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GUIDELINE SERIES

AMBIENT MONITORING GUIDELINES FOR PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

EPA-450/2-78-019
(OAQPS No. 1.2-096)

AMBIENT MONITORING GUIDELINES FOR PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

Monitoring and Data Analysis Division
Office of Air Quality Planning and Standards
and
Environmental Monitoring and Support Laboratory
Office of Research and Development

U.S. Environmental Protection Agency
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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OAQPS GUIDELINE SERIES

The guideline series of reports is being issued by the Office of Air Quality Planning and Standards (OAQPS) to provide information to State and local air pollution control agencies for example, to provide guidance on the acquisition and processing of air quality data and on the planning and analysis requisite for the maintenance of air quality. Reports published in this series will be available - as supplies permit - from the Library Services Office (MD-35), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, or, for a nominal fee, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

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FORWARD

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 No. (Area Code 919)	FTS Number
Ambient Air Quality Monitoring	Alan Hoffman or David Lutz	541-5351	629-5351
Meteorological Monitoring	James Dicke or Laurence Budney	541-5381 541-5381	629-5381 629-5381
Quality Assurance (Ambient Air Quality)	Darryl VonLehmden or John Clements	541-2415 541-2196	629-2415 629-2196
PSD Policy and Interpretation of Regulations	David Dunbar	541-5497	629-5497

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1. INTRODUCTION

The Clean Air Act Amendments of 1977, Section 165, regarding Prevention of Significant Deterioration (PSD), require that the owner or operator of any potential source of air pollution over a specified size, which is proposed to be constructed, must conduct ambient air monitoring for a period of 1 year prior to submission of the application for a permit to construct the facility. Less than 1 year of data may be acceptable if it is determined that complete and adequate analyses can be accomplished with data collected over a shorter time interval. Continuous air quality monitoring data must be used in the analyses.

The PSD reviews now include a comparision against the National Ambient Air Quality Standards (NAAQS), and EPA is focusing the monitoring requirements on obtaining the necessary data for this purpose. Therefore, only preconstruction monitoring will be required, but existing air quality data may be used provided that it is representative of the geographic area of concern. The intent is not to require extensive and costly monitoring programs by sources unless it is absolutely necessary. If preliminary modeling or other data indicate that the new source would not pose a threat to a NAAQS, the source may not need to conduct preconstruction monitoring. The need for preconstruction monitoring will be decided on a case-by-case basis by the permit granting authority. The permit granting authority is defined as the control agency that has the authority to issue new source review permits.

Hence, it would be prudent (although not required) for the source to contact the permit granting authority prior to conducting any preconstruction monitoring. This preliminary review should result in a determination as to whether it is in fact necessary to monitor. If monitoring is needed, then the pollutants, locations of the monitors, and duration of the sampling program can be defined to avoid permit processing delays.

No post-construction monitoring will be required since the increment consumption will be determined by modeling. This is because the accuracy of the measurement methods in relation to the air quality increments and the year-to-year variability of air quality data would severely limit the usefulness of the data collected. The use of air quality monitoring to determine whether the applicable increments are being maintained assumes that the baseline air quality from which deterioration is measured is accurately known. But such baseline data are generally not available, and in most cases, can only be calculated indirectly through modeling procedures. Also, the stack height provisions require that a predicted air quality impact, based upon good engineering practice stack height, be calculated using dispersion models in any case where a source uses a stack that exceeds good engineering practice.

The purpose of this guideline is to define the requirements concerning ambient air quality and meteorological data collection in support of PSD applications and to ensure consistency among U.S. Environmental Protection Agency (EPA) Regions and State air pollution control agencies in terms of the type and amount of monitoring for an adequate air quality analysis. The first section of this document covers the general requirements and the exceptions to these requirements, and the remaining sections discuss technical considerations involving the design of an ambient monitoring network, related quality assurance activities, and collection and submission of data. It must be emphasized that considerable judgment needs to be exercised in applying this guidance due to the diversity and complexity of factors that affect air quality.

2. GENERAL REQUIREMENTS

2.1 Sources Required to Consider Monitoring in Support of Permit Application

All major emitting facilities must consider monitoring for a PSD permit application. A major emitting facility is defined as any one of 28 source categories (Table 1) that have the potential to emit 100 tons per year or more of any pollutant regulated under the Clean Air Act. Any other source not in the list of 28 source categories but having the potential to emit 250 tons per year or more of any regulated pollutant is included in the definition of major emitting facilities (this also includes categories 1, 9, 24 and 25 in Table 1 below the sizes indicated). These emission cutoffs apply to both new sources and modifications to existing sources. Any new source or modification which is subject to an air quality impact analysis under the PSD regulations would need to conduct ambient monitoring except under certain conditions discussed below.

The primary use of preconstruction monitoring is to determine the status of the particular area (the source site and/or the area of source impact) with respect to the NAAQS. After it is determined that a source is subject to an air quality impact analysis, then the screening procedures outlined in Volume 10 (revised) of the Guidelines for Air Quality Maintenance Planning and Analysis[1] should be used. If a source is shown not to pose a threat to a NAAQS and is remote, then no monitoring (ambient or meteorological) will be required. Remote means that no significant sources exist within the air quality impact range of the proposed new source. If a source does not pose a threat to a NAAQS but is not remote, or if the source does pose a threat to the NAAQS, then the air quality status of the area must be determined. This can be done in several ways, i.e., by collecting air quality and meteorological data prior to construction, by modeling existing sources, or by using existing air quality and representative meteorological data.

The extent to which modeled air quality estimates and/or existing air quality and meteorological data can be used to establish the air

Table 1. MAJOR EMITTING FACILITIES

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 mills
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 facilities
23. Chemical process plants
24. Fossil-fuel boilers of more than 250,000,000 British thermal units per hour heat input
25. Petroleum storage and transfer facilities with a capacity exceeding 300,000 barrels
26. Taconite ore processing facilities
27. Glass fiber processing plants
28. Charcoal production facilities

quality status of an area must by necessity be determined on a case-by-case basis. If air quality data are required, then representative meteorological data should be obtained as well.

2.2 Pollutants To Be Monitored

Pollutants that will be increased by the quantity specified in the PSD regulations and for which an air quality increment or ceiling (ambient standard) exists must be monitored. This means the monitoring requirements apply to total suspended particulates (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), photochemical oxidants (O_3), and nitrogen dioxide (NO_2). However, if it can be established that a source will exceed the emission requirement for only one pollutant, then only that pollutant need be monitored. Hydrocarbon monitoring is not required since the 0.24 ppm standard is a guide for developing State Implementation Plans to attain the O_3 ambient standard and since these emissions are the precursors in the formation of ozone. Consequently, any source to be located in an unclassified area for ozone and that exceeds the minimum hydrocarbon emission limit will be required to monitor ozone and hydrocarbon monitoring will not be required.

2.3 Minimum Number and Location of Monitoring Sites

The number and location of monitoring sites will be determined on a case-by-case basis by the 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, etc. The number of sites will be directly related to the expected spatial variability of the pollutant in the area(s) of study. The suggested approach is to first use appropriate dispersion modeling techniques to estimate the air quality impact of the proposed source and any existing sources within the impact range of the proposed source for each pollutant averaging time. The modeled pollutant contribution of the proposed source should be analyzed in conjunction with the model results for existing sources to determine the general location of maximum concentration as discussed in Section 3.3. Monitoring should then be conducted in or as close to these areas as possible. Generally one to four sites would cover most situations in multisource settings. In remote areas where the expected pollutant variability is small due to a lack of existing sources, one monitoring site will generally be sufficient. Further, the location of this site need not necessarily be in the area of expected maximum pollutant concentration resulting from the proposed source, i.e., it could be placed at the site of the proposed facility.

For small sources, i.e., those sources for which the expected air quality impact is not significant and which will be located in remote areas, background air quality values can be used in lieu of monitoring. This is discussed in more detail in Section 3.2.

2.4 Using Existing Air Quality Data or Meteorological Data

If existing data are shown to be representative of the area under consideration, they can be used to meet the requirements. Such data might consist of:

1. Data collected by a State or local air pollution control agency.
2. Air quality data collected by a source under these requirements provided the data are no older than 2 years at the time of permit application and are considered representative of current conditions. However, data older than 2 years may be used if it is updated by the use of models.
3. TSP data being collected by a State agency or local agency may be used if it is supplemented when necessary by the source if sufficient sampling is not currently being conducted.
4. Meteorological data collected by the National Weather Service or by a source under these requirements.

The existing data used for these purposes would not have to meet the quality assurance requirements as discussed later. The permit granting authority would have to determine if the data are valid for determining the air quality status of the particular area.

2.5 Approval of Monitoring Network Prior to Data Collection

Prior approval of the monitoring network is not required. However, since 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 overall monitoring plan from the permit granting authority prior to collecting data in order to avoid delays in the processing of the permit application. Further, the review should also result in an elimination of unnecessary monitoring. Delays may result from insufficient, inadequate, poor, or unknown quality data. Table 2 lists information that should be contained in a monitoring plan.

2.6 Quality Assurance

The minimum quality assurance requirements are discussed more fully in Sections 6 and 7. In summary, the owner or operator will be responsible for ensuring and documenting that these minimum quality assurance practices are followed. Further, the audits of the monitors must be independent. As a minimum, this means the audits must be performed by someone other than the individuals operating the monitors. Preferably, an organization other than the one operating the monitor(s) should conduct these audits. Quality assurance data will be required so that precision and accuracy of the air quality data can be established.

2.7 Duration of Monitoring

As required by the Clean Air Act, the monitoring must be conducted for at least 1 year prior to the submission of the application to construct. However, under some circumstances, less than 1 year of air quality data may be acceptable. This will vary according to the pollutant being studied. For TSP, SO_2, CO, and NO_2 monitoring, less than a full year will be acceptable if the applicant demonstrates through historical data or dispersion models that the data are obtained during a time period when maximum air quality levels can be expected. A minimum of 4 months will be required. Monitoring for ozone will be required for those months in which the average daily maximum temperatures exceed 20°C (68°F) in the area under study, or for the 4 months of the year with the warmest average maximum temperatures for areas where there are not

Table 2. MINIMUM CONTENTS OF MONITORING PLAN

I. NETWORK DESCRIPTION

- Topographical description
- Land-use description
- Topographical map of proposed source and environs (including location of existing sources)
- Climatological description
- Wind rose (if available)
- Location and rationale of air quality/meteorological monitors

II. MONITOR SITE DESCRIPTION

- Universal Transverse Mercator (UTM) coordinates
- Height of probe(s) above ground
- Distance from obstructions (also indicate height of obstructions)
- Distance from other pollutant sources and roadways
- Photographs of each site (five photos: one in each cardinal direction looking out from the probe and one closeup of the probe intake)

III. MONITOR DESCRIPTION

- Manufacturer make and model number, principle of operation
- Age of instrument
- Description of calibration system

IV. SAMPLING PROGRAM DESCRIPTION

- Time periods for which pollutants will be measured
- Discussion of the use of existing data or model results in lieu of collecting ambient data

V. QUALITY ASSURANCE PROGRAM

- Calibration frequency
- Independent audit program
- Internal quality control procedures
- Data precision and accuracy calculation procedures

at least 4 months with average maximum temperatures greater than 20°C (68°F). For calculating the daily average maximum temperatures, a climatic record of at least 10 years should be used except where no record of that length that can be considered representative of the area exists.

2.8 Type of Air Quality Monitoring Equipment

All ambient air quality monitoring must be done with continuous Reference or Equivalent Methods, with the exception of TSP for which continuous Reference or Equivalent Methods do not exist. For TSP, samples must be taken in accordance with the Reference Method.

The TSP Reference Method is described in 40 CFR 50. The identification of continuous Reference or Equivalent Methods for SO_2, CO, O_3, and NO_2 which have been designated in accordance with 40 CFR 53, can be obtained by writing Environmental Monitoring and Support Laboratory, Department E (MD-76), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

2.9 Frequency of Sampling

For SO_2, CO, NO_2, O_3 and meteorological parameters, continuous analyzers must be used. Thus, continuous sampling (over the time period determined necessary) is required. For TSP, 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.

2.10 Meteorological Parameters and Measurement Methods

At least 1 year of meteorological data should be available for input to dispersion models used in analyzing the impact of the proposed new source on ambient air quality and the analyses of effects on soils, 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 many situations, on-site data collection will be required. Meteorological monitoring, instrumentation, quality assurance and data reporting requirements are addressed in Sections 4, 5, 7, and 8.

2.11 Data Reporting

The air quality and meteorological data must be reported to the permit granting authority at the time of the permit application, but could be done every 3 months. However the actual reporting frequency should be based on an agreement between the applicant and the permit granting authority.

The applicant should submit summaries of the air quality and meteorological data in a form easily comparable to the applicable averaging times of the increments and NAAQS. Using SO_2 as an example, a frequency distribution of 3-hour and 24-hour values, monthly arithmetic means, and the arithmetic mean for the entire sampling period, along with the number of 1-hour observations recorded, would be considered an appropriate data summary. In addition, all raw air quality data (i.e., 1-hour values for continuous analyzers, 24-hour values for TSP) should be submitted in hard copy.

Upon request, all air quality data should be submitted in SAROAD format. A site registration form must be submitted to the permit granting authority prior to data submission. Data must be submitted in machine-readable format, preferably on magnetic tape. Also, meteorological data for which valid SAROAD parameters and method codes exist should be submitted in SAROAD format. The applicant must also retain all strip charts, log books, and other records about the site and make this available upon request.

The quality assurance data, including precision and accuracy calculations, should be submitted for each site along with the summarized air quality data.

2.12 Summary of Typical Network Design

Table 3 lists typical network sizes, site locations, and monitoring frequency and duration for a number of source categories. The table is not intended to be all inclusive nor binding in all cases. It is presented strictly for illustrative purposes.

Table 3. EXAMPLE PSD MONITORING CASES

Source	Pollutant	Number of sites[a]	Length of monitoring	Monitor site location[b]	Frequency of sampling
Remote Power Plant (coal or oil fired)	SO_2	1	4 mos - 1 yr	on site	continuous
	TSP	1	4 mos - 1 yr	on site	1/6[c] to 1/1[d]
	CO	0	--	--	--
	NO_2	1	4 mos - 1 yr	on site	continuous
	O_3	0 - 1	4 mos - 8 mos	on site	continuous
Power Plant (with existing sources) (coal or oil fired)	SO_2	1 - 4	4 mos - 1 yr	Max impact/max conc	continuous
	TSP	1 - 4	4 mos - 1 yr	Max impact/max conc	1/1
	CO	0	--	--	--
	NO_2	1 - 2	4 mos - 1 yr	Max impact/max conc	continuous
	O_3	0 - 1	4 mos - 8 mos	on site	continuous
Oil Refinery	SO_2	1 - 4	4 mos - 1 yr	Max impact/max conc	continuous
	TSP	1 - 4	4 mos - 1 yr	Max impact/max conc	1/6 to 1/1
	CO	0 - 1	4 mos - 1 yr	Max impact	continuous
	NO_2	1	4 mos - 1 yr	Max impact	continuous
	O_3	1	4 mos - 8 mos	Max impact	continuous
Pulp & Paper	SO_2	1 - 4	4 mos - 1 yr	Max impact/max conc	continuous
	TSP	1 - 4	4 mos - 1 yr	Max impact/max conc	continuous
	CO	0 - 1	4 mos - 1 yr	Max impact	continuous

Table 3. EXAMPLE PSD MONITORING CASES (continued)

Source	Pollutant	Number of sites[a]	Length of monitoring	Monitor site location[b]	Frequency of sampling
Hydrocarbon Emissions					
remote	O_3	1	4 mos - 8 mos	on site	continuous
multisource	O_3	1	4 mos - 8 mos	downwind	continuous
Fugitive Particulate Matter Process Emissions	TSP	1	4 mos - 1 yr	on site	1/6 to 1/1
Stack Particulate Matter					
rural	TSP	1	4 mos - 1 yr	on site	1/6 to 1/1
urban	TSP	1 - 4	4 mos - 1 yr	Max impact/max conc	1/6 to 1/1

[a]In remote areas generally one site is sufficient. In multisource situations or modifications to existing sources, more sites may be necessary.

[b]In remote areas, on site monitoring is generally satisfactory. In multisource situations or modifications to existing sources, areas of maximum impact or maximum concentrations should be monitored.

[c]1/6 means one 24-hour sample every 6 days.

[d]1/1 means one 24-hour sample each day.

3. AMBIENT AIR QUALITY MONITORING

3.1 Objectives 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. The data from the PSD monitoring may be used:

1. To classify some portion of an Air Quality Control Region (AQCR) now unclassified by Section 107(d).
2. To determine the background air quality near the proposed source site.
3. To determine the air quality status where the emissions from the proposed source are expected to have the maximum impact.
4. To validate and refine models.

3.2 General Considerations

Monitoring for PSD purposes is not necessarily needed or required for all situations. Potential emissions from a new source or a modification to an existing source must be determined. If these potential emissions for any pollutant regulated by the Clean Air Act are less than 100 tons per year for any of the 28 specified categories listed in Table 1 or less than 250 tons per year for other sources, then no further analyses or monitoring will be required. However, if the potential emissions are increased by greater than 100 tons per year for any of the specified categories listed in Table 1 or greater than 250 tons per year for other sources, then the applicant must consider monitoring for 1 year unless specifically exempt by the PSD regulations.

The next step involves following the screening procedures in Reference 1, especially in Section 4.2-4.5. If the source is remote (no significant sources exist within the air quality impact area of the proposed new source) and if no current representative monitoring data are available, then the following air quality levels can be assumed as background and added to the screening procedure concentration estimates.

SO_2	20 $\mu g/m^3$
CO	1 ppm
NO_2	.01 ppm
TSP	30 - 40 $\mu g/m^3$
O_3	No values can be assumed. Any HC source or modification covered under the PSD regulations and for which an ambient review is needed, must conduct monitoring in any area which is designated as unclassified in accordance with Section 107(d) of the Clean Air Act.

These values can be used for all averaging times since in remote areas (without any significant sources) the air quality should be uniform throughout the year with the exception of minor fluctuations due to meteorology and naturally occurring emissions. It should be emphasized that a source is not required to use these values since preconstruction monitoring is always allowed in order to establish the background levels. If the sum of the screening procedure concentration estimates plus background does not pose a threat to a NAAQS, then preconstruction monitoring (ambient and meteorological) is not required.

If a source does not pose a threat to a NAAQS but is not remote, or does pose a threat to the NAAQS, the air quality status of the proposed source site and/or impact area must be determined. This can be achieved by measuring or modeling the ambient air quality, modeling, or using existing representative air quality data.

There are some exceptions to the 1-year monitoring requirement. For example, the applicant may determine if available data or calculated data can be used in lieu of monitoring. In such cases, the applicant should explain the technical basis for doing this to the permit granting authority. Also, the monitoring for ozone will be required only during the seasons when high concentrations occur. These exceptions and others have been discussed in Section 2, General Requirements.

If it is determined that monitoring will be required, then network design, probe siting criteria, meteorological monitoring, quality assurance, and data reporting must be considered. These subjects are discussed more fully in subsequent sections.

3.3 Network Design

Many factors, such as topography, climatology, population, and existing emissions sources will affect the design of a PSD network. Two situations, i.e., urban or remote, must generally be considered.

For urban or near-urban areas close to existing sources of pollutants, more monitors will generally be needed because of the variability in emissions and the resulting variability in air quality concentrations. The existing sources in these areas and their impacts on the population have to be considered along with the averaging times for each pollutant.

For remote areas in which the permit granting authority has determined there are no significant existing sources, a minimum number of monitors would be needed, i.e., one or probably two at most. Also, some concessions will be made on the location of these monitors. Since the maximum impact from these sources would be in remote areas, the monitors may be located, based on convenience or accessibility, near the source rather than near the maximum impact area. However, the maximum impact area is still the preferred location.

The ultimate network size for PSD purposes must be decided on a case-by-case basis by the permit granting authority because of the diverse factors that affect air quality. Some general procedures are discussed below and should be followed in determining network size and general station location. Additional guidance on general siting of the monitor may be found in References 2-5, which discuss highest concentration stations, isolated point sources, effects of topography, etc. The guides presented here should be followed to the maximum extent possible in developing the final PSD ambient monitoring network.

If the applicant has emission data for existing sources and meteorological data for use in a recommended EPA dispersion model, the air quality distribution before and after construction of the source can be estimated as can the portion of the air quality increment consumed by the operation of the source. This would provide sufficient information for the applicant to place a monitor at (1) the location of the maximum concentration increase expected from the proposed source, (2) the location of the maximum air pollutant concentration from existing sources of emissions, (3) 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. In some cases, two or more of these locations may coincide and thereby reduce the number of monitoring stations. In the case of SO_2, the area of maximum impact should be determined for both the 3-hour and 24-hour averages. If these two areas do not coincide, then additional monitors should be installed or the monitor should be located in the area where the greatest impact is more likely to occur.

If the applicant has no representative meteorological or emission data for existing sources, then the emissions for the proposed new source would be modeled with assumed meteorological parameters typical of the proposed source location. Monitors would be located at the modeled point(s) of maximum air pollutant concentration increase, which would also be the maximum impact area. A meteorologist should be consulted prior to application of air quality models when representative meteorological data are lacking and the rationale for the assumed meteorological parameters should be provided to the permit granting authority.

When industrial process fugitive particulate emissions are involved, the applicant should locate a monitor at the proposed source site. 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, i.e., those months when the average daily maximum ambient temperature exceeds 20°C (68°F) (or as a minimum, the 4 months with the highest daily average maximum temperature).

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 6 to 8 hours at wind speeds occurring during periods of photochemical activity. In an urban situation, ozone formation over the initial few hours may be suppressed 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.

3.4 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.

It is recognized that there may be situations when the probe siting criteria cannot be followed. If the site does not meet the siting criteria, the differences must be thoroughly documented. This documentation should help to avoid questions about the data at a later date.

3.4.1 Total suspended particulates (TSP)

3.4.1.1 Vertical placement - The most desirable height for a TSP monitor is near the breathing height. Practical considerations such as prevention of vandalism, security, accessibility, availability of electricity, etc., require that the sampler be elevated and require that a range of heights need to be specified. Therefore, the TSP monitor must be located 2 to 15 meters above ground level. The lower limit of 2 meters was based on a compromise between ease of servicing the sampler and the desire to avoid reentrainment from dusty surfaces. The upper limit of 15 meters represents a compromise between the desire to have measurements which are most representative of population exposures, and the considerations discussed below.

3.4.1.2 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. No furnace or incineration flues should be nearby. This separation distance 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 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 wastes are burned and the stack is sufficiently short so that the plume could reasonably be expected to impact on the sampler probe 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 must be placed at least 20 meters from trees. 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 at least three of the four cardinal (N, E, S, W) wind directions, and at least one of the three must be the predominate direction for the season of greatest potential pollutant concentration.

3.4.1.3 Spacing from roads - The TSP monitoring sites for PSD purposes should not be unduly influenced by roadways because the concentrated plume of particulate matter generated by vehicle traffic would have an undue impact on the TSP monitoring site. A number of studies[6-13] have shown that concentration decreases with increasing height of the monitor and distance from roadways. Therefore, monitors for PSD purposes should be located at a point where the plume generated by vehicular traffic is diminished. This would apply to those cases where the traffic is greater than several thousand vehicles per day. Figure 1 shows the requirement for siting monitors so that they are placed beyond the most concentrated portion of the plume. It contains a zone (zone B) where the impact of the roadway plume is lessened. The division between zone A and zone B is a linear relationship between sampler height and distance from roadways, which represents locations to avoid to minimize unreasonable roadway influences. This relationship is supported by an analysis of the data in the above referenced studies.[14]

However, since roads with lower traffic (several thousand vehicles per day) are generally not considered to be a major source of vehicular-related pollutants, this curve would not preclude the use of monitors in zone A for those situations. In addition, other factors such as meteorological anomalies, actual level of emissions from streets, potential exposure and availability and physical constraints of sites may constitute sufficient justification for the location of, or continuation of, a site located in zone A.

3.4.1.4 <u>Other considerations</u> - The collection efficiency for large-diameter suspended particulates is dependent upon the orientation of the sampler with respect to wind direction.[15] The collection efficiency is higher if the wind direction is at 45° to the sampler's roof ridge than if the wind is parallel to the roof ridge. The orientation should be considered to maximize collection efficiency in cases where the annual wind roses show a predominance from one direction (e.g., islands, sea coasts, etc.). Further, the site 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 2.

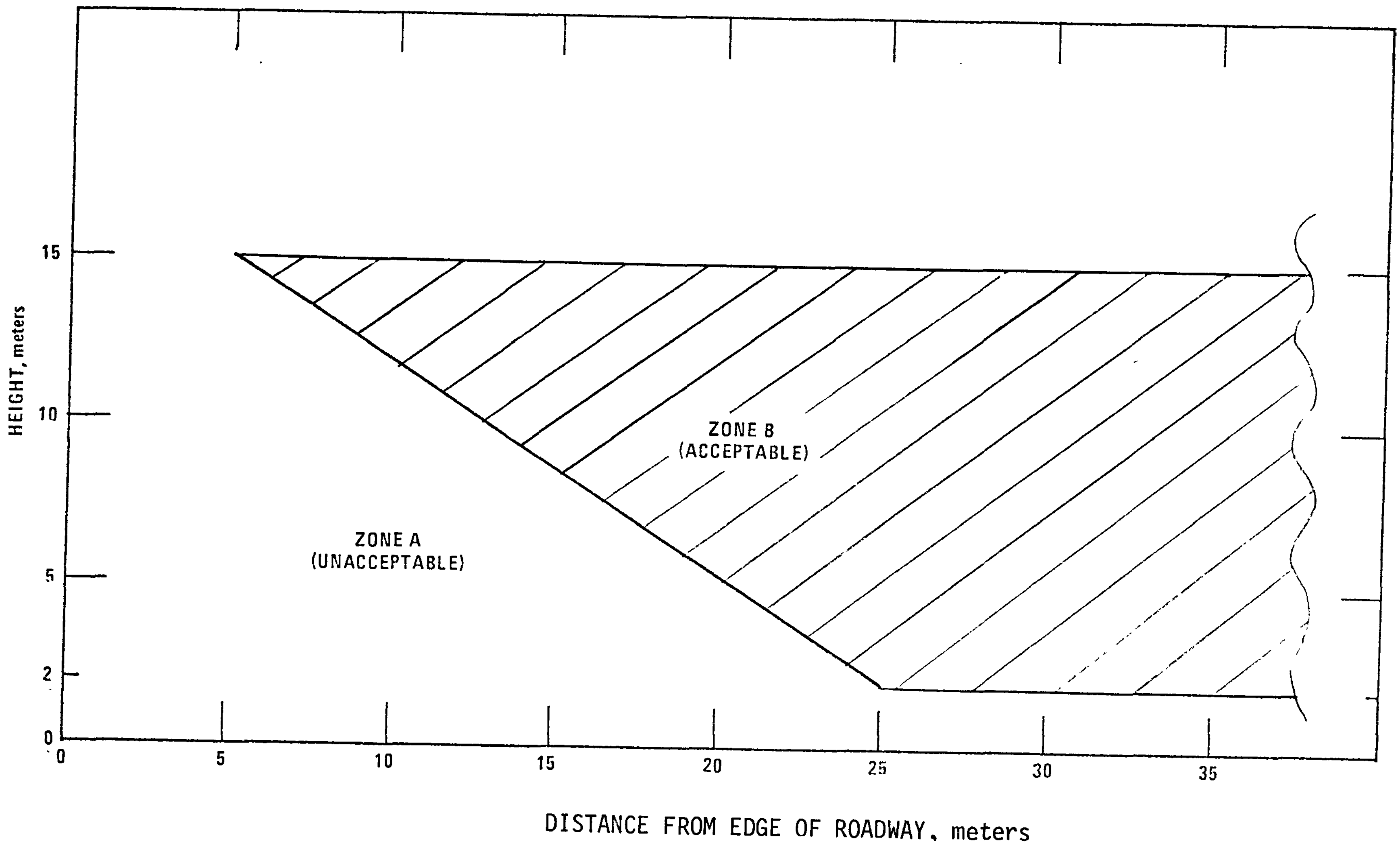

Figure 1. Acceptable zone for siting TSP monitors

3.4.2 Sulfur dioxide (SO_2)

3.4.2.1 Horizontal and vertical probe placement - As with TSP monitoring, the most desirable height for an SO_2 monitor is near the breathing height. Various factors enumerated before may require that the inlet probe be elevated. Therefore, the monitor must be located 3 to 15 meters above ground level.

If the inlet probe is located on a rooftop or an intermediate height on a building, the inlet probe must be located less than 80 percent of the mean height of the buildings in the vicinity but at least 3 meters above the ground level. Vertical uniform SO_2 distribution up to at least the mean building height over the area of interest in the city can be assumed except near the windward edge of a city (see Reference 3). The choosing of the 80 percent criteria provides a safety factor of 20 percent, which is intended to insure that the effects of any nonuniformity in vertical SO_2 levels are minimized. Thus, concentrations measured at or below this level should be similar to those existing concentrations near the breathing zone (5 to 6 feet above the ground). The inlet probe 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 and horizontally away from any supporting structure and also away from dirty, dusty areas.

3.4.2.2 Spacing from obstructions - No furnace, 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. Inlet probes must be at least 1 meter from walls, parapets, penthouses, etc., if the inlet probe is located on a roof or other structure.

The sampler must be placed more than 20 meters from trees and must also be located away from obstacles and buildings. The distance between the obstacles and the sampler must be at least twice the height that the obstacle protrudes above the sampler. Airflow must also be unrestricted in at least three of the four cardinal wind directions, and at least one of the three must be the dominant direction for the season of greatest potential pollutant concentration. Additional information on SO_2 probe siting criteria may be found in Reference 3.

3.4.3 Carbon monoxide (CO)

3.4.3.1 Horizontal and vertical probe placement - Because of the importance of measuring population exposure to CO concentrations, air should be sampled at average breathing heights. However, practical factors require that the air sampler be higher. The required height of the inlet probe for CO monitoring is therefore 3 $\pm$ 1/2 meter, which is a compromise between representative breathing height and prevention of vandalism. The recommended 1 meter range of heights is also a compromise to some extent. For consistency and comparability, it would be desirable to have all inlets at exactly the same height, but practical considerations often prevent this. Some reasonable range must be specified and 1 meter provides adequate leeway to meet most requirements. The inlet probe must be located more than 1 meter in the vertical and horizontal direction from any supporting structure.

3.4.3.2 Spacing from obstructions - Airflow must also be unrestricted in at least three of the four cardinal wind directions, and at least one of the three must be the dominant direction for the season of greatest potential pollutant concentration.

3.4.3.3 Spacing from roads - The CO monitoring sites for PSD purposes should not be unduly influenced by any one line source of CO. Therefore, the minimum setback from any roadway must be 35 meters for a CO monitoring site for PSD purposes. Additional information on CO probe siting criteria may be found in Reference 4.

3.4.4 Photochemical oxidant

3.4.4.1 Vertical and horizontal probe placement - The inlet probe for photochemical oxidant monitors should be as close as possible to the breathing zone. However, the complicating factors discussed previously require that the probe be elevated. The inlet height of the probe must be located 3 to 15 meters above ground level. The probe must also be located more than 1 meter vertically and horizontally away from any supporting structure.

3.4.4.2 Spacing from obstructions - The probe must be located away from obstacles and buildings, and the distance between the obstacles and the sampler probe must be at least twice the height that the obstacle protrudes above the sampler. The probe must also be located at least 20 meters from trees. Airflow must be unrestricted in at least three of the four cardinal wind directions, and at least one of the three must be in the predominate direction for the season of greatest potential pollutant concentration.

3.4.4.3 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. Table 4 provides the required minimum separation distances between roadways and ozone monitoring sites. The minimum separation distance must also be maintained between an ozone monitor and any other similar volume of automotive traffic, such as parking lots. Additional information on photochemical oxidant probe siting criteria may be found in Reference 5.

3.4.5 Nitrogen dioxide (NO_2)

3.4.5.1 Vertical and horizontal probe placement - The inlet height of the NO_2 probe must be located 3 to 15 meters above the ground. This is a compromise between measuring in the breathing zone and avoidance

Table 4. MINIMUM SEPARATION DISTANCE BETWEEN OZONE MONITORS AND ROADWAYS

Roadway average daily traffic, vehicles per day	Minimum separation distance from roadways to monitor, meters
<1,000	20
1,000 to 10,000	20 - 250[a]
>10,000	>250

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

of vandalism, finding suitable sites, etc. For NO_2, the height does not appear to be a critical factor since the NO_2 should be fairly well mixed and somewhat uniform in the vertical direction. The distance of the inlet probe from the supporting structure must be greater than 1 meter vertically and horizontally.

3.4.5.2 Spacing from obstructions - Buildings, trees and other obstacles may possibly scavenge NO_2. In order to avoid this kind of potential interference, the monitor must be located well away from such obstacles so that the distance between obstacles and the sampler is at least twice the height that the obstacle protrudes above the sampler. For similar reasons, a probe inlet along a vertical wall is undesirable because air moving along that wall may be subject to possible removal mechanisms. The inlet probe must also be at least 20 meters from trees. There must be unrestricted airflow in at least three of the four cardinal wind directions, and at least one of the three must be the predominate direction for the season of greatest pollutant concentration.

3.4.5.3 Spacing from roads - It is important that the monitoring site be removed from oxides of nitrogen sources to avoid measurements being totally dominated by any one roadway and to allow time for conversion (reactions) of NO emission to NO_2. Further, the effects of roadway sources must be minimized by using separation distances found in Table 5. The minimum separation distance must also be maintained between a NO_2 monitor and any other similar volume of automotive traffic such as parking lots. Additional information on NO_2 probe siting criteria may be found in Reference 5.

Table 5. MINIMUM SEPARATION DISTANCE BETWEEN NO_2 MONITORS AND ROADWAYS

Roadway average daily traffic, vehicles per day	Minimum separation distance from roadway to monitor, meters
<1,000	20
1,000 to 10,000	20 - 250[a]
>10,000	>250

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

3.4.6 Discussion and summary

Table 6 presents a summary of the requirements for probe siting criteria with respect to distances and heights. It is apparent from Table 6 that different elevation distances above the ground are shown for the various pollutants. The discussion in the text for each of the pollutants enumerated the factors why the monitor must be elevated. The differences in the specified range of heights are based on the vertical concentration gradients. For CO, the gradients in the vertical direction are very large, so a small range of heights has been specified. For SO_2, NO_2, TSP and O_3 (except near roadways), the vertical gradients are smaller and thus a larger range of heights can be used. The upper limit of 15 meters was specified for consistency between pollutants and to allow the use of a single manifold for monitoring more than one pollutant at a site.

Table 6. SUMMARY OF PROBE SITING CRITERIA

Pollutant	Height above ground, meters	Distance from supporting structure, meters: Vertical	Distance from supporting structure, meters: Horizontal[a]	Other spacing criteria
TSP	2 - 15	--	>2	a. >20 meters from trees. b. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. c. Unrestricted airflow in 3 of 4 cardinal wind directions. d. No furnace or incineration flues should be nearby.[b] e. Spacing from roads varies with height of monitor (see text).
SO_2	3 - 15	>1	>1	a. Probe on roof or intermediate height on a building must be <0.8 of the mean height of the buildings in the neighborhood. b. >20 meters from trees. c. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. d. Unrestricted airflow in 3 of 4 cardinal wind directions. e. No furnace or incineration flues should be nearby.[b]
CO	3 ± 1/2	>1	>1	a. >35 meters from roadway. b. Unrestricted air flow in 3 of 4 cardinal wind directions.
O_3	3 - 15	>1	>1	a. >20 meters from trees. b. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. c. Unrestricted airflow in 3 of 4 cardinal wind directions. d. Spacing from roads varies with roadway traffic (see text).
NO_2	3 - 15	>1	>1	a. >20 meters from trees. b. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. c. Unrestricted airflow in 3 of 4 cardinal wind directions. d. Spacing from roads varies with roadway traffic (see text).

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

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

4. METEOROLOGICAL MONITORING

4.1 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 (1) the proximity of the meteorological monitoring site to the area under consideration, (2) the complexity of the topography of the area, (3) the exposure of the meteorological sensors, and (4) the period of time during which the data are collected. More guidance for determining representativeness is presented in Reference 16.

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

1. Hourly average wind speed and direction.
2. Hourly average atmospheric stability based on Pasquill stability category or wind fluctuations (σ_θ), or vertical temperature gradient.
3. Hourly surface temperature at standard height for climatological comparisons and plume rise calculations.
4. 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 4.2 and 5.2 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.[17] 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. 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 Center, Federal Building, Asheville, N.C. 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.

A minimum of 1 year of meteorological data should be available. 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 5.2.

4.2 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 and 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 18.

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 lattice-type tower) can be severe. Thus, depending on the supporting structure, wind measuring equipment should be mounted (e.g., on booms) at least one structure width 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[19] 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,[20] 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,[21] or vertical gradients of temperature and wind speed.[22] 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.[23] 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[23] 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.

Visibility systems must be located to provide representative measurements not only prior to construction of the facility, but also for facility operational periods. Assessment of visibility impact is currently under study by EPA and other Federal agencies. Visibility definitions, monitoring methods, data requirements for modeling purposes and permit review requirements are to be the subjects of a report to Congress due in February 1979. Since final regulations for implementing Section 169 of the Clean Air Act will not be promulgated until August 1979, specific guidance cannot be given at this time.

Additional information and guidance on siting and exposure of meteorological instruments is contained in Reference 24.

5. INSTRUMENTATION

5.1 Air Quality Instrumentation

Air quality monitoring for PSD (except for TSP) must use a continuous designated Reference or Equivalent Method. The designated methods have appeared in the Federal Register. However, a list reflecting any new designations or any cancellations of a designation currently in effect may be obtained from the Environmental Monitoring and Support Laboratory, Department E (MD-76), U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711.

5.2 Meteorological Instrumentation - 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 continuously on strip charts. All variables may be recorded digitally or on multipoint recorders at intervals not to exceed 60 seconds for a given variable. 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.[25,26]

5.2.1 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. Wind direction system errors should not exceed 3 degrees from true 10-min or greater averages, including sensor orientation errors. Wind vane orientation procedures should be documented.

5.2.2 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 speed component is as specified in Section 5.2.1 for horizontal speeds.

5.2.3 Wind fluctuations

Determination of the on-site measured 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 fluctuation measurements/statistics are to be incorporated is expected to be unique or applied on a case-by-case basis, 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.[27,28] 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.

5.2.4 Vertical temperature difference

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

5.2.5 Temperature

Errors in temperature 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.

5.2.6 Humidity

Atmospheric humidity can be measured and expressed in several ways. Error in the selected measurement technique should not exceed an equivalent dewpoint temperature error of 0.5°C if the potential exists for fog formation, icing, etc., due to effluents from the proposed facility. Otherwise, errors in the equivalent dewpoint temperature should not exceed 1.0°C.

5.2.7 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,[20] 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.

5.2.8 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.[29] 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.[25,26]

5.2.9 Precipitation

A recording precipitation collector should have an accuracy of 0.25 mm (0.01 inches) liquid precipitation per hour at precipitation rates up to 7.6 cm/hour. A heated system should be used to assure proper measurement of frozen precipitation. A suitable windscreen should be used.

5.2.10 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.[30] Specific guidance must await the publication of an EPA report to Congress on visibility and promulgation of regulations in 1979.

6. QUALITY ASSURANCE FOR AIR QUALITY DATA

6.1 Introduction

The activities described here are the minimum quality assurance requirements for an organization operating a PSD network to produce monitoring data acceptable to the permit granting authority. If an organization has an ongoing quality assurance program more extensive than the one described here, EPA encourages that the program continue at that level. Likewise, if an organization wishes to develop a quality assurance program more extensive than the one required, EPA encourages that effort.

Although quality control charts are not a requirement, their use to document the activities to demonstrate within-control conditions as described in Section 6.2.1 is strongly encouraged. This recommendation is made because the control limits given for the activities of Section 6.2.1 are liberal and the development of more restrictive control limits by each organization is encouraged. Quality control charts provide a convenient and reliable means to determine when more restrictive control limits can be reasonably imposed. The construction and use of quality control charts is discussed in detail in Appendix H of Reference 31, and this source can be consulted for further information.

Frequent use is made of the term "organization." For purposes here, "organization" is defined as a source owner/operator, a government agency, or a contractor who operates an ambient air pollution monitoring network for PSD purposes.

6.2 Organization Quality Control Requirements

Each organization responsible for operating a PSD network must have a quality control program that includes the following two items: (1) activities to demonstrate that measurements are made within acceptable control conditions, and (2) assessment of organization's monitoring data for precision and accuracy.

6.2.1 Activities to demonstrate within control conditions for continuous methods

6.2.1.1 Reference or equivalent method requirements - All continuous analyzers must be EPA-designated Reference or Equivalent Methods. A list of Reference and Equivalent Methods can be obtained by writing to: Environmental Monitoring and Support Laboratory, Department E (MD-76), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

6.2.1.2 Calibration requirements - Continuous analyzers must be calibrated during installation and recalibrated whenever any one of the following conditions occurs: (1) control limit is exceeded for the span check described in Section 6.2.1.3, (2) after repair of a malfunctioning analyzer, and (3) after replacement of major component(s) of an analyzer. Zero plus a minimum of five calibration points equally spaced over the analyzer range must be used to generate a calibration curve.

All gaseous calibration standards must be traceable to National Bureau of Standards, Standard Reference Materials (SRM). The following SRM must be used to establish traceability of gaseous calibration standards: (1) SO_2 calibration standards require traceability to SRM SO_2 permeation tubes, (2) NO calibration standards require traceability to SRM NO in nitrogen, (3) NO_2 calibration standards require traceability to SRM NO_2 permeation tubes, and (4) CO calibration standards require traceability to SRM CO in air. One acceptable protocol to demonstrate traceability of calibration standards to SRM can be obtained by writing to: Environmental Monitoring and Support Laboratory, Quality Assurance Branch (MD-77), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

6.2.1.3 Span check requirements - For continuous analyzers, a periodic span check is used to demonstrate within-control conditions and also to assess the data for precision. A one-point span check must be carried out at least once per week on each analyzer at the following analyzer concentrations: (1) for SO_2, NO_2, and O_3 analyzers, between 0.08 and 0.10 ppm, and (2) for CO analyzers, between 8 and 10 ppm. In each case, determine the difference between the known span concentration and the measured concentration from the existing calibration curve. The acceptable limits for these differences are as follows: (1) for SO_2, NO_2, and O_3 analyzers the limit is $\pm$0.025 ppm, and (2) for CO analyzers $\pm$2.0 ppm.

Any time the control limit is exceeded, the analyzer must be removed from ambient monitoring, checks made to determine assignable cause(s), and corrective action taken before return of the analyzer to ambient mointoring. After return of the analyzer to ambient monitoring, the recalibration of the analyzer with zero plus a minimum of five calibration points equally spaced over the analyzer range is required.

The weekly span check data also generate information to assess the precision of the monitoring data; see Section 6.3.1.1 for procedures to be followed for calculating and reporting precision.

6.2.2 Activities to demonstrate within control conditions for integrated sampling methods

6.2.2.1 Total suspended particulate (TSP) reference method (high-volume sampler) - (a) Sampling flow rate check - Initial flow rate readings must be observed for each sampler and used to determine when corrective action is needed. The initial flow rate must be within $\pm$15 percent of the established average initial flow rate. If this limit is exceeded, recalibration or other corrective action is required. See Section 2.2.4, pages 10 and 11, Reference 32, for details.

(b) Exposed filter reweighing - A sampler of randomly selected exposed filters (filters after sampling) is reweighed. Agreement between original and repeat weights must be $\pm$5.0 mg or less if the original weights of the entire lot of exposed filters are to be accepted. If any reweighed exposed filter differs more than 5.0 mg from its original weight, the entire lot of filters must be reweighed. See Part 8.1.3, Section 2.2.8, Reference 32,for details.

(c) Recalculation of sample concentration - A sample of randomly selected calculated TSP values (in $\mu g/m^3$) is recalculated. The original and repeat calculations must agree. If this criterion is not met, all calculations for the lot are checked and corrected as necessary. See Part 8.1.4, Section 2.2.8, Reference 32, for details.

6.2.3 General description of activities to assess monitoring data precision and accuracy - Descriptions of specific activities to assess monitoring data for precision and accuracy of individual instruments follow in Sections 6.2.4 and 6.2.5. Calculation and reporting procedures for precision and accuracy are described in Section 6.3.

Precision is calculated from periodic checks made by the routine operator/analyst during the normal operation of the method. Accuracy is calculated from audits. Audits, as used here, mean independent assessments of the accuracy of the data obtained in an organization's monitoring program. Independence is achieved by using personnel, audit standards, and equipment different from those routinely used during method calibration. As a minimum, the audit personnel must be different than the operator/analyst conducting the routine operation of the measurement method. It is preferred, but not required, that a different organization than the one operating the measurement method conduct the audit.

6.2.4 Actvities to assess monitoring data precision and accuracy for continuous methods

6.2.4.1 Assessment of data for precision - Periodic span checks are used to assess continuous monitoring data for precision. A one-point span check must be carried out each week on continuous analyzers used to measure SO_2, NO_2, O_3, and CO. The concentration for this span check is described in Section 6.2.1.3. The concentration of the span gas used is the generated concentration (X), and the analyzer response is the measured response (Y) in the calculations shown in Section 6.3.1.1. All continuous analyzers must have this span check performed at least weekly.

6.2.4.2 Assessment of data for accuracy - Periodic independent audits are used to assess continuous monitoring data for accuracy. Continuous analyzers that measure SO_2, NO_2, O_3, and CO are all audited in the same way. The audit described here applies equally to all designated continuous Reference and Equivalent Methods. The audit required is the periodic challenge of the continuous analyzers with known concentrations of pollutant gas at five levels. The results of the audit are used in assessing the accuracy of monitoring data. The procedure for calculation of accuracy is described in Section 6.3.1.2.

For each pollutant monitored, it is necessary to develop a means to provide the audit pollutant gas at five levels. The audit pollutant gases can be prepared in a manner similar to the preparation of the usual calibration gases. It is required, however, that the concentrations of pollutant gases in the audit gases be determined independently and that the standards used to calibrate the analyzers being audited not be used in the analysis of the audit gases. All audit gas standards must be traceable to National Bureau of Standards, Standard Reference Materials (SRM) of the same type described in Section 6.2.1.2 for calibration standards. One acceptable protocol to demonstrate tracebility of audit gas standards to SRM is referenced in Section 6.2.1.2 .

The specific requirements for auditing continuous analyzers follow: once per sampling quarter, each Reference or Equivalent analyzer must be audited. A five-point audit must be carried out on each analyzer. The five-point audit must be carried out at the following analyzer concentrations: (1) for SO_2, NO_2, and O_3 analyzers, 0.05 ± 0.01 ppm, 0.10 ± 0.01 ppm, 0.20 ± 0.01 ppm, 0.30 ± 0.01 ppm, and 0.45 ± 0.01 ppm, and (2) for CO analyzers 5 ± 1 ppm, 10 ± 1 ppm, 20 ± 1 ppm, 30 ± 1 ppm, and 45 ± 1 ppm. The difference in concentrations (ppm) between the audit values and the measured analyzer values are used to calculate accuracy as described in Section 6.3.1.2.

6.2.5 Activities to assess monitoring data precision and accuracy for integrated sampling methods

6.2.5.1 Assessment of data for precision - Collocated samplers are used to assess data from integrated sampling methods described in Section 6.2.2. 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 located at the same elevation and should be approximately 3 meters apart to preclude airflow interference. High-volume samplers should have the same roof orientation. For the pair of collocated samplers, one sampler must be randomly designated prior to the collection of samples as the official sampler for normal routine monitoring purposes and the other will be designated as the duplicate sampler. Once designated, the identity of each sampler must be maintained. Sampling, calibration, operation, and analysis must be the same for both collocated samplers. The collocated sampler must be operated as a minimum every third day when continous sampling is used. When a less frequent sampling schedule is used, as discussed in Section 2.9, the collocated sampler must be operated at least once each week. The difference in concentration ($\mu g/m^3$) between the official and duplicate samplers is used to calculate precision as described in Section 6.3.2.1.

6.2.5.2 Assessment of data for accuracy - The assessment of accuracy for integrated sampling methods is made by auditing a portion of the measurement process.

(a) TSP method - the portion of the TSP method audited is the flow rate during sample collection. The specific requirements for auditing the flow rate of high-volume samplers follow: once per sampling quarter, audit the flow rate of each high-volume sampler. The flow rate calibration audit is conducted using a reference flow device described in Part 8.1.2, Section 2.2.8, Reference 31. The reference flow device is an orifice having five different calibrated resistance plates that are mounted on the faceplate of the high-volume sampler. In conducting the audit, one of the resistance plates is selected, and the audit flow rate is measured. This procedure is repeated, using different resistance plates, until the flow rate at five different levels is obtained. The differences in flow rates (m^3/min) between the calibrated resistance plate values and the measured sampler values are used to calculate accuracy as described in Section 6.3.2.2.

6.3 Organization calculation and reporting requirements for precision and accuracy

Calculating and reporting estimates of precision and accuracy of ambient air quality data gathered by organizations operating networks are described in this section. Precision and accuracy estimates obtained will be conservative. For example, span drift alone is used to estimate precision of continuous monitoring data, yet it is known that there are other sources of imprecision. Also, the accuracy of monitoring data from integrated sampling is estimated from audits of only a portion of the total measurement process, namely, flow measurements for TSP.

This section describes the calculation procedures for precision and accuracy for continuous methods and the TSP integrated sampling method. Precision and accuracy must be calculated each sampling quarter for each measurement instrument using information obtained in Section 6.2.3. The computed precision and accuracy must be recorded on the Data Assessment Report (Table 7) and adjoined with the quarterly submission of monitoring data.

6.3.1 Calculations for continuous methods

Calculations for precision and accuracy of individual continuous instruments are described below.

Table 7. DATA ASSESSMENT REPORT FOR PSD AIR QUALITY DATA - PART I

Organization name: ____________________

Organization address: ____________________

Reporting period: From ______________ to ______________
month/day/year month/day/year

Continuous Analyzers (CO, NO_2, O_3, SO_2) or Integrated Samplers (TSP)

Pollutant	Analyzer identification code	Precision			Accuracy		
		No. of span checks or collocated samples	95% limit*		Audit date	95% limit*	
			Lower	Upper		Lower	Upper

* Show + or - sign with limit value.

Table 7. DATA ASSESSMENT REPORT FOR PSD AIR QUALITY DATA - PART II

Organization name: ______________________________

Organization address: ______________________________

Reporting period: From ________________ to ________________
month/day/year month/day/year

Audit Results for Continuous Analyzers (CO, NO_2, O_3, SO_2)

Pollutant	Analyzer identification code	Concentration, ppm									
		Point 1		Point 2		Point 3		Point 4		Point 5	
		Known	Diff.*	Known	Diff.*	Known	Diff.*	Known	Diff.*	Known	Diff.*

*Calculate audit difference using the equation below. Show + or - sign when recording difference.
Diff. = measured $conc._{ppm}$ - known $conc._{ppm}$

6.3.1.1 Single instrument precision - Estimates of precision for ambient air quality measurements from continuous methods are calculated from the results of weekly span checks as described in Section 6.2.1.3. Each organization, at the end of each sampling quarter, calculates and reports a precision probability interval for each reference or equivalent analyzer. Directions for calculations are given below, and for reporting are given in Section 6.3.3. If monitoring data are invalidated because span drifts exceeded the limits specified in Section 6.2.1.3, DO NOT include these span drift results in the calculations of estimates of precision given below for single-instrument precision.

Let X_i represent the known concentration of the span gas and Y_i represent the measured concentration from the weekly span check. Calculate the percentage difference (d_i) for each span check using Equation 1.

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

For each instrument, calculate the quarterly average ($\bar{d}_j$), Equation 2, and the standard deviation (S_j), Equation 3

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

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

where n is the number of span check of the instrument made during the sampling quarter. For example, n is 13 if span checks are made once during each of the 13 weeks in a quarter.

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

Upper 95 percent probability limit = $\bar{d}_j + 1.96\ S_j$ (4)

Lower 95 percent probability limit = $\bar{d}_j - 1.96\ S_j$ (5)

As an example, consider the following set of data from a CO analyzer:

Week	Measured conc., Y_i, ppm	Known conc., X_i, ppm	Difference, d_i, percent
1	9.1	8.9	+2
2	8.5	8.9	-4
3	8.5	8.9	-4
4	8.6	8.9	-3
5	9.0	8.9	+1
6	8.9	8.9	0
7	9.0	8.9	+1
8	9.0	8.9	+1
9	9.0	8.9	+1
10	9.0	8.9	+1
11	8.7	8.9	-2
12	9.2	8.9	+3
13	9.4	8.9	+6
			$\Sigma = +3$

Applying Equations 2 and 3:

$$\bar{d}_j = +3/13 = +0.2\%$$

$$S_j = \left[\frac{99 - (3)^2/13}{12}\right]^{1/2} = 2.9\%$$

Applying Equations 4 and 5:

Upper limit = 0.2 + 1.96(2.9) = 5.9 or +6%

Lower limit = 0.2 - 1.96(2.9) = -5.5 or -6%

On the Data Assessment Report (Table 8), -6 is reported for the lower 95 percent limit and +6 is reported for the upper 95 percent limit for the CO analyzer precision.

6.3.1.2 Single instrument accuracy - Estimates of accuracy for ambient air quality measurements from continuous methods are calculated from the results of independent audits as described in Section 6.2.4.2. Each organization, at the end of each sampling quarter, calculates and reports an accuracy probability interval for each reference or equivalent analyzer. Directions for calculation are given below and directions for reporting are given in Section 6.3.3.

Let X_i represent the known concentration of pollutant in the audit gas for the i^{th} audit point and Y_i represent the corresponding measured value of the i^{th} audit point. Calculate the percentage difference (d_i) for each audit point using Equation 1. For each quarterly audit, calculate the average percentage difference ($\bar{d}_j$) and the standard deviation (S_j) using Equations 2 and 3, respectively. Calculate the 95 percent probability limits for accuracy using Equations 4 and 5.

As an example, consider the following data from the audit of an NO_2 analyzer:

Audit point	Measured conc., Y_i, ppm	Known conc., X_i, ppm	Difference, d_i, percent
1	0.053	0.051	3.9
2	0.107	0.102	4.9
3	0.212	0.204	3.9
4	0.321	0.307	4.6
5	0.480	0.460	4.3
			Σ = +21.6

Table 8. DATA ASSESSMENT REPORT FOR PSD AIR QUALITY DATA - PART I (Sample Entries)

Organization name: Acme Power Plant

Organization address: Route 54, Apex, North Carolina 27502

Reporting period: From 5/15/78 (month/day/year) to 8/15/78 (month/day/year)

Continuous Analyzers (CO, NO_2, O_3, SO_2) or Integrated Samplers (TSP)

Pollutant	Analyzer identification code	Precision: No. of span checks or collocated samples	Precision: 95% limit* Lower	Precision: 95% limit* Upper	Accuracy: Audit date	Accuracy: 95% limit* Lower	Accuracy: 95% limit* Upper
CO	Site 2	13	-6	+6			
NO_2	Site 2				7/11/78	+3	+5
TSP	Site 2	12	-2	+7	6/13/78	+1	+10

*Show + or - sign with limit value.

Table 8. DATA ASSESSMENT REPORT FOR PSD AIR QUALITY DATA - PART II (Sample Entries)

Organization name: Acme Power Plant

Organization address: Route 54, Apex, North Carolina 27502

Reporting period: From 5/15/78 to 8/15/78
month/day/year month/day/year

Audit Results for Continuous Analyzers (CO, NO_2, O_3, SO_2)

Pollutant	Analyzer identification code	Concentration, ppm									
		Point 1		Point 2		Point 3		Point 4		Point 5	
		Known	Diff.*	Known	Diff.*	Known	Diff.*	Known	Diff.*	Known	Diff.*
NO_2	Site 2	.051	+.002	.102	+.005	.204	+.008	.307	+.014	.460	+.020

*Calculate audit difference using the equation below. Show + or - sign when recording difference.
Diff. = measured $conc._{ppm}$ - known $conc._{ppm}$

Applying Equations 2 and 3:

$$\bar{d}_j = +21.6/5 = 4.3\%$$

$$S_j = \left[\frac{94.08 - (21.6)^2/5}{4}\right]^{\frac{1}{2}} = 0.44\%$$

Applying Equations 4 and 5:

Upper limit = 4.3 + 1.96(0.44) = 5.2 or +5%

Lower limit = 4.3 - 1.96(0.44) = 3.4 or +3%

On the Data Assessment Report (Table 8), +3 is reported for the lower 95 percent limit and +5 percent is reported for the upper 95 percent limit for the NO_2 analyzer accuracy.

6.3.2 Calculation for integrated sampling methods

Calculation methods for precision and accuracy of individual integrated samplers are described below:

6.3.2.1 Single instrument precision for TSP - Estimates of precision for ambient air quality measurements from the TSP method are calculated from results obtained from the collocation of two samplers at one sampling site as described in Section 6.2.5.1. Each organization, at the end of each sampling quarter, calculates and reports a precision probability interval using weekly collocation sampler results. The calculated precision at the one sampling site is considered indicative of the precision at all sampling sites for the TSP method. Directions for calculation are given below, and directions for reporting are given in Section 6.3.3.

Using the paired measurements described in Section 6.2.5.1, let Y_i represent the concentration of pollutant measured by the duplicate integrated sampler and X_i represent the calculation of pollutant measured by the designated official sampler during the i^{th} sampling period. Calculate the percentage difference (d_i) using

Equation 1. Calculate the average percentage difference ($\bar{d}_j$) and standard deviation (S_j) using Equations 2 and 3, respectively. Calculate the 95 percent probability limits for precision using Equations 6 and 7.

$$\text{Upper 95 percent probability limit} = \bar{d}_j + 1.96\ S_j/\sqrt{2} \qquad (6)$$

$$\text{Lower 95 percent probability limit} = \bar{d}_j - 1.96\ S_j/\sqrt{2} \qquad (7)$$

As an example, consider the following TSP data obtained using collocated high-volume samplers:

Sampling week	Duplicate sampler, Y_i, $\mu g/m^3$	Official sampler, X_i, $\mu g/m^3$	Difference, d_i, percent
1	53.0	51.9	2
2	69.9	66.6	5
3	-	67.8	-
4	58.4	55.7	5
5	48.5	46.4	5
6	61.6	58.9	5
7	57.9	59.0	-2
8	67.5	64.2	5
9	58.0	55.4	5
10	55.0	59.0	-4
11	60.0	58.1	3
12	55.8	53.1	5
13	51.4	52.8	-3
			Σ = +31

Applying Equations. 2 and 3:

$$\bar{d}_j = +31/12 = 2.6\%$$

$$S_j = \left[\frac{217 - (31)^2/12}{11}\right]^{\frac{1}{2}} = 3.5\%$$

Applying Equations 6 and 7:

$$\text{Upper limit} = 2.6 + 1.96(3.5)/\sqrt{2} = 7.4 \text{ or } 7\%$$

$$\text{Lower limit} = 2.6 - 1.96(3.5)/\sqrt{2} = -2.3 \text{ or } -2\%$$

On the Data Assessment Report (Table 8), -2 is reported for the lower 95 percent limit and +7 is reported for the upper 95 percent limit for the TSP sampler precision.

6.3.2.2 <u>Single instrument accuracy for TSP</u> - Estimates of accuracy for ambient air quality measurements from the TSP method are calculated from the results of independent audits as described in Section 6.2.5.2. Once each sampling quarter, the flow rate of each high-volume sampler is audited. Each organization, at the end of each sampling quarter, calculates and reports and accuracy probability interval for each TSP sampler. Directions for calculation are given below and directions for reporting are given in Section 6.3.3.

Let X_i represent the known flow rate for each resistance plate, and Y_i represent the measured flow rate. Calculate the percentage difference (d_i) for each flow rate using Equation 1. For each quarterly audit, calculate the average percent difference ($\bar{d}_j$) and the standard deviation (S_j) using Equations 2 and 3, respectively. Calculate the 95 percent probability limits for accuracy using Equations 4 and 5.

As an example, consider the following data from the audit of a TSP sampler:

Resistance plate no.	Measured flow rate, Y_i, m^3/min (cfm)	Known flow rate, X_i, m^3/min (cfm)	Difference, d_i, percent
13	1.53 (53.9)	1.47 (52.0)	4
10	1.39 (49.1)	1.34 (47.2)	4
7	1.21 (42.8)	1.11 (39.1)	9
18	1.73 (61.0)	1.68 (59.3)	3
5	0.99 (34.9)	0.93 (32.8)	6
			Σ = +26

Apply Equations 2 and 3:

$$\bar{d}_j = +26/5 = 5.2\%$$

$$S_j = \left[\frac{158 - (26)^2/5}{4}\right]^{1/2} = 2.4\%$$

Apply Equations 4 and 5:

Upper limit = 5.2 + 1.96(2.4) = 9.9 or 10%

Lower limit = 5.2 - 1.96(2.4) = 0.5 or 1%

On the Data Assessment Report (Table 8), +1 is reported for the lower 95 percent limit and +10 is reported for the upper 95 percent limit for TSP sampler accuracy.

6.3.3 Organization reporting requirements - At the end of each sampling quarter, the organization must calculate precision and accuracy for each continuous analyzer and each TSP sampler, and record the calculated results on Part I of the Data Assessment Report (Table 7). In addition, for each audit of a continuous analyzer (CO, NO_2, O_3, and SO_2), record the five audit concentrations and the difference between the measured concentration and the known (audit) concentration on Part II of the Data Assessment Report (Table 7). The quarterly Data Assessment Report must be submitted with the air monitoring data. All data used to calculate reported estimates of precision and accuracy, including span checks, collocated sampler results, and audit results, must be made available to the permit granting authority upon request.

The results from the example calculations in Sections 6.3.1 and 6.3.2 have been recorded on Table 8 to illustrate how to complete the Data Assessment Report. A blank copy of the Data Assessment Report is included as Table 7. This blank report may be copied and used by the organization submitting estimates of precision and accuracy for air monitoring data.

7. QUALITY ASSURANCE FOR METEOROLOGICAL DATA

New equipment requires only the field checkout and calibration procedures recommended by the manufacturer. Used equipment should receive an appropriate examination (overhaul if necessary) 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. 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 might be retained by the owner to install and operate the network) should be performed to provide an onsite evaluation of (1) the network installation, (2) inspection, maintenance and calibration procedures and logging thereof, (3) data reduction procedures, including spot checking of data, and (4) data logging and tabulation procedures. The onsite 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 audit-evaluation by an independent meteorological consultant 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.

8. DATA REPORTING

8.1 Air Quality Data Reporting

Data generated from the PSD monitoring, as well as the quality assurance data, should be submitted to the permit granting authority. This could be done on a quarterly basis. The applicant and the permit granting authority should have a prior agreement as to the format, procedure, and schedule for the data submission. The permit application would include the fourth quarter data as well as a summary of data collected during the previous 12 months. The periodic submission of data is intended to identify any problems in the data as they occur and avoid delays in processing the application due to inadequate or poor quality data. For continuous analyzers, at least 80 percent of individual hourly values are expected to be reported for the time period for which the sampling is performed. For manual methods (TSP), 80 percent of individual 24-hour values should be reported. See Section 2.11 for other considerations.

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 to observation time, and be furnished to the permit granting authority upon request. All units should be in the SI system (International System of Units). 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.

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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 critiera for various pollutants, meteorological monitoring, and quality assurance procedures.

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