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Guideline Document for Ambient Monitoring of 5-minute SO_2 Concentrations

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SECTION 1.0
INTRODUCTION

This document provides guidance to assist State, local and tribal air pollution control agencies (hereafter known as "air agencies") in deciding whether existing SO_2 ambient air quality monitors should be relocated to address concerns about the potential for high short-term SO_2 concentrations.[1] It also provides guidance on how to redesign the network in the event that an air pollution control agency determines that existing SO_2 monitors should be relocated.

This report is organized into seven sections. Section 1.0 explains the background that has led to the development of this guideline document; provides a brief overview of proposed revisions to Part 58 requirements for short-term SO_2 monitoring; discusses the purpose of this document; and comments on the references relevant to this topic. Section 2.0 explains how to use the document. Section 3.0 presents the criteria that air agencies should follow in reviewing their existing SO_2 monitoring network to determine if it is adequate for measuring short-term SO_2 peaks. Section 4.0 presents suggested criteria to assist air agencies in deciding which, if any, SO_2 monitors to relocate and where to place them. Section 5.0 provides guidance for estimating the costs associated with possibly redesigning the existing SO_2 monitoring network to address the needs to which the proposed revised Part 58 requirements respond. Section 6.0 presents guidance that assists air agencies with making decisions with respect to operation of a redesigned SO_2 network. Finally, Section 7.0 lists the references that are relevant to monitoring for 5-minute SO_2 concentrations.

The Clean Air Act and implementing regulations at 40 CFR Part 58 contain legally binding requirements. This document does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it does not impose binding, enforceable requirements on any party, and may not apply to a particular situation based upon the circumstances. EPA and State decisionmakers retain the discretion to adopt approaches

[1] As discussed later in this section, EPA has also proposed revisions to relevant monitoring requirements in 40 CFR Part 58 (60 FR 12492, March 7, 1995). If and when those revisions are promulgated, we will review this document to determine the need for any changes to conform to Part 58 rules.

to the monitoring of SO_2 concentrations, including 5-minute concentrations, that differ from this guidance where appropriate. Any decisions by EPA regarding a particular monitoring network will only be made based on the statute and regulations. Therefore, interested parties are free to raise questions and objections about the appropriateness of the application of this guidance to a particular situation; EPA will, and States should, consider whether or not the recommendations in the guidance are appropriate in that situation. This guidance is a living document and may be revised periodically without public notice. EPA welcomes public comments on this document at any time and will consider those comments in any future revision of this guidance document. Finally, this document does not prejudice any future final EPA decision regarding the proposed Intervention Level Program, the proposed revisions to Part 58, or any action taken on response to the remand of the NAAQS for SO_2.

1.1 Background

Because of a 1992 court decision [American Lung Association vs. United States Environmental Protection Agency (EPA)], the EPA was compelled to review, and if appropriate, revise the primary National Ambient Air Quality Standards (NAAQS) for SOx. A court order was subsequently issued requiring the EPA to take final action on the 1988 proposed decision not to revise the primary standards, or re-propose and take final action on the re-proposal within 1 year after the close of the public comment period. In response to this court order, the EPA initiated a review of new health information regarding the effects on asthmatics of short-term peaks of SO_2, and proposed regulatory changes to Parts 50 and 53 on November 15, 1994. In the November 15, 1994 Federal Register, the EPA proposed to retain the current 24-hour and annual primary NAAQS for SO_2. In addition, the EPA solicited comment on the need to adopt additional regulatory measures to address short-term peak SO_2 exposures. The alternative regulatory measures under consideration included: adopting a 5-minute SO_2 NAAQS of 0.6 ppm; establishing a new regulatory program under section 303 of the Clean Air Act (CAA); and augmenting implementation of the existing standards by focusing on those sources likely to produce high 5-minute peak SO_2 concentrations. EPA also stated that these additional regulatory measures should be implemented through a risk-based targeted strategy that focuses on those individual sources most likely to produce high 5-minute peak SO_2 concentrations.

The risk-based targeted strategy for implementing the regulatory measures referenced in the November 15, 1994 Federal Register was proposed on March 7, 1995. The March 7, 1995 Federal Register notice proposed a two-stage strategy. The first stage would involve identifying potential problem areas and then conducting ambient monitoring in those areas. The second stage would be to take corrective action should the monitoring conducted during the first stage reveal concentrations in excess of the appropriate trigger level. In this notice, the EPA indicates that the targeted implementation strategy would be used to identify areas that may be subject to high 5-minute SO_2 concentrations, regardless of the alternative selected (i.e., retain the existing standards, but augment their implementation, establish a new 303 program, or add a new 5-minute NAAQS). EPA also proposed revisions to 40 CFR Part 58 to allow States to reduce the number of National Air Monitoring Stations (NAMS) and State and Local Air Monitoring Stations (SLAMS) in metropolitan areas. This is designed to allow excess monitors and resources to be used toward the targeted implementation strategy.

In evaluating these three regulatory options, the EPA determined that high short-term SO_2 concentrations are a localized problem rather than a widespread national concern. As a result, the EPA published its decision to not revise the SO_2 National Ambient Air Quality Standard (NAAQS) in the May 22, 1996 Federal Register notice. However, the Administrator concluded that in some localized situations, 5-minute SO_2 concentrations above 0.60 ppm pose a health threat to sensitive individuals. The magnitude of health risk to the community is a function of the concentration and frequency of the peaks and size of the population subject to exposure.

To address the threat to public health in these localized situations, EPA published proposed revisions to 40 CFR Part 51 in the January 2, 1997 Federal Register that would establish concern and intervention levels under Section 303 of the Clean Air Act. Under this proposed IL program, a range of concentrations would be established. The lower boundary of this range would be the concern level at 0.60 ppm of SO_2, based on a 5-minute hourly maximum value. The upper boundary of this range would be the endangerment level and would be at 2.0 ppm of SO_2, based on a 5-minute hourly maximum value. A 5-minute hourly maximum value is the highest of the 5-minute averages from the 12 possible non-overlapping periods during a clock hour.

Under the proposed IL program, when a concern level is exceeded in a given area, the State would assess the situation to determine whether intervention is appropriate. In making this determination, the State would consider the magnitude of the 5-minute peak concentration; the frequency of the episodes; the history and nature of citizen complaints; available information on the potential population exposure; the type of process being used; the history of past upsets or malfunctions; the type of fuel used; knowledge of how well the source is controlled; and any other consideration that the State finds to be appropriate. If the endangerment level is exceeded, thereby exposing a significant population to imminent and substantial endangerment, the State should consider taking immediate action to protect public health. In general, as the concentration level and frequency of the episode increases and the health effects are more pronounced, the action by the State would be more stringent. Under the proposed IL program, the State, not EPA, would normally assess the health risk and implement corrective measures.

A key element of the proposed IL program would be the targeted implementation strategy that was first proposed in March 1995. Under that strategy, existing SO_2 monitors may need to be relocated to areas near point sources where peak SO_2 concentrations may exist. EPA proposed revisions to the ambient air quality surveillance requirements as part of the targeted implementation strategy (these revisions are summarized in Section 1.2). The March 7, 1995 proposal also presented a strategy States could use to prioritize potential sources of high 5-minute SO_2 peaks for monitoring. The strategy presented three groups of sources ranked by their capacity for high emission rates and their potential for high, 5-minute peaks. However, in the January 2, 1997 IL program proposal, EPA indicated that, in response to public comments on the proposed implementation strategy, the Agency would no longer require States to prioritize sources for monitoring in accordance with the three categories of industrial sources. EPA is now recommending that States evaluate the need to monitor sources based on such factors as the history of citizen complaints; knowledge of the operation of a given source; the population in the vicinity of the source; and environmental justice concerns.

EPA will be considering the need for, and appropriateness of, more comprehensive efforts for revisions to the State and local air monitoring stations for SO_2 in the course of a reanalysis of the Agency's broader

ambient air quality monitoring strategy. Any such revisions will only be made following further discussions with State and local agencies and other stakeholders.

In response to EPA's decision published on May 22, 1996 to not revise the SO_2 NAAQS, the American Lung Association and the Environmental Defense Fund petitioned the U.S. Court of Appeals for the D.C. Circuit for judicial review of EPA's decision not to establish a new 5-minute SO_2 NAAQS. On January 30, 1998, the court issued a decision that EPA failed to provide an adequate explanation for its decision and remanded the case to permit EPA to more fully explain its decision not to set a standard for short-term SO_2 peak levels.

EPA has identified interim actions that EPA will take to address 5-minute peak SO_2 levels, including publication of this monitoring guidance. Because of concerns about asthmatic individuals exposed to short-term peaks of SO_2 in localized situations, EPA intends to work with States to determine whether the existing SO_2 NAAQS and SIP requirements are being met; to take regulatory action in areas where appropriate; and initiate enforcement review/action to ensure SIP requirements are met.

1.2 Summary of Proposed Short-term SO_2 Monitoring Requirements

Requirements for ambient monitoring are established in 40 CFR Part 58 - Ambient Air Quality Surveillance. As a result of past emphasis on urban scale air quality management, the current Part 58 requirements are focused on measuring population exposure over a large area and are not generally designed to measure the influence of specific point sources. Despite changes in the profile of sources of SO_2, the SO_2 ambient air quality network has not been modified to reflect the air quality for SO_2 near industrial sources. Moreover, increased concerns about the high short-term concentrations of SO_2 occurring near point sources, together with the prevalence of low concentrations at existing networks and the great difficulty in modeling to reliably predict short-term concentrations, suggest a need to redirect monitor networks near these sources. For these reasons, EPA proposed revisions to 40 CFR Part 58 (March 7, 1995 Federal Register) that, if adopted, would direct States to redeploy SO_2 monitors around

targeted sources of SO_2 and modify the instrumentation at selected sites to measure values above 0.5 ppm.

EPA's proposed revisions to 40 CFR Part 58 include the following changes:

1) A proposed requirement to specify that monitoring methods used for 5-minute average SO_2 measurements meet the appropriate supplemental performance specifications that have been proposed to be added to 40 CFR Part 53.

2) Proposed changes to the NAMS requirements for SO_2 monitors to free up monitors to be deployed to implement the targeted monitoring strategy.

3) Proposed changes to the requirements for the minimum number of SLAMS SO_2 monitors. The requirements would also be revised to allow the use of microscale SO_2 sites for SLAMS monitors, and to encourage middle and neighborhood scale measurements near these targeted sources. EPA is also proposing that the SO_2 monitors around the targeted sources of SO_2 emissions be classified as SLAMS monitors.

4) A proposed waiver from all (or part of) the monitoring requirements. The waiver would be conditioned upon a 2-year monitoring period with low measured concentrations. In addition, monitoring would have to be in accordance with EPA guidelines for network review for source oriented SO_2 monitoring in non-urban areas. It should be noted that EPA has yet to develop this guidance, and requested comments on this waiver provision and the minimum number of years of data collection to be required.

5) A proposed requirement to prepare a targeted SO_2 monitoring plan that contains a listing of the sources to be monitored, the schedule for monitoring, and the rationale for selecting the sources. A minimum of four SO_2 monitors around each targeted source would be required. In addition, provisions are proposed that dictate how States should determine the area of expected maximum concentration for monitor deployment purposes.

6) A proposed requirement for reporting the number of 5-minute hourly maximum observations.

The comment period for the NPRM closed on June 6, 1995 and EPA received 23 comments on the proposed changes. Those comments were generally in support of the proposed changes and so, although EPA has not yet promulgated them, encouraging States to voluntarily proceed with actions in accordance with the proposal, provided doing so does not conflict with currently applicable requirements, is appropriate

and advances the public's interest in better characterizing and understanding short-term air quality.

1.3 Purpose

EPA has developed this guidance document to assist air agencies in addressing short-term peaks of SO_2. In particular, EPA has developed this guidance document with respect to the targeted implementation strategy for SO_2 emission sources as part of the proposed IL program. Specifically, this guidance document assists the air agencies in deciding if they should relocate and/or modify existing SO_2 monitors to assess the potential for high 5-minute concentrations. In addition, this guidance manual provides practical information and guidance for redesigning the SO_2 network in the event that the States decide that it is necessary to relocate and/or modify existing monitors.

1.4 Resources

In the development of this guidance manual, numerous resources and references were identified and reviewed. These references contain additional details on the technical areas addressed in this guidance manual as well as useful information that has not been summarized in this guidance document. For example, the listing of references in Section 7.0 includes a July, 1996 report providing broad guidance to States in determining if there is a need to implement an IL program and, if so, to assist in developing the program. This guidance manual supplements the July, 1996 guidance by focusing on a specific area of the proposed IL program, (i.e., determining if it is necessary to relocate existing monitors and, if so, how to redesign the network).

SECTION 2.0

HOW TO USE THIS DOCUMENT

As indicated in Section 1.0, a decision on whether to formally adopt the proposed IL program will not be made until the remand is addressed and a final decision is reached regarding whether to revise the monitoring requirements. In the meantime, States can consult the various scientific and regulatory documents, Federal Register notices, etc., dealing with this issue that have included discussion of many of the points involved in assessing whether and how to modify existing SO_2 monitoring networks (Section 7.0 contains a listing of these Federal Register notices and guidance documents). In addition, EPA is now issuing guidance to address certain aspects of the proposed IL program monitoring requirements. This document has been prepared to provide guidance, consistent with EPA's foregoing analyses and discussions, to States on how best to determine whether and how to modify their existing SO_2 monitoring networks. As air agencies contemplate how they will respond to these new proposed requirements, if adopted, this document and the following points can serve as an overall guide to their decision making process.

First, we anticipate that actions that would be taken under the proposed IL program would depend largely on ambient monitoring of 5-minute SO_2 concentrations. EPA has proposed changes to 40 CFR Part 53 (Reference and Equivalent Methods) that address requirements for response time and range for SO_2 monitors used to obtain 5-minute data. These proposed 40 CFR Part 53 requirements, if adopted, will need to be met by all SO_2 monitors that are used in the IL program to measure 5-minute SO_2 concentrations.

Moreover, we recognize that most current SLAMS/NAMS monitors are not currently located to capture maximum 5-minute exposures and may not have suitable range and response time. As such, EPA has proposed changes to Part 58 which would allow existing SLAMS/NAMS monitors to be relocated and modified for the purpose of obtaining data on 5-minute SO_2 exposures.

One underlying principle of the proposed IL program is to give the States the authority to determine

whether monitors should be relocated and modified to obtain 5-minute SO_2 data. If and when the proposed rules are adopted, this process would need to be documented and reviewed as part of the annual SLAMS network review. EPA would not require that every existing network be changed, but we would expect States to conduct some form of evaluation to determine whether modifications would be necessary, and EPA would review the adequacy of the States' determinations during the annual SLAMS network review. EPA has also proposed to require that once a monitor has been relocated, at least two years of data must be collected at the new location. If exceedances of the threshold or endangerment levels are recorded, the proposed IL program would be triggered. EPA is in the process of developing separate guidance for implementing the proposed IL program once triggered, which it will issue if and when the proposed IL program is adopted.

EPA at this time believes that relatively few areas of the country are likely to encounter short term SO_2 peaks in excess of the proposed IL program threshold level. Further, it is unclear how many of these cases would be likely to require corrective action under the proposed program. Therefore, for many areas, no changes to the existing monitoring program are likely to be needed.

However, an initial task for States will be to estimate the likelihood of exceedances of the proposed threshold level and determine whether there may be a need to conduct monitoring for 5-minute concentrations of SO_2. This is the subject of Section 3.0 of this document - Network Review.

If it is determined that there is a need for short term SO_2 monitoring, then the next task would be to design an adequate network for monitoring short term SO_2 peaks. This is the subject of Section 4.0 of this document - Network Design.

Finally, as an aid to practical planning and decision making, current costs for various short-term SO_2 monitoring scenarios are estimated, and cost data are provided for use in making more specific estimates. This is the subject of Section 5.0 of this document - Cost Estimation.

SECTION 3.0

NETWORK REVIEW

In general, the network review consists of identifying SO_2 sources, evaluating ground level impacts, assessing population exposure and then determining whether the existing network provides adequate protection against high short-term SO_2 episodes. There is a variety of information that may be available to support the network review. This includes:

- information on SO_2 sources such as emission inventories, permits, records of inspections or compliance/enforcement actions, and local knowledge,
- ambient SO_2 data,
- meteorology and/or terrain conditions that could increase SO_2 exposure,
- populations near suspected sources, and
- citizen complaints.

In addition to this information, EPA will assist, upon request, State efforts to identify areas for monitoring 5-minute SO_2 peaks by providing information compiled from various databases. This would include EPA's Geographic Targeting Database, and the Aerometric Information Retrieval System, which contains nationwide data on facility emissions, as well as ambient air monitoring data. EPA will leave the decision on how best to use this information to the State.

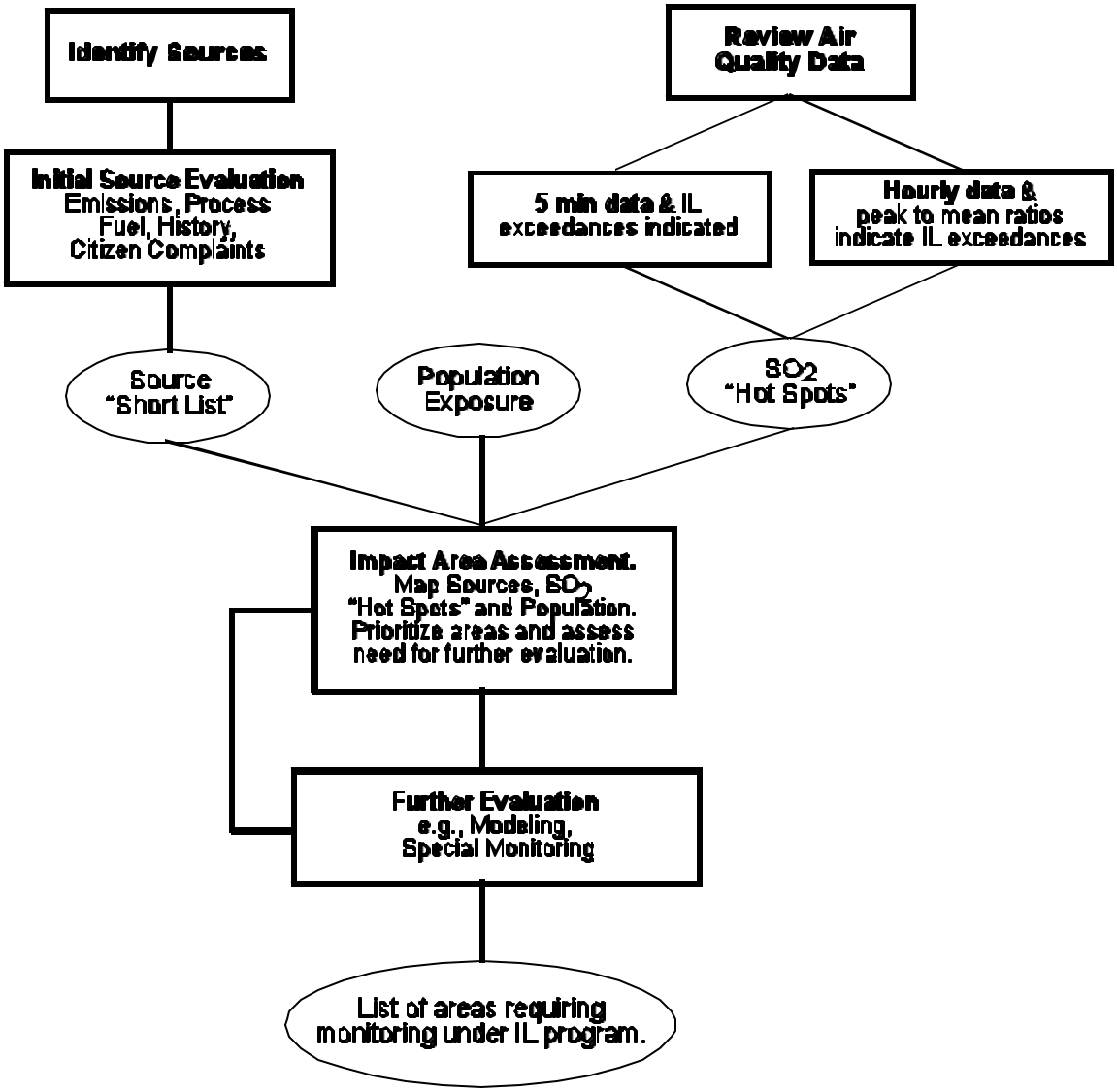
Availability and quality of each of these types of information will vary from area to area, and each area may present unique circumstances. Therefore, there is no prescribed method for evaluating these factors to determine if there is a need to modify the existing network. However, an overall structure for planning and coordinating the network review can be defined. This is illustrated in Figure 3-1.

Guidance for each stage of the network review is provided in the remainder of this section. Briefly, SO_2 sources should be identified and an initial evaluation conducted to determine the likelihood that each source

could be responsible for an exceedance under the proposed IL program. It is probable that many sources can be eliminated from further consideration at this stage. At the same time, available air quality data should be evaluated for exceedances (based on 5-minute data - if available) or possible exceedances (based on hourly data) of the proposed IL program thresholds.

Figure 3-1. Network Review for 5-Minute SO_2 Peaks

- General Procedure Outline -



The next stage should be to estimate impact areas for suspected sources and for current monitoring locations where exceedance or possible exceedance of the proposed IL program threshold is indicated. Population exposure within each of these impact areas should be assessed in a manner that is responsive to the principles of environmental justice. For each area, the results from (1) the source evaluation, (2) the air quality data review, and (3) the population assessment can be considered together to arrive at a ranking or prioritization of each area and indicate the need for further evaluation. Table 3-1 provides a basic decision matrix that illustrates how areas under consideration may be evaluated and indicates actions that might be appropriate in each case.

Where warranted, more in depth analysis such as model-based screening, dispersion modeling, or special monitoring studies should be conducted to assist final determinations of areas where further monitoring should be conducted to support implementation of the proposed IL program. Each of these stages is discussed in the following subsections of this section.

3.1 Source Identification

In the March 7, 1995 Federal Register notice, EPA proposed a targeted implementation strategy for identifying those areas where there is potential for high 5-minute SO_2 concentrations. In the proposed strategy, EPA identified sources with the potential to produce high short-term SO_2 events and ranked these sources into three categories A, B and C. Table 3-2 lists sources in each of the categories.

Initially, EPA intended to require States to evaluate all three categories of sources, with generally decreasing emphasis from Category A to C (after consideration of source-specific factors). After public comments were received and evaluated, EPA stated (in the January 2, 1997 Federal Register notice) that it does not intend to require States to prioritize sources in accordance with the three categories. However, the source identification and ranking may be used, along with other factors, as a starting point in identifying sources for monitoring.

TABLE 3-1. SUGGESTED MATRIX FOR INITIAL ASSESSMENT OF POTENTIAL IMPACT AREAS

Initial Source Evaluation Results	AQ Data Review Result	Population	Action	Priority
Source identified with potential for IL exceedances	Data indicate IL exceedance	Population in impact area	Network re-design is probably needed.	1
Source identified with potential for IL exceedances	Data indicate IL exceedance	No population in impact area	Further evaluation is warranted to verify that population is not affected.	2
No source identified	Data indicate IL exceedance	Population in impact area	Further evaluation is warranted to determine source or sources causing exceedance.	3
No source identified	Data indicate IL exceedance	No population in impact area	Further evaluation is warranted to determine source or sources causing exceedance and to verify that population is not affected.	4
Source identified with potential for IL exceedances	No data	Population in impact area	Further source evaluation is probably warranted to determine if likelihood of IL exceedances is sufficient to warrant monitoring.	5
Source identified with potential for IL exceedances	No data	No population in impact area	If the likelihood of IL exceedances is high, then further source evaluation may be needed to verify that population is not affected.	6
Source identified with potential for IL exceedances	Data do not indicate IL exceedance	Population in impact area	If monitor is reliable and adequately representative, then no further action may be needed.	7
Source identified with potential for IL exceedances	Data do not indicate IL exceedance	No population in impact area	Probably, no need for further action.	8
No source identified	No data	Population in impact area	No further action indicated.	9
No source identified	No data	No population in impact area	No further action indicated.	10
No source identified	Data do not indicate IL exceedance	Population in impact area	No further action indicated.	11
No source identified	Data do not indicate IL exceedance	No population in impact area	No further action indicated.	12

EPA's rationale for source categorization is presented in the March 7, 1995 Federal Register notice. In identifying and ranking these source types, EPA relied on: (1) available 5-minute air quality data, (2) exposure estimates for various source types - which integrated emissions potential with the size

and activity of the surrounding population and (3) EPA's Geographic Targeting Database for non-utility sources which is derived from combining data from a census of manufacturing, EPA's Facilities Index System, and EPA's Aerometric Information Retrieval System (AIRS).

In general, Category A sources have high emissions, are near monitors which measured 5-minute peaks, or are estimated, based on exposure analysis, to expose a large number of asthmatics to SO_2 concentrations greater than 0.6 ppm. In addition, Category A source types are known to have short-term releases associated with startup, shutdown or upsets. Category B sources have high annual emissions or are thought to be subject to short-term emission events. Category C sources consist of utility boilers only. Utility boilers can have high emissions; however, short term SO_2 peaks associated with these sources are not anticipated since utility boilers typically have taller stacks and steady operating conditions. This ranking should not be relied upon exclusively since, for example, a Category B source located near a population center might be more important than a Category A source in a remote location.

TABLE 3-2. EPA'S SOURCE CATEGORIZATION

Category A Sources	Sulfite pulp and paper mills Primary copper smelters Aluminum smelters Top 20% of petroleum refineries in terms of projected SO_2 emissions
Category B Sources	Kraft sulfate pulp and paper mills Secondary copper smelters Secondary lead smelters Remaining petroleum refineries Iron and steel mills Carbon black manufacturing Portland cement manufacturing Crude petroleum and natural gas extraction processes Phosphatic fertilizer manufacturing Industrial boilers Sulfuric acid plants Wet corn milling operations
Category C Sources	Utility boilers

Consideration of local SO_2 sources should not be limited to those categories identified in Table 3-2. Knowledge of specific SO_2 sources in the area is likely to be of greater value.

3.2 Source Evaluation

Once local SO_2 sources have been identified, each should be evaluated to determine if it has the potential to produce short-term SO_2 peaks. This is a process of elimination based on evaluation of the emissions characteristics of specific sources and citizen complaints. Ambient air quality data may also be used during this assessment. The end result should be a "short list" of sources that may have the potential to produce SO_2 peaks. Evaluation factors include:

- Emissions
- Fuel
- Processes
- History of operation
- Citizen complaints

Emissions - Sulfur dioxide emissions occur mainly due to the thermal oxidation of sulfur during combustion of sulfur containing coal and fuel oil and from processing of natural ores and other sulfur containing materials. Short-term emissions peaks have generally been found to occur due to malfunctions or upsets, or during startup and shutdown of processes or emissions control equipment.

Both major sources and smaller sources of SO_2 may need to be considered. A major source of SO_2 may not necessarily produce high short-term SO_2 events since steady operating conditions or controls (including high stacks) may effectively limit ground level impacts. On the other hand, a source with lesser emissions may be associated with frequent SO_2 peaks due to recurring process upsets or uncontrolled ground level fugitive emissions.

Fuel - For combustion sources, the type of fuel or raw material used and its sulfur content will have a major bearing on SO_2 emissions. Typically, about 95 percent of the sulfur contained in bituminous coal and fuel oil will be oxidized to SO_2 during combustion. For sub-bituminous coal the fraction of sulfur converted to SO_2 is somewhat less. Natural gas contains very little sulfur and its combustion typically does not contribute significantly to SO_2 emissions (AP-42 Chapter 1, Section 1). SO_2 emissions from other sulfur containing materials such as natural ores will depend on the specific sulfur content of the raw material and the process in which the raw material is being processed.

Process - In general, batch processes where emissions occur at discrete intervals are more likely to be associated with short-term SO_2 spikes than continuous processes. Sources utilizing older equipment (which may be grandfathered from control requirements) may be more likely to cause high short-term SO_2 events than sources using newer equipment. SO_2 peaks may also be associated with process or control equipment that is subject to frequent malfunctions or upsets.

History of Operations - A source with a history of malfunctions, upsets, or compliance problems may be more likely to produce short-term SO_2 peaks than sources without such a history.

Citizen Complaints - Records of citizen complaints may be important indicators of sources that may have problems. However, citizens may not have the background or resources to correctly attribute a complaint to a specific pollutant or source.

3.3 Ambient Air Quality Data Review

Most existing SO_2 monitors are not source oriented and most do not collect 5-minute data. However available ambient air quality data should be assessed to support source evaluations or help to identify additional areas of concern for the proposed IL program thresholds.

Where 5-minute SO_2 measurements are available, the data may be examined directly for exceedances of the proposed IL program threshold ranges (i.e., concern level of 0.6 ppm or endangerment level of 2.0 ppm). If such exceedances are present and can be linked to a specific source, there is a strong indication of need for monitoring in support of the proposed IL program.

In most cases, only hourly SO_2 data will be available. EPA has analyzed available 5-minute SO_2 monitoring data nationwide and developed peak-to-mean ratios that provide a rough estimate of the peak 5-minute concentration associated with a given hourly value (EPA September, 1994). To make nationwide estimates of short-term peak SO_2 levels, EPA assumed an upper bound peak to mean ratio of 3-to-1 and a lower bound ratio of 2-to-1. For example, an hourly value of 0.25 ppm would give expected 5-minute peak concentrations from 0.5 to 0.75 ppm.

It should be noted that the correlation between peak and mean values in the available data was not so strong as to justify exclusive use of peak to mean ratios as the basis for concluding that specific sources did or did not produce high short-term peak SO_2 levels on the basis of one-hour values. Overreliance on peak to mean ratios may risk underestimating peaks for some monitors and overestimating peaks for others. However, peak to mean ratios do provide useful additional information in support of an initial assessment.

3.4 Assessment of Population Exposure

In order for an area to be of concern for the proposed IL program, there would hve to be population exposure. Since the threshold level is based on health effects during exercise, the activity of the population when an exceedance occurs would also have to be considered. There may be cause for concern if there is a large population living in an area where exceedances are likely to occur; however, there is greater concern if the impact area includes locations such as parks, jogging trails or playgrounds, where people are likely to be exercising. Equal attention should be given to all populated areas to ensure responsiveness to environmental justice principles. Environmental justice refers to the principle that the health and welfare of all citizens are to be protected equally. In some cases, those most affected by an environmental problem

may be least capable of protecting themselves, and therefore should not be overlooked when seeking to remedy an environmental problem. Environmental justice concerns should be addressed in determining the need for additional SO_2 monitoring in targeted areas.

The time when the exceedances occur, and their duration should also be considered. In the case studies prepared for the Regulatory Impact Analysis (RIA) that was prepared for the SO_2 NAAQS decision, there was one instance (Case 6) where it was determined that exceedances occurred predominantly during nighttime hours and that the risk to the population was therefore low and no action (other than continued monitoring) was warranted. In another case (Case 7), the population in the impacted area was small and peaks were shown to last for very short intervals. In this case, it was also concluded that the risk to the public was low and that no further action was needed.

3.5 Impact Areas Assessment

Typically, the impact area of concern for the proposed IL program levels will extend no more than a few kilometers from the source. This is due to dispersion, which makes it unlikely that SO_2 concentrations will remain high enough to be of concern beyond this distance. The impact area will extend primarily in the predominant wind directions, but the effect of terrain (e.g., entrapment or valley flow) and local weather patterns (e.g., frequency of inversions) should be considered. During the initial evaluation, a conservative estimate of the impact area may be adopted and then refined as needed.

For a monitor recording a high SO_2 concentration, the impact area may be taken as the area represented by the monitor. Existing SO_2 monitors located in urban areas typically represent middle (100 to 500 m) and neighborhood (500 to 4,000 m) scales. In suburban areas, a SO_2 monitor would typically be representative at the neighborhood scale. Some source oriented monitors sited to record maximum concentration may represent only a micro-scale area (up to about 100 meters).

3.6 Further Evaluation

The initial evaluation is intended to narrow down the list of sources and impact areas where exceedances under the proposed IL program may be a concern. In many cases, it may be clear at this point that there is no need for additional monitoring and no further action is needed. However, if the initial evaluation points to an area or areas where there may be a problem, or if the available data do not adequately support elimination of certain areas, then further evaluation would be needed. Table 3-1 (see above) indicates several general scenarios where further evaluation may be required under the proposed program. In general, there are two types of evaluation that could help to support a determination of a need for additional monitoring: modeling and special monitoring.

Modeling - EPA has historically relied on dispersion modeling to predict air pollution impacts for a variety of planning and regulatory purposes. However, available models have not been validated for predicting 5-minute SO_2 concentrations and appropriate input data to support modeling of 5-minute SO_2 concentrations may be lacking. Therefore, EPA does not support the use of modeling alone for this purpose. However, existing EPA models may be used as a tool in assessing the extent of impact areas and for siting monitors in areas of predicted maximum concentration (FR March 7, 1995 pp. 12495). Screening models may provide a cost effective means to obtain conservative estimates of impacts.

Detailed modeling studies can be expensive, and this cost would have to be balanced against the cost of establishing monitors around suspected sources for the minimum period of two years.

Special Monitoring - "Special monitoring" is used here to refer to any type of measurements that may be used to help determine whether there is a need for siting additional monitors. This might include a saturation monitoring study or other form of limited ambient air monitoring. Saturation monitoring refers to deployment of a number of portable monitors for a short-term study to determine the distribution of pollutant impacts over an area of interest. EPA has established a repository of saturation samplers, which are capable of obtaining integrated bag samples for analysis. These samplers may be obtained on loan. Lending is governed by a priority system that considers participation in the repository, the amount and type of assistance needed, availability of resources, and the applicability of study results to other areas.

However, the samplers currently available do not have the capability to determine 5-minute SO_2 concentrations. Once again, the cost effectiveness of such an approach would have to be evaluated as monitoring studies can be expensive.

Other options - Some sources have existing continuous emissions monitors (CEMs). CEM data may be useful in establishing the likelihood of the source producing 5-minute SO_2 peaks. It may be necessary to adjust data collection efforts since most CEMs store only hourly data. In addition, some sources operate ambient SO_2 monitors, which may be able to provide additional data for network review.

SECTION 4.0
NETWORK DESIGN

Once it has been established that there is a need for additional monitoring, suitable sites should be selected and established. As a result of the network review, specific sources or groups of sources should have been targeted for monitoring. The task, then, should be to select suitable monitoring sites near these sources.

The overall objective for short-term air quality monitoring is to capture exceedances of the proposed IL program thresholds in areas where people are living and working, and in particular where people exercise. Once suspected areas have been identified and the need for monitoring has been established, then the task should be to find the optimum arrangement of short-term SO_2 monitors in terms of both protection and cost effectiveness. The general process is illustrated in Figure 4-1. Each of these steps of this general process are discussed in the following subsections of this section.

The long-standing EPA guidance on optimum site exposure for SO_2 monitoring (EPA, 1977) still serves as a useful guide. This guidance addresses siting for source oriented monitoring around isolated point sources in a variety of settings; however, it is primarily oriented toward siting to determine representative concentrations for areas of various sizes and peak concentrations in urban areas. For short-term air quality monitoring, sites will typically be source oriented and designed to measure peak concentrations that could occur in populated areas where people would engage in outdoor exercise.

4.1 Recommended Number and Location of Short-term SO_2 Monitors

EPA has suggested that, for an isolated source, 1 to 4 monitors may be needed under the proposed IL program. Furthermore, in general, these would be located at the fence line and in the expected maximum concentration area downwind of the source in the primary and secondary predominant wind directions.

Figure 4-1. Network Design Process for 5-Minute SO_2 Peaks

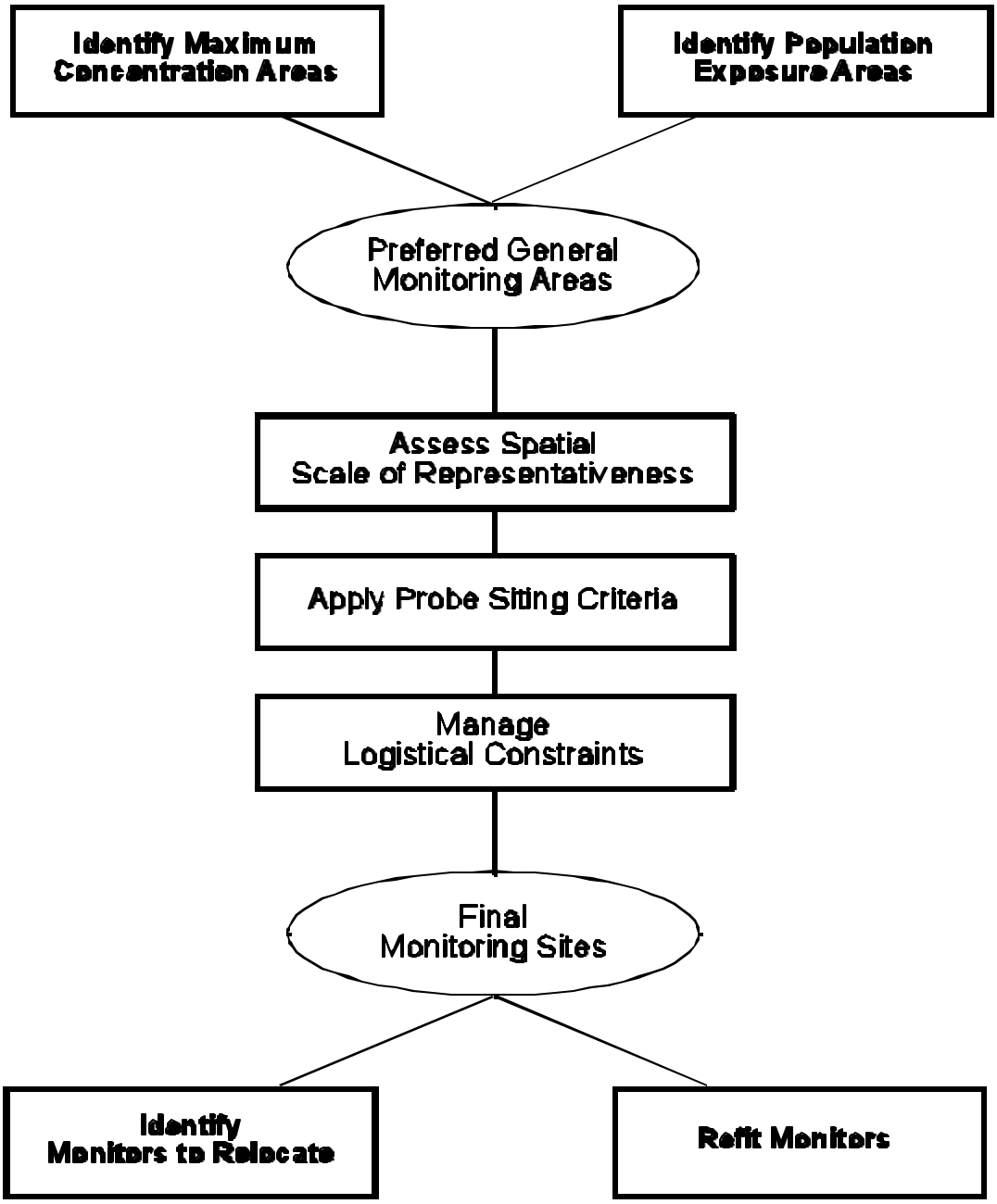
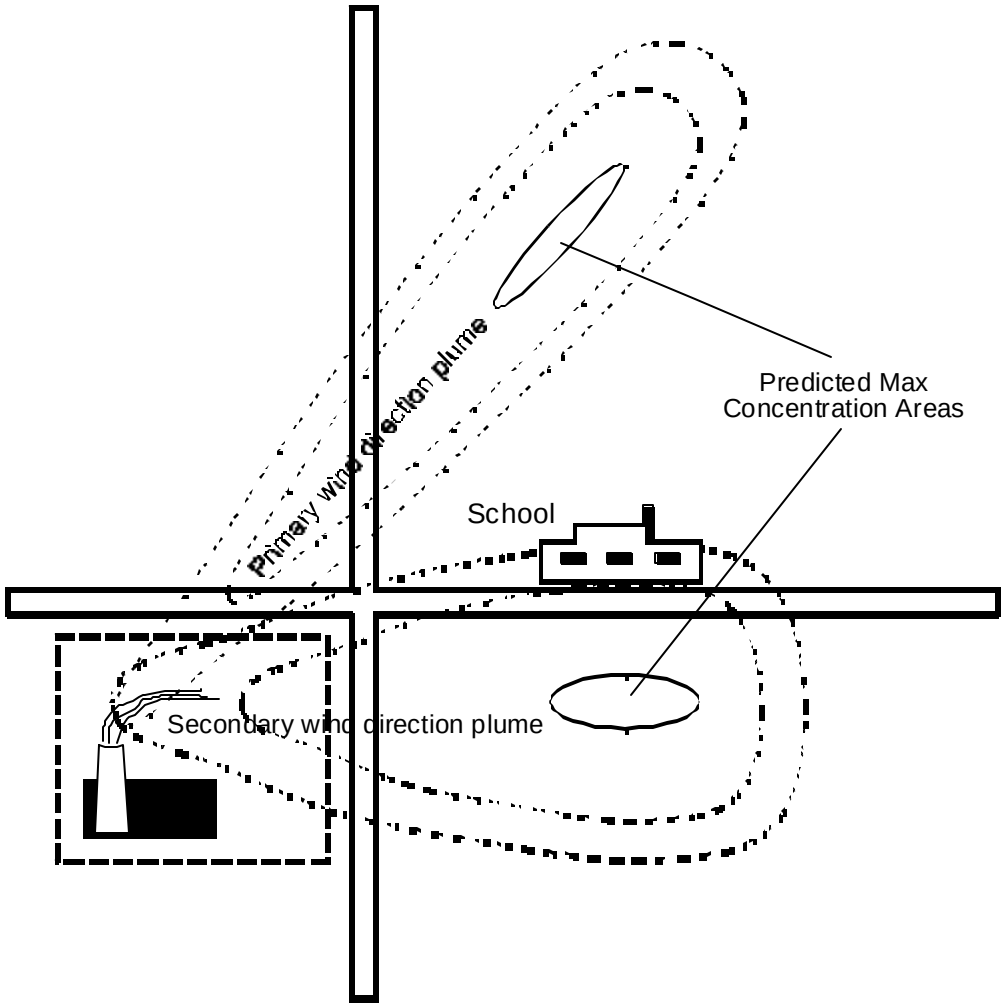


Figure 4-2 illustrates an example monitoring scenario. In this case, the predicted maximum concentration areas for the primary and secondary predominant wind directions bracket a population exposure area (a school). If the school were the only population exposure site in the area, then a single monitor located near the school could provide adequate protection. This is a simple case. For areas with several contributing sources, or highly developed and populated areas, the situation may be more complex and require additional monitoring sites. In every case, experience and judgement is needed to sort out the complexities and select monitoring sites providing adequate protection.

Figure 4-2. Example Monitoring Scenario



The predominant wind directions are usually determined by compiling representative wind data into a joint frequency distribution, which may be plotted as a wind rose. It is preferable to compile several recent years of data in the wind rose. On-site wind data is preferred; however, data from a nearby National Weather Service (NWS) station may be used. EPA's Technology Transfer Network (TTN) Support Center for Regulatory Air Models (SCRAM) web site has NWS data and public domain software for generating wind roses available for download (http://www.epa.gov/ttn/scram).

4.2 Determining Maximum Concentration Areas

Maximum concentration areas are usually identified using dispersion modeling. EPA has developed a number of dispersion models which may be applicable. The latest version of the Industrial Source Complex model (ISCST3) is one of the most generally applicable as it handles a wide variety of source and receptor configurations and meteorological conditions. The model also incorporates a screening algorithm for use in complex terrain with elevated receptors. While the model can be complex to set up, it may be effectively used for monitor siting purposes with simplified inputs to provide a conservative screening analysis of maximum concentration areas.

Another approach would be to apply screening procedures contained in the EPA document "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources" (Brode, 1988). A computerized version of this (the SCREEN model) is available from the SCRAM web site.

It should be emphasized that obtaining reliable estimates of maximum concentration areas based on modeling requires understanding and experience. Some of the considerations include:

- understanding and adequately parameterizing the meteorological and topographical characteristics of the area and their influences on local wind flow and dispersion,
- understanding the applicability and limitations of the input data,
- understanding of model applicability and limitations, and

- obtaining accurate and detailed quantitative descriptions of source characteristics and emissions related to short-term peak SO_2 emissions.

Maximum concentration areas could also be determined using a short-term saturation monitoring study. Ideally, such a study would be conducted under worst case conditions and the monitoring network would be designed to provide data for mapping the pollutant distribution over the area of interest. As discussed above, it may not be feasible to collect 5-minute SO_2 data using currently available saturation samplers; however, longer term data could be of use in mapping out maximum concentration areas.

There are tradeoffs in deciding between the monitoring and modeling approaches. Modeling always constructs an idealized scenario which may not reflect real world conditions. In theory, monitoring should provide greater certainty; however, monitoring results are essentially limited to the meteorological conditions under which the study is conducted and it can be difficult to implement a truly successful monitoring effort. Both approaches contain uncertainties and can be expensive to implement properly.

Fortunately, in many instances, a well conceived screening analysis can provide adequate certainty and it is recommended that such an analysis be conducted at least as a first step. Even if significant uncertainties remain, the results from the screening analysis can be used to guide subsequent modeling or monitoring efforts.

4.3 Determining Population Exposure Areas

An effective way to assess population exposure is to place sources and predicted impact areas on a map showing developed areas, residential areas, schools, parks, etc. The USGS 1:24,000 scale (7.5 minute) quadrangle sheets are ideal for this purpose. Scanned, digital versions of the quadrangle maps are available from USGS on CD-ROM in 1 degree blocks (64 quad sheets).

A maximum concentration region located in or near a residential area indicates a need for establishing a monitoring site. If a maximum concentration areas coincides with a school, park, jogging trail, or other area where people engage in outdoor exercises, this area should be given top consideration for monitoring.

In cases where several areas of potential population exposure to peak SO_2 concentrations are expected, several monitors may be needed. Such areas may be prioritized by determining the number of people likely to be exposed, and by assessing the likelihood that exposure will occur when people are exercising.

4.4 Determining General Monitoring Areas

Identification of maximum concentration areas and population exposure would indicate general areas where a monitor should be sited. It would also indicate the area of coverage or scale of representativeness desired for the monitor. In most cases, the impact area for peak SO_2 episodes will be fairly small - covering an area ranging from several hundred meters to a kilometer. This corresponds to micro and middle scales of representativeness in terms of Part 58, Appendix D network design criteria. Monitors should be sited so that samples will represent, as closely as possible, the appropriate scale of representativeness.

Once the general areas have been selected based on the monitoring objective and representative scale, probe siting criteria would need to be addressed. SO_2 probe siting criteria are prescribed in 40 CFR Part 58, Appendix E and are designed to ensure that comparable data are obtained across different monitoring sites. Probe siting criteria for short-term SO_2 monitors are the same as for general SLAMS and NAMS SO_2 monitors.

At this stage, the task of siting a monitor becomes largely a matter of balancing practical and logistical considerations (e.g., rights to use land, access, power, and security) against the monitoring objectives, representative scale and probe siting requirements. It is often difficult to satisfy all these objectives simultaneously.

4.5 Relocating Existing Monitors

In order to reduce the burden on States, EPA has proposed changes to Part 58 that would allow existing NAMS monitors to be relocated in support of the proposed IL program. Table 4-1 shows current and proposed NAMS siting criteria.

TABLE 4-1. CURRENT AND PROPOSED NAMS SITING CRITERIA.

Current Criteria			
Urbanized Area Population Category	**High Concentration**	**Medium Concentration**	**Low Concentration**
> 1,000,000	6-10	4-8	2-4
500,000 to 1,000,000	4-8	2-4	1-2
250,000 to 500,000	3-4	1-2	
100,000 to 250,000	1-2	0-1	
Proposed Criteria			
CMSA/MSA Population	**SO_2 Emissions (tons per year)**	**Required Number of Monitors**	
> 1,000,000	>200,000 100,000-200,000 0-100,000	3 2 1	
200,000-1,000,000	>200,000 100,000-200,000 20,000-100,000 <20,000	3 2 1 0	
50,000-200,000	>100,000 20,000-100,000 <20,000	2 1 0	

Based on this, EPA has estimated that up to two thirds of existing NAMS monitors could be relocated, if necessary, to support the proposed IL program. As a practical matter, it is unlikely that this large a number of monitors will, in fact, be relocated if the revisions are adopted as proposed.

Once the minimum number of NAMS monitors has been figured under any revised requirements, the remainder would represent the number of monitors that could be relocated. Selecting which specific monitors to relocate would depend on the role of the monitor in the network and the need to maintain monitors to provide trends data.

Whether a monitor is important to retain for trends purposes could be determined based on a review of historical data, including the concentration levels over the last 2 years. If the historical data record shows a trend which is of interest, and medium concentration levels, then the monitor should be retained in the existing network. Certainly, a monitor showing an increasing trend should be retained; however, in most cases around the country, NAMS monitors are showing decreasing trends. If a trend appears to have stabilized, and monitoring further decreases is not of interest, then such a monitor would be a candidate for relocation.

4.6 Refitting Existing Samplers for IL Program Monitoring

EPA has surveyed manufacturers of SO_2 monitors and believes that most existing monitors can be refitted for 5-minute SO_2 monitoring. The necessary changes to existing monitors have to do with response time, span and data recording.

EPA recommends that monitors used to measure 5-minute SO_2 concentrations have a 2-minute or better response time. Most current monitors are set up for recording hourly averaged values and have longer response times. In addition, EPA recommends that the concentration range span 0 to 2.0 ppm. Most current equipment has range settings of 0 -1 ppm or 0-5 ppm. Depending on the make and model of the existing monitor, meeting these new recommended specifications could require increasing the sample flow

rate, changes to electronic circuitry, software modifications, or other minor changes or adjustments. Calibration procedures would be modified to span over the new range. Finally, modifications to the data recording, transmission and storage hardware or software may be needed to handle the 5-minute data.

In addition to traditional point samplers, EPA has stated that open path monitors are another option for short-term SO_2 monitoring. UV-DOAS open path monitors are an equivalent method for SO_2, and could therefore be used in SLAMS/NAMS monitoring networks. Open path monitors have rapid response and may be spanned over the required range. One advantage of an open path monitor is that the measurement can capture potentially high SO_2 concentrations occurring anywhere along the monitoring path, providing protection over a larger area than a point monitor can. One disadvantage is that the path-averaged SO_2 concentration recorded by the open path monitor may fail to capture a high concentration that occurs over a relatively small area of the beam. States considering the use of an open path monitor should consult the EPA guidance document entitled "Recommendations for the Use of Open-Path and Fixed-Point Monitors for Determining Ambient SO_2 Concentrations." This guideline document outlines the procedures for how to orient the open path analyzer with respect to different SO_2 source types once the general site location has been selected. The document also suggests that concurrent monitoring of SO_2 may be useful when assessing potential short-term (5-minute average) SO_2 source related impacts at source-oriented micro- to middle-scale sites.

SECTION 5.0

COST ESTIMATION

Once the number and location of monitors that would need to be established is determined, the next step would be to determine the costs associated with the establishment of the monitoring network. This can be accomplished by using the information contained in the EPA guidance document "Guidance for Estimating Ambient Air Monitoring Costs For Criteria Pollutants and Selected Air Toxic Pollutants," published in October 1993. However, because specific monitoring costs for the proposed IL program were not addressed in the guidance manual, some adjustments to the costs included in the guidance manual may be appropriate. In addition, other costs, specific to monitoring for 5-minute concentrations may be incurred. These can include costs resulting from making modifications to the monitor and data acquisition system to measure 5-minute concentrations. In cases where the State or local agency decides to relocate existing monitors to meet the proposed IL monitoring requirements, additional costs associated with dismantling of the existing station will also be incurred. This section presents information that will allow air agencies to estimate costs associated with short-term SO_2 monitoring generally, and would also allow them to estimate costs associated with meeting the proposed IL program monitoring requirements.

The costs associated with short-term SO_2 monitoring will vary depending on the number of assessment areas that need to be monitored, the number of monitors that a State decides is needed for each area, and the approach that the State decides to use to meet the proposed IL program monitoring requirements. Since the number of monitors used and the number of areas to be monitored could vary from agency to agency, the cost information is presented on a per monitor basis.

In addition, four general cases are presented that represent the four different approaches that could be employed to meet the proposed IL program monitoring requirements. These four cases consist of the following:

Case 1 - The State or local agency decides to relocate an existing monitor(s) to an existing monitoring site.

Case 2 - The State or local agency decides to relocate an existing monitor(s) to a new monitoring site.

Case 3 - The State or local agency decides to deploy a new monitor(s) at an existing monitoring site.

Case 4 - The State or local agency decides to deploy a new monitor(s) at a new monitoring site.

In this manner a State or local agency could use the cost information presented for the Case that best matches the approach that the agency selects for short-term SO_2 monitoring. The costs presented for that Case can then be scaled up to correspond to the number of monitors to be used at the monitoring site. For example, if an agency elects to relocate a total of 3 existing monitors to an existing monitoring site, the costs presented for Case 1 would need to be increased by a factor of three. If the agency elects to establish multiple monitoring sites, the costs would increase in direct proportion to the number of monitoring sites established. For example, if an agency decides to relocate existing monitors to two different monitoring sites, the costs for Case 1 would need to be counted twice (once for each site). In addition, the costs for each site would need to be scaled up to correspond with the number of monitors to be deployed at each site. By following this guidance and the costs presented in this section, the State or local air agency will be able to develop a reasonable estimate of the costs associated with establishing or expanding short-term SO_2 monitoring. The agency may also use this information to assist in selecting a specific approach by examining the relative costs associated with each approach.

Based on the cost monitoring guidance document referenced above, cost estimates for monitoring networks are outlined for eight general monitoring activities. These eight activities are (1) network design and siting, (2) station installation, (3) sampling, (4) analysis, (5) maintenance, (6) data management and reporting, (7) quality assurance/quality control (QA/QC), (8) management and supervision. The applicability of each of these activities to implementation of the proposed IL monitoring program is a function of which case is selected. For example, Case 1 (relocating existing monitors to an existing site) would not incur any costs for a SO_2 analyzer since the analyzer has been previously purchased. In addition, since the costs estimates for the proposed IL program are incremental costs (i.e., costs that would be incurred over and beyond the current costs associated with running the existing monitoring network), Case 1 would also not incur any costs for sampling and analysis, data management, quality assurance and supervision. These costs are

currently being incurred as part of operating the existing monitor that would be relocated and would not be additional costs that would be incurred under a Case 1 situation. Table 5-1 presents a listing of the eight general monitoring activities and identifies which cases would incur additional costs as a result of implementing the proposed IL monitoring requirements. Table 5-2 gives a listing of costs for each monitoring activity for continuous monitoring for SO_2 . These costs are directly from the cost monitoring guidance document and have not been adjusted to account for inflation since 1993 (the date of the cost guidance manual).

Based on the applicability matrix (Table 5-1) and the cost matrix (Table 5-2), the following are the estimated total costs on a per monitor basis for each Case as defined above. These costs reflect both one-time capital expenditures, and annualized operation and maintenance costs. Capital expenditures are annualized over the appropriate amortization periods and summed with the annual operation and maintenance costs to give an average annualized cost over the lifetime of the monitoring system (assumed to be five years). As such, the following costs represent per monitor annualized costs.

Case 1	$3,000
Case 2	$22,000
Case 3	$47,000
Case 4	$66,000

These are rough approximations that reflect the assumptions and considerations that were incorporated into the monitoring cost guidance manual. As such, air agencies should evaluate additional factors when estimating the total costs associated with establishing or expanding short-term SO_2 monitoring. One of these factors is recognizing the assumptions that were used in developing the cost estimates included in the cost manual. For example, network design activities are performed on a network basis as opposed to a per monitor basis. Nevertheless, the monitoring cost manual bases the network design costs on a per monitor basis. Five monitoring sites per network is assumed, so network design costs for networks that consist of fewer sites would be higher while costs for the design of networks with more than five stations

would be less. These types of qualitative judgements should be applied when estimating the costs of establishing or expanding short-term SO_2 monitoring.

In addition, these costs are in calendar year 1993 year dollars. A State may consider escalating these dollars to present day dollars to account for inflation over the past 6 years. Based on the GDP Implicit Price Deflator Index for 1999, published by the U.S. Department of Commerce, the per monitor costs listed above should be increased by 15 percent to estimate per monitor annualized costs adjusted to present day (1999) dollars.

Other qualitative factors that need to be considered when estimating monitoring costs for establishing or expanding short-term SO_2 monitoring depend on the approach selected. For example, Cases 1 and 2 would require the dismantling of the existing monitor for relocation to the new IL monitoring site. This is a cost that is not addressed in the cost guidance manual. A rough rule of thumb to apply is that the effort to dismantle a monitor is the same as the costs to install that monitor. Based on this assumption, it is reasonable to assume that the costs in the guidance manual for monitor installation roughly approximate the costs for dismantling the monitor. These dismantling costs should be added to the costs presented above to obtain a better estimate of the costs associated with meeting the proposed IL monitoring requirements when an existing monitor will be relocated.

Other factors that should be addressed are the costs associated with making modifications to the monitor and the data acquisition system for measuring 5-minute concentrations. This can include modifying the monitor and changing the ranges in the data acquisition system for 5-minute monitoring. This is not a major effort, but will involve a few hours labor and the cost of the span gas. Modifications to the monitor will also need to be made to shorten the response time. However, these modifications are a function of the specific monitor that is being used. The state or local agency should contact the monitor manufacturer to obtain an estimate of these costs. In general, these costs should be relatively minor. At a minimum, these costs should be factored into the estimate of the costs for establishing or expanding short-term SO_2 monitoring.

TABLE 5-1. APPLICABILITY OF MONITORING ACTIVITIES

Cost Elements	Case 1	Case 2	Case 3	Case 4
Network Design				
Network Design Study	X	X	X	X
Site Selection	-	X	-	X
Site Installation				
SO_2 Analyzer	-	-	X	X
Multi-gas Calibrator	-	-	X	X
Zero Air Supply	-	-	X	X
Ambient Air Intake Manifold Assembly	-	-	X	X
Data Logger	-	-	X	X
Strip Chart Recorder	-	-	X	X
Power Drop	-	X	-	X
Land/lease	-	X	-	X
Procurement	-	X	-	X
Shelter	-	X	-	X
Optional Shelter Equipment	-	X	-	X
Site Preparation	-	X	-	X
Equipment Installation	X	X	X	X
Sampling and Analysis				
Supplies	-	-	X	X
Utilities	-	-	X	X
Routine Site Visits	-	-	X	X
Maintenance				
Spare Parts/supplies	-	-	X	X
Remedial Repairs	-	-	X	X
Routine Maintenance	-	-	X	X
Data Management				
Data Acquisition/Processing	-	-	X	X
Data Reporting	-	-	X	X
Data Validation	-	-	X	X
Quality Assurance				
Multi-gas Calibration/Audit System	-	-	X	X
Audits	-	-	X	X
Routine Calibrations	-	-	X	X
Coordination/Implementation	-	-	X	X
Training	-	-	X	X
QA Plan Preparation	-	-	X	X
Supervision				
Planning/Coordination	-	-	X	X

Supervision/Review	-	-	X	X

TABLE 5-2. COST ESTIMATES FOR CONTINUOUS MONITORING OF SULFUR DIOXIDE

Cost Elements	Labor Hours	Cost ($)
Network Design		
Network Design Study	40	2,280
Site Selection	24	792
Site Installation		
SO_2 Analyzer		9,300
Multi-gas Calibrator		3,600
Zero Air Supply		3,000
Ambient Air Intake Manifold Assembly		1,280
Data Logger		2,100
Strip Chart Recorder		2,300
Power Drop		350
Land/lease		1,500
Procurement	8	288
Shelter		8,700
Optional Shelter Equipment		4,000
Site Preparation		3,000
Equipment Installation		528
Sampling and Analysis		
Supplies		400
Utilities		960
Routine Site Visits	52	1,716
Maintenance		
Spare Parts/supplies		500
Remedial Repairs	16	528
Routine Maintenance	20	660
Data Management		
Data Acquisition/Processing	26	936
Data Reporting	24	1,008
Data Validation	34	1,428
Quality Assurance		
Multi-gas Calibration/Audit System		7,200
Audits	672	
Routine Calibrations	26	858
Coordination/Implementation	12	600

Cost Elements	Labor Hours	Cost ($)
Training	1,008	
QA Plan Preparation	20	840
Supervision		
Planning/Coordination	32	1,600
Supervision/Review	32	1,600

SECTION 6.0

CONTINUED MONITORING AND WAIVING MONITORING REQUIREMENTS

Once monitoring sites are established, they should be operated for a minimum period of 2 years in order to monitor the range of SO_2 peaks that might occur due to changing conditions such as source operations and meteorology. After this 2-year period, monitoring could be discontinued if data indicate that the risk of exposures to SO_2 peaks over the proposed IL program threshold is sufficiently low. This should be addressed by the State air agency on a case by case basis. The following scenarios are illustrative.

No exceedances of proposed IL program thresholds are recorded during the 2-year period. Monitoring could most likely be discontinued; however, consideration should be given to relocating the monitor if a network review indicates that exceedances in another location are still possible.

A minimal number of exceedances are recorded, or exceedances occur during times when the risk of exposure is low. Overall risk to the public is low as indicated by the IL program monitors. Monitoring could be discontinued; however, a network review should be conducted in support of this decision. If the network review indicates a possibility of an increased number of exceedances, or during times of elevated risks of exposure, monitoring should be continued.

Exceedances are recorded early in the 2-year period; however, actions are taken at the source which prove to reduce the number of exceedances. Monitoring should probably be continued for at least 2 years after the date when the corrective actions occurred.

SECTION 7.0

REFERENCES

1. EPA Optimum Site Exposure Criteria for SO_2 Monitoring. EPA-450/3-77-013. April 1977

2. Brode, R.W., 1988. Screening Procedures for Estimating the Air Quality Impact of Stationary Sources. EPA-450/4-88-010.

3. EPA 1994, Review of the National Ambient Air Quality Standards for Sulfur Oxides: Assessment of Scientific and Technical Information. Supplement to the 1986 OAQPS Staff Paper Addendum. EPA-452/R-94-013. September 1994. This provides an assessment of health effects and exposure for 5 min SO_2 and serves as the scientific basis for the proposed IL program. Of particular interest for monitoring is the discussion on the use of Peak to Mean ratios for estimating 5-minute peak concentrations from hourly data. The staff used a lower bound of 2:1 (peak to mean) and an upper bound of 3:1 to place a range on 5-minute estimates based on hourly data to account for variability in peak to mean ratios for different source types and dispersion conditions.

4. 59 FR 58958, November 15, 1994, National Ambient Air Quality Standards for Sulfur Oxides (Sulfur Dioxide) - Reproposal. In this notice EPA considered short-term peak SO_2 exposures and proposed not to revise the 24-hour and annual SO_2 NAAQS. This notice also contains proposed changes to the 40 CFR part 53 rules for reference and equivalent methods to provide for monitoring short-term SO_2 peaks.

5. 60 FR 12492, March 7, 1995, Proposed Requirements for Implementation Plans and Ambient Air Quality Surveillance for Sulfur Oxides (Sulfur Dioxide) National Ambient Air Quality Standards. 40 CFR Parts 51 and 58. This notice lays out the three strategies that were initially proposed to deal with the 5-minute SO_2 issue. These included targeted implementation of the existing SO_2 NAAQS, the IL program under section 303, and revising the SO_2 NAAQS to add a new 5-minute standard for SO_2 of 0.6 ppm. It also describes the targeted implementation strategy to be used whichever option was selected. The discussion of the targeted implementation strategy contains much useful guidance for network review and design. The notice also contains proposed revisions to Part 58 allowing relocation of SLAMS SO_2 monitors around point sources.

6. Regulatory Impact Analysis 9/30/96. Issued by Air Quality Strategies and Standards Division of OAQPS. Attempts a cost/benefit analysis of the proposed IL program. The uncertainties are large, but the analysis is based on a reasonable approach using best available data. Also gives a cogent description of proposed IL program and provides brief guidance for implementation once trigger levels are measured. It does not address in detail proposed requirements or procedures for monitoring network review. The heart of the document is comprised of 7 case studies exploring

different scenarios and implementation alternatives. These seem to be based on actual cases, but the source names and locations are omitted. Bases a good part of the cost analysis on EPA's estimate that there are about 10 cases nationally where the proposed IL program needs to be assessed. Of these, it is estimated that perhaps five would require action. These estimates are based on limited ambient monitoring data and on public comments and discussion related to earlier proposals.

7. 61 FR 25566, May 22, 1996, Final decision not to revise SO_2 NAAQS.

8. ECR Inc. July , 1996. General Guidance Principles of Obtaining and Siting SO_2 Monitored for 5-Minute SO_2 Concentrations. This is a broad discussion of SO_2 monitoring for 5-minute peak concentrations including: Part 58 monitoring regulation proposed changes in response to 5-minute SO_2 peaks (60 FR 12492, March 7, 1995), network review and design and site selection.

9. 62 FR 210, January 2, 1997, Proposed Implementation Requirements for Reduction of Sulfur Oxide (Sulfur Dioxide) Emissions. 40 CFR Part 51 dealing with State Implementation Plan (SIP) requirements. Proposes IL program under section 303 of the Clean Air Act. Thoroughly describes and justifies IL program. Refers to Part 58 monitoring proposed changes in FR March 7, 1995 which provide for relocation of SLAMS monitors and affirms these changes as giving the states flexibility to implement a response to EPA's IL program. States that "States and Tribes would be able to identify areas to be monitored based on State or Tribal priorities, source emissions, citizen complaints, location of sensitive populations or other variables." It also provides some detail on source prioritization and monitor allocation - including a re-statement that the EPA would not require States or Tribes to prioritize sources in accordance with the 3 categories presented in the March 7, 1995 Federal Register notice.

10. 63 FR 24782, May 5, 1998, National Ambient Air Quality Standards for Sulfur Oxides (Sulfur Dioxide); Intervention Level Program. This notice announces the schedule for responding to the remand of the final decision on the SO_2 NAAQS and the interim actions that EPA will take to address 5-minute peak SO_2 levels. EPA also solicits comments and information.

11. U.S. Department of Commerce, Bureau Economic Analysis, October 1998, Survey of Current Business, WEFA, World Economic Group.

12. Sonoma Technology and Sigma Research Corporation, "Recommendations for the Use of Open-Path and Fixed-Point Monitors for Determining Ambient SO_2 Concentrations," EPA Contract 68D30020, Work Assignment No.2-94, January 1994.

13. TRC Environmental Corporation, "Network Design, Siting, and Quality Assurance Guidelines for Ultraviolet Differential Absorption Spectrometer (UV-DOAS) Open Path Analyzer," EPA Contract 68D30029, Work Assignment 2-73, May, 1996.