ENVIRONMENTAL PROTECTION AGENCY

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RIN 2060–AF34

Implementation of New or Revised Ozone and Particulate Matter (PM) National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations

AGENCY: Environmental Protection Agency (EPA).

ACTION: Advance notice of proposed rulemaking (ANPR).

SUMMARY: The EPA is providing advance notice of key issues for consideration in the development of new or revised policies and/or regulations to implement revised NAAQS for ozone and PM, and development of a regional haze program. The EPA is under court order to issue a proposed decision on whether to retain or revise the PM NAAQS by November 29, 1996, and to issue a final rulemaking for PM by June 29, 1997. The Agency anticipates following the same schedule for the ozone standard and also intends to propose a regional haze program in mid-1997. If revised NAAQS replace existing NAAQS, there would be a period of time to phase in new requirements while continuing to address the requirements of the current programs. Further, ozone, PM and regional haze are products of interrelated chemical conversions in the atmosphere, and new approaches will be needed to identify and characterize affected areas and to assign planning, management and control responsibilities. This could lead to integrated implementation policies for ozone, PM and regional haze control programs. This ANPR provides a broad scientific and policy perspective on these issues and addresses implementation issues that have been identified, such as the need for regional strategies, and is a continuation of the advisory process first announced on September 11, 1995 (60 FR 47171) and further explained by the Agency on June 12, 1996 (61 FR 29719). Through today's action, the Agency is providing a brief discussion of a broad range of options, principles and questions related to each of these key issues. The options/principles/questions in this ANPR were designed to provide sufficient background information to stimulate public interest and comments and are not intended to indicate preferences or decisions by the EPA. By publishing this information at this time, the EPA is providing more time for the public to develop input and comments than would occur following the publication of the subsequent regulatory notices for the implementation strategies and regional haze program. An explanation and structure of the Federal Advisory Committee Act (FACA) Subcommittee is provided in **SUPPLEMENTARY INFORMATION.** Applicable terms and definitions are provided in the Appendix.

DATES: Written comments on this proposal must be received by February 18, 1997.

ADDRESSES: *Comments.* Comments should be submitted (in duplicate if possible) to the Air and Radiation Docket and Information Center, 401 M Street, SW, Washington, DC 20460, Attention Docket Number A–95–38.

Docket. The public docket for this action is available for public inspection and copying between 8:00 a.m. and 4:00 p.m., Monday through Friday, at the Air and Radiation Docket and Information Center (6102), Attention Docket A–95–38, South Conference Center, Room 4, 401 M Street, SW, Washington, DC 20460. A reasonable fee for copying may be charged.

FOR FURTHER INFORMATION CONTACT: For general FACA Subcommittee questions and comments, contact Ms. Denise Gerth, U.S. EPA, MD–15, Research Triangle Park, NC 27711, telephone (919) 541–5550. For specific questions and comments on the ANPR, contact Ms. Sharon Reinders, U.S. EPA, MD–15, Research Triangle Park, NC 27711, telephone (919) 541–5284.

SUPPLEMENTARY INFORMATION: The following communications and outreach mechanisms have been established:

Overview information—A World Wide Web (WWW) site has been developed for overview information on the NAAQS and the ozone/PM/regional haze FACA process. The Uniform Resource Location (URL) for the home page of the web site is http://www.epa.gov/oar/faca/

Detailed and technical information—Available on the O3/PM/RH Bulletin Board on the Office of Air Quality Planning and Standards (OAQPS) Technology Transfer Network (TTN), which is a collection of electronic bulletin board systems operated by OAQPS containing information about a wide variety of air pollution topics. The O3/PM/RH Bulletin Board contains separate areas for each of the FACA Subcommittee's five work groups and includes meeting materials, issue papers, as well as general areas with information about the process, participants, etc. The TTN can be accessed by any of the following three methods:

—By modem; the dial-in number is (919) 541–5742. Communications software should be set with the following parameters: 8 Data Bits, No Parity, 1 Stop Bit (8–N–1) 14,400 bps (or less).
—Full Duplex.
—ANSI or VT–100 Terminal Emulation.

The TTN is available on the WWW site at the following URL: http://ttnwww.rtpnc.epa.gov. The TTN can also be accessed on the Internet using File Transfer Protocol (FTP); the FTP address is ttnftp.rtpnc.epa.gov. The TTN Helpline is (919) 541–5384.

I. Purpose and Objectives

This ANPR outlines policy and technical implementation issues and identifies a broad range of options/principles/questions for each issue associated with the potential revision of the ozone and PM NAAQS and with the development of a regional haze program. Although the proposals to change the ozone and PM NAAQS have been made, the possibility that such changes may be promulgated necessitates this advance notice, as well as the ongoing implementation discussions under the FACA discussed elsewhere in this notice. The alternative approach of waiting until possible standard revisions are actually promulgated would, in the Agency's judgement, cause inevitable delays and disruptions in national, State and local efforts to achieve clean, healthy air, especially those related to attainment of the NAAQS for ozone. The ozone and PM NAAQS proposals are scheduled for publication in December 1996 with final action scheduled for mid-1997. The EPA intends to propose a regional haze program in mid-1997.

In advance of these actions, the EPA published an ANPR entitled, *National Ambient Air Quality Standards for Ozone and Particulate Matter,* on June 12, 1996 (61 FR 29719) which announced the Agency's plans to propose decisions on whether to retain or revise the ozone and PM NAAQS. That ANPR also described the FACA process and the Subcommittee for Ozone, PM and Regional Haze Implementation Programs (Subcommittee). The Subcommittee is composed of 60 representatives from State, local and tribal organizations; environmental groups, industry and trade groups (including small business representatives), consultants; academic/scientific communities; and Federal agencies. The organization of the Subcommittee includes a Coordination

Group and four work groups: (1) Base Programs Analyses and Policies Work Group, (2) National and Regional Strategies Work Group, (3) Science and Technical Support Work Group, and (4) Communications and Outreach Work Group. The Subcommittee was established under the Clean Air Act Advisory Committee (CAAAC) to provide advice and recommendations to the EPA on developing new, integrated approaches for implementing potential revised NAAQS for ozone and PM, as well as for implementing a new regional haze reduction program. Through this process, EPA is engaging in communications with segments of society that may be affected by the implementation of NAAQS and the regional haze program. This announcement is a further attempt to invite stakeholders to participate in the implementation development process, to assure that their concerns will be addressed and their options assessed, and, ultimately increase the effectiveness of NAAQS implementation strategies and the regional haze program.

The implementation issues described in this ANPR form the basis of the Subcommittee's deliberations and for the most part were developed through the various work groups and the Coordination Group. The presentation of these issues and corresponding options/principles/questions is designed primarily to provide advance notice for the public who are not directly involved in the FACA process. Interested readers are directed to EPA's TTN and WWW site for an up-to-date status of the work groups' and Subcommittee's deliberations on these issues. This includes work group issue papers with options and, where appropriate, draft recommendations.

While the EPA is interested in considering new and innovative approaches to implementation, it is imperative to ensure that momentum is maintained in the current implementation programs, and that current programs and efforts such as the Ozone Transport Assessment Group (OTAG) continue in order to protect public health and welfare. As a consequence, the Subcommittee is providing recommendations to EPA regarding the development of an interim implementation policy (IIP), which was published in December 1996. The IIP will provide EPA's guidance to the State and local agencies on appropriate actions during the transitional period of time between any revision of the NAAQS and the development of new integrated implementation strategies. This is especially important since it is expected that any new NAAQS will be at least as stringent as the current NAAQS, and reductions in emissions to achieve the current NAAQS will be beneficial in achieving the revised NAAQS. While the IIP will provide guidance during the transition period, EPA will also develop implementation strategies for the potential new ozone/PM/regional haze programs.

The final integrated implementation programs for ozone, PM and regional haze are being developed in two phases. In Phase I, the air quality management framework issues will be addressed (proposal—mid-1997). Phase II will focus on more detailed control strategy development (proposal—mid-1998). These phases are described in more detail in subparagraph IV.

II. Scientific and Technical Discussion

The following discussion relies on the Scientific and Technical Support Work Group of the FACA Subcommittee. This group is developing a draft conceptual model framing our current scientific understanding of ozone, fine particles and haze, the associated gaps and uncertainties, and based on the technical basis and issues underlying the integration of regulatory programs for ozone, fine particles and regional haze, and the specification of geographic scales required for air quality management. This conceptual model provides a technical basis for the Subcommittee's deliberations of these issues. This document is undergoing further review prior to acceptance by the CAAAC. Regarding the rationality of integration, the initial response of the Science and Technical Support Work Group was a qualified yes, given the regional nature of the pollutants (i.e., regionalization), spatial patterns of air quality indices, precursors, sources, atmospheric chemistry and meteorological processes which affect more than one pollutant, and control options. The following discussion focuses on the relationships between ozone and fine particles, given the close linkage between fine particle levels and regional haze (the widespread impairment of visibility in every direction, mostly attributed to fine particle light scattering and absorption), with the following assumptions:

—Understanding the emission sources and atmospheric processes which are responsible for elevated air pollutant levels requires an examination of urban and regional geographical scales;
—Ozone and fine particles may exhibit similar spatial patterns, although the frequency (and importance) of concurrent patterns is not well understood;
—Many of the emission precursors (and sources of precursors) to ozone, fine particles and regional haze are the same;
—Many of the atmospheric processes (chemistry and meteorology) affecting ozone, fine particles, and regional haze are the same; and
—Several critically-important information gaps exist which create very difficult challenges for air quality management of these pollutants.

A. Interacting Spatial Scales of Emissions, Atmospheric Processes and Air Quality Indices

As explained in greater detail below, there are a variety of emissions that are precursors to elevated levels of ozone, fine particles, and regional haze and of sources to these emissions. Historically, attempts at air quality management of these problems focused on local sources in the context of an anonymous background term quantifying imported air quality. The evolution in our understanding of the spatial and temporal scales of the effects on ozone, fine particles, and regional haze of the emissions from all sources has, however, spawned the recognition of the need for a larger geographical perspective. This larger geographical perspective, which considers individual sources over regional, as well as local scales, is needed to support quantitative analysis of the relative contribution of the various source types and of their emission types (species) that contribute to nonattainment levels and regional haze. The need for an altered perspective has been recognized by the establishment of the Ozone Transport Commission (OTC), the OTAG, and the Grand Canyon Visibility Transport Commission (GCVTC).

Air quality management in the metropolitan statistical area or consolidated metropolitan statistical area (MSA or CMSA) has worked well historically to control the local source effect on nonattainment problems. This is evidenced by the significant decrease in the number of ozone nonattainment areas over the past decade. As these controls have reduced emissions and as modeling tools have progressed, the role of the effect of sources beyond the MSA or CMSA and the varying spatial scales of air quality indices and atmospheric processes continue to be investigated and supported by a strong body of scientific evidence:

—The 1991 National Academy of Science (NAS) Report, *Rethinking Ozone in Urban and Regional Scales*

(National Research Council (NRC), 1991);
—The 1993 NAS Report, *Protecting Visibility in National Parks and Wilderness Areas* (NRC, 1993);
—The National Acid Precipitation Assessment Program (Trijonis et al., 1990); and
—The Southern Oxidant Study (Chameides and Cowling, 1995).

Recent analyses based on ambient air monitoring data (Rao, 1995) and regional acid deposition model air quality modeling (Appleton, 1995) suggest a very broad spatial air pollution region covering the greater part of the Eastern United States (U.S.). These studies indicate that, while sources still have their largest influence in the near field, the zones of potential influence of source regions (e.g., an urban city) can under certain conditions extend out hundreds of kilometers (km) for ozone, fine particles, and regional haze. Moreover, these scales appear to be similar for ozone and fine particles. In other words, sources once thought to be remote with respect to nonattainment levels of ozone, fine particles, and regional haze are seen as potential contributors to those levels. The analyses suggest that chemical and meteorological processes which influence pollutant generation, air mass movement and pollutant removal (e.g., clouds and precipitation) are key factors in defining regional zones of influence. When the various nonattainment areas of the Eastern U.S. are surrounded by even conservative estimates of the zones of influence of these other sources, what results is a modeling domain that may span the greater part of the Eastern U.S. Accordingly, efficient air quality management requires addressing these additional sources, atmospheric processes and related impacts as scales of interactions over multiple spatial and temporal frames.

In air quality management practice, the term ''transport'' has been used in a very broad context beyond the strict meteorological definition of the term. This broad context includes: (1) The overall regionalization of both the scale of pollutant distributions and zone of influence of sources, (2) the interaction (or effect of one area on another) among local, urban and regional source scales, and (3) meso and large-scale meteorological phenomena (such as recirculation due to stagnant high pressure systems and land-sea interactions, large-scale movement of air masses with fairly uniform motion, and other events perhaps as simple as widespread elevated temperatures). The prevalence and importance of biogenic volatile organic compounds (VOC) emissions (e.g., emissions from trees) in the Eastern U.S. are ''regionwide,'' as are many other area source emissions such as those emitted by motor vehicles. All of these regional attributes are enhanced by the relatively flat and consistent terrain in the East and Midwest, contrasting the greater topographic and meteorological effects in the Western U.S., although the West can also experience regional problems.

Several physical and chemical events act together in determining pollutant concentrations over multiple space and time scales. Moving air masses carry all chemical species including precursors, fast-reacting intermediates, and chemical sinks, as well as the specific pollutant species of interest (e.g., fine particles and ozone). Removal of pollutants occurs continuously through deposition. Also, the impact of these pollutants is not simply additive. Ozone (or precursors) transported from one location can affect ozone levels downwind by indirectly accelerating atmospheric chemical reactions through the production of chemical intermediates (e.g., hydroxyl radicals). Clouds play several roles in modifying concentrations by: (1) Dissolving soluble gases (e.g., nitric acid, sulfur dioxide (SO_2), hydrogen peroxide) and generating aerosols through aqueous phase reactions, (2) circulating and venting pollutants to high altitudes where strong winds promote large horizontal transport, and (3) removing pollutants through precipitation. Cloud-related dissolution and transport also contribute to pollutant removal. Vertical air mass movements, or phenomena as basic as the daily mixed layer growth, affect air concentrations on various scales. Superimposed on these processes are a variety of emission sources with their own spatial, temporal and component (speciation) scales. Depending on location, pollutant and season, one particular spatial scale (e.g., urban) may (or may not) exert a dominating influence on air quality relative to another scale (e.g., regional). Even in cases where local and urban sources are responsible for most of the ''local'' air quality, an assessment of the contribution of distant sources to local air quality is required to reach such a conclusion. Thus, to avoid the exclusion of potentially important considerations in air quality analysis, ''regionality'' or ''interacting scales'' is a more descriptive term (than transport) which encompasses the broader meaning and effects of several complex interacting phenomena operating over extensive and multiple time and space scales.

The Eastern U.S. differs markedly, topographically and climatologically, from the West, so any extension to the West based on Eastern analyses (or vice versa) is not necessarily appropriate (important differences exist between Northern and Southern regions as well). The monitoring data and modeling analyses of the GCVTC process highlight the challenge of identifying and quantifying specific sources, some at great distances in order to estimate their effects in Western national parks and wilderness areas. The variations in topography, meteorology and source distribution across regions require that area- and case-specific differences be accounted for in any air management approach. The effects of emission reduction strategies should be viewed through multiple scales, considering regional and urban scale consequences (i.e., health and welfare protection).

A few points summarizing ''interacting scales'' and ''regionality'' should be considered in air management practices:
—Air quality modeling and historical monitoring trends have shown that local air management practices have the greatest influence on near field concentration impacts.
—Analyses of observations in the Eastern U.S. reveal the existence of very broad multistate regions (interacting scales approaching linear scales of 1000 km or more) of elevated pollutant levels and zones of influence (Rao, 1996).
—Air quality modeling data for the East suggest that similar regions of influence exist for ozone and fine particles (Dennis, 1996), although only sparse monitoring data exist to support these similarities.
—Modeling analyses for the Grand Canyon National Park (and other) Class 1 areas show that fine particles and precursors causing visibility impairment episodes are derived from both nearby (less than 50 km) and more distant (up to 1000 km) regions of influence (NRC, 1993; GCVTC, 1996).
—Area and case-specific analyses are required to delineate reasonable geographic areas for air quality planning purposes because of the wide regional variations in meteorology, topography and source distribution.
—The use of terms such as ''transport'' or ''background'' inadequately describes the complex set of emissions, chemistry, meteorological processes and interacting scales which contribute to the regionalization of air pollution.

—Because of broad spatial extents and gradations of interacting scales ranging from regional down to sub-grid cell scales, an air quality assessment focusing on a particular scale (e.g., urban) must consider effects due to interactions across various space and time scales. The concept of a single MSA/CMSA nonattainment area may be inconsistent with the spatial and temporal scales for ozone, fine particles and haze problems.

B. Technical Basis and Considerations for Integrating Ozone, Fine Particles and Regional Haze Implementation Programs

The technical and scientific rationale for underlying the integration of ozone, fine particles and regional haze air quality management practices is based on a mix of empirical observations, atmospheric processes and practical administrative concerns. While this discussion focuses on common attributes across pollutant groups, it is important to recognize and distinguish those attributes where there is little linkage. Many examples and inferences presented here tend to reflect what is known about Eastern U.S. air quality issues (e.g., ozone) with possibly little relation to Western U.S. phenomena. At the risk of generalizing (and simplifying) air quality descriptions for illustrative purposes, recognition that a generalized approach cannot operate effectively everywhere must be retained. The discussion focuses on the relationship between ozone and fine particles, with the implicit assumption that fine particle levels and chemical composition directly relate to regional visibility impairment, given the strong relationship between the constituents of fine particles and the manmade portion of visibility impairment. Regional haze is a widespread, largely uniform impairment of visibility in every direction over a large area, mostly due to light scattering from fine particles from multiple sources.

1. Empirical Evidence for Integration

Ozone and PM–10 (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers) concentrations in the Eastern U.S. can exhibit similar spatial patterns during summer time episodes (Northeast States for Coordinated Air Use Management (NESCAUM), 1995). Analyses of PM data consistently indicate that fine particles constitute the majority mass fraction of PM–10 in the summertime East (EPA, 1996). In combination, these observations qualitatively imply concurrence of elevated ozone and fine particles. However, quantification of the similarity and frequency of such events is severely restricted by a lack of a fine particles data base in the East. While more data exist in certain Western locations, the episodic relationships between ozone and PM appears to be more complex than in the East. For example, a major component of the fine particle problem in Los Angeles (as well as the San Joaquin Valley, Salt Lake City and Denver) is wintertime formation of ammonium nitrate, which is not stable at the high temperatures associated with elevated ozone. High levels of fine particles in Western nonattainment areas can impair visibility when high ozone concentrations are not observed. Nevertheless, ''smog'' events in Los Angeles are almost always accompanied by impaired visibility, and visibility is directly associated with fine particle levels. Although some limited empirical evidence is highly suggestive of area specific concurrent events, other considerations as described below provide a stronger rationale for the appropriate level of integration across ozone, fine particles and regional haze control programs.

2. Emissions and Atmospheric Process Linkages Across Ozone, Fine Particles and Regional Haze

Several connections exist among ozone, PM and the resulting effect of visibility impairment. The linkages are based on the existence of common emission precursors, source categories and atmospheric chemistry and meteorological processes which affect more than one pollutant. For example, emissions of oxides of nitrogen (NO_X) potentially can lead to both ozone and fine particle formation. A combustion source often emits both SO_2 (a fine particle precursor) and NO_X (an ozone precursor). The sequence of atmospheric chemistry reactions underlying ozone formation is in part responsible for fine particle formation. Similar meteorological processes affect the movement, mixing and removal of ozone, fine particles and precursors. Some of these connections are complicated and will be explained more completely in forthcoming FACA science documents. The following are very brief descriptions of the connections across pollutant categories.

—*Common ''direct'' precursor emissions.* Emissions of NO_X, VOC and carbon monoxide (CO) are considered precursors for ozone formation. The NO_X, VOC and sulfur (SO_X, mostly as SO_2) emissions can also lead to fine particle formation through ''secondary'' atmospheric chemical reactions. Both ozone and a substantial fraction (which can vary greatly with season and location) of fine particles are the result of secondary formation processes. The major components (which also are highly variant) of secondary fine particles include sulfates, carbon (elemental and organic) and nitrates. The fraction of fine particles due to secondary processes is highly variant in space and time. During certain conditions (e.g., available ammonia, negligible sulfate, low temperatures), NO_X emissions can lead to fine PM ammonium nitrate formation. Several directly-emitted organic compounds contribute to fine particle organic aerosols. These organic compounds may contribute as ''primary'' organic aerosols, that is, they almost immediately condense to the aerosol phase during the emissions process or shortly downstream. Or, certain VOC (e.g., toluene) which exist as gases under most conditions can undergo atmospheric reactions and transform into condensible ''secondary'' organic aerosols. Thus, a VOC like toluene can contribute to both ozone or fine particle formation as a precursor emission.

—*Common source categories.* Based on the multiple roles of precursors, a particular source (natural or anthropogenic) emitting one precursor (e.g., NO_X or VOC) can affect ozone and fine particles, and a single source emitting multiple precursors (e.g., combustion process releasing NO_X, VOC, CO and SO_X) can affect multiple pollutant source categories. In this case, integration is not dependent on atmospheric chemical linkages. This commonality among sources should lead to a more consistent approach in estimating emissions of multiple precursors within a specific source category. For instance, a consistent approach needs to be applied for estimating and projecting both NO_X and SO_X emissions from a combustion source.

—*Interaction of atmospheric chemistry reaction cycles and ''indirect'' precursors.* Much of the general atmospheric chemistry involved in ozone formation can affect fine particle formation, as alluded to above, in certain instances. For example, ozone is the major initiator of hydroxyl radicals, a chemical intermediate which converts SO_2 and nitrogen dioxide (NO_2) to more oxidized sulfate (e.g., sulfuric acid) and nitrate (nitric acid) forms. Both sulfates and nitrates can contribute to fine particle formation. Clearly, a linkage between ozone and fine particles exists through the role of ozone in generating hydroxyl radicals. Note that this linkage between ozone and fine particles is at the process level and does not require coexisting ''high'' ozone and fine particle levels. Many other important linkages involving oxidizing chemical species (radicals and peroxides) exist within the NO_X, VOC, SO_X, ozone chemistry system. A correct characterization of the basic ozone chemistry and the associated linkages among the precursors is needed to predict the affect of changing emissions on air quality indices. Consequently, the predictive air quality models used to assess ozone and fine particle impacts should include a basic core set of atmospheric chemical reactions (i.e., a gas phase ozone chemistry mechanism).

Because of their common atmospheric chemical linkages, many precursors associated with one pollutant might be considered as an ''indirect'' precursor for another pollutant as well. Virtually all precursor emissions (NO_X, SO_X, VOC, CO) undergo initial attack by hydroxyl radicals and participate in the general cycling of various chemical intermediate species. Therefore, precursors that typically may not be associated with a particular secondary pollutant, such as the effect of VOC on either sulfate or nitrate, indirectly participate through their roles in atmospheric chemistry. In this general context, the term precursor does not imply a positive effect on an associated secondary species as the emission precursor may only share in certain atmospheric chemical processes without leading to increases in a secondary pollutant. Multiple possibilities exist. For example, NO_X, which affects the cycling of hydroxyl radicals (which convert SO_X to sulfate), could act indirectly as a sulfate particle precursor. The majority of VOC species that do not transform into organic aerosols could nevertheless be fine particle precursors through their general role (i.e., cycling of radicals) in atmospheric chemistry. Nitrogen oxides could serve as indirect precursors for aerosol sulfate formation. This ''universal'' pool of precursors does not imply that reductions of any specific precursor lead to reductions of every pollutant. Just as reductions in NO_X potentially can raise local ozone levels, a reduction of a fine particle precursor possibly can increase ozone or increase a different fine particle component (e.g., SO_X reductions leading to increased ammonium nitrate, or NO_X reductions increasing sulfate formation). These examples are some of several conceivable indirect precursor relationships. Many other relationships with similarly unknown degrees of effect exist. Thus, integrated implementation is far from a straightforward exercise. Complex air quality simulation models (in combination with simpler models and receptor/observational methods) which include approximations of these process linkages will need to be exercised to account for the multiple nonlinearities and positive and negative feedbacks. This complexity demands that high quality emission inventories, technically credible models, and spatially and temporally representative monitoring data will be needed in predicting pollutant concentrations and control strategies.

3. Integrating Control Strategy Development Through an Air Quality Modeling Approach

What does integration mean from an implementation perspective? Given the complex mechanisms for and linkages between ozone and fine particle formation, the formulation of control strategies should acknowledge the need to optimize control options; control of one precursor might affect both ozone and fine particles or might be detrimental for one or both. For example, one might start with ozone management strategies being developed as part of ongoing urban and regional planning efforts and attempt to quantify the future impact on secondary aerosols. On the other hand, because NO_X controls might increase ozone levels in certain localized urban areas or because SO_2 reductions might lead to increased concentrations, efficient air quality management would attempt to optimize the system in relation to VOC, NO_X and SO_X emission reductions.

The real benefit of integration is the prospect of a more systematic, efficient and comprehensive treatment of emission inventories, episode selection, and atmospheric physics and chemistry that might empower the air quality manager to characterize source-to-receptor effects in an orderly way. The addition of data on the costs and effectiveness of control options would enable the air quality manager to identify the cost-effective means for attaining a variety of air quality goals.

To this end, emission bases underlying most current ozone modeling efforts include most of the sources for aerosol formation (but not necessarily the aerosol-specific emissions such as organic aerosols from motor vehicles). Notable exceptions include emissions from many of the fugitive primary particle sources and most sources of ammonia. The result of this hypothetical exercise could produce the residual aerosol- (and regional haze-) related air quality benefits from an ozone precursor control perspective. [Additional analysis directed at the specific needs for meeting fine particle and visibility concerns could follow this ozone oriented approach. Ideally, an objective (and likely iterative) ability to assess the benefits and tradeoffs associated with managing all three pollutant categories would evolve.] Although this example does not represent ''full'' integration given the unidirectional information flow (ozone to particles), it does acknowledge similarities among programs and avoids mistakes and inefficiencies incurred from independent analyses. Aside from any direct regulatory policy, the linkages across pollutants and emissions are reasons by themselves for planning for more effective and efficient development and use of emissions, air quality models and monitoring networks which address sometimes confounding multiple pollutants and their related health/welfare effects, and control options.

4. Distinctions Among Ozone, Fine Particles and Regional Haze

Concurrent ozone and fine particle episodes may be expected to occur given similarities in the meteorological and atmospheric chemistry processes underlying ozone and fine particle formation, maintenance and destruction. As discussed above, the linkages associated with emission source categories and physical and chemical processes exist more frequently than the occurrence of coepisodic events. For example, several basic atmospheric chemical reactions involved in ozone and fine particle formation occur whether or not high ozone and fine particle levels are generated in the atmosphere. Nevertheless, several distinctions among the pollutants persist. These differences include the contribution of primary particles to total fine particles (and especially PM–10) and wintertime (actually nonsummertime) fine particle events. Some primary particles are generated by strong wind conditions (e.g., soil/geologic material) and other mechanical processes (e.g., roadway fugitives). A fraction of primary PM peaks in summer in most of the Western third of the country where there is little precipitation for 6–8 months per year, and dry, windy conditions lead to the generation and movement of geologic materials. As discussed earlier, ammonium nitrate, a significant fine particle component in the West, is stable at relatively low wintertime temperatures and therefore does not form significant levels during the high summertime temperatures. Meteorological effects which influence the creation, maintenance or removal of high levels of ozone and fine particles may be significantly different between pollutants, regions of the country, and times of the year. Other specific emissions-driven events such as forest burning and wintertime woodsmoke (a major wintertime source of urban PM) bear virtually no relation to ozone. Many of these PM episodes can be dominated by either primary or secondary fine particle components, or by primary anthropogenic coarse PM emissions. Research exploring the frequency and characterization of coepisodic and uni-episodic events would yield further insight into underlying causes of events and provide direction for integrated implementation opportunities.

Visibility protection presents several additional considerations beyond the scope of topics covered under ozone and fine particles. First, fine particle concentrations that are far below any potential NAAQS can adversely affect visibility in a significant manner, particularly in more pristine environments, such as Federal Class I areas in the rural West. For this reason, visibility management needs to consider the protection of ''clean'' days separately from assessments focusing on highly impaired days. The meteorology and emissions characteristics during ''clean'' days differ from those common during high pollution episodes. This concern raises complex technical issues related to the ability of models and monitoring instruments, which often have been designed or tested for meeting ''high'' concentration requirements, to characterize ''low'' level conditions. Second, relative humidity plays a significant role in enhancing visibility impairment, particularly in the East. In humid conditions, particularly above 70 percent relative humidity, sulfates, nitrates, and certain organics readily take on water and expand to sizes comparable to the wavelength of light. Particles in this size range (e.g., 0.1 to 1.0 micron in diameter) are efficient scatterers of light. Third, unlike the NAAQS approach of setting a national standard, the regional haze program has as its goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Federal Class I areas which impairment results from manmade air pollution. States are required to make ''reasonable progress'' toward this goal. The notion of background versus manmade air pollution raises several technical and policy challenges, particularly in the protection of visibility in ''cleaner'' environments, where small increases of fine particles can lead to significant visibility changes.

Generally, PM–10 is not considered in the integration discussions of ozone, fine particles and regional haze. This is because the coarse fraction (e.g., greater than 2.5 micron) typically is derived from primary emissions (e.g., fugitives and geologic material) with little association to ozone from a process (or episodic) perspective. In addition, visibility impairment leading to regional haze is overwhelmingly associated with the fine particle fraction of PM–10.

C. Major Technical Issues

The principal technical issues associated with integrated air quality management involve the adequacy of data bases and models (including specific process formulations) on which to base credible assessments. Generally, the tools (ambient data, models and emissions data) underlying ozone analyses are better developed than those for fine particles. Major efforts in chemical mechanism development, ambient monitoring methods and establishment of national and special study efforts for monitoring, emissions and modeling have resulted in a wealth of information and familiarity with these tools. This relative abundance of knowledge for ozone should not be construed as a science lacking uncertainty as significant technical issues remain (e.g., the current North American Research Strategies for Tropospheric Ozone (NARSTO) effort) and even more are yet to be defined. A sampling of these issues include the representativeness of emission inventories, particularly biogenic emissions; uncertainties in the modeling system (e.g., chemical characterizations of aromatics and biogenics, treatment of vertical mixing processes); difficulties in monitoring techniques (carbonyls, NO_X–NO_2, polar VOC); and lack of measurements (e.g., total reactive nitrogen, upper air data). In some cases, these gaps are significant and could compromise our ability to perform highly credible ozone analyses and to ascribe confidence levels in our results.

Consideration of fine particles and regional haze presents several additional issues which are a result of: (1) A very complex multiphase, multicomponent, multiseason aerosol system; (2) the complex covariance of these data; and 3) the present PM–10 form of the NAAQS which has resulted in few regulatory needs to hasten an improved characterization. Significant concerns include major positive and negative measurement artifacts (related to gas-particle phase changes); a simple lack of ambient data, especially urban fine particle measurements; poor quality assurance/control of ambient sampler data; emissions data with poor general spatial applicability; limited availability, limited application and evaluation of regionally-accurate air quality models; and highly empirical treatment of organic aerosols within the available models. These gaps are interconnected in the sense that quality model evaluation and improvement rely on available quality measurements. The issue is further complicated by difficulties (due to complexities, lack of precedence and resource constraints) in designing a data collection program to evaluate a gridded model's ability to characterize fine particles covering wide scales of time (annual, seasonal, daily) and spatial resolution (regional, urban, local). On the positive side, a strong history of using ambient data for PM source apportionment is probably more adaptable to fine particle analyses than ozone, given that the measurable components of secondary fine particles (e.g., sulfate) have some direct linkage to precursors, whereas an ozone measurement by itself provides no inference regarding contributing precursors.

Several interesting atmospheric chemistry questions remain to be answered; two examples include nitrate fine particle formation and organic aerosols. Where and when do ammonia and sulfate become limiting factors in ammonium nitrate formation? The relatively abundant nitrate fine particles at sites in the urban West contrast with abundant regional sulfate fine particles in the East. Substantive decreases in SO_2 emissions could lead to increased nitrate fine particle formation in the East if sufficient ammonia (a highly uncertain emissions category) is available. What impacts will NO_X emission reductions have on fine particles? Many possibilities exist. If nitrate is significant, one would expect a reduction in fine particles. However, if sufficient sulfur remains available, NO_X reductions could increase or decrease sulfate formation (and, therefore, fine particles) depending on a complex cycling of oxidizing species. Reductions in NO_X emissions could actually lead to sulfate increases by reducing competition (between SO_X and NO_X) for gas phase oxidizing radicals, or by increasing peroxide levels leading to greater aqueous phase sulfate production. Or, NO_X reductions could slow down sulfate formation through overall reductions in ozone and other oxidants. This relationship is very complex, and we must exercise caution in associating fine particle benefits with NO_X reductions in the Eastern U.S.

What are the relative contributions of primary and secondary organic aerosols across varying spatial (and time) scales? The potential for large secondary organic aerosol production from biogenic sources (e.g., pinene emissions) exists throughout the East. How significant are biogenic-derived aerosols compared to local/urban contributions from primary anthropogenic organic aerosols? How different are these relative contributions across seasons, given that secondary organic aerosol formation increases during the summer? Many uncertainties underlie the integration of primary and secondary particles, aside from integrating particles and ozone. For instance, what are the interactive roles exerted by elemental carbon emissions and other products of incomplete combustion and geologic materials in both primary contribution to PM and as formation nuclei for highly complex secondary PM? On balance, the ability to perform ozone air quality assessments far exceeds that of fine particles. However, the infrastructure for conducting fine particle analyses appears to be in place as a result of progress gained from ozone and acid deposition modeling and existing monitoring programs for ozone and visibility (i.e., the Interagency Monitoring of Protected Visual Environments (IMPROVE) program). Finally, although uncertainties remain in transforming particles into visibility impairment within short averaging times, the IMPROVE methodologies for particle and visibility measurements (and the relationships between particles and visibility) are widely accepted.

Specific issues across PM and ozone include the ability to formulate fully-integrated models accounting for multidirectional effects on several pollutants. For example, the formation of secondary organic aerosols is a loss mechanism for VOC which presently is not accounted for in ozone modeling efforts. Many other integration topics exist, and collectively there is uncertainty regarding the overall importance of one pollutant imparting an effect on another.

Two basic issues span the gap between science and policy: (1) The manner in which tools are applied, and (2) accommodating scientific findings and uncertainties in air quality management decision making. The first topic reflects the concerns of how one applies deterministic (i.e., models that establish exact cause and effect relationships) and uncertain air quality models to probabilistic forms of the standard in ascribing rigid control requirements. The selection of ''severe'' meteorological episodes versus ''prototypical'' episodes for ozone and PM–10 modeling has been controversial and remains a difficult model application issue. Equally complicated is the emerging need to model seasonal and annual cases. The debate on the credibility of models is fueled by the manner in which they are applied as much as by concerns about their formulations and supporting data bases. The second topic acknowledges the need for conducting policy-relevant as opposed to policy-driven research and recognizing the different time scales operating in research and policy arenas (where the timeframe demands move much faster than research results). Extremely useful information emerges continuously from research programs, yet a separate, sometimes very significant, time-lag occurs before information is considered in the policy-setting process. Hence, opportunities must be available to incorporate the latest science into policy.

D. Integrating Models and Observations for Sound Air Quality Management Practice

Much emphasis has been placed on the complementary and integrated use of models and ambient data in air quality management practice (Rao et al., 1996). Several facets are associated with this topic, ranging from the need to evaluate models with sound data bases to conducting fully integrated analysis optimized through the separate, strong attributes of data and models. As the technical debate on the use of models and data continues to mature, perceptions such as ''model'' or ''data'' are replaced by the intelligent and integrated use of ''models and data.'' Clearly, the demand for measurements initiated by the National Academy of Sciences Ozone Report (NRC, 1991) to provide feedback information loops, as well as empirically-based corroboration of predictive tools, has been adopted by large segments of the air quality community and reflected in major efforts such as the Photochemical Assessments Measurement Stations (PAMS) and NARSTO.

An appreciation of the strengths of models and observations can assist the understanding of current analyses and lead to improved techniques. A model's strength is its ability to: (1) Integrate an enormous spectrum of data (e.g., emissions and meteorological variables) and process understandings (e.g., chemical mechanisms and flow phenomena), and (2) serve as an exceptional space and time mapping tool. This latter attribute reflects the model's unique ability to predict into the future and to supplement (or fill in) present gaps in observed data. The process formulations embedded in models enable the addressing of many ''what if'' questions related to emissions control. However, models are engineering tools that invoke substantial approximations of scientific understandings of natural phenomena, both their formulations and application methods reflect engineering principles more than fundamental science. Observations provide a basis for testing and diagnosing models. Also, in some instances, observations add another benefit. They can capture process-type relationships by themselves (e.g., the emergence of observational-based models for defining NO_X and VOC control preferences). However, often observations are very sparse.

Applied in isolation, the use of either models or observations alone is not desirable. Space and time constraints often bias the interpretation of observational analyses (i.e., analysis results reflect time and space of monitors which may or may not reflect the scales of concern). Models suffer from a very large spectrum of weaknesses because they attempt to portray so many phenomena. Most critical though is the risk of using a potentially biased model that is assumed bias free. The integrated use of observations and models mitigates the individual weaknesses of both approaches and produces a powerful air quality management tool, especially when applied in an iterative (even retrospective) manner to continually assess model results and related implementation strategies.

E. Summary

Air quality assessments for fine particles, ozone, and regional haze must consider emissions, meteorological processes, atmospheric chemistry, and deposition, all of which interact over multiple spatial and temporal scales. Examining in detail the sources only from the MSA/CMSA surrounding the monitor reporting nonattainment levels of air quality may need to be augmented (on a space and time basis) for responsibly allocating those levels to the sources causing them. When examining the issues on expanded time and space scales, the air quality management should also take into account the similarities of these air quality indices, such as their common precursor emissions (e.g., NO_X, VOC); common emissions sources (e.g., mobile sources, stationary and area source combustion emissions, biogenics); and shared chemical and meteorological processes (e.g., transport, transformation, precipitation, and removal).

The principal technical issues associated with integrated air quality management involve the adequacy of data bases and models (including specific-process formulations) on which to base credible assessments. Many of these gaps are interconnected since model evaluations rely on available high quality measurements of emissions, atmospheric processes (such as wind fields) and ambient concentrations. On balance, the ability to perform ozone air quality assessments far exceeds that of fine particles, due mostly to the development of ozone research as well as a lack of urban fine particle measurements and important emissions components. However, many of the components of the infrastructure for conducting fine particle analyses appears to be in place as a result of progress gained from ozone, acid deposition, and visibility modeling and monitoring programs. The integrated application of models and observed data is strongly encouraged. In combination, both approaches help to mitigate the weakness of an isolated approach, producing a powerful tool for air quality management.

III. Schedules

Both the ozone NAAQS notice of proposed rulemaking (NPR) and the PM NAAQS NPR are expected to be published in December 1996 with promulgation of both the PM and ozone NAAQS scheduled for mid-1997. The previously-described IIP will be proposed for comment in late 1996 and finalized in mid-1997 and will apply during the time period following promulgation of any revised NAAQS. The ozone, PM and regional haze programs are tentatively planned to be developed on a common schedule.

As indicated above, the integrated implementation strategy for ozone and PM NAAQS will be issued in two phases. The Phase I implementation strategy which will give guidance to State and local agencies concerning actions prior to and including designation of areas not attaining potential new PM and ozone NAAQS will be proposed in mid-1997 with a public comment period prior to adoption of the strategy. The EPA expects that the Subcommittee and CAAAC will make recommendations regarding formulation of the Phase I strategy prior to proposal. In mid-1998, the Phase I implementation strategy will be finalized. (Note that prior to recommendations from the Subcommittee and CAAAC, EPA will refer to areas not attaining new NAAQS as nonattainment areas.)

Also in mid-1998, the Phase II implementation strategy will be proposed. This strategy will provide guidance for the events and actions between area designation and submittal and approval of State implementation plans (SIP's). This will include control strategies. The EPA expects that the Subcommittee and the CAAAC will also make recommendations regarding formulation of the Phase II strategy prior to proposal. In mid-1999, the Phase II implementation strategy will be finalized.

Unlike the NAAQS, the regional haze rule will not set a specific ambient pollutant standard. However, the rule will include criteria for measuring reasonable progress and the methods to measure progress. The EPA currently intends to publish the regional haze NPR in mid-1997 (with Phase I). The EPA is exploring ways to coordinate regional haze program implementation with NAAQS implementation.

IV. Framing of Phase I Implementation Issues

The Phase I issues below were identified by EPA with substantial input from the Subcommittee and represent the priority issues which must be addressed as soon as possible after the revision of the NAAQS. These issues and options are subject to change as the FACA process and deliberations continue. The options/principles/questions which are presented are not all inclusive and are designed to stimulate public discussion. These options/principles/questions are not intended to indicate preference or represent any decisions and are under active FACA consideration. Consistent with the broad mandate given to the Subcommittee, the EPA is actively seeking new ways to implement the potential revised ozone and PM NAAQS and regional haze programs, and at this time is not evaluating legal constraints in the Clean Air Act (Act) which may limit or change some policy options identified below. For example, revision of an ozone or PM NAAQS will require EPA to determine the effect of the new planning requirements triggered by the revised NAAQS on the existing planning requirements in the various subparts of part D of title I of the Act. The EPA is not addressing such legal issues in this notice. The purpose of this advance notice is to stimulate public interest and comments on a wide range of policy issues and options, without limitation at this stage, from legal constraints. After the FACA process produces policy options and recommendations and as the EPA develops a proposed and final integrated implementation strategy, the EPA will consider legal authorities and constraints which may be present in the current Act.

The issues identified below regarding implementation of a potential ozone or PM NAAQS revision generally use as their frame of reference the basic planning requirements of part A of title I of the Act and the basic nonattainment planning requirements of subpart 1 of part D of title I of the Act. Similarly, the discussion below addressing development of a regional haze program does not analyze pertinent legal issues but endeavors to use as a general frame of reference the visibility protection provisions in sections 169A and 169B of the current Act. Rather than focusing on the statutory requirements, however, the following discussion identifies technical and policy issues and options under consideration. Again, interested readers are directed to the EPA TTN and WWW site for an up-to-date status of FACA deliberations on these issues. The EPA is including the issues with sufficient background information in this ANPR to allow interested individuals to comment on the development of the implementation strategies.

Upon a proposal to revise current NAAQS or promulgate new NAAQS for ozone and PM and regulations for regional haze, the following characterize the most important implementation issues identified so far that should be considered. The issues are divided into two phases of implementation development. The options/principles/questions are presented as a broad range of possibilities and are not listed in any order of preference.

A. Phase I Issues

1. Regional Haze Program Development

In order to place the following discussions on the issues associated with joint programs in the proper perspective, this section begins with a discussion of issues and questions related to the development of a regional haze program. As described in section II, regional haze is produced by emissions of fine particles and their precursors from a multitude of manmade and natural sources located across a broad geographic area. Fine particles impair visibility by scattering and absorbing light. Average visual range in most of the Western U.S. is

100–150 km. In most of the East, the average visual range is less than 35 km. The following discussion includes general background on the existing visibility protection program, recommendations to EPA for improving regional haze conditions, and key issues for consideration in a new regional haze program.

Under a national visibility goal that calls for the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Federal Class I areas which impairment results from manmade air pollution, the EPA's 1980 visibility regulations addressed local visibility impairment that was ''reasonably attributable'' to a single source or small group of nearby sources. Under these rules, the 36 States containing mandatory Federal Class I areas were required to: (1) develop a program to assess and remedy visibility impairment from new and existing sources, (2) develop a long-term strategy to assure progress toward the national goal, (3) develop a visibility monitoring strategy, (4) consider ''integral vistas'' outside of Federal Class I areas in all aspects of visibility protection, and (5) notify Federal land managers (FLM) of proposed new major stationary sources and consider visibility analyses conducted by FLM in their permitting decisions.

The 1980 rules were designed to be the first phase in EPA's overall program to protect visibility. The EPA explicitly deferred action addressing impairment from regional haze due to the need for further research and improvements in several technical areas, including visibility monitoring, modeling, and the relationship between specific emitted pollutants and visibility impairment. The GCVTC was established to assess scientific and technical information regarding adverse impacts on visibility in the transport region and provide recommendations to the EPA for addressing these adverse impacts. Within 18 months of receipt of the GCVTC recommendations, the Administrator is required to carry out her ''regulatory responsibilities under section 169A, including criteria for measuring 'reasonable progress' toward the national goal.'' In developing the regional haze program, EPA will also have the benefit of recommendations from the 1993 report of the NRC Committee on Haze in National Parks and Wilderness Areas, *Protecting Visibility in National Parks and Wilderness Areas,* and from the work of the FACA Subcommittee on Ozone, PM and Regional Haze Implementation Programs. The following addresses key issues for consideration in developing a regional haze program.

Issue: Applicability—Currently, States containing mandatory Federal Class I areas where visibility has been identified as an important value, or having sources which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area, must revise their SIP's to make reasonable progress toward the national visibility goal. Existing visibility regulations apply to the 36 States containing one or more mandatory Federal Class I areas. Studies have shown that regional haze can be caused by fine particles that are transported hundreds or even thousands of kilometers. Thus, sources in States having no mandatory Federal Class I areas could potentially contribute to impairment in Federal Class I areas in other States. The regional haze program should address the potential applicability to all States.

Issue: Regional Haze Planning Areas—It has been recognized in many forums that programs to mitigate regional haze may require multistate or regional approaches to technical assessment, planning, and/or control strategy implementation. Potential regional approaches are currently under discussion through the FACA process. Key questions to be considered are: (a) if regional approaches are taken, should one set of multistate groupings be developed to address ozone, PM, and regional haze implementation programs, or should separate approaches be taken for each of the three programs; and (b) should existing or new institutions be responsible for future planning activities related to these three programs?

Issue: Definition of Reasonable Progress—The term ''reasonable progress'' was not specifically defined in the 1980 visibility regulations for purposes of regional haze. Current regulations require SIP's to contain such emission limits, schedules of compliance and other measures as may be necessary to make reasonable progress toward the national goal, including: (1) requirements for best available retrofit technology (BART) for certain major sources of pollution, and (2) a long-term strategy for making reasonable progress toward meeting the national goal.

In the June 1996 report from the GCVTC, the Public Advisory Committee defines reasonable progress as ''achieving continuous emission reductions necessary to reduce existing impairment and attain steady improvement in visibility in mandatory Federal Class I areas, and managing emissions growth so as to prevent perceptible degradation of clean air days.'' In the GCVTC report, visibility impairment is defined in terms of total light extinction and deciview. The legislative history of the 1990 Amendments to the Act also addresses the issue of reasonable progress and perceptible improvement. Senator Adams, the sponsor of the 1990 revisions to the visibility protection program stated that, ''At a minimum, progress and improvement must require that visibility be perceptibly improved compared to periods of impairment, and that it not be degraded or impaired during conditions that historically contribute to relatively unimpaired visibility.''

Question: What should be the criteria for measuring reasonable progress?

The assessment of reasonable progress can involve quantitative and nonquantitative factors. From a quantitative perspective, measurement of reasonable progress could incorporate assessments of visibility trends, emission reductions, or a combination of both. Tracking visibility trends suggests a periodic assessment of visibility conditions (e.g., averages of 20 percent best and worst days, annual average) as derived from visibility monitoring data and use of a common metric nationally. The light extinction coefficient would be a logical choice since it has been used widely for years and is routinely calculated from optical and aerosol measurements for all IMPROVE sites. Tracking progress will also require the initial documentation of a baseline level of anthropogenic visibility impairment at mandatory Federal Class I areas. The GCVTC has recommended an emission reduction target approach, including review of compliance with an SO_2 percent emission reduction target in the year 2000 and 5-year progress reviews thereafter. Nonquantitative progress factors could address whether a State has taken certain administrative or technical actions determined necessary for measuring and achieving progress over time.

Other questions related to reasonable progress include:

Question: How frequently should progress be measured?

Question: Since monitors are located at only about one-quarter of the 156 mandatory Federal Class I areas, how can progress be demonstrated for sites without monitoring?

Question: Should reasonable progress be demonstrated on a ''regional'' basis (i.e., for groups of Federal Class I areas), with certain IMPROVE sites deemed representative of others lacking monitoring?

Question: Would tracking of emissions reductions and conducting regional modeling be an acceptable surrogate to using monitoring data?

Question: Would the GCVTC approach, which specifies maintaining (rather than improving) average ''clean day'' conditions, be appropriate for areas with higher levels of anthropogenic pollution and thus greater room for improvement (such as most of the Eastern U.S. and selected areas in the West)?

Question: How should a reasonable progress determination take into account the degree of improvement in visibility which may reasonably be anticipated, the costs of compliance, the time necessary for compliance, and the energy and nonair quality environmental impacts of compliance, and the remaining useful life of any existing source subject to such requirements?

Question: What should be required in a State's long-term strategy for making reasonable progress under the regional haze program?

One element of the reasonable progress demonstration should describe the State's strategies for preventing future impairment and ensuring continued progress for a long-term strategy. Estimates of future population growth and associated changes in emissions, and a plan to ensure reasonable progress under these anticipated conditions, could be required by the program. Current visibility regulations require States to revise their long-term strategies every 3 years with respect to reasonably attributable impairment. A regional haze program should address long-term strategies for mitigating all types of visibility impairment, including regional haze impacts.

Another consideration is the implementation of current statutory requirements. An EPA Report to Congress dealing with the effects of the 1990 Act Amendments on visibility in Class I areas estimated that Class I areas from Maine to Georgia would see perceptible improvements in summer and winter visibility under expected implementation of the Amendments. The most significant improvements are expected for Class I areas along the Central and Southern portions of the Appalachian Mountains. The 1993 report indicates that modeled future improvements in annual average Eastern regional visibility are directly related to expected reductions of SO_2 emissions under title IV of the Act (i.e., the acid rain program). Note, however, that current models are not reliable enough to estimate the extent of improvement in the number of clear and hazy days at specific locations.

Question: How should regional haze regulations address the requirement for BART for sources that may reasonably be anticipated to contribute to regional haze?

Rules for regional haze are required to address BART for any major source placed in operation between 1962 and 1977 that ''emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility'' in a mandatory Federal Class I area. The EPA's current visibility rules limit BART to major stationary sources whose contribution is ''reasonably attributable'' to impairment in a Federal Class I area. Recognizing that determinations of BART for regional haze involves contributions from multiple sources, EPA solicits comment on how technological controls, costs, the degree of improvement in visibility which may reasonably be anticipated, and other factors contained in section 169A(g)(2) should be considered.

Section 169A(g)(2) defines BART as follows: ''* * * in determining best available retrofit technology, the State (or the Administrator in determining emission limitations which reflect such technology) shall take into consideration the costs of compliance, the energy and nonair quality environmental impacts of compliance, any existing pollution control technology in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology * * *.'' (42 U.S.C. 7491(g)(2).

Under the existing visibility program, the BART process has involved extensive technical assessments to demonstrate that emissions from a specific major source contribute a specific amount of impairment at a specific Federal Class I area. The regional haze program should address whether the BART requirement would be interpreted differently for the purposes of remedying existing impairment due to the cumulative emissions from sources located across broad regions.

One alternative interpretation could involve the identification of sources potentially subject to BART, development of emission rates determined to be equivalent to BART for key source categories, the estimation of total emission reductions that would be achieved if BART-level emission rates are implemented, incorporation of these reductions into regional emission reduction targets, and implementation of programs by the States to achieve these emission reductions. Regional emission reduction targets for BART could be met through reductions from BART-eligible stationary sources, or the program could potentially allow an equivalent level of reductions through some other means, such as a trading program. Under such an approach, proposed emission reductions planned for attaining any new NAAQS will improve visibility conditions to some degree. Thus, program integration is needed to assess the extent to which strategies for attaining the NAAQS will help meet section 169A requirements for making reasonable progress and implementing BART.

Question: What should be the process for FLM's and EPA involvement in reviewing SIP revisions and reasonable progress demonstrations?

States are required to consult in person with the appropriate FLM's before holding a public hearing on any SIP revisions for visibility. The regional haze program, therefore, should define roles and responsibilities of FLM's, States, and EPA in the review of SIP revisions and reasonable progress demonstrations. It should include ways that input from FLM's and EPA can be incorporated early in program planning activities.

Issue: Visibility SIP revisions due after 12 months—States will be required to revise their SIP's within 12 months of promulgation of regional haze regulations.

The regional haze rules will need to identify the program elements to be addressed in these SIP's. Monitoring strategies, emissions inventories and tracking, emission limitations, schedules of compliance, and adequacy of personnel, funding, and authority for program implementation are all important areas for consideration. The EPA seeks input on other elements that should be included in visibility SIP's and how to coordinate regional haze program implementation with NAAQS implementation.

Issue: Monitoring Program—Since 1987, EPA has supported the IMPROVE network in cooperation with the National Park Service, other FLM's, and State organizations. The IMPROVE network employs aerosol, optical (i.e., nephelometers and transmissometers) and scene (i.e., 35 mm photography) measurements. Direct measurements are taken of fine particles and precursors that contribute to visibility impairment at more than 40 mandatory Federal Class I areas across the country. Aerosol measurements are taken twice a week for PM–10 and fine particle masses and for key constituents of fine particles, such as sulfate, nitrate, organic and elemental carbon, soil dust, and several other elements. Measurements for specific aerosol constituents are used to calculate ''reconstructed'' aerosol light extinction by multiplying the mass for each constituent by its empirically-derived scattering and/or absorption efficiency. These reconstructed light extinction levels are cross-checked with nephelometer and/or transmissometer measurements. Knowledge of the main constituents of a site's light extinction ''budget'' is critical for source apportionment and control strategy development. These methodologies allow estimates of how proposed changes in atmospheric constituents would affect future visibility conditions.

Currently, the IMPROVE monitoring protocols for aerosol, optical, and scene measurements are not included as Federal reference methods because visibility is not regulated under the NAAQS. The EPA is developing a visibility monitoring guidance document, however, that will identify important methods and procedures for effective aerosol, optical, and scene monitoring.

Question: Will the current IMPROVE network be sufficient to determine reasonable progress for mandatory Federal Class I areas?

States implementing a new regional haze program can benefit from the existing infrastructure of the IMPROVE network, established protocols, existing sites, and historical data available. The fact that monitoring equipment is located at only about a quarter of the 156 mandatory Federal Class I areas, however, raises the issue of whether the current configuration is representative of all sites, and whether the network needs expansion. The GCVTC, in its recommendations on future technical needs, states that: ''The current IMPROVE monitoring network only measures aerosol samples twice a week and at only a few Federal Class I sites * * *. Consideration should be given to expanding the coverage or redeployment of resources in the IMPROVE network to enhance completeness of the data set, including on tribal lands. In addition, background surveillance sites could be established at intermediate locations between Federal Class I areas and large regional sources (metropolitan areas) to provide a better understanding of the intermediate course of atmospheric chemistry and transport. Monitoring should be maintained at existing sites in order to allow for long-term trend analysis.''

As discussed above, visibility SIP submittals and State reasonable progress demonstrations likely will rely on monitored data from the IMPROVE network. Thus, it should be determined whether the existing geographic distribution of IMPROVE network sites is adequate for making future determinations of reasonable progress in all Federal Class I areas and for verifying models for predicting possible visibility effects of future air quality management strategies. In addition, the ability for the current cooperative arrangement between EPA, FLM's and the States for managing and funding the network in the future should be assessed.

2. Designations for New NAAQS and Regional Haze Planning Areas

Under the current statutory requirements and EPA policy, EPA is required to designate areas as attainment, nonattainment, or unclassifiable after promulgation of a new or revised NAAQS. The designation process allows EPA to identify geographic regions where the public is subject to potential health risks, to alert the public to the existence of those areas, and to require States to establish control programs to mitigate those health risks.

The EPA is giving advance notice that regional haze planning areas (to address Federal Class I areas) may need to be established for the purposes of conducting technical assessments and developing plans to abate haze on a regional basis. This is the approach to reducing haze recommended by the NRC, as well as the GCVTC. Because haze results from direct emissions of fine particles and fine particle and ozone precursors, the Subcommittee is considering whether regional haze planning areas should coincide with nonattainment areas or other types of control strategy areas established to reduce ozone and PM.

Given that EPA will designate areas and may establish regional haze planning areas, there are several issues that must be resolved. These relate mainly to the timing of designations, the basis for designations (e.g., the use of monitoring or modeling data), the size of nonattainment areas, and the role of transport in the designations process. These requirements raise questions such as the following.

Question: What are EPA's options in developing designation schemes for areas violating the new revised NAAQS?

Question: Should there be differentiation in designations between areas where violations are occurring and the source areas contributing to the problem?

Question: Should nonattainment status be changed to indicate only a public health risk or should nonattainment both indicate the public health risk and trigger control strategies?

Other questions identified to date include the following.

Question: What information should be used as a basis for designating areas and establishing regional haze planning areas, e.g., monitoring data, modeling data, other data, or combinations of monitoring, modeling, and other data?

Question: If monitoring or modeling data are relied upon, will adequate information be available within the appropriate timeframe?

Question: To what extent, if any, should the boundaries of nonattainment areas, control strategy areas and regional haze planning areas coincide or should there be separate areas for ozone, PM, and regional haze?

Question: How can incentives be created to monitor air quality in order to gain a better scientific understanding of the pollutants and avoid disincentives when NAAQS violations are measured? How can incentives be created for private sectors to form monitoring partnerships with EPA and States?

3. Mechanisms to Address Regional Strategies

Question: How do we develop or use existing institutional mechanisms to effectively implement control strategies incorporating multistate regionally—or nationally-applicable measures?

Reviews of monitoring/modeling data suggest that violations of new ozone NAAQS in the center of the range described by the Clean Air Science Advisory Committee (CASAC) are likely to be more widespread than is the case with the current NAAQS. Further, data available at this time suggest that if a PM–2.5 NAAQS is established in the lower end of the range being considered, it too may result in a problem which is regional in scope. By its definition, regional haze is a regional problem. Areas that present the most concerns for visibility protection (i.e., Federal Class I areas such as national parks and wilderness areas) are often located at considerable distances from anthropogenic sources of visibility degradation.

The likely regional scope of problems meeting new NAAQS or visibility goals implies a need for measures applied over large (e.g., multistate) geographical areas.

Question: Should a framework for institutional mechanisms be identified and developed for facilitating development and implementation of strategies to reduce regional transport of ozone, fine particles, and their precursors?

Recently, several cooperative efforts have emerged to better understand and address regional problems. Some of these have been mandated, others are voluntary. Examples include NESCAUM, Mid-Atlantic Regional Air Management Association (MARAMA), Lake Michigan Air Directors Consortium (LADCO), OTC, Southeast States Air Regional Management (SESARM), OTAG, Western States Air Resources Council (WESTAR), GCVTC, State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) and the Environmental Commissioners of States organization (ECOS).

Question: What attributes of existing multistate institutions have been successful or appear essential for assisting in the development and implementation of a regional strategy? Can or should multistate institutions be developed using one or more existing institutions as a starting point?

To identify an appropriate institutional mechanism to facilitate State implementation of programs to meet several air quality goals which are regional in scope, it is first necessary to more specifically define what principles are appropriate for such a group. The following principles, developed by the National and Regional Strategies Work Group to guide their deliberations, are proposed for consideration.

Principle: The institutional mechanism which is established should develop an operating protocol whereby participating States can reach agreement on regional measures to implement. The protocol would address such issues as, who gets to vote?; what constitutes consensus?; to what extent are consensus decisions binding?; what should be the role of the private sector?; what steps should be followed if there is no compliance with an agreement?

Principle: The institutional mechanism should develop a means for summarizing and distributing information on the scientific basis, technical viability and capital/operating costs associated with measures under consideration. In addition, the institution should provide a means, along with the EPA, for facilitating distribution of consistent information regarding emissions, air quality, meteorological data and modeling results to member States.

Question: When considering possible regional strategies, what limitations are imposed by State laws or other constraints? Are clear priority options or ''operating principles'' needed for any institutional mechanism which is formed to help implement regional control measures? The following principles serve as possible examples.

Principle: Use the institutional mechanism as a means to establish positive incentives for upwind areas to reduce precursor emissions. Possible approaches to consider include: having downwind areas/sources defray some of the control costs at upwind locations in exchange for not having to implement the most costly controls in their area, use of performance goals rather than specific measures, and providing a ''bonus credit'' for early implementation.

Principle: Use the institutional mechanism as a means for fostering communication among States and the private sector involved with implementing measures. This goal envisions the mechanism as providing an information clearinghouse on what different States are doing and the appropriate contacts for further details. The institutional mechanism might also serve as the means for facilitating periodic meetings on various subjects related to implementing regional strategies in a coordinated fashion.

Principle: Use the institutional mechanism as a means for promoting use of improved analytical tools and data bases as well as to promote use of consistent assumptions among the States which are implementing regional measures.

4. Integration of NAAQS and Regional Haze Implementation Programs

Question: When and where does it make sense to develop and implement integrated criteria and policies for urban ozone, fine particles and regional haze control programs?; for regional ozone, fine particle and regional haze control programs?

As discussed in the previous science section, the photochemical reactions involving VOC, NO_X and sunlight which produce ozone also produce other secondary pollutants. The photochemical reactions can result in oxidation of SO_2 and NO_X to produce visibility-reducing species which may be regarded as fine PM or as haze. This realization leads to the question of whether control of ozone, fine particles and haze can be optimized through consideration of all of them together in an integrated fashion rather than considering each separately. This issue considers first how to decide if integration is appropriate and second, if it is, then what integrated control strategies should be implemented to reduce the impact on public health and improve visibility caused by regional haze?

Before key national/regional/multipollutant control strategies can be developed, a clear understanding of what integration of ozone, PM, and regional haze means to the implementation process must be established. For instance, if the goal is to minimize the burden on the regulated industry, then the outcome of the control strategy may look different from one with the goal of maximizing the risk reduction to public health and welfare. Will the knowledge and understanding of these approaches be understood and the technical tools needed to integrate the programs be available, or must new state-of-the-science and technical tools be developed?

While the focus of control strategy integration centers around the ozone, PM and regional haze programs, some consideration of how other programs affect these programs will need to be assessed (i.e., acid rain, climate change, stratospheric ozone, ecosystem protection, toxics). A number of questions arise when considering the feasibility of an integrated strategy.

Question: What should be the basis for designing control strategies?

Question: Should integration utilize consistent or uniform modeling approaches to understanding long-range transport? What is the most practical way to accomplish this?

Question: Is an atmospheric chemistry linkage needed between all the programs? Currently, efforts are under way for fine particles and ozone. There may be some SO_2 chemistry included and limited toxics integration. Are these adequately characterized?

Question: How should multipollutant integration fit into the development and initiation of control strategies and programs?

Question: How can contributing sources be identified?

Question: If equity between control of long-range transport and control of local generation of pollutants is important, how could it be defined?

Question: What qualitative considerations can be made to provide assurance that control programs for ozone, PM, regional haze, toxics, acid deposition, etc., are integrated with one another?

To identify an appropriate framework for implementing efficient programs that meet several air quality goals for pollutants which are regional in scope, it is first necessary to more specifically define what principles are appropriate. As indicated above, the following principles are guiding the National and Regional Strategies Work Group deliberations and could provide an initial set for consideration:

Principle: Pursue integrated control strategies for simultaneously reducing ambient concentrations of tropospheric ozone and fine PM if there are sufficient observation-based data to demonstrate both an environmental and economic benefit to integration.

Principle: Emphasize performance-based control strategies in lieu of prescriptive command-and-control strategies.

Principle: Develop controls that establish emission reduction responsibility based on the contribution to the problems, while also considering cost-effectiveness.

Principle: Emphasize broad-scale control strategies for contributing sources where dictated by sound science.

Principle: Focus on the interactions of the pollutants and the interactions between control strategies, identifying both positive and negative interactions.

Principle: Integrate the implementation of the three programs (ozone, PM, and regional haze) to the greatest extent possible.

Principle: Recognize that decisions need to be made based on scientific information that is improving and find institutional mechanisms to allow for mid-course corrections when significant new information is available.

5. Prevention of Significant Deterioration (PSD) of Air Quality and Nonattainment New Source Review (NSR)

Protection of the NAAQS, including new and revised standards, is provided in part under Federal regulations requiring the preconstruction review of large new and modified stationary sources of air pollution, referred to as ''major stationary sources.'' As described below, the nature of the changes which EPA will be proposing to the implementation policies for the NAAQS for both ozone and PM will necessitate consideration of significant changes to these regulations commensurate with the types of issues already described in this ANPR.

Two separate preconstruction review programs exist, based on the air quality attainment status of the proposed location of source construction. Major stationary sources locating in areas designated attainment or unclassifiable for a particular pollutant are subject to requirements for the PSD of air quality. Major stationary sources located in areas designated nonattainment for a particular pollutant must undergo review via nonattainment NSR requirements.

Under the PSD program, a major stationary source is defined as one that emits or has the potential to emit 250 tons per year (tpy) or more of any air pollutant, except where a source is one in a category specifically listed as a 100 tpy major source category. In addition to the pollutant for which the source is major, the PSD preconstruction review applies to each regulated pollutant which the major source will have the potential to emit in significant amounts, as defined by EPA regulations. Sources required to undergo PSD review generally must demonstrate to the applicable permitting authority that proposed emissions increases will not cause or contribute to violations of the NAAQS or maximum allowable pollutant concentration increases (known as increments). Under certain circumstances, the source may also need to demonstrate that emissions will not have an adverse impact on air quality related values in Federal Class I areas. The air quality impact analyses associated with these demonstrations rely upon the use of both predicted (modeled) air quality and measured (ambient monitoring) data. The predictions of air quality using air dispersion models require the use of emissions data for the new or modified source and certain existing sources within the potential area of impact. Where adequate ambient data are not available, the permitting authority may require the PSD applicant to collect 1 year of ambient monitoring data. As described earlier in this ANPR, changes in the way which air quality assessments are made, considering how emissions, meteorological processes, atmospheric chemistry, and deposition occur over multiple spacial and temporal scales, will likely affect the way in which future PSD air quality impact analyses are carried out for ozone and PM.

In addition, the PSD applicant must demonstrate that proposed emissions increases will be controlled through the use of best available control technology (BACT). The determination of BACT involves the selection of the most effective control technology for reducing emissions of a particular pollutant on a case-by-case basis, taking into consideration energy, environmental and economic impacts and other costs. Decisions for controlling PM, for example, could be affected by the particle size, as well as the chemical composition, of the PM proposed to be emitted. Moreover, changes to the requirements for applying BACT to individual sources may be needed to more adequately address the consideration of precursor contributions and atmospheric chemistry in selecting the best controls to provide the most effective ambient benefits for ozone and PM.

Increments for PM were originally defined for total suspended particulate (TSP). The EPA later replaced those increments with PM–10 increments following replacement of the TSP NAAQS with the PM–10 NAAQS. Should EPA adopt NAAQS for PM which include standards for both PM–10 and fine particles, then EPA will need to consider how that will affect the current PM–10 increments. Increments for ozone have never been established because of the technical difficulty associated with predicting ambient concentration changes resulting from individual stationary sources of VOC.

Under the nonattainment NSR regulations, ''major source'' is defined generally as any stationary source that emits, or has the potential to emit, in consideration of controls, 100 tpy or more of the nonattainment pollutant, except in specific cases where lower thresholds apply to more serious nonattainment classifications. The basic nonattainment NSR requirements for the construction or modification of major stationary sources in nonattainment areas and the ozone transport region include the requirement that the lowest achievable emission rate technology be installed, and that the increased emissions of the nonattainment pollutant from the proposed new major source or major modification be offset by actual emissions decreases of the same pollutant from one or more existing sources. The offsets may come from the same nonattainment area or another nonattainment area of equal or higher classification as long as the offsetting emissions contribute to the air quality problem in the area where the decrease is being credited. As with PSD, the NSR requirements for control technology application and offsets do not adequately account for precursor activities or for the complexities associated with atmospheric chemistry.

Any revised ozone and PM NAAQS may suggest that existing implementing guidance, EPA's nonattainment NSR rules, and the States' nonattainment NSR programs will need to be reviewed and revised in various ways to address the integrated implementation approach being contemplated.

The FACA Subcommittee and work groups will look into how the current PSD/NSR programs for ozone and PM–10 attainment, unclassifiable and nonattainment areas could be adapted or modified. Some PSD/NSR questions that may consider include:

Question: What types of mitigation procedures should be required of major new or modified sources that would contribute to violations of the revised NAAQS for ozone or PM, or to visibility impairment in Federal Class I areas?

Question: Should PSD/NSR requirements reflect the potential for broad intra and interstate nonattainment areas, control areas, and regional haze planning areas that could result when addressing implementation under revised NAAQS for ozone and PM?

Question: What approach should be developed for the treatment of ozone and fine particle precursors for PSD/NSR applicability purposes?

Question: Should the PSD/NSR programs allow for precursor substitutions when environmentally beneficial to meet offset and control technology requirements?

Question: How can availability, crediting, and location of emissions offsets be restructured under a more regionalized implementation strategy for PM?

6. Attainment Dates

Areas designated nonattainment with respect to a primary NAAQS are, under the current statutory structure, required to achieve attainment as expeditiously as practicable, but no later than 5 years from the date the area was designated nonattainment. The EPA may extend this date up to an additional 5 years. This extension may be a full 5 years or any 1 year increment in between. Additionally, the Administrator may grant two 1-year extensions.

With respect to a potential new secondary ozone NAAQS, areas designated nonattainment are required, under the current statutory structure, to achieve attainment of the secondary NAAQS as ''expeditiously as practicable'' following designation. Secondary nonattainment areas are not bound to the same 10-year deadline as primary areas.

Question: Given the preceding discussion, how should attainment dates for primary and secondary NAAQS be established?

B. Phase II Issues

As discussed earlier in this notice, in Phase I, the FACA Subcommittee and work groups will address air quality management framework issues. The EPA plans to propose the resulting Phase I strategy in mid-1997. Phase II of the integrated implementation strategy will focus on more detailed control strategy development. The EPA plans to propose the Phase II strategy in mid-1998. The Phase II implementation issues include:

—Classifications of nonattainment areas;
—Control requirements (e.g., reasonably available control measures including reasonably available control technology);
—Economic incentive programs;
—State implementation plan requirements;
—Overall control program integration;
—Measures of progress; and,
—Institutional processes.

All of these issues will be discussed in greater detail at a later date. Interested readers are directed to EPA's TTN and WWW site for an up-to-date status of the work groups and Subcommittee deliberations on these issues.

V. Administrative Requirements

A. Executive Order 12866

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

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

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

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

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

Pursuant to the terms of Executive Order 12866, it has been determined that this ANPR announces a significant regulatory action, and as such, will be submitted to OMB for review. Any written comments from OMB to EPA, any written EPA responses to those comments, and any changes made in response to OMB suggestions or recommendations will be included in the docket. The docket is available for public inspection at the EPA's Air and Radiation Docket and Information Center, which is listed in the ADDRESSES section of this notice.

B. Miscellaneous

Requirements under the Unfunded Mandates Act of 1995, the Paperwork Reduction Act, and the Regulatory Flexibility Act will be addressed if and when the Agency issues a proposed rule based on the comments received on this ANPR.

List of Subjects in 40 CFR Part 51

Environmental protection, Administrative practice and procedure, Air pollution control, Carbon monoxide, Nitrogen dioxide, Ozone, Particulate matter, Sulfur oxides, Volatile organic compounds.

Dated: December 4, 1996.

Carol M. Browner,

Administrator.

Appendix

Definitions

Annual sulfate conversion: Although significant gas phase transformation of sulfur dioxide occurs, aqueous phase oxidation is believed to be responsible for the majority of annual sulfate conversion in the Eastern U.S.

''Best'' and ''worst'' days: Can be defined as the average of the 20 percent best and worst days, respectively, as measured in terms of total light extinction.

Chemical sinks: Termination compounds that essentially remove other compounds (e.g., nitric acid, hydrogen and organic peroxides). Some ''sinks'' can eventually break down and reform precursor compounds (e.g., peroxy acetyl nitrate, PAN).

Deciview: Derived from the light extinction coefficient and describes changes in uniform atmospheric extinction that can be perceived by a human observer. It is designed to be linear with respect to perceived visual changes over its entire range in a way that is analogous to the decibel scale for sound. A 1-deciview change is roughly equivalent to a 10 percent change in visibility.

Improve: A federally-administered visibility monitoring network for Federal Class I areas in several States that failed to submit SIP's containing monitoring strategies as required in the 1980 visibility regulations.

Intermediates: Include the short-lived radicals (hydroxyl, hydro-, and organic-peroxy) which perform many of the important atmospheric oxidation reactions.

Mandatory Federal Class I Areas: Areas designated as mandatory Federal Class I areas are those national parks exceeding 6000 acres, wilderness areas and memorial parks exceeding 5000 areas, and all international parks which were in existence on August 7, 1977.

Precursors: Compounds which contribute or lead to the formation of a secondary pollutant. For example, NOx and VOC are ozone precursors.

Reasonably attributable: Visibility impairment, as defined in 40 CFR 51.301, that is ''attributable by visual observation or any other technique the State deems appropriate.'' It includes impacts to mandatory Federal Class I areas caused by smoke, plumes or layered hazes from a single source or group of sources.

Visibility regulations: See 45 FR 80084 (December 2, 1980) (codified at 40 CFR 51.300–307).

VOC species: Most low molecular weight VOC species (which are most prevalent in ambient air) are not expected to contribute significantly to secondary aerosol formation. Certain aromatics, and higher molecular weight alkanes and alkenes (>6 carbons) are believed to be the major contributors to secondary organic aerosol formation.

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