaining analyses for this pollutant.

2.4 Part 4 - Ambient Air Quality Analysis

Each application by a PSD source or modification must contain an air quality analysis for each BACT pollutant to demonstrate that its new pollutant emissions would not violate either the applicable NAAQS or the applicable PSD increment. This analysis ensures that the existing air quality is better than that required by national standards and that baseline air quality is not degraded beyond the applicable PSD increment. Two narrow exemptions to this requirement are specified in the regulations and involve certain existing sources with low BACT emissions and sources of temporary emissions meeting certain criteria.

In making the above determinations, many PSD sources must first assess the existing air quality for each applicable air pollutant that it emits in the affected area. The requirement to monitor existing air quality may not apply to (a) pollutants for which the new emissions proposed by the applicant would cause impacts less than the significant monitoring concentrations (Table A-2), or (b), situations where the background concentration of the pollutant is below the significant monitoring values. This exemption should not be used when there is an apparent threat to an applicable PSD increment or NAAQS based on modeling alone or when there is a question of adverse impact on a Class I area. When monitoring data are required, the applicant must provide ambient montioring data that represent air quality levels in the year's period preceding the PSD application. Where existing data are not judged representative or adequate, then the applicant must conduct its own monitoring program. Typically, monitoring data are used by applicants to support or extend the assessment made with air quality dispersion modeling.

TABLE A-2. SIGNIFICANT MONITORING CONCENTRATIONS

Pollutant	Air Quality Concentration (ug/m^3) and Averaging Time
Carbon monoxide	575 (8-hour)
Nitrogen dioxide	14 (Annual)
Sulfur dioxide	13 (24-hour)
Particulate Matter	10 (24-hour) for TSP
Particulate Matter	10 (24-hour) for PM_{10}
Ozone	a
Lead	0.1 (3-month)
Asbestos	b
Beryllium	0.001 (24-hour)
Mercury	0.25 (24-hour)
Vinyl chloride	15 (24-hour)
Fluorides	0.25 (24-hour)
Sulfuric acid mist	b
Total reduced sulfur (including H_2S)	c
Reduced sulfur (including H_2S)	c
Hydrogen sulfide	0.2 (1-hour)

[a]No specific air quality concentration for ozone is prescribed. Exemptions are granted when a source's VOC emissions are 100 tons/year.

[b]No acceptable monitoring techniques available at this time. Therefore, monitoring is not required until acceptable techniques are available.

[c]No acceptable monitoring techniques available at this time. However, techniques are expected to be available shortly.

In addition to the above discussion, EPA in general intends to limit the application of air quality models to a downwind distance of 50 kilometers. This is because dispersion parameters commonly in use are based on experiments relatively close to sources, and extending these parameters to long downwind distances results in great uncertainty as to accuracy of the model estimates at such distances. EPA does not intend to analyze the impact of a source beyond the point where the concentrations from the source fall below certain levels (generally based on Class I increments) shown in Table A-3. However, since the 1977 Clean Air Act Amendments provide special concern for Class I areas, any reasonably expected impacts for these areas must be considered irrespective of the 50 km limitation on the above significant values.*

2.5 Part 5 - Source Impact Analysis

The proposed source or modification must demonstrate that significant net emissions increases (including secondary emissions and fugitive emissions), would not cause or contribute to air pollution in the violation of any NAAQS or any applicable maximum allowable increase over the baseline concentration in any area.

2.6 Part 6 - Additional Impact Analysis

An applicant is also required to analyze whether its proposed emissions increases would impair visibility, or impact on soils or vegetation. Not only must the applicant look at the direct effect of source emissions on these resources, but it also must consider the impacts from general commercial, residential, industrial and other growth associated with the proposed source or modification.

2.7 Part 7 - File Complete PSD Application

After completion of the preceeding analyses, the source may submit a PSD application to the permit granting authority. The application, after being judged complete and being reviewed for proper determination of applicability, BACT, and air quality impacts, must undergo adequate

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*It should be noted that there are three separate and distinct sets of values which are considered "significant" within the PSD program:

(a) Significant emissions rates;
(b) Significant monitoring concentrations; and
(c) Significant ambient impacts (including the specific significant Class I area impacts).

As pointed out, each set of values has a different application, and therefore, this guideline has been worded to clarify the appropriate values to be used while assessing the need to collect monitoring data.

TABLE A-3. SIGNIFICANT AMBIENT AIR QUALITY IMPACTS

	Averaging Time				
Pollutant	Annual	24-Hour	8-Hour	3-Hour	1 Hour
SO_2	1 ug/m^3	5 ug/m^3	--	25 ug/m^3	--
PM_{10}	1 ug/m^3	5 ug/m^3	--	--	--
NO_2	1 ug/m^3	--	--	--	--
CO	--	--	0.5 mg/m^3	--	2 mg/m^3

NOTE: This table does not apply to Class I areas. A significant impact for Class I areas is 1 ug/m^3 on a 24-hour basis for PM_{10} and SO_2.

public participation. The regulations solicit and encourage participation by the general public, industry, and other affected persons impacted by the proposed major stationary source or major modification. Specific public notice requirements, including a public comment period and the opportunity for a public hearing must be met before the PSD review agency takes final action on a PSD application. The public notice must indicate whether the reviewing authority has proposed approval, denial, or conditional approval of the proposed major source or major modification. Consideration is given to all comments received provided they are relevant to the scope of the review.

The source shall also submit all information necessary to perform any analysis in Parts 1-6 above or make any determinations required in Parts 1-6. Such information shall include (a) a description of the nature, location, design capacity, and typical operating schedule of the proposed source or modification, including specifications and drawings showing its design and plant layout, (b) a detailed schedule for construction of the proposed source or modification, and (c) a detailed description as to what system of continuous emission reduction is planned for the proposed source or modification, emission estimates, and any other information necessary to determine that best available control technology would be applied. The proposed source or modification shall also provide information on (a) the air quality impact of the proposed source or modification, including meteorological and topographical data necessary to estimate such impact, and (b) the air quality impacts, and the nature and extent of any or all general commercial, residential, industrial, and other growth which has occurred since August 7, 1977 in any area the proposed source or modification would affect.

3. DECISIONS FOR MONITORING DATA REQUIREMENTS

Figure A-1 and the discussion that followed in Section 2 provided an overview of the various activities relating to a PSD permit application. This section will go into more detail on those activities that need to be considered in deciding if air quality monitoring data will be required.

It should be noted that the procedures described in this appendix do not include any details on how the modeling analyses are to be conducted but only indicate at what points (boxes) the results of such analyses are necessary. Also, while these procedures lead to a determination of when air quality monitoring is likely to be required, they do not lead to a decision as to when meteorological monitoring is necessary (for model input). Guidance on the requirements and procedures for conducting modeling analyses is contained in reference 14. Section 5 of this guideline describes general meteorological monitoring requirements, and reference 62 also provides further guidance on this subject.

Figures A-2 and A-3 show various steps that must be made for a proposed PSD source or modification in order to assess how the monitoring data requirement might apply. The decisions in these flow diagrams must be applied separately for each regulated pollutant that would be emitted from a proposed source or modification. Boxes 1-14 apply to Figure A-2 and boxes 15-29 apply to Figure A-3

Box 1. Is proposed source a major stationary source or major modification locating in a PSD area?

A major stationary source is defined as any one of 28 source categories (Table A-4) which emits, or has the potential to emit, 100 tons per year or more of any pollutant regulated under the Act. In addition, the definition includes any other stationary source which emits, or has the potential to emit, 250 tons per year or more of any regulated pollutant. Finally, major stationary source also means any physical change occurring at a stationary source (which prior to the change is not major) if the change by itself would be major. That is, the change itself would result in an equivalent stationary source which would emit 100 tons per year or more for any pollutant regulated under the Act for any one of the 28 source categories (Table A-4), or 250 tons per year for any other stationary source. The pollutants regulated under the Act were shown in Part 2-Pollutant Applicability Determination.

A stationary source generally includes all pollutant-emitting activities which belong to the same industrial grouping, are located on contiguous or adjacent properties, and are under common control. Pollutant activities which belong to the same major group as defined in a standard industrial classification scheme developed by the Office of Management and Budget are considered part of the same industrial grouping.

The rest of the PSD size applicability for proposed new stationary sources is simply that the candidate source would be a major stationary

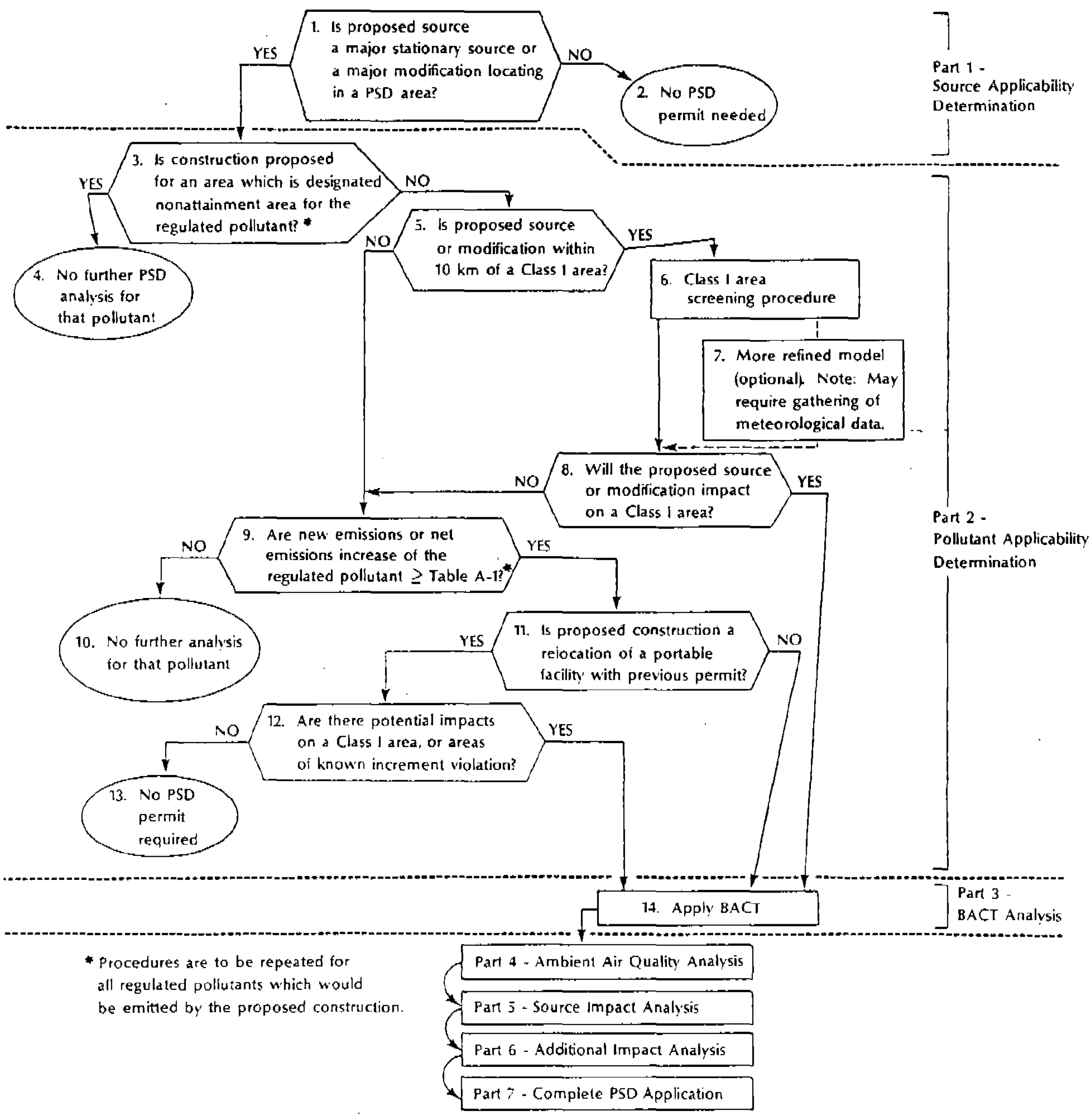

Figure A-2. Procedures used to determine the monitoring data requirement.

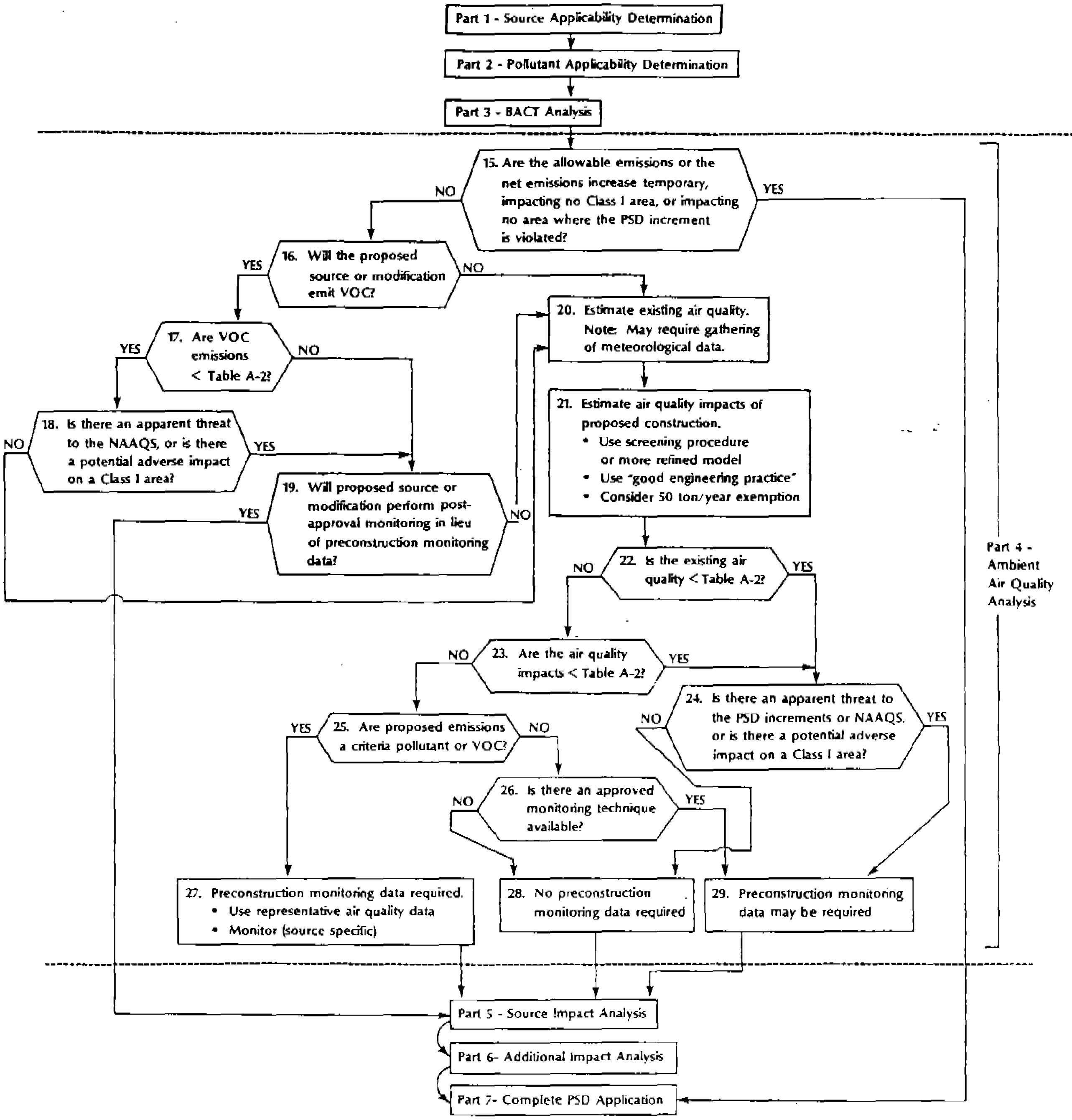

FIGURE A-3. PROCEDURES USED TO DETERMINE THE MONITORING DATA REQUIREMENT.

TABLE A-4. MAJOR STATIONARY SOURCES

1. Fossil-fuel fired steam electric plants of more than 250,000,000 British thermal units per hour heat input
2. Coal cleaning plants (with thermal dryers)
3. Kraft pulp mills
4. Portland cement plants
5. Primary zinc smelters
6. Iron and steel mill plants
7. Primary aluminum ore reduction plants
8. Primary copper smelters
9. Municipal incinerators capable of charging more than 250 tons of refuse per day
10. Hydrofluoric acid plants
11. Sulfuric acid plants
12. Nitric acid plants
13. Petroleum refineries
14. Lime plants
15. Phosphate rock processing plants
16. Coke oven batteries
17. Sulfur recovery plants
18. Carbon black plants (furnace process)
19. Primary lead smelters
20. Fuel conversion plants
21. Sintering plants
22. Secondary metal production plants
23. Chemical process plants
24. Fossil-fuel boilers (or combinations thereof) totaling of mcre than 250,000,000 British thermal units per hour heat imput
25. Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels
26. Taconite ore processing plants
27. Glass fiber processing plants
28. Charcoal production plants

source in terms of its potential to emit. The applicability rules for determining whether a major modification would occur are more complex.

A "major modification" is generally a physical change in or a change in the method of operation of a major stationary source which would result in a significant net emissions increase in the emissions of any regulated pollutant. In determining if a proposed increase would cause a significant net increase to occur, several detailed calculations must be performed. First, the source owner must quantify the amount of the proposed emissions increase. This amount will generally be the potential to emit of the new or modified unit. Second, the owner must document and quantify all emissions increases and decreases that have occurred or will occur contemporaneously (generally within the past five years) and have not been evaluated as part of a PSD review. The value of each contemporaneous decrease and increase is generally determined by subtracting the old level of actual emissions from the new or revised one. Third, the proposed emissions increase and the unreviewed contemporaneous changes must then be totalled. Finally, if there is a resultant net emissions increase that is larger than values specified in Table A-1, the modification is major and subject to PSD review.

Certain changes are exempted from the definition of major modification. These include: (a) routine maintenance, repair and replacement; (b) use of an alternative fuel or raw material by revision of an order under sections 2(a) and (b) of the Energy Supply and Environmental Coordination Action of 1974 (or any superseding legislation); (c) use of an alternative fuel by reason of an order or rule under section 125 of the Clean Air Act; (d) use of an alternative fuel at a steam generating unit to the extent it is generated from municipal solid waste; (e) use of an alternative fuel or raw material which the source was capable of accommodating; before January 6, 1975 or which the source is approved to use under any permit issued under 40 CFR 52.21, or under regulations approved pursuant to 40 CFR 51.24; and (f) an increase in the hours of operation, or the production rate. The last two exemptions, (e) and (f), can be used only if the corresponding change is not prohibited by certain permit conditions established after January 6, 1975.

If the size of a proposed source or modification thus qualifies as major, its prospective location or existing location must also qualify as a PSD area, in order for PSD review to apply. A PSD area is one formally designated by the state as "attainment" or "unclassifiable" for any pollutant for which a national ambient air quality standard exists. This geographic applicability test generally does not take into account what new pollutant emissions caused the construction to be major. It looks simply at whether the source is major for any pollutant and will be located in a PSD area. The one exception is that if a major stationary source emits only non-attainment pollutants, then no PSD review would apply.

If a proposed source or modification would be subject to PSD review based on size, location, and pollutants emitted, it still may escape the PSD review requirements under certain grandfather provisions under 40 CFR

52.21(i). For example, a proposed source or modification that was not subject to the 1978 PSD rules and had received all necessary Federal, State and local air permits before August 7, 1980, would not be subject to the 1980 regulations. (See the PSD regulations for other exemptions.)

Finally, the PSD regulations contain some specific exemptions for some forms of source construction. The requirements of the PSD regulations do not apply to any major stationary source or major modification that is (a) a nonprofit health or educational institution (only if such exemption is requested by the governor), or (b) a portable source which has already received a PSD permit and proposes relocation, or the source or modification would be a major stationary source or major modification only if fugutive emissions, to the extent quantifiable, are considered in calculating the potential to emit of the stationary source or modification and the source does not belong to any of the categories listed in Table A-4.

Box 2. No PSD permit needed.

If the source has met the appropriate deadlines for construction; and is not a major stationary source, a major modification, is not located in a PSD area, or is not subject to the specific exemptions mentioned above, the PSD program is not applicable, and therefore, no PSD permit is needed.

Box 3. Is construction proposed for an area which is designated nonattainment area for the regulated pollutant?

If the project is a major stationary source or a major modification, the prospective location must also qualify as a PSD area in order for the PSD review to apply. A PSD area is defined as an area formally designated by the State as "attainment" or "unclassifiable" for any pollutant for which a NAAQS exists. An area not classified as either "attainment" or "unclassifiable" would be classified as "nonattainment". If the proposed construction is in a nonattainment area for any pollutant, proceed to box 4 for that pollutant; for all other regulated pollutants, proceed to box 5.

Box 4. No further PSD analysis for that pollutant.

If the proposed major stationary source or major modification will emit pollutants from an area that has been designated as "nonattainment", then the proposed source or modification is exempt from further PSD review for only those pollutants. However, the proposed source or modification must meet the applicable preconstruction requirements for each nonattainment pollutant. (See 40 CFR 51.18 and 40 CFR 52.24.)

The pollutant applicability determination would be continued for all other regulated pollutants (except nonattainment pollutants) emitted by a proposed major stationary source or major modification by proceeding to box 5.

Box 5. Is proposed source or modification within 10 km of a Class I area?

The PSD regulations [40 CFR 51.24(b)(23)(iii) and 40 CFR 52.21(b)(23)(iii)] require that a proposed source or modification, which plans to construct within 10 km of a Class I area must demonstrate that if it would not impact the area, (less than 1 ug/m^3) even if the proposed emissions are below the applicable significant emissions rates listed in Table A-1. If the proposed source or modification is within 10 km of a Class I area, proceed to box 6; if not, proceed to box 9.

Box 6. Class I area screening procedure.

If the proposed source or modification is within 10 km of a Class I area, then the screening procedures described in reference 62 may be used to estimate the impact on the Class I area. This screening procedure is based on a simple but conservative model for estimating each concentration due to the emissions from the proposed source or modification.

Box 7. More refined model (optional).

A proposed source or modification may choose not to accept or use the concentration estimates derived from the screening procedures in box 6, and may elect to use a more refined model which would more adequately reflect the impact on the Class I area from the proposed source or modification. It should be emphasized that in order to perform a refined modeling analysis, it may be necessary to collect 1 year of on-site meteorological data for the model input if an adequate amount of representative data are not already available. The application of any model used in this analysis must be consistent with reference 14 as discussed in section 5.1. The application of any different model must be approved by EPA in order to avoid any delays in the processing of the permit application. Applicants should consult with the reviewing authority before investing considerable resources in the use of the different models. Therefore, the documentation and specific description of the model should be provided to the reviewing authority before the results are submitted.

The concentration estimates from the screening procedure or the refined model, are subsequently used in the Part 4-Ambient Air Quality Analysis and Part 5-Source Impact Analysis.

Box 8. Will the proposed source or modification impact on a Class I area?

If a proposed source or modification is within 10 km of a Class I area, the proposed source or modification must be prepared to demonstrate for each regulated pollutant it would emit that there would be no significant impact on the Class I area. Significant impact is defined in the PSD regulations [40 CFR 51.24(b)(23)(iii) and 40 CFR 52.21(b)(23)(iii)] as 1 microgram per cubic meter (ug/m^3) or more, 24-hour average.

Box 9. Are new emissions or net emissions increase of the regulated pollutant ≥Table A-1?

If the proposed source or modification is not within 10 km of a Class I area, or if the proposed source is within 10 km of a Class I area and has no significant impact on the Class I area, then the emissions for each pollutant from the proposed source of modification are compared to the significant emissions rates in Table A-1.

Box 10. No further analysis for that pollutant.

If the emissions from the proposed source or modification are not significant as defined in Table A-1, no further analysis is required for that pollutant. However, a similar review must be performed for all other regulated pollutants by proceeding to box 5 for the next pollutant.

Box 11. Is proposed construction a relocation of a portable facility with previous permit?

This question is actually an applicability question that is normally considered under the Part 1-Source Applicability Determination. However, there are certain other questions (see boxes 3, 5 and 8 of Figure A-2) which are normally asked under pollutant applicability that are also germane to permitting a portable facility relocation. Thus, the reason for including box 11 in Part 2.

The source must be a portable facility which has previously received a permit under the PSD regulations, the owner proposes to relocate the facility, and emissions at the new location would be temporary (not exceeding its allowable emissions). If the facility meets these requirements, then proceed to box 12; if not, proceed to box 14.

Box 12. Are there potential impacts on a Class I area, or areas of known increment violation?

The emissions from the portable source should not exceed its allowable emissions, and the emissions from the temporary source should impact no Class I area and no area where an applicable increment is known to be violated. If there are potentially adverse impacts on a Class I area, or significant impacts on areas of known increment violation, proceed to box 14; if not, proceed to box 13.

Box 13. No PSD permit required.

If there are no potential impacts on a Class I area, or areas of known increment violation, no PSD permit is required.

Box 14. Apply BACT.

"Best available control technology" means an emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60 and 61. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

Box 15. Are the allowable emissions or the net emissions increase temporary, impacting no Class I area, or impacting no area where the PSD increment is violated?

Temporary emissions are defined as emissions from a temporary source that would be less than 2 years in duration, unless the Administrator determines that a longer time period would be appropriate. If all of the conditions above are not met, proceed to box 16; if they are met, proceed to Part 7-Complete PSD Application.

Box 16. Will the proposed source or modification emit VOC?

If the proposed source or modification will emit VOC, proceed to box 17; if not, proceed to box 20. Also proceed to box 20 if the pollutants are TSP, PM_{10}, SO_2, CO, NO_2, or Pb.

Box 17. Are VOC emissions < Table A-2?

If the VOC emissions rates from the proposed source or modification are less than the value in Table A-2 (100 tons/year), proceed to box 18; if not, proceed to box 19.

Box 18. Is there an apparent threat to the NAAQS, or is there a potential adverse impact on a Class I area?

If the projected air quality after construction is equal to or greater than 90 percent of the NAAQS, a threat to the NAAQS would generally exist. Potential adverse impacts on a Class I area must be determined on a case-by-case basis by the permit granting authority. Therefore, if there is an apparent threat to the NAAQS, or if there are potential adverse impacts on a Class I area, then proceed to box 19; if not, proceed to box 20.

Box 19. Will proposed source modification perform postapproval monitoring in lieu of preconstruction monitoring data?

The PSD regulations [40 CFR 51.24(m)(1)(v) and 40 CFR 52.21(m)(1)(vi)] give special considerations regarding ozone monitoring data to new or modified sources of volatile organic compounds which have satisfied all conditions of 40 CFR 51, Appendix S, section IV. This section generally requires affected sources to meet lowest achievable emission rate limitations, secure emissions offsets which provide an overall net air quality improvement, and ensure all other major sources in the same State are in compliance with the applicable SIP. If a proposed source or modification has met all of the above conditions for VOC, then the proposed source or modification may provide postapproval monitoring data for ozone in lieu of providing preconstruction data. Postapproval monitoring data are data collected after the date of approval of the PSD application. However, in no case should the postapproval monitoring be started later than 2 years after the start-up of the new source or modification.

If the proposed source or modification will provide postapproval monitoring, proceed to the Part 5-Source Impact Analysis; if not, proceed to box 20 for the remainder of the ambient air quality analysis.

Box 20. Estimate existing air quality.

The proposed source or modification must perform an initial analysis to estimate the existing air quality concentrations. The screening procedures described in reference 62 may be used. The screening procedures are based on simple models for estimating air quality due to the emissions from existing and approved but not yet built sources. A proposed source or modification may choose not to accept or use the concentration estimates derived from the screening procedure above, and may elect to use a more refined model which would more adequately reflect the impact from existing sources. It should be emphasized that in order to perform a refined modeling analysis, it is generally necessary to collect 1 year of on-site meteorological data for the model input. The application of any model used in this analysis must be consistent with reference 14 as discussed in section 5.1. The application of any model should be approved by the permit granting authority to avoid any future delays in the processing of the permit application. Therefore, the documentation of the specific description of the model should be provided to the permit granting authority before the results are submitted.

The concentration estimates from the screening procedure or the optional refined model will be used in the remaining portions of the ambient air quality analysis.

Box 21. Estimate air quality impacts of proposed construction.

The proposed source or modification must estimate its air quality impacts to demonstrate that its new pollutant emissions would not violate either the applicable NAAQS or the applicable PSD increment. The proposed source or modification must use the screening procedures or more refined model, consider "good engineering practice" for stack height, and consider the TSP and SO_2 increment exclusion for Class II areas under 50 tons per year exemption. These factors are discussed in more detail below.

(a) Screening procedure or more refined model.

If the proposed source or modification used the screening procedure or more refined model in box 6 or 7 previously to estimate the impact, then those results may be used in this impact analysis. If the screening procedure or more refined model was not previously determined, then the screening procedures described in reference 62 may be used. This screening procedure is based on a simple model for estimating each concentration due to the emissions from the proposed source or modification. A proposed source or modification may choose not to accept or use the concentration estimates derived from the screening procedure above, and may elect to use a more refined model which would more adequately reflect the impact from the proposed source or modification. It should be emphasized that in order to perform a refined modeling analysis, it is generally necessary to collect 1 year of on-site meteorological data for the model input. The application of any model used in this analysis must be consistent with reference 14 as discussed in Section 5.1. The application of any model should be approved by the permit granting authority to avoid any future delays in the processing of the permit application. Therefore, the documentation and specific description of the model should be provided to the permit granting authority before the results are submitted.

The concentration estimates from the screening procedure or the optional refined model will be used in the remaining portions of the ambient air quality analysis.

(b) "Good engineering practice" (GEP) for stack height.

The 1978 PSD regulations [1] provide for requiring GEP in the impact analysis for stack heights. The degree of emission limitations required for the control of any air pollutant would not be affected by stack heights (in existence after December 31, 1970) as exceeds good engineering practice, or any other dispersion techniques implemented after then.

(c) Consider 50 tons per year exemption.

The PSD regulations [40 CFR 51.24(i)(7) and 40 CFR 52.21(i)(7)] as they apply to a major modification exempt PM_{10} and SO_2 from the Class II increment consumption review if all of the following conditions are met:

(1) the net increase of all pollutants regulated under the Act after application of BACT would be less than 50 tons/year, (2) no pollutant would be causing or contributing to a violation of the standards (NAAQS), and (3) source must have been in existence on March 1, 1978. The results of the impact analysis as described in this box will be used for subsequent portions of the ambient air quality analysis.

Box 22. Is the existing air quality < Table A-2?

The proposed source or modification must determine the existing air quality concentration in the area of impact of the proposed source or modification before construction for each applicable pollutant. Modeling by itself or in conjunction with monitoring data would be used for this determination. Application of these models must be consistent with reference 14.

If the proposed source or modification is remote and not affected by other readily identified man-made sources, two options for determining existing air quality concentrations from existing data are available. The first option is to use air quality data collected in the vicinity of the proposed source or modification, the second option is to use average measured concentrations from a "regional" site to establish a background concentration. Additional guidance on determining the background air quality concentrations may be found in reference 14. See also the discussion or use of representative air quality data in Section 2.4 of this guideline.

If the existing air quality is less than the values in Table A-2, proceed to box 24; if not, proceed to box 23.

Box 23. Are the air quality impacts < Table A-2?

The projected impact of the proposed source or modification was previously determined by the screening procedure or refined model estimates. These modeled concentrations are compared to the significant monitoring concentrations shown in Table A-2. If these modeled concentrations are less than the values in Table A-2, proceed to box 24; if not, proceed to box 25.

Box 24. Is there an apparent threat to PSD increments or NAAQS, or is there a potential adverse impact on a Class I area?

An apparent threat to a PSD increment is consumption by the proposed source or modification of 90 percent or more of the remaining allowable increment. An apparent threat to the NAAQS is when the projected air quality after construction is equal to or greater than 90 percent of the NAAQS. Potential adverse impacts on a Class I area must be determined on a case-by-case basis by the permit granting authority.

Therefore, if there is an apparent threat to PSD increments or NAAQS, or if there is a potential adverse impact on a Class I area, proceed to box 29; if not, proceed to box 28.

Box 25. Are proposed emissions a criteria pollutant or VOC?

Determine if the pollutant is a criteria pollutant (TSP, PM_{10}, SO_2, CO, NO_2 or Pb) or VOC. If the pollutant is a criteria pollutant or VOC, proceed to box 27; if not, proceed to box 26.

Box 26. Is there an approved monitoring technique available?

Acceptable measurement methods currently exist for some noncriteria pollutants, while other methods are currently under review and have not been designated as an acceptable measurement method. Section 2.6 of this guideline discussed the designation of acceptable measurement methods for noncriteria pollutants. If an acceptable measurement method does exist, proceed to box 29; if not, proceed to box 28.

Box 27. Preconstruction monitoring data required.

Preconstruction air quality monitoring data are required for this part of the ambient air quality analysis. The proposed source or modification has the option of using representative air quality data or monitoring. Considerations and constraints on the use of existing data were discussed in Section 2.4 of this guideline. It should be noted that a dispersion model may be used in verifying the representativeness of the data. If a proposed source or modification chooses to monitor instead of using representative air quality data, then the specifics to be followed on network design, probe siting, quality assurance, number of monitors, etc., were previously discussed in this guideline.

The monitoring data required in this box will be used in Parts 5, 6 and 7 of the PSD permit application.

Box 28. No preconstruction monitoring data required.

If there is no approved monitoring technique for the noncriteria pollutants, or if there is no apparent threat to PSD increments or NAAQS, or if there is no potentially adverse impact on a Class I area, then generally no preconstruction monitoring data will be required. However, proceed to the Part 5-Source Impact Analysis for remaining analyses.

Box 29. Preconstruction monitoring data may be required.

The permit granting authority must determine on a case-by-case basis if monitoring data will be required when there is an apparent threat to PSD increments or NAAQS, or when there is a potential adverse impact on a Class I area. Special attention must be given to Class I areas where the proposed source or modification would pose a threat to the remaining allowable increment. For those situations where the air quality concentration before construction is near the concentrations shown in Table A-2 and there are uncertainties associated with this air quality determination then preconstruction air quality monitoring data may be required. Some situations where noncriteria monitoring may be required were discussed in Section 2.1.3 of this guideline.

Regardless of the monitoring data decision, proceed on to the Part 5-Source Impact Analysis for remaining analyses.

REFERENCES

1. Federal Register 43:26380-26410. June 19, 1978.

2. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). U.S. Environmental Protection Agency, Research Triangle Park, NC. OAQPS No. 1.2-096. May 1978.

3. Federal Register 44:51924-51959. September 5, 1979.

4. United States Court of Appeals, No. 78-1006, Alabama Power Company, et. al., Petitioners v. Douglas M. Costle, as Administrator, Environmental Protection Agency, et. al., Respondents. Decided December 14, 1979.

5. Federal Register 45:52676-52748. August 7, 1980.

6. Federal Register 52:24634-24750. July 1, 1987.

7. Federal Register 44:27558-27604. May 10, 1979.

8. Pace, T.G., et al., Procedures for Estimating Probability of Nonattainment of a PM_{10} NAAQS Using Total Suspended Particulate or PM_{10} Data. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/4-86-017, December 1986.

9. Ludwig, F.L., J.H. Kealoha, and E. Shelar. Selecting Sites for Monitoring Total Suspended Particulates. Stanford Research Institute, Menlo Park, CA. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/3-77-018. June 1977, Revised December 1977.

10. Ball, R.J. and G.E. Anderson. Optimum Site Exposure Criteria for SO_2 Monitoring. The Center for the Environment and Man, Inc., Hartford, CT. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/3-77-013. April 1977.

11. Ludwig, F.L. and J.H.S. Kealoha. Selecting Sites for Carbon Monoxide Monitoring. Stanford Research Institute, Menlo Park, CA. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/3-75-077. September 1975.

12. Ludwig, F.L. and E. Shelar. Site Selection for the Monitoring of Photochemical Air Pollutants. Stanford Research Institute, Menlo Park, CA. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/3-78-013. April 1978.

13. Pelton, D.J. and R.C. Koch. Optimum Sampling Site Exposure Criteria for Lead. GEOMET Technologies, Inc., Rockville, MD. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/4-84-012. February 1984.

14. Guideline on Air Quality Models (Revised). OAQPS, U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/2-78-027R (NTIS PB 288-783). July 1986.

15. Federal Register 51:9582-9600. March 19, 1986.

16. Bryan, R.J., R.J. Gordon, and H. Menck. Comparison of High Volume Air Filter Samples at Varying Distances from Los Angeles Freeway. University of Southern California, School of Medicine, Los Angeles, CA. (Presented at 66th Annual Meeting of Air Pollution Control Association, Chicago, IL., June 24-28, 1973. APCA 73-158.)

17. Teer, E.H. Atmospheric Lead Concentration Above an Urban Street. Master of Science Thesis, Washington University, St. Louis, MO. January 1971.

18. Bradway, R.M., F.A. Record, and W.E. Belanger. Monitoring and Modeling of Resuspended Roadway Dust Near Urban Arterials. GCA Technology Division, Bedford, MA. (Presented at 1978 Annual Meeting of Transportation Research Board, Washington, D.C. January 1978.)

19. Pace, T.G., W.P. Freas, and E.M. Afify. Quantification of Relationship Between Monitor Height and Measured Particulate Levels in Seven U.S. Urban Areas. U.S. Environmental Protection Agency, Research Triangle Park, NC. (Presented at 70th Annual Meeting of Air Pollution Control Association, Toronto, Canada, June 20-24, 1977. APCA 77-13.4.)

20. Harrison, P.R. Considerations for Siting Air Quality Monitors in Urban Areas. City of Chicago, Department of Environmental Control, Chicago, IL. (Presented at 66th Annual Meeting of Air Pollution Control Association, Chicago, IL., June 24-28, 1973. APCA 73-161.)

21. Study of Suspended Particulate Measurements at Varying Heights Above Ground. Texas State Department of Health, Air Control Section, Austin, TX. 1970. p. 7.

22. Rodes, C.E. and G.F. Evans. Summary of LACS Integrated Pollutant Data. In: Los Angeles Catalyst Study Symposium. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-600/4-77-034. June 1977.

23. Lynn, D.A. et. al. National Assessment of the Urban Particulate Problem: Volume I, National Assessment. GCA Technology Division, Bedford, MA. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/3-75-024. June 1976.

24. Pace, T.G. Impact of Vehicle-Related Particulates on TSP Concentrations and Rationale for Siting Hi-Vols in the Vicinity of Roadways. OAQPS, U.S. Environmental Protection Agency, Research Triangle Park, NC. April 1978.

25. Air Quality Criteria for Lead. Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC. EPA-600/8-77-017. December 1977.

26. Lyman, D.R. The Atmospheric Diffusion of Carbon Monoxide and Lead from an Expressway. Ph.D. Dissertation, University of Cincinnati, OH. 1972.

27. Burton, R.M. and J.C. Suggs. Distribution of Particulate Matter from the Roadway of a Philadelphia Site. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1983 (Draft).

28. Koch, R.C. and H.E. Record. Network Design and Optimum Site Exposure Criteria for Particulate Matter, GEOMET Technologies, Inc., Rockville, MD. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68-02-3584. March 1983.

29. Wechter, S.G. Preparation of Stable Pollutant Gas Standards Using Treated Aluminum Cylinders. ASTM STP. 598:40-54, 1976.

30. Wohlers, H.C., H. Newstein and D. Daunis. Carbon Monoxide and Sulfur Dioxide Adsorption On and Description From Glass, Plastic and Metal Tubings. J. Air Poll. Con. Assoc. 17:753, 1976.

31. Elfers, L.A. Field Operating Guide for Automated Air Monitoring Equipment. U.S. NTIS. p. 202, 249, 1971.

32. Hughes, E.E. Development of Standard Reference Material for Air Quality Measurement. ISA Transactions, 14:281-291, 1975.

33. Altshuller, A.D. and A.G. Wartburg. The Interaction of Ozone with Plastic and Metallic Materials in a Dynamic Flow System. Intern. Jour. Air and Water Poll., 4:70-78, 1961.

34. CFR Title 40 Part 53.22, July 1976.

35. Butcher, S.S. and R.E. Ruff. Effect of Inlet Residence Time on Analysis of Atmospheric Nitrogen Oxides and Ozone. 43:1890, 1971.

36. Slowik, A.A. and E.B. Sansone. Diffusion Losses of Sulfur Dioxide in Sampling Manifolds. J. Air Poll. Con. Assoc., 24:245, 1974.

37. Yamada, V.M. and J.R. Charlson. Proper Sizing of the Sampling Inlet Line for a Continuous Air Monitoring Station. Environ. Sci. and Technol., 3:483, 1969.

38. Quality Assurance Handbook for Air Pollution Measurement Systems; Volume I - Principles. U.S. Environmental Protection Agency (MD-77) Research Triangle Park, NC. EPA Publication No. EPA-600/9-76-005. March 1976.

39. Quality Assurance Handbook for Air Pollution Measurement Systems; Volume II - Ambient Air Specific Methods. U.S. Environmental Protection Agency (MD-77), Research Triangle Park, NC. EPA Publication No. EPA-600/4-77-027a. May 1977.

40. Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Air Pollution Analyzers, U.S. Environmental Protection Agency (MD-77), Research Triangle Park, NC. Protocol No. 2. June 1978.

41. Transfer Standards for Calibration of Ambient Air Monitoring Analyzers for Ozone. U.S. Environmental Protection Agency, Department E (MD-77), Research Triangle Park, NC. EPA Publication No. EPA-600/4-79-056. September 1979.

42. Cole, H.S. Guidance for National Air Quality Trend Stations (NAQTS): Review of Meteorological Data Sources. OAQPS, U.S. Environmental Protection Agency, Research Triangle Park, NC. January 1978 (Draft).

43. On-Site Meteorological Instrumentation Requirements to Characterize Diffusion from Point Sources. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA-600/9-81-020 (NTIS No. PB 81-247-223). April 1981.

44. Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations). U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA-450/ 4-80-023. (NTIS No. PB82-145-301). July 1981.

45. Gill, G.C., L.E. Olsson, J. Sela, and M. Suda. Accuracy of Wind Measurements on Towers or Stacks. Bull. Amer. Meteorol. Soc. 48:665-674, September 1967.

46. Turner, D.B. Workbook of Atmospheric Dispersion Estimates, Revised. Office of Air Programs, U.S. Department of Health, Education and Welfare, Research Triangle Park, NC. Publication No. AP-26. 1970.

47. Onsite Meteorological Programs. Nuclear Regulatory Commission, Washington, D.C. NRC Guide 1.23 February 1972.

48. Weber, A.H. Atmospheric Dispersion Parameters in Gaussian Plume Modeling - Part 1: Review of Current Systems and Possible Future Developments. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-600/4-76-030a. July 1976.

49. Holzworth, G.C. Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States. Office of Air Programs, U.S. Department of Health, Education and Welfare, Research Triangle Park, NC. Publication No. AP-101. 1972.

50. Protecting Visibility: An EPA Report to Congress. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Publication No. EPA-450/5-79-008. October 1979.

51. Interim Guidance for Visibility Monitoring. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA-450/2-80-082 (NTIS No. PB81-157-760). November 1980.

52. Workbook for Estimating Visibility Impairment. U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA-450/4-80-031 (NTIS No. PB81-157-885). November 1980.

53. Guidelines for Siting and Exposure of Meteorological Instruments for Environmental Purposes. Meteorology and Assessment Division, U.S. Environmental Protection Agency, Research Triangle Park, NC. January 1976 (Draft).

54. Hoehne, W.E. Progress and Results of Functional Testing. National Oceanic and Atmospheric Administration, Sterling, VA. NOAA Technical Memorandum NWS T&EL-15. April 1977.

55. Stone, R. J. National Weather Service Automated Observational Networks and the Test and Evaluation Division Functional Testing Program. In: Preprint Volume for Fourth Symposium on Meteorological Observations and Instrumentation, Denver, CO. April 10-14, 1978.

56. Mazzarella, D.M. Meteorological Sensors in Air Pollution Problems. In: Proceedings of the Second Joint Conference on Sensing of Environmental Pollutants. Instrument Society of America, Pittsburgh, PA. 1973.

57. Mazzarella, D.M. Meteorological Instruments for Use Near the Ground - Their Selection and Use in Air Pollution Studies. Science Associates, Inc., Princeton, NJ. (Presented at Conference on Air Quality Meteorology and Atmospheric Ozone, Boulder, CO., 1977.)

58. Johnson, W.B. and R.E. Ruff. Observational Systems and Techniques in Air Pollution Meteorology. In: Lectures on Air Pollution and Environmental Impact Analyses. American Meteorological Society, Boston, MA. 1975.

59. George. D.H. and K.F. Zeller. Visibility Sensors in Your Air Quality Program. In: Proceedings of the Second Joint Conference on Sensing of Environmental Pollutants. Instrument Society of America, Pittsburgh, PA. 1973.

60. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements. U.S. Environmental Protection Agency (MD-77), Research Triangle Park, NC. EPA Publication No. EPA-600/4-82-060. February 1983.

61. American Society for Testing Materials. Standard for Metric Practice, E-380-76. ASTM, 1916 Race Street, Philadelphia, PA 19103. 1976.

62. Budney, L.J., Guidelines for Air Quality Maintenance Planning and Analysis Volume 10 (Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources. U.S. Environmental Protection Agency, Research Triangle Park, NC. OAQPS No. 1.2-029R, EPA Publication No. EPA-450/4-77-001. October 1977.

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16. ABSTRACT

Ambient air monitoring guidelines are described for sources that may be required to monitor the air quality under the Prevention of Significant Deterioration (PSD) regulations. Some step-by-step discussion is presented for a source to determine if monitoring will be necessary. Situations where existing air quality and meteorological data, modeling, and use of assumed background concentrations for certain areas may be used in lieu of monitoring, are shown.

If a source must undertake a monitoring program, general guidance is given for pollutants to be monitored, number and location of monitoring sites, equipment, frequency and duration of sampling, and data reporting. More detailed guidance is discussed for air quality monitoring probe siting criteria for various pollutants, meteorological monitoring, and quality assurance procedures.

17. KEY WORDS AND DOCUMENT ANALYSIS

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