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Part III

Environmental Protection Agency

40 CFR Parts 51, 72, 75, and 96
Rule To Reduce Interstate Transport of Fine Particulate Matter and Ozone (Interstate Air Quality Rule); Proposed Rule

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40 CFR Parts 51, 72, 75, and 96

[FRL–7604–3]

Rule To Reduce Interstate Transport of Fine Particulate Matter and Ozone (Interstate Air Quality Rule)

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: In today's action, EPA is proposing to find that 29 States and the District of Columbia contribute significantly to nonattainment of the national ambient air quality standards (NAAQS) for fine particles ($PM_{2.5}$) and/or 8-hour ozone in downwind States. The EPA is proposing to require these upwind States to revise their State implementation plans (SIPs) to include control measures to reduce emissions of sulfur dioxide (SO_2) and/or nitrogen oxides (NO_X). Sulfur dioxide is a precursor to $PM_{2.5}$ formation, and NO_X is a precursor to both ozone and $PM_{2.5}$ formation. Reducing upwind precursor emissions will assist the downwind $PM_{2.5}$ and 8-hour ozone nonattainment areas in achieving the NAAQS. Moreover, attainment would be achieved in a more equitable, cost-effective manner than if each nonattainment area attempted to achieve attainment by implementing local emissions reductions alone.

Based on State obligations to address interstate transport of pollutants under section 110(a)(2)(D) of the Clean Air Act (CAA), EPA is proposing statewide emissions reduction requirements for SO_2 and NO_X. The EPA is proposing that the emissions reductions be implemented in two phases, with the first phase in 2010 and the second phase in 2015. The proposed emissions reduction requirements are based on controls that are known to be highly cost effective for electric generating units (EGUs).

Today's action also discusses model multi-State cap and trade programs for SO_2 and NO_X that States could choose to adopt to meet the proposed emissions reductions in a flexible and cost-effective manner. The EPA intends to propose the model trading programs in a future supplemental action.

DATES: The comment period on this proposal ends on March 30, 2004. Comments must be postmarked by the last day of the comment period and sent directly to the Docket Office listed in **ADDRESSES** (in duplicate form if possible).

Up to two public hearings will be held prior to the end of the comment period. The dates, times and locations will be announced separately. Please refer to **SUPPLEMENTARY INFORMATION** for additional information on the comment period and public hearings.

ADDRESSES: Comments may be submitted by mail to: Air Docket, Environmental Protection Agency, Mail code: 6102T, 1200 Pennsylvania Ave., NW., Washington, DC 20460, Attention Docket ID No. OAR–2003–0053.

Comments may also be submitted electronically, by facsimile, or through hand delivery/courier. Follow the detailed instructions provided under **SUPPLEMENTARY INFORMATION.**

Documents relevant to this action are available for public inspection at the EPA Docket Center, located at 1301 Constitution Avenue, NW., Room B102, Washington, DC between 8:30 a.m. and 4:30 p.m., Monday through Friday, excluding legal holidays. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: For general questions concerning today's action, please contact Scott Mathias, U.S. EPA, Office of Air Quality Planning and Standards, Air Quality Strategies and Standards Division, C539–01, Research Triangle Park, NC, 27711, telephone (919) 541–5310, e-mail at *mathias.scott@epa.gov.* For legal questions, please contact Howard J. Hoffman, U.S. EPA, Office of General Counsel, Mail Code 2344A, 1200 Pennsylvania Avenue, NW., Washington, DC, 20460, telephone (202) 564–5582, e-mail at *hoffman.howard@epa.gov.* For questions regarding air quality analyses, please contact Norm Possiel, U.S. EPA, Office of Air Quality Planning and Standards, Emissions Modeling and Analysis Division, D243–01, Research Triangle Park, NC, 27711, telephone (919) 541–5692, e-mail at *possiel.norm@epa.gov.* For questions regarding statewide emissions inventories and emissions reductions requirements, please contact Ron Ryan, U.S. EPA, Office of Air Quality Planning and Standards, Emissions Modeling and Analysis Division, Mail Code D205–01, Research Triangle Park, NC, 27711, telephone (919) 541–4330, e-mail at *ryan.ron@epa.gov.* For questions regarding the EGU cost analyses, emissions inventories and budgets, please contact Kevin Culligan, U.S. EPA, Office of Atmospheric Programs, Clean Air Markets Division, Mail Code 6204J, 1200 Pennsylvania Avenue, NW., Washington, DC, 20460, telephone (202) 343–9172, e-mail at *culligan.kevin@epa.gov.* For questions regarding the model cap and trade programs, please contact Sam Waltzer, U.S. EPA, Office of Atmospheric Programs, Clean Air Markets Division, Mail Code 6204J, 1200 Pennsylvania Avenue, NW., Washington, DC, 20460, telephone (202) 343–9175, e-mail at *waltzer.sam@epa.gov.* For questions regarding the regulatory impact analyses, please contact Linda Chappell, U.S. EPA, Office of Air Quality Planning and Standards, Air Quality Strategies and Standards Division, Mail Code C339–01, Research Triangle Park, NC, 27711, telephone (919) 541–2864, e-mail at *chappell.linda@epa.gov.*

SUPPLEMENTARY INFORMATION:

Regulated Entities

This action does not propose to directly regulate emissions sources. Instead, it proposes to require States to revise their SIPs to include control measures to reduce emissions of NO_X and SO_2. The proposed emissions reductions requirements that would be assigned to the States are based on controls that are known to be highly cost effective for EGUs.

Public Hearing

The EPA will hold up to two public hearings on today's proposal during the comment period. The details of the public hearings, including the times, dates, and locations will be provided in a future **Federal Register** notice and announced on EPA's Web site for this rulemaking at *http://www.epa.gov/interstateairquality/.*

The public hearings will provide interested parties the opportunity to present data, views, or arguments concerning the proposed rule. The EPA may ask clarifying questions during the oral presentations, but will not respond to the presentations or comments at that time. Written statements and supporting information submitted during the comment period will be considered with the same weight as any oral comments and supporting information presented at a public hearing.

How Can I Get Copies of This Document and Other Related Information?

Docket. The EPA has established an official public docket for this action under Docket ID No. OAR–2003–0053. The official public docket consists of the documents specifically referenced in this action, any public comments received, and other information related to this action. Although a part of the official docket, the public docket does not include Confidential Business Information (CBI) or other information whose disclosure is restricted by statute.

The official public docket is the collection of materials that is available for public viewing at the Air Docket in the EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the Air Docket is (202) 566–1742. A reasonable fee may be charged for copying.

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For additional information about EPA's electronic public docket, visit EPA Dockets online or *see* 67 FR 38102; May 31, 2002.

The EPA has also established a Web site for this rulemaking at *http://www.epa.gov/interstateairquality/* which will include the rulemaking actions and certain other related information.

How and to Whom Do I Submit Comments?

You may submit comments electronically, by mail, by facsimile, or through hand delivery/courier. To ensure proper receipt by EPA, identify the appropriate docket identification number, OAR–2003–0053, in the subject line on the first page of your comment. Please ensure that your comments are submitted within the specified comment period. Comments received after the close of the comment period will be marked "late." The EPA is not required to consider these late comments. If you wish to submit CBI or information that is otherwise protected by statute, please follow the instructions below under, "How Should I submit CBI to the Agency?" Do not use EPA Dockets or e-mail to submit CBI or information protected by statute.

Electronically. If you submit an electronic comment as prescribed below, EPA recommends that you include your name, mailing address, and an e-mail address or other contact information in the body of your comment. Also include this contact information on the outside of any disk or CD ROM you submit, and in any cover letter accompanying the disk or CD ROM. This ensures that you can be identified as the submitter of the comment and allows EPA to contact you in case EPA cannot read your comment due to technical difficulties or needs further information on the substance of your comment. The EPA's policy is that EPA will not edit your comment, and any identifying or contact information provided in the body of a comment will be included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment.

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Electronic mail. Comments may be sent by e-mail to *A-and-R-Docket@epa.gov,* Attention Docket ID No. OAR–2003–0053. In contrast to EPA's electronic public docket, EPA's e-mail system is not an "anonymous access" system. If you send an e-mail comment directly to the Docket without going through EPA's electronic public docket, EPA's e-mail system automatically captures your e-mail address. The e-mail addresses that are automatically captured by EPA's e-mail system are included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket. Electronic submissions will be accepted in WordPerfect or ASCII file format. Avoid the use of special characters and any form of encryption.

Disk or CD ROM. You may submit comments on a disk or CD ROM that you mail to the mailing address identified under Docket above. These electronic submissions will be accepted in WordPerfect or ASCII file format. Avoid the use of special characters and any form of encryption.

By Mail. Send your comments to Air Docket (in duplicate if possible), Environmental Protection Agency, Mail code: 6102T, 1200 Pennsylvania Ave.,

NW, Washington, DC, 20460, Attention Docket ID No. OAR–2003–0053.

By Hand Delivery or Courier. Deliver your comments to: Air Docket, Environmental Protection Agency, 1301 Constitution Avenue, NW, Room B108, Mail code: 6102T, Washington, DC 20004, Attention Docket ID No. OAR–2003–0053. Such deliveries are only accepted during the Docket's normal hours of operation as identified above under Docket.

By Facsimile. Fax your comments to (202) 566–1741, Attention Docket ID. No. OAR–2003–0053.

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Do not submit information that you consider to be CBI electronically through EPA's electronic public docket or by e-mail. Send or deliver information identified as CBI only to the following address: Roberto Morales, U.S. EPA, Office of Air Quality Planning and Standards, Mail Code C404–02, Research Triangle Park, NC 27711, telephone (919) 541–0880, e-mail at *morales.roberto@epa.gov*, Attention Docket ID No. OAR–2003–0053. You may claim information that you submit to EPA as CBI by marking any part or all of that information as CBI (if you submit CBI on disk or CD ROM, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is CBI). Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

In addition to one complete version of the comment that includes any information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket and EPA's electronic public docket. If you submit the copy that does not contain CBI on disk or CD ROM, mark the outside of the disk or CD ROM clearly that it does not contain CBI. Information not marked as CBI will be included in the public docket and EPA's electronic public docket without prior notice. If you have any questions about CBI or the procedures for claiming CBI, please consult the person identified in the **FOR FURTHER INFORMATION CONTACT** section.

What Should I Consider as I Prepare My Comments for EPA?

You may find the following suggestions helpful for preparing your comments:

1. Explain your views as clearly as possible.

2. Describe any assumptions that you used.

3. Provide any technical information and/or data you used that support your views.

4. If you estimate potential burden or costs, explain how you arrived at your estimate.

5. Provide specific examples to illustrate your concerns.

6. Offer alternatives.

7. Make sure to submit your comments by the comment period deadline identified.

8. To ensure proper receipt by EPA, identify the appropriate docket identification number in the subject line on the first page of your response. It would also be helpful if you provided the name, date, and **Federal Register** citation related to your comments.

Outline

I. Background

A. Summary of Rulemaking and Affected States

The CAA contains a number of requirements to address nonattainment of the $PM_{2.5}$ and the 8-hour ozone national ambient air quality standards (NAAQS), including requirements that States address interstate transport that contributes to such nonattainment.[1] Based on air quality modeling, ambient air quality data analyses, and cost analyses, EPA proposes to conclude that emissions in certain upwind States result in amounts of transported fine particles ($PM_{2.5}$), ozone, and their emissions precursors that significantly contribute to nonattainment in downwind States. In today's action, we are proposing State implementation plan (SIP) requirements for the affected upwind States under CAA section 110(a)(1) to meet the requirements of section 110(a)(2)(D). Clean Air Act Section 110(a)(2)(D) requires SIPs to contain adequate provisions to prohibit air pollutant emissions from sources or activities in those States from "contribut[ing] significantly to nonattainment in," a downwind State of the $PM_{2.5}$ and ozone NAAQS. In particular, EPA is proposing to require SIP revisions in 29 States and the District of Columbia to ensure that SIPs provide for necessary regional reductions of emissions of SO_2 and/or NO_X, which are important precursors of $PM_{2.5}$ (NO_X and SO_2) and ozone (NO_X). Achieving these emissions reductions will help enable $PM_{2.5}$ and ozone nonattainment areas in the eastern half of the United States to prepare attainment demonstrations. Moreover, attainment would ultimately be achieved in a more certain, equitable, and cost-effective manner than if each nonattainment area attempted to implement local emissions reductions alone. We are proposing to require the submission of SIP measures that meet the specified SO_2 and NO_X emissions reductions requirements within 18 months after publication of the notice of final rulemaking.

The EPA has evaluated current scientific and technical knowledge and conducted a number of air quality data and modeling analyses regarding the contribution of pollutant emissions to interstate transport. These evaluations and modeling analyses are summarized in section II, Characterization of the Origin and Distribution of 8-Hour Ozone and $PM_{2.5}$ Air Quality Problems, section IV, Air Quality Modeling to Determine Future 8-Hour Ozone and $PM_{2.5}$ Concentrations, and section V, Air Quality Aspects of Significant Contribution for 8-Hour Ozone and Annual Average $PM_{2.5}$ Before Considering Cost. The EPA proposes to find, after considering relevant information, that SO_2 and NO_X emissions in the District of Columbia and the following 28 States significantly contribute to nonattainment in a downwind State with respect to the $PM_{2.5}$ NAAQS: Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia, and Wisconsin. The EPA also proposes to find, after considering relevant information, that NO_X emissions in the District of Columbia and the following 25 States significantly contribute to nonattainment in a downwind State with respect to the 8-hour ozone NAAQS: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia, and Wisconsin. In addition to proposing findings of significant contribution to nonattainment, EPA is proposing to assign emissions reductions requirements for SO_2 and/or NO_X that each of the identified States must meet through SIP measures.

The proposed emissions reductions requirements are based on controls that EPA has determined to be highly cost effective for EGUs under an optional cap and trade program. However, States have the flexibility to choose the measures to adopt to achieve the specified emissions reductions. If the State chooses to control EGUs, then it must establish a budget—that is, an emissions cap—for those sources. Due to feasibility constraints, EPA is proposing that the emissions reductions be implemented in two phases, with the first phase in 2010 and the second phase in 2015. These requirements are described in more detail in section VI, Emissions Control Requirements; section VII, State Implementation Plan Schedules and Requirements; and section VIII, Model Cap and Trade Program.

Section VIII discusses model multi-State cap and trade programs for SO_2 and NO_X that EPA is developing that States could choose to adopt to meet the proposed emissions reductions in a flexible and cost-effective way. We intend to propose the model trading programs in a future supplemental notice of proposed rulemaking (SNPR) to be issued by May 2004. We plan to address several additional issues in the SNPR.

Sulfur dioxide and NO_X are not the only emissions that contribute to interstate transport and $PM_{2.5}$ nonattainment. However, EPA believes that given current knowledge, it is not appropriate at this time to specify emissions reduction requirements for direct $PM_{2.5}$ emissions or organic precursors (*e.g.* volatile organic compounds (VOCs) or ammonia (NH_3)). (For further discussion of EPA's proposal on which pollutant emissions to regulate, see section III.) Therefore, we are not proposing new SIP requirements for emissions of these pollutants for the purpose of reducing the interstate transport of $PM_{2.5}$. States may, however, need to consider additional reductions in some or all of these emissions as they develop SIPs to attain and maintain the $PM_{2.5}$ standards. Similarly, for 8-hour ozone, we continue to rely on the conclusion of the Ozone Transport Assessment Group (OTAG) that analysis of interstate transport control opportunities should focus on NO_X, rather than VOCs.[2]

Section III of this preamble, Overview of Proposed Interstate Air Quality Rule, explains in broad overview our assessment of the interstate pollution transport problem and our development of this proposal to address transport under the CAA.

The requirements in this proposal are intended to address regional interstate transport of air pollution. There are likely more localized transport problems that will remain, particularly between contiguous urban areas located in two or more States. States that share an interstate nonattainment area are expected to work together in developing the nonattainment SIP for that area, reducing emissions that contribute to local-scale interstate transport problems.

In this preamble, we generally refer to States as both the sources and receptors of interstate transport that contributes to nonattainment. We intend to refer to Tribal governments in a similar way. Clean Air Act section 301(d) recognizes that American Indian Tribal

[1] In today's proposal, when we use the term "transport" we mean to include the transport of both fine particles ($PM_{2.5}$) and their precursor emissions and/or transport of both ozone and its precursor emissions.

[2] The OTAG was active from 1995–1997 and consisted of representatives from the 37 states in that region; the District of Columbia; EPA; and interested members of the public, including industry and environmental groups. See discussion below under NO_X SIP Call for further information on OTAG.

governments are generally the appropriate authority to implement the CAA in Indian country. The Tribal Authority Rule (TAR) (63 FR 7262; February 12, 1998 and 59 FR 43960–43961; August 24, 1994) discusses the provisions of the CAA for which it is appropriate to treat Tribes in a manner similar to States. Therefore, in this preamble, unless otherwise specified, when we discuss the role of the State in implementing the Interstate Air Quality Rule, we are also referring to the Tribes. In certain parts of this preamble, however, we ask for comments on addressing the special needs of the Tribes. Section VI provides a more complete discussion of this Tribal issue.

Our benefit-cost analysis concludes that substantial net economic benefits to society are likely to be achieved as a result of the emissions reductions associated with this rulemaking. The results detailed in section XI show that this rule would be highly beneficial to society, with annual net benefits by 2010 of approximately $55 billion ($58 billion annual benefits compared to annual social cost of approximately $3 billion) and net annual benefits by 2015 of $80 billion ($84 billion in benefits compared to annual social costs of $4 billion). Therefore, even if the benefits were overestimated by as much as a factor of twenty, benefits would still exceed costs.

B. General Background on Air Quality Impacts of $PM_{2.5}$ and Ozone

1. What Are the Effects of Ambient $PM_{2.5}$?

On July 18, 1997, we revised the NAAQS for particulate matter (PM) to add new standards for fine particles, using as the indicator particles with aerodynamic diameters smaller than a nominal 2.5 micrometers, termed $PM_{2.5}$. We established health- and welfare-based (primary and secondary) annual and 24-hour standards for $PM_{2.5}$ (62 FR 38652). The annual standards are 15 micrograms per cubic meter, based on the 3-year average of annual mean $PM_{2.5}$ concentrations. The 24-hour standard is a level of 65 micrograms per cubic meter, based on the 3-year average of the annual 98th percentile of 24-hour concentrations.

Fine particles are associated with a number of serious health effects including premature mortality, aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions, emergency room visits, absences from school or work, and restricted activity days), lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and cardiac arrhythmia. The EPA has estimated that attainment of the $PM_{2.5}$ standards would prolong tens of thousands of lives and prevent tens of thousands of hospital admissions each year, as well as hundreds of thousands of doctor visits, absences from work and school, and respiratory illnesses in children. Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children. Health studies have shown that there is no clear threshold below which adverse effects are not experienced by at least certain segments of the population. Thus, some individuals particularly sensitive to fine particle exposure may be adversely affected by fine particle concentrations below those for the annual and 24-hour standards. More detailed information on health effects of fine particles can be found on EPA's Web site at: *http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html.*

At the time EPA established the primary standards in 1997, we also established welfare-based (secondary) standards identical to the primary standards. The secondary standards are designed to protect against major environmental effects caused by PM such as visibility impairment, soiling, and materials damage.

The EPA also established the regional haze regulations in 1999 for the improvement of visual air quality in Class I areas which include national parks and wilderness areas across the country.

As discussed in other sections of this preamble, EGUs are a major source of SO_2 and NO_X emissions, both of which contribute to fine particle concentrations. In addition, EGU NO_X emissions contribute to ozone problems, described in the next section. We believe today's proposal will significantly reduce SO_2 and NO_X emissions that contribute to $PM_{2.5}$ and 8-hour ozone problems described here. The control strategies we are proposing are discussed in detail in section III and section VI below.

2. What Are the Effects of Ambient Ozone?

On July 18, 1997, EPA promulgated identical revised ozone primary and secondary ozone standards that specified that the 3-year average of the fourth highest daily maximum 8-hour average ozone concentration could not exceed 0.08 ppm. In general, the revised 8-hour standards are more protective of public health and the environment and more stringent than the pre-existing 1-hour ozone standards. There are more areas that do not meet the 8-hour standard than there are that do not meet the 1-hour standard. Short-term (1- to 3-hour) and prolonged (6- to 8-hour) exposures to ambient ozone have been linked to a number of adverse health effects. Short-term exposure to ozone can irritate the respiratory system, causing coughing, throat irritation, and chest pain. Ozone can reduce lung function and make it more difficult to breathe deeply. Breathing may become more rapid and shallow than normal, thereby limiting a person's normal activity. Ozone also can aggravate asthma, leading to more asthma attacks that require a doctor's attention and the use of additional medication. Increased hospital admissions and emergency room visits for respiratory problems have been associated with ambient ozone exposures. Longer-term ozone exposure can inflame and damage the lining of the lungs, which may lead to permanent changes in lung tissue and irreversible reductions in lung function. A lower quality of life may result if the inflammation occurs repeatedly over a long time period (such as months, years, a lifetime).

People who are particularly susceptible to the effects of ozone include children and adults who are active outdoors, people with respiratory diseases, such as asthma, and people with unusual sensitivity to ozone.

In addition to causing adverse health effects, ozone affects vegetation and ecosystems, leading to reductions in agricultural crop and commercial forest yields; reduced growth and survivability of tree seedlings; and increased plant susceptibility to disease, pests, and other environmental stresses (*e.g.*, harsh weather). In long-lived species, these effects may become evident only after several years or even decades and thus have the potential for long-term adverse impacts on forest ecosystems. Ground-level ozone damage to the foliage of trees and other plants can also decrease the aesthetic value of ornamental species used in residential landscaping, as well as the natural beauty of our national parks and recreation areas. The economic value of some welfare losses due to ozone can be calculated, such as crop yield loss from both reduced seed production (*e.g.*, soybean) and visible injury to some leaf crops (*e.g.*, lettuce, spinach, tobacco) and visible injury to ornamental plants (*i.e.*, grass, flowers, shrubs), while other types of welfare loss may not be fully quantifiable in economic terms (*e.g.*, reduced aesthetic value of trees growing in heavily visited National parks). More detailed information on health effects of ozone

can be found at the following EPA Web site: *http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_index.html.*

3. What Other Environmental Effects Are Associated With SO_2 and NO_X, the Main Precursors to $PM_{2.5}$ and Ozone Addressed in This Proposal?

This proposed action will result in benefits in addition to the enumerated human health and welfare benefits resulting from reductions in ambient levels of PM and ozone. Reductions in NO_X and SO_2 will contribute to substantial visibility improvements in many parts of the Eastern U.S. where people live, work, and recreate, including Federal Class I areas such as the Great Smoky Mountains. Reductions in these pollutants will also reduce acidification and eutrophication of water bodies in the region. In addition, reduced mercury emissions are anticipated as a result of this proposal. Reduced mercury emissions will lessen mercury contamination in lakes and thereby potentially decrease both human and wildlife exposure.

C. What Is the Ambient Air Quality of $PM_{2.5}$ and Ozone?

1. What Is the $PM_{2.5}$ Ambient Air Quality?

The $PM_{2.5}$ ambient air quality monitoring for the 2000–2002 period shows that areas violating the standards are located across much of the eastern half of the United States and in parts of California. Based on these data, 120 counties have at least one monitor that violates either the annual or the 24-hour $PM_{2.5}$ standard. Most areas violate only the annual standard; a small number of areas violate both the annual and 24-hour standards; and no areas violate just the 24-hour standard. The population of these 120 counties totals 65 million people.

Only two States in the western half of the U.S., California and Montana, have counties that exceed the $PM_{2.5}$ standards. On the other hand, in the eastern half of the U.S., 175 sites in 106 counties exceeded the annual $PM_{2.5}$ standard of 15.0 micrograms per cubic meter ($\mu g/m^3$) over the 3-year period from 2000 to 2002 and 395 sites meet the annual standard. No sites in the eastern half of the United States exceed the daily $PM_{2.5}$ standard of 65 $\mu g/m^3$. The 106 violating counties are located in a distinct region made up of 19 States (plus the District of Columbia), extending from St. Clair County, Illinois (East St. Louis), the western-most violating county, to New Haven, Connecticut, the eastern-most violating county, and including the following States located in between: Illinois, Michigan, Indiana, Ohio, Pennsylvania, New York, New Jersey, Kentucky, West Virginia, Virginia, Maryland, Delaware, Tennessee, North Carolina, Alabama, Georgia, and South Carolina.

Because interstate transport is not thought to be a main contributor to exceedances of the $PM_{2.5}$ standards in California or Montana, today's proposal is focused only on the $PM_{2.5}$ monitoring sites in the Eastern U.S.

Speciated ambient data, which measures the major components of $PM_{2.5}$ (sulfate, nitrate, total carbonaceous mass, and crustal material) are invaluable in understanding the nature and extent of the $PM_{2.5}$ problem. Speciated data from the Interagency Monitoring of Protected Visual Environments (IMPROVE), the Clean Air Status and Trends Network (CASTNET), both predominantly rural networks, along with EPA's Speciation Network, show that ambient concentrations of $PM_{2.5}$ species have distinctive seasonal and geographic patterns within the eastern United States.

Mass associated with ammonium sulfate concentrations make up a significant portion (25 to 50 percent) of the annual average $PM_{2.5}$ mass. The largest sulfate contributions to $PM_{2.5}$ mass occur during the summer season mainly within a large multi-State area centered near Tennessee and Southwest Virginia. Sulfate concentrations during the winter season are relatively low.

Concentrations of ammonium nitrate particles typically comprise less than 25 percent of the annual average $PM_{2.5}$ mass. Nitrates tend to be highest during the winter months over large portions of the Midwest including northern Ohio, Indiana, Michigan, and eastern Wisconsin. Relatively higher winter concentrations are also reported within and near major urban areas including metropolitan New York, Philadelphia, and the Baltimore-Washington, DC area. Nitrate concentrations reported in southern States represent a somewhat smaller portion of the $PM_{2.5}$ mass, primarily due to warmer temperatures that are less conducive to nitrate formation and chemical stability.

Total carbon also contributes a significant amount of mass to annual $PM_{2.5}$ levels (25 to 50 percent) but does not exhibit strong seasonal or regional concentration patterns. As with nitrate, total carbon concentrations are higher in and near urban areas.

Concentrations of the last $PM_{2.5}$ component, crustal, are relatively small (less than 10 percent of $PM_{2.5}$ mass) and do not exhibit strong regional or seasonal trends. (For further discussion on the science of $PM_{2.5}$ formation, see section II; for further discussion of EPA's proposal on which pollutant emissions to regulate, see section III.)

2. What Is the Ozone Ambient Air Quality?

Almost all areas of the country have experienced some progress in lowering ozone concentrations over the last 20 years. As reported in the EPA's report, "Latest Findings on National Air Quality: 2002 Status and Trends," [3] national average levels of 1-hour ozone improved by 22 percent between 1983 and 2002 while 8-hour levels improved by 14 percent over the same time period. The Northeast and Pacific Southwest (particularly Los Angeles) have shown the greatest 20-year improvement. Even so, on balance, ozone has exhibited the slowest progress of the six major pollutants tracked nationally. During the most recent 10 years, ozone levels have been relatively constant reflecting little if any air quality improvement. During the period from 1993 to 2002, additional control requirements have reduced emissions of the two major ozone precursors, although at different rates. Emissions of VOCs were reduced by 25 percent from 1993 levels, while emissions of NO_X declined by only 11 percent. During the same time period, gross domestic product increased by 57 percent and vehicle miles traveled increased by 23 percent.

Despite the progress made nationally since 1970, ozone remains a significant public health concern. Presently, wide geographic areas, including most of the nation's major population centers, experience unhealthy ozone levels—concentrations exceeding the NAAQS for 8-hour ozone. These areas include much of the eastern half of the United States and large areas of California. More specifically, 297 counties with a total population of over 115 million people currently violate the 8-hour ozone standard.

Existing regulatory requirements (*e.g.*, Federal motor vehicle standards, EPA's regional NO_X rule known as the NO_X SIP Call, and local measures already adopted under the CAA) are expected to reduce over time the geographic extent of the nation's 8-hour ozone problem. However, the number of people living in areas with unhealthy ozone levels will remain significant for the foreseeable future because existing control programs alone will not eliminate unhealthy ozone levels in some of the nation's largest population centers.

[3] EPA 454/K–03–001, August 2003.

D. What Is the Statutory and Regulatory Background for Today's Action?

1. What are the CAA Provisions on Attainment of the $PM_{2.5}$ and Ozone NAAQS?

The CAA, which was extensively amended by Congress in 1990, contains numerous State planning and attainment requirements associated with the PM and ozone NAAQS. In 1997, EPA revised the NAAQS for PM to add new annual average and 24–hour standards for fine particles, using $PM_{2.5}$ as the indicator (62 FR 38652). At the same time, EPA issued its final action to revise the NAAQS for ozone (62 FR 38856) to establish new 8–hour standards. These standards were subject to litigation, which delayed implementation. The litigation was sufficiently resolved in 2001 to permit the EPA and States to begin the process of implementing the new $PM_{2.5}$ and 8–hour ozone standards. *See Whitman* v. *American Trucking Ass'n.*, 121 S.Ct. 903 (2001).

Following promulgation of new NAAQS, the CAA requires all areas, regardless of their designation as attainment, nonattainment, or unclassifiable, to submit SIPs containing provisions specified under section 110(a)(2). This includes provisions to address the following required SIP elements: emission limits and other control measures; provisions for meeting nonattainment requirements; ambient air quality monitoring/data system; program for enforcement of control measures; measures to address interstate transport; provisions for adequate funding, personnel, and legal authority for implementing the SIP; stationary source monitoring system; authority to implement the emergency episode provisions in their SIPs; provisions for SIP revision due to NAAQS changes or findings of inadequacy; consultation requirements with local governments and land managers; requirement to meet applicable requirements of part C related to prevention of significant deterioration and visibility protection; air quality modeling/data; stationary source permitting fees; and provisions for consultation and participation by affected local entities affected by the SIP. In addition, SIPs for nonattainment areas are generally required to include additional emissions controls providing for attainment of the NAAQS.

Under subpart 1 of part D, the SIPs must include, but are not limited to, the following elements: (1) Reasonably available control measures (RACM) and reasonably available control technology (RACT) control measures, (2) measures to assure reasonable further progress (RFP), (3) an accurate and comprehensive inventory of actual emissions for all sources of the relevant pollutant in the nonattainment area, (4) enforceable emissions limits for stationary sources, (5) permits for new and modified major stationary sources, (6) measures for new source review (NSR), and (7) contingency measures which should be ready to be implemented without further action from the State or EPA.

Section 110(a)(2)(D) provides a tool for addressing the problem of transported pollution. This provision applies to all SIPs for each pollutant covered by a NAAQS and to all areas regardless of their attainment designation. Under section 110(a)(2)(D) a SIP must contain adequate provisions prohibiting sources in the State from emitting air pollutants in amounts that will contribute significantly to nonattainment in one or more downwind States.

The CAA section 110(k)(5) authorizes EPA to find that a SIP is substantially inadequate to meet any CAA requirement. If EPA makes such a finding, it must require the State to submit, within a specified period, a SIP revision to correct the inadequacy. This is generally known as a "SIP call." In 1998, EPA used this authority to issue the NO_x SIP Call, discussed below, to require States to revise their SIPs to include measures to reduce NO_x emissions that were significantly contributing to ozone nonattainment problems in downwind States.

2. What Is the NO_x SIP Call? [4]

In the early 1990's, EPA recognized that ozone transport played an important role in preventing downwind areas from developing attainment demonstrations. In response to a recommendation by the Environmental Council of States, EPA formed a national work group to assess and attempt to develop consensus solutions to the problem of interstate transport of ozone and its precursors in the eastern half of the country. This work group, the Ozone Transport Assessment Group (OTAG), which was active from 1995–1997, consisted of representatives from the 37 States in that region; the District of Columbia; EPA; and interested members of the public, including industry and environmental groups. The OTAG completed the most comprehensive analysis of ozone transport that had ever been conducted, developing technical data, including up-to-date inventories and state-of-the-art air quality modeling, to quantify and identify the sources of interstate ozone transport. The OTAG concluded that regional NO_x emissions reductions are effective in producing ozone benefits, while VOC controls are effective in reducing ozone locally and are most advantageous to urban nonattainment areas.

In 1998, EPA promulgated a rule, based in part on the work by OTAG, determining that 22 States [5] and the District of Columbia in the eastern half of the country significantly contribute to 1-hour and 8-hour ozone nonattainment problems in downwind States.[6] This rule, generally known as the NO_x SIP Call, required those jurisdictions to revise their SIPs to include NO_x control measures to mitigate the significant ozone transport. The EPA determined the emissions reductions requirements by projecting NO_x emissions to 2007 for all source categories and then reducing those emissions through controls that EPA determined to be highly cost effective. The affected States were required to submit SIPs providing the resulting amounts of emissions reductions.

Under the NO_x SIP Call, States have the flexibility to determine the mix of controls to meet their emissions reductions requirements. However, the rule provides that if the SIP controls EGUs, then the SIP must establish a budget, or cap, for EGUs. The EPA recommended that each State authorize a trading program for NO_x emissions from EGUs. We developed a model cap and trade program that States could voluntarily choose to adopt.

In response to litigation over EPA's final NO_x SIP Call rule, the U.S. Court of Appeals for the District of Columbia Circuit issued two decisions concerning the NO_x SIP Call and its technical amendments.[7] The Court decisions generally upheld the NO_x SIP Call and technical amendments, including EPA's

[4] For a more detailed background discussion, *see* 67 FR 8396; February 22, 2002.

[5] The jurisdictions are: Alabama, Connecticut, Delaware, District of Columbia, Georgia, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, West Virginia, and Wisconsin.

[6] *See* "Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone; Final Rule," 63 FR 57,356 (October 27, 1998). The EPA also published two Technical Amendments revising the NO_x SIP Call emission reduction requirements. (64 FR 26,298; May 14, 1999 and 65 FR 11222; March 2, 2000).

[7] *See Michigan* v. *EPA*, 213 F.3d 663 (D.C. Cir. 2000), *cert. denied*, 532 U.S. 904 (2001) (NO_x SIP call) and *Appalachian Power* v. *EPA*, 251 F.3d 1026 (D.C. Cir. 2001) (technical amendments).

interpretation of the definition of "contribute significantly" under CAA section 110(a)(2)(D). The litigation over the NO_x SIP Call coincided with the litigation over the 8-hour NAAQS. Because of the uncertainty caused by the litigation on the 8-hour NAAQS, EPA stayed the portion of the NO_x SIP Call based on the 8-hour NAAQS (65 FR 56245, September 18, 2000). Therefore, for the most part, the Court did not address NO_x SIP Call requirements under the 8-hour ozone NAAQS. As in the NO_x SIP Call, in today's action EPA is exercising its Federal role to ensure States work in a coordinated way to solve regional pollution transport problems. Today's action follows the NO_x SIP Call approach in many ways.

3. What Is the Acid Rain Program and Its Relationship to This Proposal?

Title IV of the CAA Amendments of 1990 established the Acid Rain Program to address the deposition of acidic particles and gases. These particles and gases are largely the result of SO_2 and NO_x emissions from power plants that are transported over long distances in the atmosphere. In the environment, acid deposition causes soils and water bodies to acidify, making the water unsuitable for some fish and other wildlife. Acid deposition also damages forest soils by stripping soil nutrients, as well as damaging some sensitive tree species including maple and pine trees, particularly at high elevations. It speeds the decay of buildings, statues, and sculptures that are part of our national heritage. The nitrogen portion of acid deposition contributes to eutrophication in coastal ecosystems, the symptoms of which include algal blooms (some of which may be toxic), fish kills, and loss of plant and animal diversity. Finally, acidification of lakes and streams can increase the amount of methyl mercury available in aquatic systems. Most exposure to mercury results from eating contaminated fish.

The Acid Rain Program requires a phased reduction of SO_2 (and, to a lesser extent, NO_X) emissions from power generators that sell electricity. Larger EGUs were covered in 1995 with additional generators being added in 2000. Acid Rain Program affected sources would likely be affected by today's action, which proposes to require additional cost-effective SO_2 and NO_X reductions from large EGUs.

The Acid Rain Program utilizes a market-based cap and trade approach to require power plants to reduce SO_2 emissions to 50 percent of the 1980 emission levels. At full implementation after 2010, emissions will be limited (*i.e.*, "capped") to 8.95 million tons in the contiguous United States. Individual existing units are directly allocated their share of the total emissions allowances—each allowance is an authorization to emit a ton of SO_2—in perpetuity. New units are not allocated allowances. Today's rule builds off of the Acid Rain cap and trade program and allows sources to use SO_2 allowances to meet the proposed emissions caps. This effectively reduces the national cap on SO_2 emissions.

The Acid Rain Program has achieved major SO_2 emissions reductions, and associated air quality improvements, quickly and cost effectively. In 2002, SO_2 emissions from power plants were 10.2 million tons, 41 percent lower than 1980.[8] These emissions reductions have translated into substantial reductions in acid deposition, allowing lakes and streams in the Northeast to begin recovering from decades of acid rain. Cap and trade under the Acid Rain Program has created financial incentives for electricity generators to look for new and low-cost ways to reduce emissions, and improve the effectiveness of pollution control equipment, at costs much lower than predicted. The Program's cap on emissions, its requirement that excess emissions be offset with allowances (with the potential for fines and civil prosecution), and its stringent emissions monitoring and reporting requirements ensure that environmental goals are achieved and sustained, while allowing for flexible compliance strategies which take advantage of trading and banking. The level of compliance under the Acid Rain Program continues to be uncommonly high with over 99 percent of the affected sources holding sufficient allowances by the annual compliance deadline. Even this handful of non-compliant sources did not compromise the integrity of the cap because each ton emitted in excess of allowances must be automatically offset.

Title IV also specifies a two-part, rate-based strategy to reduce NO_X emissions from coal-fired electric power plants. Beginning in 1996 with larger units, the Acid Rain Program included smaller EGUs and required additional reductions from the larger units in 2000. By basing the required levels of NO_X reductions on commercially available combustion controls, title IV has reduced NO_X emissions to 2.1 million tons per year beginning in 2000. Utilities have the flexibility to comply with the rule by: (1) Meeting the standard annual emissions limitations; (2) averaging the emissions rates of two or more boilers; or (3) if a utility cannot meet the standard emission limit, applying for a less stringent alternative emission limit (AEL) based upon its unique application of NO_x emissions control technology on which the rule is based.

4. What Is the Regional Haze Program and Its Relationship to This Proposal?

Regional haze is visibility impairment that is caused by the same types of sources likely to be affected by this proposed rule. These types of sources emit fine particles and their precursors, and they are located across a broad geographic area.[9] In 1977, in the initial visibility protection provisions of the CAA, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of SO_2, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources."[10] The fine particulate matter, or $PM_{2.5}$, that impairs visibility by scattering and absorbing light also causes serious health effects and mortality in humans discussed earlier in this section. Data from the existing visibility monitoring network show that visibility impairment caused by air pollution occurs virtually all of the time at most national park and wilderness area monitoring stations.[11]

Under the 1999 Regional Haze Rule,[12] States are required to set periodic goals for improving visibility in the 156 Class I areas, and to adopt long-term strategies to meet the goal of returning visibility in these areas to natural conditions (*see* 40 CFR part 81, subpart D). Today's proposal will reduce SO_2 and NO_X emissions in 29 States, assisting those States and their neighbors in making progress toward their visibility goals.

5. What Is the Proposed Utility Control Program for Air Toxics and Its Relationship to This Proposal?

Today's interstate air quality proposal affecting SO_2 and NO_X emissions is related to a proposal signed on December 15, 2003 to regulate mercury from certain types of EGU's using the

[8] U.S. Environmental Protection Agency, *EPA Acid Rain Program: 2002 Progress Report* (EPA 430–R–03–011), November 2003. (Available at: *http://www.epa.gov/airmarkets/cmprpt/arp02/2002report.pdf)*

[9] *See, e.g.*, U.S. EPA, National Center for Environmental Assessment, Office of Research and Development, Research Triangle Park, NC, *Air Quality Criteria for Particulate Matter*, EPA/600/P–95/001bF, April 1996.

[10] H.R. Rep. No. 95–294 at 204 (1977).

[11] National Park Service, *Air Quality in the National Parks: A Summary of Findings from the National Park Service Air Quality Research and Monitoring Program*. Natural Resources Report 88–1. Denver CO, July 1988.

[12] 64 FR 35714, July 1, 1999.

maximum achievable control technology (MACT) provisions of section 112 of the CAA or using the performance standards provisions under section 111 of the CAA.

The EPA believes that a carefully designed multi-pollutant approach—a program designed to control NO_X, SO_2, and mercury at the same time—is the most effective way to reduce emissions from electric utilities. One key feature of this approach is the interrelationship of the timing and cap levels for SO_2, NO_X, and mercury. Today, we know that electric utilities can reduce their emissions of all three pollutants by installing flue gas desulfurization (FGD) (which controls SO_2 and mercury emissions) and selective catalytic reduction (SCR) (which controls NO_X and mercury). We have designed the interstate transport proposal and the mercury section 111 proposal to take advantage of the combined emissions reductions that these technologies provide. Taken together, these proposals would coordinate emissions reductions from electric utilities to achieve necessary health protections cost effectively.

II. Characterization of the Origin and Distribution of 8-Hour Ozone and $PM_{2.5}$ Air Quality Problems

This section presents a simplified account of the occurrence, formation, and origins of ozone and $PM_{2.5}$, as well as an introduction to certain relevant scientific and technical terms and concepts that are used in the remainder of this proposal. It also provides scientific and technical insights and experiences relevant to formulating control approaches for reducing the contribution of transport to these air quality problems.

A. Ground-level Ozone

1. Ozone Formation

Ozone is formed by natural processes at high altitudes, in the stratosphere, where it serves as an effective shield against penetration of harmful solar UV–B radiation to the ground. The ozone present at ground level as a principal component of photochemical smog is formed in sunlit conditions through atmospheric reactions of two main classes of precursor compounds: VOCs and NO_X (mainly NO and NO_2). The term "VOC" includes many classes of compounds that possess a wide range of chemical properties and atmospheric lifetimes, which helps determine their relative importance in forming ozone. Sources of VOCs include man-made sources such as motor vehicles, chemical plants, refineries, and many consumer products, but also natural emissions from vegetation. Nitrogen oxides are emitted by motor vehicles, power plants, and other combustion sources, with lesser amounts from natural processes including lightning and soils. Key aspects of current and projected inventories for NO_X and VOC are summarized in section IV of this proposal and EPA Web sites (*e.g., http://www.epa.gov/ttn/chief*).

The relative importance of NO_X and VOC in ozone formation and control varies with location- and time-specific factors, including the relative amounts of VOC and NO_X present. In rural areas with high concentrations of VOC from biogenic sources, ozone formation and control is governed by NO_X. In some urban core situations, NO_X concentrations can be high enough relative to VOC to suppress ozone formation locally, but still contribute to increased ozone downwind from the city. In such situations, VOC reductions are most effective at reducing ozone within the urban environment and immediately downwind.

The formation of ozone increases with temperature and sunlight, which is one reason ozone levels are higher during the summer. Increased temperature increases emissions of volatile man-made and biogenic organics and can indirectly increase NO_X as well (*e.g.*, increased electricity generation for air conditioning). Summertime conditions also bring increased episodes of large-scale stagnation, which promote the build-up of direct emissions and pollutants formed through atmospheric reactions over large regions. The most recent authoritative assessments of ozone control approaches[13] [14] have concluded that, for reducing regional scale ozone transport, a NO_X control strategy would be most effective, whereas VOC reductions are most effective in more dense urbanized areas.

2. Spatial and Temporal Patterns of Ozone

Studies conducted in the 1970's established that ozone occurs on a regional scale (*i.e.* 1000's of kilometers) over much of the Eastern U.S., with elevated concentrations occurring in rural as well as metropolitan areas.[15] [16] While progress has been made in reducing ozone in many urban areas, the Eastern U.S. continues to experience elevated regional scale ozone episodes in the extended summer ozone season.

Regional 8-hour ozone levels are highest in the Northeast and Mid-Atlantic areas with peak 2002 (3-year average of the 4th highest value for all sites in the region) ranging from 0.097 to 0.099 parts per million (ppm).[17] The Midwest and Southeast States have slightly lower peak values (but still above the 8-hour standard in many urban areas) with 2002 regional averages ranging from 0.083 to 0.090 ppm. Regional-scale ozone levels in other regions of the country are generally lower, with 2002 regional averages ranging from 0.059 to 0.082 ppm. Nevertheless, some of the highest urban 8-hour ozone levels in the nation occur in southern and central California and the Houston area.

B. Fine Particles

1. Characterization and Origins of Fine Particles

Particulate matter is a chemically and physically diverse mixture of discrete particles and droplets. It exists in the air in a range of particle sizes, from submicrometer to well above 30 micrometers (μm). Most of the mass of particles is distributed in two size modes that are termed fine and coarse particles. Although there is some overlap at the division of the modes (1 to 3 μm), fine and coarse particles generally have different origins, source types, chemical composition, and atmospheric transport and removal processes. In particular, because of their small size and mechanisms of formation, fine particles can be created and transported substantial distances (hundreds to over 1000 km) from emission sources.

As noted above, EPA has established NAAQS for fine particles, which are defined as those smaller than a nominal 2.5 μm (aerodynamic diameter) or $PM_{2.5}$. Standards also exist for particles smaller than a nominal 10 μm aerodynamic diameter (or PM_{10}) which include both fine particles and inhalable coarse mode particles. For reasons summarized in section III below, today's proposal focuses on reducing significant transport of $PM_{2.5}$ as it affects attainment of the annual standards.

Fine particles can be directly emitted from sources or, like ozone, can be formed in the atmosphere from precursor gases. Directly emitted particles are often termed "primary" particles, while those formed in the

[13] Ozone Transport Assessment Group, *OTAG Final Report*, 1997.

[14] NARSTO, *An Assessment of Tropospheric Ozone Pollution—A North American Perspective*, July 2000.

[15] National Research Council, *Rethinking the Ozone Problem in Urban and Regional Air Pollution*, 1991.

[16] NARSTO, *An Assessment of Tropospheric Ozone Pollution—A North American Perspective*, July 2000.

[17] U.S. EPA, *Latest Findings on National Air Quality*, August 2003.

atmosphere are called "secondary" particles.[18] The most common source of directly emitted $PM_{2.5}$ is incomplete combustion of fuels containing carbon (fossil or biomass), which produces carbonaceous particles consisting of a variety of organic substances and black carbon (soot), as well as gaseous carbon monoxide, VOCs and NO_X. Certain high energy industrial processes also emit primary $PM_{2.5}$. Examples of direct $PM_{2.5}$ sources include diesel and gasoline vehicles, open burning, residential wood burning, forest fires, power generation, and industrial metals production and processing.

The major gaseous precursors of secondary $PM_{2.5}$ include SO_2, NO_X, certain VOCs and NH_3. The SO_2 and NO_X form, respectively, sulfuric and nitric acids, which then react with ammonia to form various sulfate and nitrate compounds. At typical summertime humidities in the East, these substances absorb water and the particles exist as tiny droplets. Ammonia generally would not form atmospheric particles in the absence of acidic sulfates and nitrates. Certain reactive VOCs of relatively high molecular weight (*e.g.*, toluene, xylenes in gasoline) can be oxidized to form secondary organic aerosol particles (SOA) in the same kinds of photochemical processes that produce ozone.

The major sources of secondary $PM_{2.5}$ forming gases (SO_2, NO_X, certain VOCs, NH_3) include nearly every source category of air pollutants. Major SO_2 sources in the U.S. include coal-fired power plants and industrial boilers and smelters. Major NO_X sources were summarized in subsection 1 (ozone) above. Significant man-made sources of organic PM precursors (particularly aromatic compounds [19]) include motor vehicle fuels, solvents, petrochemical facilities, diesel and gasoline vehicle emissions, and biogenic emissions from trees. Ammonia is emitted from numerous livestock and other agricultural activities and natural processes in soil, but smaller source categories may be important in urban areas.

Secondary formation of $PM_{2.5}$ involves complex processes that depend on factors such as the amounts of needed precursor gases; the concentrations of other reactive species such as ozone (O_3), hydroxyl radicals (OH^-), or hydrogen peroxide (H_2O_2); atmospheric conditions including solar radiation, temperature and relative humidity (RH); and the interactions of precursors and pre-existing particles with cloud or fog droplets or in the liquid film on solid particles. Significantly, these processes indicate an important link between $PM_{2.5}$ and the pollutants and sources that form ozone. More complete discussions of the formation and characteristics of secondary particles can be found in the U.S. EPA Criteria Document,[20] and in the recent NARSTO Fine Particle Assessment.[21] More complete discussions of the characteristics and sources of both primary and secondary particles can be found in the U.S. EPA Staff Paper on Review of the National Ambient Air Quality Standards for Particulate Matter.[22]

2. Spatial and Temporal Patterns of $PM_{2.5}$ and Major Components

As noted in section I above, the most recent $PM_{2.5}$ monitoring data (2000–2002) show numerous counties in violation of the annual standards across much of the Eastern U.S., as well as in southern and central California. A major reason for the high values in eastern urban areas is the regional contributions from sources distant to these areas.[23] This is illustrated by comparing recent $PM_{2.5}$ data from the EPA Speciation Network (urban sites) and the IMPROVE Network (non-urban sites). A tabular summary comparing these urban and rural ambient data is included in the Air Quality Data Analysis Technical Support Document. This comparison suggests that in the East, rural regional transport contributes well over half of the $PM_{2.5}$ observed in urban areas.

The EPA Speciation Network and IMPROVE data also permits comparison of the regional contribution of the major components that comprise $PM_{2.5}$. The major chemical compounds/classes typically measured or estimated include sulfate, and nitrate, ammonium (estimated from sulfate and nitrate in IMPROVE), total carbonaceous materials (TCM), including black carbon and estimated organic carbon, and crustal-related materials. The crustal materials reflect intrusion of the smallest particles originating in the coarse mode as well as a number of fine mode metals and other elements present in small amounts.

Nationally, the most recent urban $PM_{2.5}$ composition data show a significant contribution of carbonaceous material at all sites, with sulfates higher in the East and nitrates higher in the West. Crustal material is typically less than 5 to 10 percent of the total. Focusing on the rural eastern sites representative of the regional contribution, sulfates and associated ammonium are the largest fraction, followed by carbonaceous material. Nitrates are also a significant contributor to $PM_{2.5}$ in the more northern areas of the Eastern U.S., especially in the industrial Midwest (about 20 percent).

Rao and Frank [24] (2003) have compared the concentrations of sulfates and carbonaceous particles for specific pairs of urban and nearby non-urban sites. In the East, sulfate at urban monitoring locations is only slightly higher than at nearby non-urban sites. In contrast, carbonaceous material at urban sites is significantly higher than at the non-urban sites. The similarity of urban and rural sulfates suggests that ambient sulfate is present on a regional scale and that most urban sulfate is likely associated with regional transport. On the other hand, urban carbonaceous material appears to have both a regional and an urban component. The much higher concentrations in urban areas indicate the importance of local sources. Detailed source apportionment studies discussed in section V below suggest that mobile and other combustion sources, which are much more concentrated in urban areas, may explain much of the elevated urban carbon concentrations.

Seasonal variations in $PM_{2.5}$ and components provide useful insights into the relative importance of various sources and atmospheric processes. In the East, rural $PM_{2.5}$ concentrations are usually significantly higher in the summertime than in the winter. In large urban areas, however, summer/winter differences are smaller, and winter peaks may be higher. More specifically, $PM_{2.5}$ concentrations in urban areas in the Northeast, industrial Midwest, and upper Midwest regions peak both in the winter and in the summer and are

[18] These terms used in the context of atmospheric science should not be confused with similar terms that are used in section 109 of the CAA to distinguish standards that are intended to protect public health (primary) from those that protect public welfare (secondary).

[19] Grosjean, D., Seinfeld, J.H., *Parameterization of the formation potential of secondary organic aerosols*, Atmospheric Environment 23, 1733–1747, 1989.

[20] U.S. EPA, National Center for Environmental Assessment, *Air Quality Criteria for Particulate Matter, 4th External Review Draft*. June 2003.

[21] NARSTO, *Particulate Matter Science for Policy Makers—A NARSTO Assessment*. February 2003.

[22] U.S. EPA, *Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information OAQPS Staff Paper—First Draft*. August 2003.

[23] NARSTO, *Particulate Matter Science for Policy Makers—A NARSTO Assessment*. February 2003.

[24] V. Rao, N. Frank, A. Rush, F. Dimmick, *Chemical Speciation of $PM_{2.5}$ in Urban and Rural Areas*, In the Proceedings of the Air & Waste Management Association Symposium on Air Quality Measurement Methods and Technology, San Francisco, on November 13–15, 2002.

lowest in the spring and fall. The concentrations in the peak seasons in the Northeast and industrial Midwest are 5 $\mu g/m^3$ or more higher in concentration than the low seasons. The peak seasons in the upper Midwest are less than 5 $\mu g/m^3$ higher than the low seasons. In the Southeast, however, the urban areas have just one peak that occurs in the summer, and that peak is only 4 to 5 $\mu g/m^3$ higher than the lowest season.

The seasonal pattern of summer $PM_{2.5}$ peaks in rural areas does not vary as much by region as do urban patterns. The composition data show that these summer peaks are due to elevated regional sulfates and organic carbon. Urban and rural nitrates tend to be low in the summer and significantly higher in the winter, when sulfates are lowest. Wintertime urban peaks appear to consist of increased ammonium nitrate and carbonaceous material of local origin.[25]

3. Implications for Control of Transported $PM_{2.5}$

The interplay between sulfates and nitrates observed in the seasonal data above is of particular importance. The formation of ammonium nitrate is favored by availability of ammonia and nitric acid vapor, low temperatures, high relative humidity, and the absence of acid sulfate particles. At higher summer temperatures when photochemical processes and meteorological conditions in the East produce high sulfate levels, ammonia and nitric acid vapor tend to remain in the gas phase rather than forming ammonium nitrate particles. In winter months, with cooler temperatures and lower sulfur-related acidity, the presence of sufficient nitric acid and ammonia favors formation of nitrate particles.

The chemistry summarized above has consequences for the effectiveness of SO_2 reductions in lowering regional and urban $PM_{2.5}$ concentrations. Both observations and modeling simulations (*see* subsection II.B.4 below) suggest that regional SO_2 reductions are effective at reducing sulfates and $PM_{2.5}$. When SO_2 reductions reach a certain point in relation to other relevant reactants and conditions, however, the ammonia formerly associated with sulfate can react with excess nitric acid vapor to form nitrate particles, effectively replacing at least part of the $PM_{2.5}$ reduction due to sulfate. This phenomenon is termed "nitrate replacement." Under these conditions, SO_2 reductions will not be as effective at reducing $PM_{2.5}$. Empirical evidence based on ambient measurements and modeling simulations show nitrate replacement changes under differing scenarios involving meteorological factors and relative concentrations of important components.[26,27] Obviously, sulfate reduction approaches (SO_2 controls) will be more effective at lowering $PM_{2.5}$ if complemented by strategies that reduce nitrates (NO_X controls), particularly in the winter.

This chemistry also has implications for the role of ammonia sources in contributing to regional $PM_{2.5}$. As noted above, ammonia would not be present in particle form were it not for the presence of sulfuric and nitric acids. Significant reductions of these acids through SO_2 and NO_X controls would also reduce particulate ammonia, without the need for ammonia controls. As evidenced in the discussion above, it is clear that any effects of ammonia emissions controls on $PM_{2.5}$ would vary considerably with the concentrations of sulfate, total ammonia (gas phase plus aerosol), total nitric acid temperature, and location and season. In some cases, a decrease in ammonia will have no effect on $PM_{2.5}$, while in other cases, the decrease will reduce total nitrate contributions.[28]

In essence, the effect of significant reductions in ammonia on $PM_{2.5}$ is least in conditions with low particulate nitrate levels (*e.g.*, warm conditions) or low nitric acid vapor levels (*e.g.*, through NO_X reductions) in comparison to ammonia levels. The most significant effects of ammonia control would occur in conditions where there is an abundance of nitric acid, in which ammonia limits particulate nitrate formation. Therefore, significant reductions in SO_2 and NO_X emissions would create conditions that would reduce the effectiveness of ammonia controls in reducing $PM_{2.5}$.

In addition to these direct effects of ammonia controls on $PM_{2.5}$, ammonia is a weak base that serves to partially neutralize acids that occur in $PM_{2.5}$. As such, reducing ammonia will make $PM_{2.5}$, clouds, and precipitation more acidic, thereby exacerbating acidifying precipitation (acid rain) and possibly causing health effects related to $PM_{2.5}$ acidity. Through this increased acidity of clouds and fogs, ammonia reductions can slow the conversion of SO_2 to particle sulfate.[29] The increased acidity associated with ammonia reductions may also increase the formation of secondary organic aerosols, according to recent laboratory studies.[30] In contrast, NO_X reductions can both slow sulfate formation through oxidant chemistry, while also reducing acidity.

A further complication in consideration of ammonia controls is the uncertainty regarding the location and temporal variations in ammonia emissions, particularly in urban areas. This is an area of active research and investigation for EPA and others. It is of note that the maximum concentration of ammonium nitrates occurs in the winter, a period that is expected to have the lowest ammonia emissions from agricultural activities;[31] by contrast, the potential $PM_{2.5}$ benefit of reducing ammonia emissions in the summer when they may be at a peak is limited to the ammonium itself, because this is the time of lowest ammonium nitrate particle levels.

The origins of the carbonaceous component of regional transport are even less well characterized. It reflects a complex mixture of hundreds or even thousands of organic carbon compounds, most of which have not yet been successfully quantified. In addition to directly emitted carbonaceous materials from fires and transport from urban areas, a varying amount is likely derived from biogenic emissions—which may include both primary and transformed secondary materials. Because the observed summertime increase in organic particles may be related to photochemical activity, it is reasonable to expect that—as for regional ozone—NO_X reductions might produce some benefits. Further, recent work by Jang *et al.* suggests that acidic aerosols (*e.g.*, sulfates) *may* increase the formation of secondary organic aerosols (SOA).[32]

Despite significant progress that has been made in understanding the origins

[25] NARSTO, *Particulate Matter Science for Policy Makers—A NARSTO Assessment.* February 2003.

[26] NARSTO, *Particulate Matter Science for Policy Makers—A NARSTO Assessment.* February 2003.

[27] Blanchard and Hidy. J., *Effects of Changes in Sulfate, Ammonia, and Nitric Acid on Particulate Nitrate Concentrations in the Southeastern United States,* Air & Waste Manage. Assoc. 53:283–290. 2003.

[28] The marginal effectiveness of reducing ammonia on $PM_{2.5}$ is examined in West, J. J., A. S. Ansari, and S. N. Pandis, *Marginal PM $_{2.5}$: nonlinear aerosol mass response to sulfate reductions in the eastern U.S.,* Journal Air & Waste Management Assoc., 49(12): 1415–1424, 1999.

[29] NARSTO, *Particulate Matter Science for Policy Makers—A NARSTO Assessment.* February 2003.

[30] Jang, M.; Czoschke, N. M.; Lee, S.; Kamens, R. M., *Heterogeneous Atmospheric Aerosol Production by Acid-Catalyzed Particle Phase Reactions,* Science, 2002, 298, 814–817.

[31] Battye, W., V. P. Aneja, and P. A. Roelle, *Evaluation and improvement of ammonia emissions inventories, Atmospheric Environment,* 2003, 37, 3873–3883.

[32] Jang, M.; Czoschke, N. M.; Lee, S.; Kamens, R. M., *Heterogeneous Atmospheric Aerosol Production by Acid-Catalyzed Particle Phase Reactions,* Science, 2002, 298, 814–817.

and properties of SOA, it remains the least understood component of $PM_{2.5}$. Moreover, the contribution of primary and secondary organic aerosol components to measured organic aerosol concentrations is thought to be highly variable and is a controversial issue.[33] The relative amounts of primary versus secondary organic compounds in the ambient air throughout the U.S., however, appear to vary with location and time of year. While carbonaceous material appears to be a significant component in regional transport in the East, it is currently not possible to determine with certainty the relative contribution of primary versus secondary carbonaceous particles, or to fully quantify the fraction that might be reduced by control of man-made sources. The EPA and others have funded substantial research and monitoring efforts to clarify these issues. New information from the scientific community continues to emerge to improve our understanding of the relationship between sources of PM precursors and secondary particle formation.

4. Air Quality Impacts of Regional SO_2 Reductions

As noted above, sulfates from SO_2 comprise the largest component of regional transport in the East. Fortunately, we already have significant observational evidence of the effectiveness of reducing regional SO_2 emissions. By contrast, while small to modest NO_X emissions reductions from control programs to date have resulted in reduced nitrate deposition in some portions of the East,[34] we have no comparable long-term experience in observing the expected effects of more substantial regional reductions for NO_X. Perhaps the best documented example of the results of any major regional air pollution control program is reflected in the experience of the title IV Acid Rain Program (*see* section VIII below). From 1990 to date, this market-based program reduced SO_2 emissions from electric utilities throughout the country, with most of the emissions reductions achieved by sources in the East. The regional reductions have resulted in substantial improvements in air quality and deposition throughout the East. The spatial and temporal patterns of these improvements have been observed at most eastern rural monitoring networks.[35]

The signal of regional air quality has been detected by the CASTNET. The CASTNET sites in rural areas of the Midwest and East measured high average SO_2 concentrations prior to the Acid Rain Program, particularly in areas of the Ohio River Valley and into New York and eastern Pennsylvania where electric utility SO_2 emissions were high. Average concentrations of sulfates throughout this area were elevated throughout an even broader region, indicating that sulfates were being transported from the SO_2 emission sources to areas throughout the East.

Since 1990, SO_2 concentrations at CASTNET sites have been reduced substantially in the areas where concentrations were high before the Acid Rain Program.[36] A comparison of current mean SO_2 concentrations (3-year average 2000–2002) to SO_2 concentrations before the Program (1990–1992) shows that all sites decreased. The largest decrease was observed at sites from Illinois to northern West Virginia across Pennsylvania to western New York.

Rural monitoring networks have also been able to detect temporal patterns in SO_2 and sulfate concentrations. Temporal trends in rural concentrations of these pollutants can be used to determine if monitored concentrations responded to changes in emissions trends. The most substantial drop in SO_2 emissions occurred in 1995 when Phase I of the Acid Rain Program began. After 1995, emissions increased slightly, as sources began to use allowances that they had banked by reducing emissions before the program began, until Phase II of the program began in 2000 and emissions declined again.[37]

Monitored SO_2 concentrations, sulfate concentrations at eastern CASTNET sites, sulfur concentrations in precipitation at eastern National Atmospheric Deposition (NADP) sites, and total (Dry + Wet) sulfur deposition at NADP and CASTNET sites closely tracked the yearly trends in SO_2 emissions from Acid Rain Program sources from 1990–2002. Notably, the most significant decline in the various pollutants was observed in 1995 immediately after Phase I began.[38]

These trends in air quality and deposition at rural monitoring sites show that a large, regional emission reduction program can achieve significant, observable environmental improvements throughout a broad area, especially where pollution levels are elevated before the program is implemented. In addition, the temporal trend in observed improvements shows that emissions reductions can lead to immediate environmental improvements. Additional discussions of the air quality impacts of regional SO_2 reductions can be found in the U.S. Air Quality and Emission Trends Report,[39] as well as recent reports from IMPROVE[40] and the National Atmospheric Deposition Program.[41]

III. Overview of Proposed Interstate Air Quality Rule

A. Purpose of Interstate Air Quality Rule

For this rulemaking, EPA has assessed the role of transported emissions from upwind States in contributing to unhealthy levels of $PM_{2.5}$ and 8-hour ozone in downwind States. Based on that assessment, the EPA is proposing emissions reduction requirements for SO_2 and NO_X that would apply to upwind States.

Emissions reductions to eliminate transported pollution are required by the CAA and supported by sound policy. Clean Air Act section 110(a)(2)(D) requires SIP revisions for upwind States to eliminate emissions that contribute significantly to nonattainment downwind. Under section 110(a)(1), these SIP revisions were required in 2000 (three years after the 1997 revision of the $PM_{2.5}$ and 8-hour ozone NAAQS); EPA proposes that they be submitted as expeditiously as practicable, but no later than 18 months after the date of promulgation.

There are also strong policy reasons for addressing interstate pollution transport, and for doing so now. First, emissions from upwind States can alone, or in combination with local emissions, result in air quality levels that exceed the NAAQS and jeopardize the health of citizens in downwind communities. Second, interstate pollution transport requires some consideration of reasonable balance between local and regional controls. If significant contributions of pollution from upwind States go unabated, the downwind area must achieve greater

[33] NARSTO, *Particulate Matter Science for Policy Makers—A NARSTO Assessment*. February 2003.

[34] Butler, Thomas J., Gene E. Likens, Francoise M. Vermeylen and Barbara J. B. Stunder. The relation between NO_X emissions and precipitation NO_3^- in the eastern USA, Atmospheric Environment, Volume 37, Issue 15, May 2003, Pages 2093–2104.

[35] U.S. EPA, *Clean Air Status and Trends Network 2002 Annual Report*. November 2003.

[36] U.S. EPA, *Acid Rain Progress Report*, November 2003.

[37] U.S. EPA, *Clean Air Status and Trends Network 2002 Annual Report*, November 2003.

[38] U.S. EPA, *Clean Air Status and Trends Network 2002 Annual Report*. November 2003.

[39] U.S. EPA, *National Air Quality and Emissions Trends Report*, 1999. March 2001.

[40] Malm, William C., *Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States:" Report III*. May 2000.

[41] *National Atmospheric Deposition Program, National Atmospheric Deposition Program, 2002 Annual Summary*. 2003.

local emissions reductions, thereby incurring extra clean-up costs in the downwind area. Third, requiring reasonable controls for both upwind and local emissions sources should result in achieving air quality standards at a lesser cost than a strategy that relies solely on local controls. For all these reasons, EPA believes it is important to address interstate transport as early as possible. Doing so as we are today, in advance of the time that States must adopt local nonattainment plans, will make it easier for states to develop plans to reach attainment of the standards.

The EPA previously addressed interstate pollution transport for ozone in rules published in 1998 and 2000. These rules, known as the NO_X SIP Call and Section 126 Rule, are substantially reducing ozone transport and helping downwind areas meet the 1-hour and 8-hour ozone standards. However, EPA is reassessing ozone transport in this rulemaking for two reasons. First, several years have passed since promulgation of the NO_X SIP Call and updated data are available. Second, in view of the difficulty some areas are expected to have meeting the 8-hour ozone standards, EPA believes it is important to assess the degree to which ozone transport will remain a problem after full implementation of the existing rules, and to determine whether further controls are warranted to ensure continued progress toward attainment. Today's rulemaking is EPA's first attempt to address interstate pollution transport for $PM_{2.5}$.

B. Summary of EPA's Key Findings and Proposed Remedy for Interstate Transport

Based on a multi-part assessment summarized below, EPA has concluded that:

- Without adoption of additional emissions controls, a substantial number of urban areas in the central and eastern regions of the U.S. will continue to have levels of $PM_{2.5}$ or 8-hour ozone (or both) that do not meet the national air quality standards.
- Although States have not yet developed plans for meeting the $PM_{2.5}$ and 8-hour ozone standards, predictive analyses by EPA for the year 2010 show that even with implementation of substantial local controls, many areas would continue to experience unhealthy air quality in that year. Consequently, EPA has concluded that small contributions of pollution transport to downwind nonattainment areas should be considered significant from an air quality standpoint because these contributions could prevent or delay downwind areas from achieving the health-based standards.
- Based on our analyses, we have concluded that SO_2 and NO_X are the chief emissions contributing to interstate transport of $PM_{2.5}$. For the 8-hour ozone nonattainment, EPA continues to believe, in accordance with the conclusion of the Ozone Transport Assessment Group (OTAG), that the focus of interstate transport control should be on NO_X.
- For both $PM_{2.5}$ and 8-hour ozone, EPA has concluded that interstate transport is a major contributor to the projected nonattainment problem in the Eastern U.S. in 2010. In the case of $PM_{2.5}$, the nonattainment areas analyzed are estimated to receive a transport contribution attributable to SO_2 and NO_X emissions ranging from 4.22 to 7.36 $\mu g/m^3$ on an annual average basis, with an average of 5.47 $\mu g/m^3$ across all nonattainment areas. In the case of 8-hour ozone, the nonattainment areas analyzed receive a transport contribution of more than 20 percent of their ambient ozone concentrations, and 21 of 47 had a transport contribution of more than 50 percent.
- Typically, two or more States contribute transported pollution to a single downwind area, so that the "collective contribution" is much larger than the contribution of any single State.

Based on these conclusions, EPA is proposing to make several findings, and to require the remedy summarized below:

- For $PM_{2.5}$, we are proposing to find that SO_2 and NO_X emissions in 28 States and the District of Columbia will contribute significantly in 2010 to $PM_{2.5}$ levels in downwind nonattainment areas in amounts that exceed an air quality significance threshold proposed today.
- For ozone, we are proposing to find that NO_X emissions in 25 States and the District of Columbia will contribute significantly in 2010 to ozone levels in excess of the 8-hour standards in downwind nonattainment areas in amounts that exceed the air quality significance threshold EPA previously established in the 1998 NO_X SIP Call, and which we propose today to continue to use.
- We are also proposing to find that emissions reductions from EGUs in the identified upwind States and the District of Columbia would be highly cost effective. As in the NO_X SIP Call, we propose to find that these highly cost-effective reductions constitute the significant contributions to downwind nonattainment in other States that must be eliminated under the CAA.
- We are proposing that the level of reductions that would be highly cost effective corresponds to power sector emissions caps in a 28-state plus District of Columbia region of 2.7 million annual tons for SO_2 and 1.3 million annual tons for NO_X.
- In order to strike a balance between the feasibility of achieving a substantial amount of emissions reductions, and the need to achieve them as expeditiously as practicable for attainment of health standards, we are proposing that the emissions caps for the affected States (and the District of Columbia) be implemented in two phases, with the first phase in 2010 and the second phase in 2015. The first phase caps would be 3.9 million tons for SO_2 and 1.6 million tons for NO_X.
- We estimate that, compared to the emissions that would otherwise occur in 2010 and 2015, this proposal would result in emissions reductions of 3.6 million tons SO_2 (40 percent) and 1.5 million tons NO_X (49 percent) by 2010, and 3.7 million tons SO_2 (44 percent) and 1.8 million tons NO_X (58 percent) by 2015.
- Compared to EGU emissions in 2002 in the affected States, at full implementation of today's proposal SO_2 emissions would be reduced about 71 percent. On the same basis, NO_X emissions would be reduced 65 percent.
- The proposed emissions reductions would be met by affected States using one of two options for compliance: (1) Participating in an interstate cap and trade system that caps emissions from the electric generating sector, thereby reducing the costs of emissions reductions while ensuring that the required reductions are achieved by the region as a whole (an approach EPA believes is preferable); or (2) meeting an individual State emissions budget through measures selected by the State in accord with the requirements discussed in sections VI and VII below.

Today's proposal relies on information and analysis relevant to determining whether sources in upwind States emit in amounts that "contribute significantly to [downwind] nonattainment," which the upwind States' SIPs are required to prohibit under section 110(a)(2)(D)(i)(I).

C. Coordination of Multiple Air Quality Objectives in Today's Rulemakings

1. Linkages Between Interstate Air Quality and Mercury Rulemakings

As noted above, today's proposal for reducing the transport of pollutants that contribute significantly to violations of the $PM_{2.5}$ and 8-hour ozone air quality standards is accompanied by separate

actions proposing EPA's approach for addressing mercury from power plants. The EPA has endeavored to recognize and integrate the pollution reduction requirements incorporated in today's proposed rules so as to provide benefits for public health and the environment in a manner that has proven effective in other programs. In so doing, we were guided by our experience and success in implementing the title IV Acid Rain Program for reducing some of the same pollutants. We have also fully considered the extensive analyses and assessment of options that EPA has conducted over the last eight years in developing proposals that would establish an integrated multi-pollutant program for addressing the power sector, including the President's Clear Skies Act.

Our experience with title IV and the assessments leading to the proposed Clear Skies Act have suggested that we can achieve substantial benefits at reduced costs by expanding the market-based mechanisms of title IV to achieve substantial reductions in SO_2, NO_X, and mercury, and by recognizing the interactions inherent in designing control strategies in an integrated rather than sequential manner. This approach has the added advantage of providing regulatory certainty, both for the States, which are charged with developing attainment strategies for areas that are affected by interstate transport, and for sources that would be affected by today's proposed rules for addressing transport and mercury emissions.

While EPA still hopes that Congress will adopt the Administration's Clear Skies multi-pollutant legislation, the outcome of that process is not certain. Accordingly, we believe it is our responsibility to move forward to achieve these reductions as expeditiously as possible under existing regulatory authorities. We believe today's proposals reflect the best regulatory approach for making expeditious progress towards meeting air quality standards and other health and environmental goals, while providing flexibility that will minimize the cost of compliance. We have incorporated ambitious emissions reduction schedules to ensure the combined reductions of all pollutants occur as quickly as is feasible. We are proposing to offer, as an option for implementing the SO_2 and NO_X reductions, emissions cap and trade programs that would provide a seamless transition from the current title IV and NO_X SIP Call programs.

2. Linkages Between $PM_{2.5}$ and 8-hour Ozone Transport Requirements

Although $PM_{2.5}$ and ozone are distinct NAAQS with separate implementation requirements, in reality they are closely linked in many ways. Because of these linkages, we have considered $PM_{2.5}$ and ozone in an integrated manner in developing this proposal. The linkages between $PM_{2.5}$ and ozone arise from their interactions in atmospheric chemistry, the overlap in the pollutants and emission sources that contribute to elevated ambient levels, and similarities in their implementation schedules. Emissions of NO_X and SO_2 contribute to $PM_{2.5}$ nonattainment, and NO_X emissions also contribute to 8-hour ozone nonattainment. Moreover, because the power generation sector and other source types are major emitters of both NO_X and SO_2, and because control actions for these pollutants may reinforce or compete with each other, it is also appropriate to address NO_X and SO_2 control requirements in an integrated manner, keeping in mind that the relevant provisions of the CAA must, in the end, be met for each NAAQS and its associated pollutant precursors.

3. Linkages Between Interstate Air Quality Rulemaking and Section 126 Petitions

Recent history of how EPA and the States have relied on certain CAA transport provisions indicates that a brief discussion of these provisions may be useful. In the NO_X SIP Call rule, we determined that under section 110(a)(2)(D), the SIP for each affected State (and the District of Columbia) must be revised to eliminate the amount of emissions that contribute significantly to nonattainment in downwind States. We further determined that amount, for each State, as the quantity of emissions that could be eliminated by the application of highly cost-effective controls on specified sources in that State.

During July-August, 1997, EPA received petitions under CAA section 126 from eight northeastern states. The petitions asked EPA to find that specified sources in specified upwind States were contributing significantly to nonattainment in the petitioning States. Shortly after promulgation of the NO_X SIP Call, in May, 1999, EPA promulgated a rule making affirmative technical determinations for certain of the section 126 petitions. Relying on essentially the same record as we had for the NO_X SIP Call rulemaking, we made the affirmative technical determinations with respect to the same sources in certain of the same States covered under the NO_X SIP Call. Moreover, we approved a section 126 remedy based on the same set of highly cost-effective controls. However, EPA withheld granting the findings for the petitions. Instead, we stated that because we had promulgated the NO_X SIP Call—a transport rule under section 110(a)(2)(D)—as long as an upwind State remained on track to comply with that rule, EPA would defer making the section 126 finding. 64 FR 28250 (May 25, 1999) ("May 1999 Rule").

Following promulgation of the May 1999 Rule, however, the U.S. Court of Appeals for the D.C. Circuit stayed the NO_X SIP Call. We then promulgated a revised section 126 rule, in January 2000. 65 FR 2674 (January 18, 2000) ("January 2000 Rule"). We stated that because upwind States were no longer obliged to adhere to the requirements of the NO_X SIP Call, we would go ahead and make the section 126 findings.

Even so, in the January 2000 Rule, we further indicated that we were considering rescinding the section 126 finding with respect to an affected State if, in general, we approved a SIP revision submitted by the affected State as fully achieving the amount of reductions required under the NO_X SIP Call. The reason for this rescission would be the fact that the affected State's SIP revision would fulfill the section 110(a)(2)(D) requirements, so that there would no longer be any basis for the section 126 finding with respect to that State. In this manner, the NO_X SIP Call and the Section 126 Rules would be harmonized.

Today, we are similarly proposing a remedy under section 110(a)(2)(D) to eliminate the significant contribution of emissions, in this case both SO_2 and NO_X, from upwind States to downwind States' nonattainment of the fine particle and 8-hour ozone standards. We believe it would be appropriate to apply the same approach to any section 126 petitions submitted in the future, should there be any, as we used under the NO_X SIP Call and the related section 126 rules. Thus, we expect that the remedy we would provide in response to a section 126 petition concerning reductions in EGU emissions of SO_2 or NO_X by 2010 would be identical to that provided in this rulemaking under section 110(a)(2)(D), assuming that the petition relies on essentially the same record. Thus, we would expect to take the same position we took in the May 1999 Rule—that as long as EPA has promulgated a transport rule under section 110(a)(2)(D), the transport rule and the section 126 timeframes are roughly comparable, and a State is on

track to comply with the transport rule, then EPA is not required to approve section 126 petitions targeting sources in that State if those petitions rely on essentially the same record.

If a section 126 petition is submitted, we would obviously need to set out in more detail our approach to the interaction between section 110(a)(2)(D) and section 126 in our response to that petition. Today, we are setting forth our general view of the relationship between these two sections and seeking comment on this view and on the issues raised by the interaction between these sections.

D. Overview of How EPA Assessed Interstate Transport and Determined Remedies

This section provides a conceptual overview of the EPA's technical and legal analyses of the problem of interstate pollution transport as it affects attainment of the $PM_{2.5}$ and 8-hour ozone standards. It is intended to provide an overall context for the more detailed discussions below. In general, EPA has taken a two-step approach in interpreting section 110(a)(2)(D). In the first step, EPA conducted an air quality assessment to identify upwind States which contribute significantly (before considering cost) to downwind nonattainment. In the second step, EPA conducted a control cost assessment to determine the amount of emissions in each upwind State that should be reduced in order to eliminate each upwind State's significant contribution to downwind nonattainment.

This two-step approach involved multiple technical assessments, which are listed below in brief, and explained in further detail in the subsections that follow. The EPA addressed:

(1) The degree and geographic extent of current and expected future nonattainment with the $PM_{2.5}$ and 8-hour ozone NAAQS;

(2) The potential impact of local controls on future nonattainment;

(3) The potential for individual pollutants to be transported between States;

(4) The extent to which pollution transport across State boundaries will contribute to future $PM_{2.5}$ and 8-hour ozone nonattainment; and

(5) The availability and timing of emissions reduction measures that can achieve highly cost-effective reductions in pollutants that contribute to excessive $PM_{2.5}$ and 8-hour ozone levels in downwind nonattainment areas.

1. Assessment of Current and Future Nonattainment

The EPA assessed the degree and geographic extent of current nonattainment of the $PM_{2.5}$ and 8-hour ozone NAAQS. For the 3-year period 2000–2002, 120 counties with monitors exceed the annual $PM_{2.5}$ NAAQS and 297 counties with monitor readings exceed the 8-hour ozone NAAQS.[42] Nonattainment of the $PM_{2.5}$ standards exists throughout the Eastern U.S.—from western Illinois and Tennessee eastward—and in California. Nonattainment of the 8-hour ozone standards also exists widely east of the continental divide—from eastern Texas and Oklahoma to the Atlantic coast—as well as in California and Arizona.

In analyzing significant contribution to nonattainment, we determined it was reasonable to exclude the Western U.S., including the States of Washington, Idaho, Oregon, California, Nevada, Utah, and Arizona from further analysis due to geography, meteorology, and topography. Based on these factors, we concluded that the $PM_{2.5}$ and 8-hour ozone nonattainment problems are not likely to be affected significantly by pollution transported across these States' boundaries. Therefore, for the purpose of assessing States' contributions to nonattainment in other States, we have only analyzed the nonattainment counties located in the rest of the U.S.

We assessed the prospects for future attainment and nonattainment in 2010 and 2015 with the 8-hour ozone NAAQS using the Comprehensive Air Quality Model with Extensions (CAM_X), and with the $PM_{2.5}$ NAAQS using the Regional Modeling System for Aerosols and Deposition (REMSAD).[43] These two forecasting years were chosen because they include the range of expected attainment dates for many $PM_{2.5}$ nonattainment areas, and under our proposed 8-hour implementation rule, the range of expected attainment dates for many 8-hour ozone nonattainment areas. In addition, considering the likely schedule for this rulemaking and the implementation steps that would follow it (*see* section VII), we believe that 2010 would be the first year in which sizable emission reductions could confidently be expected as a result of this rulemaking.

In modeling the 2010 and 2015 "base cases," we took into account adopted State and Federal regulations (*e.g.*, mobile source rules, the NO_X SIP Call) as well as regulations that have been proposed and that we expect will be promulgated before today's proposal is finalized.

Based on this approach we predicted that, in the absence of additional control measures, 47 counties with air quality monitors would violate the 8-hour ozone NAAQS in 2010, and 34 counties would violate in 2015. For $PM_{2.5}$ we predicted that 61 counties would violate the standards in 2010, and 41 counties would violate in 2015.[44] These counties are listed in Tables IV–3 and IV–4. The counties with predicted nonattainment are widely distributed throughout the central and eastern regions of the U.S. The degree of predicted nonattainment in both years spans a range of values from close to the NAAQS level to well above the NAAQS level. Given the number and geographic extent of predicted future nonattainment problems, we continued the assessment to quantify the role of interstate contributions to nonattainment.

2. Prospects for Progress Towards Attainment Through Local Reductions

The assessments of future nonattainment presented above considered only the effect of emission reduction measures already adopted or that are specifically required and that we expect will be adopted by the time this rule is promulgated. Once designated, States containing $PM_{2.5}$ and 8-hour ozone nonattainment areas will be required to submit SIPs that may include additional local emission reduction measures designed to achieve attainment. Accordingly, we assessed, to the extent feasible with available methods, whether it would be possible for nonattainment areas to attain the annual $PM_{2.5}$ and 8-hour ozone NAAQS through local emissions reductions with reasonably available control measures, or whether the amount of transport from

[42] *See* "Air Quality Data Analysis Technical Support Document for the Proposed Interstate Air Quality Rule (January 2004)." We expect that the actual designation of $PM_{2.5}$ and 8-hour ozone nonattainment areas will be based on 2001–2003 data. We plan to update our assessment to reflect the most recent data available at the time we issue the final rule.

[43] *See* section IV, Air Quality Modeling to Determine Future 8-hour Ozone and $PM_{2.5}$ Concentrations, for more detail on the approach summarized in this subsection.

[44] The EPA also considered the current and likely future nonattainment of the PM_{10} NAAQS and the 24-hour average $PM_{2.5}$ NAAQS. Only a small number of areas are presently experiencing PM_{10} exceedances, and all have approved SIPs that are expected to result in attainment through local control measures. Accordingly, we do not believe that interstate transport will be an important consideration for PM_{10} implementation in the period from 2010, or beyond, and therefore PM_{10} is not a subject of today's proposal. Few areas, all in the western U.S., presently have violations of the 24-hour average $PM_{2.5}$ NAAQS, and all of these are also violating the annual $PM_{2.5}$ NAAQS. We believe that to the extent interstate transport is contributing to nonattainment of the 24-hour $PM_{2.5}$ NAAQS, actions aimed at the broader problem of $PM_{2.5}$ nonattainment will correct any transport affecting 24-hour $PM_{2.5}$ also. The 24-hour $PM_{2.5}$ standard was not further assessed in our analysis for today's proposal.

upwind States would make this difficult or impossible. This information could then be used to determine whether upwind States should be expected to reduce their emissions.

a. Fine Particles

We conducted an assessment of the emissions reductions that States may need to include in nonattainment SIPs, and identified measures that could provide those emission reductions. We focused on the counties predicted to be nonattainment in the 2010 base case.

For our analysis of States' ability to attain the $PM_{2.5}$ standards, we developed a group of emissions reduction measures for SO_2, NO_X, direct $PM_{2.5}$, and volatile organic compounds (VOC) as a surrogate for measures that States would potentially implement prior to 2009 in an effort to reach attainment. The measures address a broad range of source types.[45] We analyzed the effect of applying this group of local controls in two different ways. First, we analyzed the impact of the emission controls on the immediate area in which they were applied. We applied the local control measures in three sample cities: Philadelphia, Birmingham, and Chicago. The group of local emissions controls was estimated to achieve ambient annual average $PM_{2.5}$ reductions ranging from about 0.5 $\mu g/m^3$ to about 0.9 $\mu g/m^3$, which was less than the amount needed to bring any of the three cities into attainment in 2010. The detailed results of this three-city analysis are provided in section IV.

Second, we analyzed the impact of applying the group of local controls to all 290 counties that are located in metropolitan areas in the eastern and central U.S. and that contain one or more of the counties projected to be nonattainment in 2010. This analysis was designed to assess whether applying local controls in upwind nonattainment areas, as States are expected to do, would significantly reduce transport to downwind States.

Based on this analysis, we concluded that for many $PM_{2.5}$ nonattainment areas it would be difficult, if not impossible, to reach attainment unless transport is reduced to a much greater degree and over a much broader regional area than by the simultaneous adoption of local controls within specific nonattainment areas. In addition, we found that much of the air quality improvement that did occur in downwind areas with this strategy was due to reductions in transported sulfate attributable to upwind SO_2 emissions. This indicates in particular that broader reductions in regionwide emissions of SO_2, from sources located both inside and outside potential nonattainment areas, would lead to sizable reductions in $PM_{2.5}$ concentrations.[46]

b. Eight-Hour Ozone

Our analyses suggest that NO_X emissions in upwind States will contribute a sizable fraction of the projected 8-hour ozone nonattainment problem in most nonattainment areas east of the continental divide in 2010 (even after the substantial improvements expected from implementing the NO_X SIP Call).[47] Our analysis also shows that additional highly cost-effective reductions of NO_X from power plants are available. Given continued widespread ozone nonattainment, we believe it is appropriate to require additional reductions in NO_X emissions that contribute to future nonattainment due to interstate transport.

Although numerous areas will attain the 8-hour ozone standards in the near term with existing controls, EPA believes that 15–20 areas east of the continental divide will need further emissions reductions (in some cases, large reductions) to attain the 8-hour standard. These areas have already adopted numerous measures to reduce 1-hour ozone levels.

We analyzed the effect of local measures on 8-hour ozone attainment. We conducted a preliminary scoping analysis in which hypothetical total NOx and VOC emissions reductions of 25 percent were applied in all projected nonattainment areas east of the continental divide in 2010. Despite these substantial reductions, approximately eight areas were projected to have ozone levels exceeding the 8-hour standard. We believe that this hypothetical local control scenario is an indication that attaining the 8-hour standard will entail substantial cost in a number of areas, and that further regional reductions are warranted.

3. Assessment of Transported Pollutants and Precursors

a. Fine Particles

Section II provides a summary of our knowledge concerning the nature of $PM_{2.5}$ and its precursors. We have reviewed several studies that confirm the presence of interstate transport and identify many States as either sources or receptors. We have also conducted new analyses based on comparisons of newly available urban and rural ambient air quality data, source-receptor relationships, satellite observations, and wind trajectories. The details of these most recent analyses are contained in section V. These analyses show a wide range of transport patterns for $PM_{2.5}$. On different days in a year, transport follows a variety of paths, suggesting that to some extent emissions originating in one upwind State make some contribution to annual average $PM_{2.5}$ in many downwind States, even if the upwind State is a considerable distance from the downwind States.

These analyses further conclude that sources of SO_2 and NO_X emissions continue to play a strong role in transported $PM_{2.5}$. They suggest that nearly all the particulate sulfate in the cities we examined appears to result from transport from upwind sources outside the local urban area, while upwind and local contributions for the particle nitrate and carbonaceous components of $PM_{2.5}$ are likely to come from both upwind and local sources. These findings are consistent with what is known about the location of emissions sources for these pollutants and their atmospheric formation and transport mechanisms.

Based on a consideration of these findings regarding the origin and relative contribution of the major components to transported $PM_{2.5}$ in rural areas of the U.S. (see section II), as well as the results of modeling the air quality improvements of adopting highly cost-effective controls on SO_2 and NO_X emissions from EGUs in certain states east of the continental divide (see section IX), EPA proposes to base the $PM_{2.5}$ requirements on man-made SO_2 and NO_X emissions, and not other pollutants. As summarized below, current information related to sources and controls for the other components identified in transported $PM_{2.5}$ (carbonaceous particles, ammonium, and crustal materials) does not, at this time, provide an adequate basis for regulating the regional transport of emissions responsible for these $PM_{2.5}$ components.

Carbonaceous substances (organic compounds and soot) form a large

[45] See section IV and Tables IV–5, IV–6, and IV–7 for details on the analyses of local control measures.

[46] This particular type of analysis is not able to similarly distinguish the separate effects of upwind and local NO_X emissions reductions, but other types of analysis described in section V show the usefulness of upwind NO_X reductions in reducing $PM_{2.5}$ concentrations in nonattainment areas. detailed results of this three-city analysis are provided in section IV.

[47] Emissions reductions required under section 110(a)(2)(D) alone will not eliminate all transported ozone. Because areas with the highest interstate transport contributions tend to be located relatively close to major nonattainment areas in adjoining states, we expect that controls adopted for attainment purposes in upwind nonattainment areas will also reduce interstate ozone transport.

component of $PM_{2.5}$ in rural and urban areas of the East. As discussed in section II, the origins and effectiveness of alternative controls in reducing transported carbonaceous materials are particularly uncertain, and our ability to identify and quantify appropriate measures is quite limited. Some significant fraction may be of natural origin, including biogenic emissions and wildfires. The EPA has already issued national rules to reduce the most significant direct man-made source category of carbonaceous materials, the mobile source sector. These rules will provide some reduction of transported carbonaceous material, as well as significant reductions in urban areas. For other sources, the primary emissions of carbonaceous materials are not currently quantified with certainty. While controls for other man-made sources (*e.g.*, prescribed fires, home heating) may be of significance in developing local control approaches for $PM_{2.5}$ (*e.g.*, as in the analysis summarized in section III.D.2), their relative effectiveness in addressing regional transport is not well enough understood at this time. Substantial uncertainty also exists in attempting to model the formation processes and regional transport of secondary organic particles deriving from biogenic or man-made emissions of organic precursors. To the extent that the production of regional secondary organic particles is related to ozone formation processes, regional NO_X reductions could provide some additional benefit. Measures adopted to reduce man-made VOC emissions should also tend to reduce secondary organic $PM_{2.5}$.

We also do not feel it is necessary or appropriate at this time to attempt to reduce the ammonium portion of $PM_{2.5}$ through regional ammonium controls. As indicated in section II, it is reasonable to expect that simultaneous significant reductions in regional SO_2 and NO_X emissions will also result in a decrease in particulate phase ammonium, while reducing the relative effectiveness of additional ammonia reductions. The alternative of reducing regional ammonia loadings in place of SO_2 and NO_X controls is unattractive because it increases the acidity of $PM_{2.5}$ and of deposition, and is less effective at reducing total loadings of fine particles. Further, while local ammonia reductions might reduce nitrates in some locations, the peak nitrate concentrations in the East come in the wintertime, when ammonia emissions are lowest. As noted in section II, in such circumstances, reductions in NO_X are likely to be effective in reducing nitrates. Finally, the strength and location of ammonia emissions sources, including agricultural operations, are uncertain, and the costs and net effectiveness of alternative regional-scale ammonia controls from a variety of rural and urban sources cannot be adequately quantified. The EPA continues to support research on ammonia emissions, controls and atmospheric processes, which should inform State and local control agency decisions on ammonia controls in the future.

We are proposing not to address direct emissions of crustal material because, among other things, the amount of crustal material is generally a small fraction of total $PM_{2.5}$ in nonattainment areas, crustal material does not appear to be much involved in regional-scale transport on an annual basis, and we face uncertainties in inventories and control costs for crustal material. While most crustal material on a regional scale is likely derived from soils, a small but uncertain fraction of certain components of combustion emissions are classified as "crustal" or "soil derived." As a practical matter, we expect that implementation of today's proposed controls to reduce SO_2 and NO_X from coal-fired EGUs would have co-benefits in reducing those direct emissions of $PM_{2.5}$ that are now classified as crustal material.

The proposed decisions to focus on SO_2 and NO_X reductions for addressing interstate pollution transport should not preclude controls related to carbonaceous particles, ammonium, or other significant $PM_{2.5}$ sources on a local basis, where these can be adopted cost effectively in local $PM_{2.5}$ control plans. We welcome comment on the choice to not regulate the above components of transported $PM_{2.5}$, including further information regarding the cost effectiveness of controls.

b. Ozone

Section II summarizes our knowledge regarding ozone and its precursors. We continue to rely on the assessment of ozone transport made in great depth by the OTAG in the mid-1990s. As indicated in the NO_X SIP Call proposal, the OTAG Regional and Urban Scale Modeling and Air Quality Analysis Work Groups reached the following conclusions:

- Regional NO_X emissions reductions are effective in producing ozone benefits; the more NO_X reduced, the greater the benefit.
- Controls for VOC are effective in reducing ozone locally and are most advantageous to urban nonattainment areas. (62 FR 60320, November 7, 1997)

We reaffirm this conclusion in this rulemaking, and propose to address only NO_X emissions for the purpose of reducing interstate ozone transport.

4. Role of Interstate Transport in Future Nonattainment

a. Fine Particles

For $PM_{2.5}$, we used a "zero-out" approach to assess $PM_{2.5}$ transport coming from each of the 41 States that lie at least partly east of the continental divide, *i.e.*, New Mexico northwards to Montana and all States east of those. Our zero-out approach consisted of air quality model runs for each State, both with and without each State's man-made SO_2 and NO_X emissions. We then compared the predicted downwind concentrations in the 2010 base case, which included the State's SO_2 and NO_X emissions, to the "zero-out" case which excluded all of the State's man-made SO_2 and NO_X emissions. From these results, we were able to evaluate the impact of, for example, Ohio's total man-made SO_2 and NO_X emissions on each projected downwind nonattainment county in 2010. Using the results of this modeling, we identified States as significantly contributing (before considering costs) to downwind nonattainment based on the predicted change in the $PM_{2.5}$ concentration in the downwind nonattainment area which receives the largest impact.

As detailed in section VI below, EPA's modeling indicates a wide range of maximum downwind nonattainment impacts from the 41 States. The largest contribution is from Ohio on Hancock County, WV where the annual $PM_{2.5}$ impact is 1.90 $\mu g/m^3$. Rhode Island has the lowest maximum contribution to a downwind nonattainment area, registering a maximum impact of 0.01 $\mu g/m^3$ on New Haven, Connecticut.

We have considered what level of air quality impact should be regarded as significant (without taking costs into account), and believe that the level should be a small fraction of the annual $PM_{2.5}$ NAAQS of 15.0 $\mu g/m^3$. Our reasoning is based on two factors. First, as EPA determined in 1997 when we established the $PM_{2.5}$ NAAQS, there are significant public health impacts associated with ambient $PM_{2.5}$, even at relatively low levels. By the same token, as summarized earlier, EPA's modeling indicates that at least some nonattainment areas will find it difficult or impossible to attain the standards without reductions in upwind emissions. In combination, these factors suggest a relatively low value for the

$PM_{2.5}$ transport contribution threshold is appropriate.

Second, our analysis of "base case" $PM_{2.5}$ transport shows that many upwind States contribute to concentrations in each of the areas predicted to be nonattainment in 2010. This "collective contribution" is a feature of the $PM_{2.5}$ transport problem, in part because the annual nature of the NAAQS means that wind patterns throughout the year—rather than wind patterns during one season of the year or on a few worst days during the year—play a role in determining how States contribute to each other. The implication is that to address the transport affecting a given nonattainment area, many upwind States must reduce their emissions, even though their individual contributions may be relatively small. By the same token, as summarized earlier, EPA's modeling indicates that at least some nonattainment areas will find it difficult or impossible to attain the standards without reductions in upwind emissions. In combination, these factors suggest a relatively low value for the $PM_{2.5}$ transport contribution threshold is appropriate.

We adopted a similar approach for determining the significance level for ozone transport in the NO_X SIP Call rulemaking, and the D.C. Circuit viewed this approach as reasonable when the Court generally upheld the NO_X SIP Call. The Court acknowledged that EPA had set a relatively low hurdle for States to pass the air quality component (and thus be considered to contribute significantly, depending on costs): "EPA's design was to have a lot of States make what it considered modest NO_X reductions. * * *" *See Michigan* v. *EPA*, 213 F.3d 663(D.C. Cir. 2000), *cert. denied*, 532 U.S. 904 (2001). Indeed, the Court intimated that EPA could have established an even lower hurdle for States to pass the air quality component:

> EPA has determined that ozone has *some* adverse health effects—however slight—at every level [citing National Ambient Air Quality Standards for Ozone, 62 FR 38856 (1997)]. Without consideration of cost it is hard to see why *any* ozone-creating emissions should not be regarded as fatally "significant" under section 110(a)(2)(D)(i)(I)." 213 F.3d at 678 (emphasis in original).

We believe the same approach should apply in the case of $PM_{2.5}$ transport.

In applying this approach, we first considered a significance level of 0.10 $\mu g/m^3$. This is a small level, which is consistent with the factors described. Further, an increment of this size in the annual average $PM_{2.5}$ concentration is the smallest one that can make the difference between compliance and violation of the NAAQS for an area very near the NAAQS, due to the treatment of significant digits and rounding in the definition of the NAAQS. Because the $PM_{2.5}$ NAAQS is 15.0 $\mu g/m^3$ (three significant figures), a concentration after rounding of 15.1 $\mu g/m^3$ would be a violation.[48]

On the other hand, we then considered that the air quality forecasts we have conducted in assessing future air quality impacts have, of necessity, been based on modeling, not monitoring data. In evaluating such results, we believe it is, on balance, more appropriate to adopt a small percentage value of the standard level, rather than absolute number derived from monitoring considerations. A percentage amount that is close to the value derived from the monitoring level described above is 1 percent. We therefore propose to adopt an annual $PM_{2.5}$ significance level equal to 1 percent of the standard. We believe that contributions equal to or greater than 0.15 $\mu g/m^3$ would reflect a reasonable threshold for determining significant levels of interstate transport.

Applying the proposed cutoff of 0.15 $\mu g/m^3$ or higher to the results of the transport impact assessment identifies SO_2 and NO_X emissions in 28 States and the District of Columbia as contributing significantly (before considering costs) to nonattainment in another State. These States, with their maximum downwind $PM_{2.5}$ contributions, are listed in section V, Table V–5.

Although we are proposing to use 0.15 $\mu g/m^3$ as the air quality criteria, we have also analyzed the effects of using 0.10 $\mu g/m^3$. Based on our current modeling, two additional states, Oklahoma and North Dakota, would be included if we were to adopt 0.10 $\mu g/m^3$ as the air quality criterion. Thus, today's proposal includes the State EGU budgets that would apply if these two states were included under the final rule. The EPA requests comments on the appropriate geographic scope of this proposal and the merits of the proposed 0.15 $\mu g/m^3$ threshold level as indicating a potentially significant effect of air quality in nonattainment areas in neighboring states. We request comments on the use of higher and lower thresholds for this purpose.

[48] An area with a reported rounded concentration of 15.0 $\mu g/m^3$ would have actual air quality somewhere in the range of 14.95 to 15.04 $\mu g/m^3$. An increase of 0.10 $\mu g/m^3$ would make the rounded concentration equal 15.1 $\mu g/m^3$, which would constitute an exceedance, no matter where in the 14.95 to 15.04 $\mu g/m^3$ range the concentration fell originally. This is not the case with any increase less than 0.10 $\mu g/m^3$. For example, an increase of 0.09 $\mu g/m^3$ when added to 14.95 $\mu g/m^3$ and then rounded would result in a NAAQS compliance value of 15.0 $\mu g/m^3$, a passing result.

b. Eight-Hour Ozone

In assessing the role of interstate transport to 8-hour ozone nonattainment, we have followed the approach used in the NO_X SIP Call, but have used an updated model and updated inputs that reflect current requirements (including the NO_X SIP Call itself).[49] Using updated contribution results, we rely on the same contribution indicators, or metrics, that were used to make findings in the NO_X SIP Call. Section V and the air quality technical support document present the 8-hour ozone transport analysis and findings in detail.

In general, we found a range in how much transport from each upwind State contributes to 2010 nonattainment in downwind States. The EPA's modeling indicates from 22 to 96 percent of the ozone problem is due to transport, depending on the area.

Based on the same metrics employed in the NO_X SIP Call, we have concluded that, even with reductions from the NO_X SIP Call and other control measures that will reduce NO_X and VOC emissions, interstate transport of NO_X from 25 States and the District of Columbia will contribute significantly to downwind 8-hour ozone nonattainment in 2010. These States are listed in Table V–2. We are deferring findings for Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota, which at this time cannot be assessed on the same basis as States to the east because they are only partially included in the modeling domain. We intend to conduct additional modeling for these six States using a larger modeling domain, and may propose action on them based on that modeling in a supplemental proposal.

5. Assessment of Potential Emissions Reductions

Today's proposal generally follows the statutory interpretation and approach under section 110(a)(2)(D) developed in the NO_X SIP Call rulemaking. Under this interpretation, the emissions in each upwind State that contribute significantly to nonattainment are identified as being those emissions which can be eliminated through highly cost-effective controls.

Section 110(a) requires upwind States to eliminate emissions that contribute significantly to nonattainment

[49] The modeling for today's proposal, and the proposal itself fulfills EPA's commitment in the 1998 NO_X SIP Call final rule to reevaluate by 2007. *See* 63 FR 57399; October 27, 1998.

downwind, and to do so through a SIP revision that must be submitted to EPA within 3 years of issuance of revised NAAQS. In addition, States are required to submit SIPs that provide for attainment in nonattainment areas no later than 3 years after designation.

Through these provisions, the CAA places the responsibility for controls needed to assure attainment on both upwind States and their sources, and on local sources of emissions. The CAA does not specify the relative shares of the burden that each should carry, but section 110(a)(2)(D) clearly mandates that upwind States reduce those emissions that contribute significantly to downwind nonattainment. Moreover, as a matter of broad policy, even if an area could attain the NAAQS through technically feasible, but costly, local controls alone, some consideration needs to be given to a reasonable balance between regional and local controls to reach attainment. In the absence of regional controls on upwind sources, downwind States would be forced to obtain greater emissions reductions, and incur greater costs, to offset the transported pollution from upwind sources.

For the $PM_{2.5}$ and 8-hour ozone NAAQS, our air quality modeling shows attainment with local controls alone would be difficult or impossible for many areas. Our analysis in section VI shows that substantial regional reductions in SO_2 and NO_X emissions from EGUs are available at costs that are well within the levels of historically adopted measures. An attainment strategy that relies on a combination of local controls and regional EGU controls is a more equitable and therefore a more reasonable approach than a strategy that relies solely on local controls.

a. Identifying Highly Cost-Effective Emissions Reductions

As the second step in the two-step process for determining the amount of significant contribution, we must determine the amount of emissions that may be eliminated through highly cost-effective controls. Today we are proposing to retain the concept of highly cost-effective controls as developed and used in the NO_X SIP Call, in which we determined such controls by comparing the cost of recently required controls, and to apply it to the SO_2 and NO_X precursors of $PM_{2.5}$ and 8-hour ozone nonattainment.

For today's proposal, EPA independently evaluated the cost effectiveness of strategies to reduce SO_2 and NO_X to address $PM_{2.5}$ and ozone nonattainment. We developed criteria for highly cost-effective amounts through: (1) comparison to the average cost effectiveness of other regulatory actions and (2) comparison to the marginal cost effectiveness of other regulatory actions. These ranges indicate cost-effective controls. The EPA believes that controls with costs towards the low end of the range may be considered to be highly cost effective because they are self-evidently more cost effective than most other controls in the range. We also considered other factors. Our approach to the cost-effectiveness element of significant contribution and the results of our analysis are presented in section VI.

The other factors we have considered include the applicability, performance, and reliability of different types of pollution control technologies for different types of sources; the downwind impacts of the level of control that is identified as highly cost effective; and other implementation costs of a regulatory program for any particular group of sources. We also consider some of these same factors in determining the time period over which controls should be installed. Depending on the type of controls we view as cost effective, we must take into account the time it would take to design, engineer, and install the controls, as well as the time period that a source would need to obtain the necessary financing. These various factors, including engineering and financial factors, are discussed in section VI. We may also consider whether emissions from a particular source category will be controlled under an upcoming regulation (a MACT standard, for example).

Today's action proposes emissions reductions requirements based on highly cost-effective emissions reductions obtainable from EGUs. Section VI explains the proposed requirements.

b. Timing for Submission of Transport SIPs

We are proposing today to require that $PM_{2.5}$ and 8-hour ozone transport SIPs be submitted, under CAA section 110(a)(1), as soon as practicable, but not later than 18 months from the date of promulgation of this rule. Based on the experience of States in developing plans to respond to the NO_X SIP Call, we believe this is a reasonable amount of time. The NO_X SIP Call required States to submit SIPs within 12 months of the final rule, a period within the maximum 18 months allowed under section 110(k)(5) governing States' responses to SIP calls. The 12-month period was reasonable for the NO_X SIP Call given the focus on a single pollutant, NO_X, and the attainment deadlines facing downwind 1-hour ozone nonattainment areas. Since today's proposal requires affected States to control both SO_2 and NO_X emissions, and to do so for the purpose of addressing both the $PM_{2.5}$ and 8-hour ozone NAAQS, we believe it is reasonable to allow affected States more time than was allotted in the NO_X SIP Call to develop and submit transport SIPs. Since we plan to finalize this rule no later than mid-2005, SIP submittals would be due no later than the end of 2006. Under this schedule, upwind States' transport SIPs would be due before the downwind States' $PM_{2.5}$ and 8-hour ozone nonattainment SIPs, under CAA section 172(b). We expect that the downwind States' 8-hour ozone nonattainment area SIPs will be due by May 2007, and their nonattainment SIPs for $PM_{2.5}$ by January 2008.[50] As explained in section VII below, today's proposed requirement that the upwind States submit the transport SIP revisions even before the downwind States submit nonattainment SIPs is consistent with the CAA SIP submittal sequence, will provide health and environmental benefits, and will assist the downwind States in their attainment demonstration planning.

c. Timing for Achieving Emissions Reductions

As discussed in section VI, engineering and financial factors suggest that only a portion of the emissions reductions that EPA considers highly cost effective can be achieved by January 1, 2010. To ensure timely protection of public health, while taking into account these considerations, we are proposing to implement highly cost-effective reductions in two phases, with a Phase I compliance date of January 1, 2010, and a Phase II compliance date of January 1, 2015.

Based on EPA's analysis, we believe that a regional emissions cap on SO_2 of 3.9 million tons together with a NO_X emissions cap of 1.6 million tons is achievable by January 1, 2010, and therefore we are proposing these limits as the Phase I requirements.[51] The EPA believes the remaining highly cost-effective SO_2 and NO_X emissions reductions can be achieved by January 1, 2015, and will be helpful to areas with $PM_{2.5}$ or 8-hour ozone attainment dates approaching 2015. The EGU caps

[50] The actual dates will be determined by relevant provisions in the CAA and EPA's interpretation of these provisions published in upcoming implementation rules for the $PM_{2.5}$ and 8-hour ozone NAAQS.

[51] Because Connecticut is affected only by the 8-hour ozone findings, NO_X emissions reductions are not necessary until the ozone season. Therefore, for Connecticut only, EPA is proposing a Phase I NO_X reduction compliance date of May 1, 2010.

in the proposed control region would be lowered in the second phase to 2.7 million tons for SO_2 and 1.3 million tons for NO_X. The current 28-state[52] emissions, baseline emissions in 2010 and 2015 and proposed regional emissions caps are shown in Table III–1.

TABLE III–1.—SO_2 AND NO_X REGIONWIDE EMISSIONS REDUCTIONS AND EMISSIONS CAPS

	2002 Emissions (tons)	2010 (tons)		2015 (tons)	
		Baseline emissions	Cap	Baseline emissions	Cap
SO_2	9.4M	9.0M	3.9M	8.3M	2.7M
NO_X	3.7M	3.1M	1.6M	3.2M	1.3M

We derived these amounts as follows: The SO_2 emissions limitations correspond to 65 percent of the affected States' title IV allowances in 2015, and 50 percent in 2010. The NO_X emissions limitations correspond to the sum of the affected States' historic heat input amounts, multiplied by an emission rate of 0.125 mmBtu for 2015 and 0.15 mmBtu for 2010. Historic heat input is derived as the highest annual heat input during 1999–2002. We are proposing that these regionwide limits correspond to costs that meet the highly cost-effective criteria.

Further, EPA proposes to apportion these regionwide amounts to the individual States in the region as follows: For SO_2, EPA proposes to apportion the regionwide amounts to the individual States in the region in proportion to their title IV allocations. This would amount to requiring reductions in the amount of 65 percent of each affected State's title IV allocations for 2015, and 50 percent for 2010. The EPA is considering requiring an adjustment to these amounts to account for the fact that the utility industry has changed since the title IV allocation formulae were developed. For NO_X, EPA proposes to apportion the regionwide amounts to the individual States in the region in proportion to their historic heat input, determined as the average of several years of heat input.

d. Compliance Approaches and Statewide Emissions Budgets

Today's proposal affects 28 upwind States and the District of Columbia for the purpose of addressing $PM_{2.5}$ transport, and 25 States and the District of Columbia for the purpose of addressing ozone transport. For States required to reduce NO_X emissions to address 8-hour ozone transport, the NO_X reductions must be implemented at least during the ozone season. For States required to reduce SO_2 and NO_X emissions to address $PM_{2.5}$ transport, the NO_X and SO_2 reductions must be achieved annually. For States affected for both $PM_{2.5}$ and ozone, EPA is proposing that compliance with the $PM_{2.5}$-related annual emissions reduction requirement be deemed sufficient for compliance with the seasonal ozone-related emissions reduction requirement.

The EPA also wants to streamline potentially overlapping compliance requirements between the existing NO_X SIP Call and today's proposed action, while ensuring that the ozone benefits of the NO_X SIP Call are not jeopardized. The EPA is proposing that States may choose to recognize compliance with the more stringent annual NO_X reduction requirements contained in today's rulemaking as satisfying the original NO_X SIP Call seasonal reduction requirements for sources that States cover under both the NO_X SIP Call and today's proposal.

We are proposing to calculate the amount of required reductions on the basis of controls available for EGUs. We believe these EGU reductions represent the most cost-effective reductions available. In 2010, considering other controls that will be in place, but not assuming a rule to address transported pollution is implemented, EGUs are projected to emit approximately one-quarter of the total man-made NO_X emissions in 2010 and two-thirds of the man-made SO_2 emissions in the region proposed for reductions in today's rulemaking. Extensive information exists indicating that highly cost-effective controls are available for achieving significant reductions in NO_X and SO_2 emissions from the EGU sector.

We are proposing that (as under the NO_X SIP Call) States obtaining reductions from EGUs to comply with today's proposal must cap their EGUs at levels that will assure the required reductions. In addition, today's action proposes an approach which permits the use of title IV SO_2 allowances at discounted levels that provide for a planned transition toward accomplishing the objectives of the interstate air quality rule.

Based on our experience in the NO_X SIP Call, we anticipate that States will choose to require EGUs to participate in the cap and trade programs administered by EPA. If States choose to participate in the cap and trade programs, States must adopt the model cap and trade programs, described in section VIII. The cap and trade programs will create incentives for EGUs to reduce SO_2 and NO_X emissions starting no later than 2010, and probably somewhat earlier, and continuing to 2015 and beyond. The model cap and trade programs are designed to satisfy all the SO_2 and NO_X emissions reduction requirements proposed in today's rule.

If a State imposes the full amount of SO_2 and NO_X emissions reductions on EGUs that EPA has deemed highly cost effective, we are taking comment on whether this approach to compliance with the interstate air quality rule by affected EGUs in affected States would satisfy for those sources the Best Available Retrofit Technology (BART) requirements of the CAA. We are further soliciting comment, for the circumstances just described, on whether compliance through participation in a regionwide or statewide cap and trade program, rather than source-specific emissions limits, could satisfy the BART requirements for those sources.

States that choose to obtain some of the required SO2 or NO_X reductions from non-EGU sources must adopt control measures for those other sources. To assure accurate accounting of emissions reductions, these States will have to establish sector-specific baseline emission inventories for 2010 and 2015. These States will also have to measure projected emissions reductions from adopted measures from these baselines. The sector-specific baseline inventory minus the amount of

[52] Excludes emissions from Connecticut.

reduction the State chooses to obtain from that sector is the sector budget for those sources. The SIP must contain a projection showing that compliance with the adopted measure(s) for that sector will ensure that emissions from the sector will meet the sector budget.

E. Request for Comment on Potential Applicability to Regional Haze

We believe that the emissions reductions that would result from today's proposed rulemaking would help the States in making substantial progress towards meeting the goals and requirements of the Regional Haze rule in the Eastern U.S. As a result of the predicted emissions reductions, we anticipate that visibility would improve in Class I areas in this region, including in areas such as the Great Smoky and Shenandoah National Parks. We request comment on the extent to which the reductions achieved by these rules would, for States covered by the IAQR, satisfy the first long term strategy for regional haze, which is required to achieve reasonable progress towards the national visibility goal by 2018.

We also request comment on whether the cap and trade approach proposed in this rulemaking is a suitable mechanism that could be expanded to help other States meet their regional haze obligations under the CAA. If we were to propose this approach, we would address this further in a supplemental notice and we would need to amend our Regional Haze rule to specify that, in establishing a reasonable progress goal for any Class I area as required by CAA section 169A and our rule, the State would need to submit a SIP revision that, at a minimum, would enable the State to participate in a cap and trade program that reflects a rate of progress based on specified levels of SO_2 and NO_X reductions that we find are reasonable in light of the natural visibility goal that Congress established in 1977. Such an approach could be proposed to apply to areas identified in our final Regional Haze rule (64 FR 35714, July 1, 1999) as having emissions that may reasonably be anticipated to cause or contribute to an impairment of visibility in at least one Class I area, to reduce those emissions. We note that, under such an approach, we could consider two separate NO_X emission levels and two separate cap and trade zones for NO_X. States included on the basis of their contribution to either ozone or $PM_{2.5}$ nonattainment would be in one zone and would need to meet the NO_X emission reduction requirements discussed elsewhere in this action. States included only on the basis of needing to achieve reasonable progress goals would be in a separate zone and would need to meet a level specifically designed to address that issue. We request comment on what emissions levels should be considered for SO_2 and NO_X if we were to pursue such an approach. We also request comment on how such an approach could be integrated with and combine the efforts of Regional Planning Organizations that are working to address regional haze.

F. How Will the Interstate Air Quality Rule Apply to the Federally Recognized Tribes?

The Tribal Authority Rule (TAR) (40 CFR part 49), which implements section 301(d) of the CAA, gives Tribes the option of developing CAA programs, including Tribal Implementation Plans (TIPs). However, unlike States, Tribes are not required to develop implementation plans. Specifically, the TAR, adopted in 1998, provides for the Tribes to be treated in the same manner as a State in implementing sections of the CAA. The EPA determined in the TAR that it was appropriate to treat Tribes in a manner similar to a State in all aspects except specific plan submittal and implementation deadlines for NAAQS-related requirements, including, but not limited to, such deadlines in CAA sections 110(a)(1), 172(a)(2), 182, 187, and 191.[53]

In addition, the TAR also indicates that section 110(a)(2)(d) applies to the Tribes. This provision of the Act requires EPA to ensure that SIPs and TIPs ensure that their sources do not contribute significantly to nonattainment downwind. In fact, Tribes generally have few emissions sources and thus air quality problems in Indian country are generally created by transport into Tribal lands. Specifically, in the February 12, 1998 preamble to the Tribal Air Rule we stated:

> EPA notes that several provisions of the CAA are designed to address cross-boundary air impacts. EPA is finalizing its proposed approach that the CAA protections against interstate pollutant transport apply with equal force to States and Tribes. Thus EPA is taking the position that the prohibitions and authority contained in sections 110(a)(2)(D) and 126 of the CAA apply to Tribes in the same manner as States. As EPA noted in the preamble to its proposed rule, section 110(a)(2)(D), among other things, requires States to include provisions in their SIPs that prohibit any emissions activity within the State from significantly contributing to nonattainment * * * In addition, section 126 authorizes any State or Tribe to petition EPA to enforce these prohibitions against a State containing an allegedly offending source or group of sources. See 63 FR 7262, 59 FR 43960–43961.

[53] *See* 40 CFR 49.4(a).

Because the Tribes, like the States are our regulatory partners, in developing the interstate air quality rule we want to ensure that the Tribes' air quality and sovereignty are protected. Thus, we are exploring areas in the rule development where Tribes will be impacted. One area, in particular, is in the establishment of emissions reduction requirements and budgets. We are not aware of the presence of any EGUs on tribal lands located in the States for which EPA has conducted air quality modeling for today's proposal. Although, it is possible that EGUs may locate in Indian country in the future. We are requesting comment on whether and how to apply any emissions reductions or budget requirements to the Tribes, as well as comments on other areas of the rule that will impact the Tribes.

IV. Air Quality Modeling To Determine Future 8-Hour Ozone and $PM_{2.5}$ Concentrations

A. Introduction

In this section, we describe the air quality modeling performed to support today's proposal. We used air quality modeling primarily to quantify the impacts of SO_2 and NO_x emissions from upwind States on downwind annual average $PM_{2.5}$ concentrations, and the impacts of NO_x emissions from upwind States on downwind 8-hour ozone concentrations.

This section includes information on the air quality models applied in support of the proposed rule, the meteorological and emissions inputs to these models, the evaluation of the air quality models compared to measured concentrations, and the procedures for projecting ozone and $PM_{2.5}$ concentrations for future year scenarios. We also present the results of modeling locally applied control measures designed to reduce concentrations of $PM_{2.5}$ in projected nonattainment areas. The Air Quality Modeling Technical Support Document (AQMTSD) contains more detailed information on the air quality modeling aspects of this rule.[54] Updates made between the proposed rule and the final rule to components of the ozone and PM modeling platform will be made public in a Notice of Data Availability.

[54] "Air Quality Modeling Technical Support Document for the Proposed Interstate Air Quality Rule (January 2004)" can be obtained from the docket for today's proposed rule: OAR–2003–0053.

B. Ambient 8-Hour Ozone and Annual Average $PM_{2.5}$ Design Values

1. 8-Hour Ozone Design Values

Future year levels of air quality are estimated by applying relative changes in model-predicted ozone to current measurements of ambient ozone data. Current measurements of ambient ozone data come from monitoring networks consisting of more than one thousand monitors located across the country. The monitors are sited according to the spatial and temporal nature of ozone, and to best represent the actual air quality in the United States. More information on the monitoring network used to collect current measurements of ambient ozone is in the Air Quality Data Analysis Technical Support Document.[55]

In analyzing the ozone across the United States, the raw monitoring data must be processed into a form pertinent for useful interpretations. For this action, the ozone data have been processed consistent with the formats associated with the NAAQS for ozone. The resulting estimates are used to indicate the level of air quality relative to the NAAQS. For ozone air quality indicators, we developed estimates for the 8-hour ozone standard. The level of the 8-hour ozone NAAQS is 0.08 ppm. The 8-hour ozone standard is not met if the 3-year average of the annual 4th highest daily maximum 8-hour ozone concentration is greater than 0.08 ppm (0.085 is rounded up). This 3-year average is called the annual standard design value. As described below, the approach for forecasting future ozone design values involved the projection of 2000–2002 ambient design values to the various future year emissions scenarios analyzed for today's proposed rule. These data were obtained from EPA's Air Quality System (AQS) on August 11, 2003. A more detailed description of design values is in the Air Quality Data Analysis Technical Support Document. A list of the 2000–2002 Design Values is available at *http://www.epa.gov/airtrends/values.html.*

2. Annual Average $PM_{2.5}$ Design Values

Future year levels of air quality are estimated by applying relative changes in model predicted $PM_{2.5}$ to current measurements of ambient $PM_{2.5}$ data. Current measurements of ambient $PM_{2.5}$ data come from monitoring networks consisting of more than one thousand monitors located across the country. The monitors are sited according to the spatial and temporal nature of $PM_{2.5}$, and to best represent the actual air quality in the United States. More information on the monitoring network used to collect current measurements of ambient $PM_{2.5}$ is in the Air Quality Data Analysis Technical Support Document.

In analyzing the $PM_{2.5}$ data across the United States, the raw monitoring data must be processed into a form pertinent for useful interpretations. For this action, the $PM_{2.5}$ data have been processed consistent with the formats associated with the NAAQS for $PM_{2.5}$. The resulting estimates are used to indicate the level of air quality relative to the NAAQS. For $PM_{2.5}$, the annual standard is met when the 3-year average of the annual mean concentration is 15.0 $\mu g/m^3$ or less. The 3-year average annual mean concentration is computed at each site by averaging the daily Federal Reference Method (FRM) samples taken each quarter, averaging these quarterly averages to obtain an annual average, and then averaging the three annual averages. The 3-year average annual mean concentration is also called the annual standard design value. As described below, the approach for forecasting future $PM_{2.5}$ design values involved the projection of 1999–2001 and 2000–2002 ambient design values to the various future year emissions scenarios analyzed for today's proposed rule. These data were obtained from EPA's Air Quality System (AQS) on July 9, 2003. A more detailed description of design values is in the Air Quality Data Analysis Technical Support Document. A list of the 1999–2001 and 2000–2002 Design Values is available at *http://www.epa.gov/airtrends/values.html.*

C. Emissions Inventories

1. Introduction

In order to support the air quality modeling analyses for the proposed rule, emission inventories were developed for the 48 contiguous States and the District of Columbia. These inventories were developed for a 2001 base year to reflect current emissions and for future baseline scenarios for years 2010 and 2015. The 2001 base year and 2010 and 2015 future base case inventories were in large part derived from a 1996 base year inventory and projections of that inventory to 2007 and 2020 as developed for previous EPA rulemakings for Heavy Duty Diesel Engines (HDDE) (*http://www.epa.gov/otaq/models/hd2007/r00020.pdf*) and Land-based Non-road Diesel Engines (LNDE) (*http://www.epa.gov/nonroad/454r03009.pdf*). The inventories were prepared at the county level for on-road vehicles, non-road engines, and area sources. Emissions for EGUs and industrial and commercial sources (non-EGUs) were prepared as individual point sources. The inventories contain both annual and typical summer season day emissions for the following pollutants: oxides of nitrogen (NO_X); volatile organic compounds (VOC); carbon monoxide (CO); sulfur dioxide (SO_2); direct particulate matter with an aerodynamic diameter less than 10 micrometers (PM_{10}) and less than 2.5 micrometers ($PM_{2.5}$); and ammonia (NH_3). Additional information on the development of the emissions inventories for air quality modeling and State total emissions by sector and by pollutant for each scenario are provided in the AQMTSD.

2. Overview of 2001 Base Year Emissions Inventory

Emissions inventory inputs representing the year 2001 were developed to provide a base year for forecasting future air quality, as described below in section IV.D. for ozone and section IV.E. for $PM_{2.5}$. Because the complete 2001 National Emissions Inventory (NEI) and future year projections consistent with that NEI were not available in a form suitable for air quality modeling when needed for this analysis, the following approach was used to develop a reasonably representative "proxy" inventory for 2001 in model-ready form that retained the same consistency with the existing future year projected inventories as the 1996 model-ready inventory that was used as the basis for those projected inventories.

The EPA had available model-ready emissions input files for a 1996 Base Year and a 2010 Base Case from a previous analysis. In addition, robust NEI estimates were available for 2001 for three of the six man-made emissions sectors: EGUs; on-road vehicles; and non-road engines. For the EGU sector, State-level emissions totals from the NEI 2001 were divided by similar totals from the 1996 modeling inventory to create a set of 1996 to 2001 adjustment ratios. Ratios were developed for each State and pollutant. These ratios were applied to the model-ready 1996 EGU emissions file to produce the 2001 EGU emissions file.

The NEI 2001 emissions estimates for the on-road vehicles and non-road engines sectors were available from the MOBILE6 and NONROAD2002 models, respectively. Because both of these models were updates of the versions used to produce the existing 1996 model-ready emissions files and their associated projection year files, a

[55] "Air Quality Data Analysis Technical Support Document for the Proposed Interstate Air Quality Rule (January 2004)" can be obtained from the docket for today's proposed rule: OAR–2003–0053.

slightly different approach than that used for the EGUs was used to adjust the 1996 model-ready files to produce files for 2001.

The updated MOBILE6 and NONROAD2002 models were used to develop 1996 emissions estimates that were consistent with the 2001 NEI estimates. A set of 1996–to–2001 adjustment ratios were then created by dividing State-level total emissions for each pollutant for 2001 by the corresponding consistent 1996 emissions. These adjustment ratios were then multiplied by the gridded model-ready 1996 emissions for these two sectors to produce model-ready files for 2001. These model-ready 2001 files, therefore, maintain consistency with the future year projection files that were based on the older emission model versions but also capture the effects of the 1996 to 2001 emission changes as indicated by the latest versions of the two emissions models.

Consistent estimates of emissions for the 2001 Base Year were not available at the time modeling was begun for two other emission sectors: non-EGU point sources and area sources. For these two sectors, linear interpolations were performed between the gridded 1996 emissions and the gridded 2010 Base Case emissions to produce 2001 gridded emissions files. These interpolations were done separately for each of the two sectors, for each grid cell, for each pollutant. As the 2010 Base Case inventory was itself a projection from the 1996 inventory, this approach maintained consistency of methods and assumptions between the 2001 and 2010 emissions files.

3. Overview of the 2010 and 2015 Base Case Emissions Inventories

The future base case scenarios generally represent predicted emissions in the absence of any further controls beyond those State, local, and Federal measures already promulgated plus other significant measures expected to be promulgated before the final rule from today's proposal. Any additional local control programs which may be necessary for areas to attain the annual $PM_{2.5}$ NAAQS and the ozone NAAQS are not included in the future base case projections. The future base case scenarios do reflect projected economic growth, as described in the AQMTSD.

Specifically, the future base case scenarios include the effects of the LNDE as proposed, the HDDE standards, the Tier 2 tailpipe standards, the NO_X SIP Call as remanded (excludes controls in Georgia and Missouri), and Reasonably Available Control Techniques (RACT) for NO_X in 1-hour ozone nonattainment areas. Adjustments were also made to the non-road sector inventories to include the effects of the Large Spark Ignition and Recreational Vehicle rules; and to the non-EGU sector inventories to include the SO_2 and particulate matter co-benefit effects of the proposed Maximum Achievable Control Technology (MACT) standard for Industrial Boilers and Process Heaters. The future base case scenarios do not include the NO_X co-benefit effects of proposed MACT regulations for Gas Turbines or stationary Reciprocating Internal Combustion Engines, which we estimate to be small compared to the overall inventory; or the effects of NO_X RACT in 8-hour ozone nonattainment areas, because these areas have not yet been designated.

4. Procedures for Development of Emission Inventories

a. Development of Emissions Inventories for Electric Generating Units

As stated above, the 2001 Base Year inventory for the EGU sector was developed by applying State-level adjustment ratios of 2001 NEI[56] emissions to 1996 emissions for the EGU sector to the existing model-ready 1996 EGU file. Adjustments were thus made in the modeling file to account for emissions reductions that had occurred between 1996 and 2001, but at an aggregated State-level, rather than for each individual source. Future year 2010 and 2015 Base Case EGU emissions used for the air quality modeling runs that predicted ozone and $PM_{2.5}$ nonattainment status were obtained from version 2.1.6 of the Integrated Planning Model (IPM) (*http://www.epa.gov/airmarkets/epa-ipm/index.html*). However, results from this version of the IPM model were not available at the time that the air quality model runs to determine interstate contributions ("zero-out runs") were started. Therefore, we used EGU emissions from the previous IPM version (v2.1) for the zero-out air quality model runs and associated 2010 Base Case. Updates applied to the IPM model between versions 2.1 and 2.1.6 include the update of coal and natural gas supply curves and the incorporation of several State-mandated emission caps and New Source Review (NSR) settlements.

Tables IV–1 and IV–2 provide State-level emissions totals for the 2010 Base Case for SO and NO_X, respectively, for each of the five sectors. These tables are helpful in understanding the relative magnitude of each sector to the total inventory. In addition, these tables include, for comparison, a column showing the EGU emissions from the older version 2.1 IPM outputs that were used for the zero-out modeling analysis. Our examination indicates that the EGU differences between the two IPM outputs are generally minor and have not affected the content of this proposal.

TABLE IV–1.—STATE SO_2 EMISSIONS BY SECTOR IN THE 2010 BASE CASE [1]

ST	EGU v21	EGU v216	Non-EGU	On-road	Non-road	Area	Total
AL	494,700	473,000	121,300	600	1,600	51,900	648,400
AZ	47,800	47,800	120,800	600	700	4,300	174,200
AR	119,300	122,700	17,500	300	500	21,200	162,100
CA	17,300	17,300	44,000	3,400	13,000	10,700	88,400
CO	90,400	73,100	15,900	500	800	4,700	94,900
CT	6,600	6,300	7,600	300	400	500	15,000
DE	36,800	46,400	38,400	100	300	10,200	95,400
DC	0	0	2,100	0	100	5,800	8,000
FL	230,300	233,200	90,400	1,700	15,100	44,700	385,300
GA	610,000	609,200	92,800	1,100	2,600	6,700	712,300
ID	0	0	26,800	200	300	8,800	36,000
IL	591,500	600,800	277,200	1,100	1,700	36,400	917,300
IN	599,000	670,400	152,200	800	1,100	2,200	826,700
IA	186,200	169,900	84,000	300	600	14,600	269,400

[56] The 2001 NEI emissions for EGUs includes emissions for units reporting to EPA under title IV.