6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 51, 72, 75, and 96

[FRL-]

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 (PM2.5) 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 (SO2) and/or nitrogen oxides (NOx). Sulfur dioxide is a precursor to PM2.5 formation, and NOx is a precursor to both ozone and PM2.5 formation. Reducing upwind

precursor emissions will assist the downwind PM2.5 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 SO2 and NOx. 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 SO2 and NOx 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

[insert 60 days from publication]. 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 NOx and SO2. 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.

Electronic Access. You may access this Federal Register document electronically through the EPA Internet under the "Federal Register" listings at http://www.epa.gov/fedrgstr/.

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at http://www.epa.gov/edocket/ to submit or view public comments, access the index listing of the contents of the

official public docket, and to access those documents in the public docket that are available electronically. Once in the system, select “search,” then key in the appropriate docket identification number.

Certain types of information will not be placed in the EPA Dockets. Information claimed as CBI and other information whose disclosure is restricted by statute, which is not included in the official public docket, will not be available for public viewing in EPA’s electronic public docket. The EPA’s policy is that copyrighted material will not be placed in EPA’s electronic public docket but will be available only in printed, paper form in the official public docket. To the extent feasible, publicly available docket materials will be made available in EPA’s electronic public docket. When a document is selected from the index list in EPA Dockets, the system will identify whether the document is available for viewing in EPA’s electronic public docket. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the docket facility identified above. The EPA intends to work towards providing electronic access to all of the publicly

available docket materials through EPA's electronic public docket.

For public commenters, it is important to note that EPA's policy is that public comments, whether submitted electronically or in paper, will be made available for public viewing in EPA's electronic public docket as EPA receives them and without change, unless the comment contains copyrighted material, CBI, or other information whose disclosure is restricted by statute. When EPA identifies a comment containing copyrighted material, EPA will provide a reference to that material in the version of the comment that is placed in EPA's electronic public docket. The entire printed comment, including the copyrighted material, will be available in the public docket.

Public comments submitted on computer disks that are mailed or delivered to the docket will be transferred to EPA's electronic public docket. Public comments that are mailed or delivered to the Docket will be scanned and placed in EPA's electronic public docket. Where practical, physical objects will be photographed, and the photograph will be placed in EPA's electronic public docket along with a brief description written by the

docket staff.

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.

EPA Dockets. Your use of EPA's electronic public docket to submit comments to EPA electronically is EPA's preferred method for receiving comments. Go directly to EPA Dockets at http://www.epa.gov/edocket, and follow the online instructions for submitting comments. To access

EPA's electronic public docket from the EPA Internet Home Page, select "Information Sources," "Dockets," and "EPA Dockets." Once in the system, select "search," and then key in Docket ID No. OAR-2003-0053. The system is an "anonymous access" system, which means EPA will not know your identity, e-mail address, or other contact information unless you provide it in the body of your comment.

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.

How Should I Submit CBI To the Agency?

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 PM2.5 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

[1] In today's proposal, when we use the term "transport" we mean to include the transport of both fine particles (PM2.5) and their precursor emissions and/or transport of both ozone and its precursor emissions.

certain upwind States result in amounts of transported fine particles (PM2.5), 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 PM2.5 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 SO2 and/or NOx, which are important precursors of PM2.5 (NOx and SO2) and ozone (NOx). Achieving these emissions reductions will help enable PM2.5 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 SO2 and NOx 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 PM2.5 Air Quality Problems, section IV, Air Quality Modeling to Determine Future 8-Hour Ozone and PM2.5 Concentrations, and section V, Air Quality Aspects of Significant Contribution for 8-Hour Ozone and Annual Average PM2.5 Before Considering Cost. The EPA proposes to find, after considering relevant information, that SO2 and NOx emissions in the District of Columbia and the following 28 States significantly contribute to nonattainment in a downwind State with respect to the PM2.5 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 NOx 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 SO2 and/or NOx 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 SO2 and NOx 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 NOx are not the only emissions that contribute to interstate transport and PM2.5 nonattainment. However, EPA believes that given current knowledge, it is not appropriate at this time to specify emissions reduction requirements for direct PM2.5

emissions or organic precursors (e.g. volatile organic compounds (VOCs) or ammonia (NH3)). (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 PM2.5. States may, however, need to consider additional reductions in some or all of these emissions as they develop SIPs to attain and maintain the PM2.5 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 NOx, 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.

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[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 NOx SIP Call for further information on OTAG.

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 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 PM2.5 and Ozone

1. What are the Effects of Ambient PM2.5?

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 PM2.5. We established health- and welfare-based (primary and secondary) annual and 24-hour standards for PM2.5 (62 FR 38652). The annual standards are 15 micrograms per cubic meter, based on the 3-year average of annual mean PM2.5 concentrations. The 24-hour standard is a level of 65 micrograms per cubic meter, based on the 3-year average of the annual 98^{th} 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 PM2.5 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 SO2 and NOx emissions, both of which contribute to fine particle concentrations. In addition, EGU NOx emissions contribute to ozone problems, described in the next section. We believe today's proposal will significantly reduce SO2 and NOx emissions that contribute to PM2.5 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

SO2 and NOx, the Main Precursors to PM2.5 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 NOx and SO2 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 PM2.5 and Ozone?

1. What is the PM2.5 Ambient Air Quality?

The PM2.5 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 PM2.5 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 PM2.5 standards. On the other hand, in the eastern half of the U.S., 175 sites in 106 counties exceeded the annual PM2.5 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 PM2.5 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 PM2.5 standards in California or Montana, today's proposal is focused only on the PM2.5 monitoring sites in the Eastern U.S..

Speciated ambient data, which measures the major components of PM2.5 (sulfate, nitrate, total carbonaceous mass, and crustal material) are invaluable in understanding the nature and extent of the PM2.5 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 PM2.5 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 PM2.5 mass. The largest sulfate contributions to PM2.5 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 PM2.5 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 PM2.5 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 PM2.5 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 PM2.5 component, crustal, are relatively small (less than 10 percent of PM2.5 mass) and do not exhibit strong regional or seasonal trends. (For further discussion on the science of PM2.5

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 NOx declined by only 11

[3] EPA 454/K-03-001, August 2003.

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 NOx rule known as the NOx 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.

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

1. What are the CAA Provisions on Attainment of the PM2.5 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 PM2.5 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 PM2.5 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 NOx SIP Call, discussed below, to require States to revise their SIPs to include measures to reduce NOx emissions that were significantly contributing to ozone nonattainment problems in downwind States.

2. What is the NOx 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

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

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 NOx 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 NOx SIP Call, required those

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[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 NOx SIP Call emission reduction requirements. (64 FR 26,298; May 14, 1999 and 65 FR 11222; March 2, 2000).

jurisdictions to revise their SIPs to include NOx control measures to mitigate the significant ozone transport. The EPA determined the emissions reductions requirements by projecting NOx 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 NOx 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 NOx 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 NOx SIP Call rule, the U.S. Court of Appeals for the District of Columbia Circuit issued two decisions concerning the NOx SIP Call and its technical amendments.[7] The Court

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

decisions generally upheld the NOx SIP Call and technical amendments, including EPA's interpretation of the definition of "contribute significantly" under CAA section 110(a)(2)(D). The litigation over the NOx 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 NOx SIP Call based on the 8-hour NAAQS (65 FR 56245, September 18, 2000). Therefore, for the most part, the Court did not address NOx SIP Call requirements under the 8-hour ozone NAAQS.

As in the NOx 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 NOx 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 SO2 and NOx 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 SO2 (and, to a lesser extent, NOx) 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 SO2 and NOx reductions from

large EGUs.

The Acid Rain Program utilizes a market-based cap and trade approach to require power plants to reduce SO2 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 SO2 – 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 SO2 allowances to meet the proposed emissions caps. This effectively reduces the national cap on SO2 emissions.

The Acid Rain Program has achieved major SO2 emissions reductions, and associated air quality improvements, quickly and cost effectively. In 2002, SO2 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

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

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 NOx 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 NOx reductions on commercially available combustion controls, title IV has reduced NOx 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 NOx 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

[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

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 PM2.5, 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

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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.

these areas to natural conditions (see 40 CFR part 81, subpart D). Today's proposal will reduce SO2 and NOx 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 SO2 and NOx emissions is related to a proposal signed on December 15, 2003 to regulate mercury from certain types of EGU's using the 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 NOx, SO2, 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 SO2, NOx, and mercury. Today, we know that electric utilities can reduce their emissions of all three pollutants by installing flue gas desulfurization (FGD) (which controls SO2 and mercury

emissions) and selective catalytic reduction (SCR) (which controls NOx 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 PM2.5 Air Quality Problems

This section presents a simplified account of the occurrence, formation, and origins of ozone and PM2.5, 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 NOx (mainly NO and NO2). 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 NOx and VOC are summarized in section IV of this proposal and EPA web sites (e.g., www.epa.gov/ttn/chief).

The relative importance of NOx and VOC in ozone formation and control varies with location- and time-specific factors, including the relative amounts of VOC and NOx present. In rural areas with high concentrations of VOC from biogenic sources, ozone formation and control

is governed by NOx. In some urban core situations, NOx 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 NOx 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 NOx control strategy would be most

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

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

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

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[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.

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 PM2.5. Standards also exist for particles smaller than a nominal 10 μm aerodynamic diameter (or PM10) 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 PM2.5 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 atmosphere are called "secondary" particles.[18] The most common source of directly emitted PM2.5 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 NOx. Certain high energy industrial processes also emit primary PM2.5. Examples of direct PM2.5 sources

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[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).

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 PM2.5 include SO2, NOx, certain VOCs and NH3. The SO2 and NOx 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 PM2.5 forming gases (SO2, NOx, certain VOCs, NH3) include nearly every source category of air pollutants. Major SO2 sources in the U.S. include coal-fired power plants and industrial boilers and smelters. Major NOx 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 PM2.5 involves complex processes that depend on factors such as the amounts of needed precursor gases; the concentrations of other reactive species such as ozone (O3), hydroxyl radicals (OH-), or hydrogen peroxide (H2O2); 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 PM2.5 and the pollutants and sources that form ozone. More complete discussions of the formation and characteristics of secondary particles can be found in

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

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 PM2.5 and Major Components

As noted in section I above, the most recent PM2.5 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

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[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.

comparing recent PM2.5 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 PM2.5 observed in urban areas.

The EPA Speciation Network and IMPROVE data also permits comparison of the regional contribution of the major components that comprise PM2.5. 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 PM2.5 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 PM2.5 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

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[24] V. Rao, N. Frank, A. Rush, F. Dimmick, Chemical Speciation of PM2.5 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.

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 PM2.5 and components provide useful insights into the relative importance of various sources and atmospheric processes. In the East, rural PM2.5 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, PM2.5 concentrations in urban areas in the Northeast, industrial Midwest, and upper Midwest regions peak both in the winter and in the summer and are 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 PM2.5 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 PM2.5

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

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

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 SO2 reductions in lowering regional and urban PM2.5 concentrations. Both observations and modeling simulations (see subsection II.B.4 below) suggest that regional SO2 reductions are effective at reducing sulfates and PM2.5. When SO2 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 PM2.5 reduction due to sulfate. This phenomenon is termed “nitrate replacement.” Under these conditions, SO2 reductions will not be as effective at reducing PM2.5. 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 (SO2 controls) will be more effective at lowering PM2.5 if complemented by strategies that reduce nitrates (NOx controls), particularly in the winter.

This chemistry also has implications for the role of ammonia sources in contributing to regional PM2.5. 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 SO2 and NOx 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 PM2.5 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 PM2.5, while in other cases, the decrease

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[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.

will reduce total nitrate contributions.[28]

In essence, the effect of significant reductions in ammonia on PM2.5 is least in conditions with low particulate nitrate levels (e.g., warm conditions) or low nitric acid vapor levels (e.g., through NOx 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 SO2 and NOx emissions would create conditions that would reduce the effectiveness of ammonia controls in reducing PM2.5.

In addition to these direct effects of ammonia controls on PM2.5, ammonia is a weak base that serves to partially neutralize acids that occur in PM2.5. As such, reducing ammonia will make PM2.5, clouds, and precipitation more acidic, thereby exacerbating acidifying precipitation (acid rain) and possibly causing health effects related to PM2.5 acidity. Through this increased acidity of clouds and fogs, ammonia reductions

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[28] The marginal effectiveness of reducing ammonia on PM2.5 is examined in West, J. J., A. S. Ansari, and S. N. Pandis, Marginal PM2.5: nonlinear aerosol mass response to sulfate reductions in the eastern US, *Journal Air & Waste Management Assoc.*, 49(12): 1415-1424, 1999.

can slow the conversion of SO2 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, NOx 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 PM2.5 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

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[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.

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 - NOx 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 and properties of SOA, it

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[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.

remains the least understood component of PM2.5. 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 SO2 Reductions

As noted above, sulfates from SO2 comprise the

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

largest component of regional transport in the East. Fortunately, we already have significant observational evidence of the effectiveness of reducing regional SO2 emissions. By contrast, while small to modest Nox 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 NOx. 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 SO2 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

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[34] Butler, Thomas J., Gene E. Likens, Francoise M. Vermeylen and Barbara J. B. Stunder. The relation between NOx emissions and precipitation $NO3^-$ in the eastern USA, *Atmospheric Environment,* Volume 37, Issue 15, May 2003, Pages 2093-2104.

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 SO2 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 SO2 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 SO2 emission sources to areas throughout the East.

Since 1990, SO2 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 SO2 concentrations (3-year average 2000-2002) to SO2 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

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[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.

detect temporal patterns in SO2 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 SO2 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 SO2 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 SO2 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

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[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.

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 SO2 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 PM2.5 and 8-hour ozone in downwind

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[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.

States. Based on that assessment, the EPA is proposing emissions reduction requirements for SO2 and NOx 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 PM2.5 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 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 NOx 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 NOx 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 PM2.5.

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 PM2.5 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 PM2.5 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 SO2 and NOx are the chief emissions contributing to interstate transport of PM2.5. 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 NOx.
- For both PM2.5 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 PM2.5, the nonattainment areas analyzed are estimated to receive a transport contribution attributable to SO2 and NOx 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 PM2.5, we are proposing to find that SO2 and NOx emissions in 28 States and the District of Columbia will contribute significantly in 2010 to PM2.5 levels in downwind nonattainment areas in amounts that exceed an air quality significance threshold proposed today.
- For ozone, we are proposing to find that NOx 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 NOx 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 NOx 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 SO2 and 1.3 million annual tons for NOx.
- 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 SO2 and 1.6 million tons for NOx.
- 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 SO2 (40 percent) and 1.5 million tons NOx (49 percent) by 2010, and 3.7 million tons SO2 (44 percent) and 1.8 million tons NOx (58 percent) by 2015.

- Compared to EGU emissions in 2002 in the affected States, at full implementation of today's proposal SO2 emissions would be reduced about 71 percent. On the same basis, NOx 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 PM2.5 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 SO2, NOx, 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 SO2 and NOx reductions, emissions cap and trade programs that would provide a seamless transition from the current title IV and NOx SIP Call programs.

2. Linkages Between PM2.5 and 8-hour Ozone Transport Requirements

Although PM2.5 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 PM2.5 and ozone in an integrated manner in developing this proposal. The linkages between PM2.5 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 NOx and SO2 contribute to PM2.5 nonattainment, and NOx emissions also contribute to 8-hour ozone nonattainment. Moreover, because the power generation sector and other source types are major emitters of both NOx and SO2, and because control actions for these pollutants may reinforce or compete with each other, it is also appropriate to address NOx and SO2 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 NOx 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 NOx 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 NOx SIP Call rulemaking, we made the affirmative technical determinations with respect to the same sources in certain of the same States covered under the NOx 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 NOx 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 NOx 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 Nox 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 NOx 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 NOx 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 SO2 and NOx, 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 NOx 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 SO2 or NOx 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 PM2.5 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 PM2.5 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 PM2.5 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 PM2.5 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 PM2.5 and 8-hour ozone NAAQS. For the 3-year period 2000-2002, 120 counties with monitors exceed the annual PM2.5 NAAQS and 297 counties

with monitor readings exceed the 8-hour ozone NAAQS.[42] Nonattainment of the PM2.5 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 PM2.5 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

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[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 PM2.5 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.

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 (CAMx), and with the PM2.5 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 PM2.5 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 NOx SIP Call) as well as regulations that have been proposed and that we expect

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[43] See section IV, Air Quality Modeling to Determine Future 8-hour Ozone and PM2.5 Concentrations, for more detail on the approach summarized in this subsection.

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 PM2.5 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

[44] The EPA also considered the current and likely future nonattainment of the PM10 NAAQS and the 24-hour average PM2.5 NAAQS. Only a small number of areas are presently experiencing PM10 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 PM10 implementation in the period from 2010, or beyond, and therefore PM10 is not a subject of today's proposal. Few areas, all in the western U.S., presently have violations of the 24-hour average PM2.5 NAAQS, and all of these are also violating the annual PM2.5 NAAQS. We believe that to the extent interstate transport is contributing to nonattainment of the 24-hour PM2.5 NAAQS, actions aimed at the broader problem of PM2.5 nonattainment will correct any transport affecting 24-hour PM2.5 also. The 24-hour PM2.5 standard was not further assessed in our analysis for today's proposal.

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 PM2.5 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 PM2.5 and 8-hour ozone NAAQS through local emissions reductions with reasonably available control measures, or whether the amount of transport from 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 PM2.5 standards, we developed a group of emissions reduction measures for SO2, NOx, direct PM2.5, 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 PM2.5 reductions ranging from about 0.5 μg/m^3 to about 0.9

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

$\mu g/m^3$, 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 PM2.5 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 SO2 emissions. This indicates in particular that broader reductions in regionwide

emissions of SO2, from sources located both inside and outside potential nonattainment areas, would lead to sizable reductions in PM2.5 concentrations.[46]

b. Eight-hour Ozone

Our analyses suggest that NOx 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 NOx SIP Call).[47] Our analysis also shows that additional highly cost-effective reductions of NOx from power plants are available. Given continued widespread ozone nonattainment, we believe it is appropriate to require additional reductions in NOx emissions that contribute to future nonattainment due to

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[46] This particular type of analysis is not able to similarly distinguish the separate effects of upwind and local NOx emissions reductions, but other types of analysis described in section V show the usefulness of upwind NOx reductions in reducing PM2.5 concentrations in nonattainment areas.

[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.

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 PM2.5 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 PM2.5. 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 PM2.5 in many downwind States, even if the upwind State is a considerable distance from the downwind States.

These analyses further conclude that sources of SO2 and NOx emissions continue to play a strong role in transported PM2.5. 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 PM2.5 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 PM2.5 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 SO2 and NOx emissions from EGUs in certain states east of the continental divide (see section IX), EPA proposes to base the PM2.5 requirements on man-made SO2 and NOx emissions, and not other pollutants. As summarized below, current information related to sources and controls for the other components identified in transported PM2.5 (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 PM2.5 components.

Carbonaceous substances (organic compounds and soot) form a large component of PM2.5 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 PM2.5 (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 NOx reductions could provide some additional benefit. Measures adopted to reduce man-made VOC emissions should also tend to reduce secondary organic PM2.5.

We also do not feel it is necessary or appropriate at this time to attempt to reduce the ammonium portion of PM2.5 through regional ammonium controls. As indicated in section II, it is reasonable to expect that simultaneous significant reductions in regional SO2 and NOx 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 SO2 and NOx controls is unattractive because it increases the acidity of PM2.5 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 NOx 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 PM2.5 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 SO2 and NOx from coal-fired EGUs would have co-benefits in reducing those direct emissions of PM2.5 that are now classified as crustal material.

The proposed decisions to focus on SO2 and NOx reductions for addressing interstate pollution transport should not preclude controls related to carbonaceous particles, ammonium, or other significant PM2.5 sources on a local basis, where these can be adopted cost effectively in local PM2.5 control plans. We welcome comment on the choice to not regulate the above components of transported PM2.5, 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 NOx SIP Call proposal, the OTAG Regional and Urban Scale Modeling and Air Quality Analysis Work Groups reached the following conclusions:

- Regional NOx emissions reductions are effective in producing ozone benefits; the more NOx 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 NOx emissions for the purpose of reducing interstate ozone transport.

4. Role of Interstate Transport in Future Nonattainment

a. Fine Particles

For PM2.5, we used a “zero-out” approach to assess PM2.5 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 SO2 and NOx emissions. We then compared the predicted downwind concentrations in the 2010 base case, which included the State’s SO2 and NOx emissions, to the “zero-out” case which excluded all of the State’s man-made SO2 and NOx emissions. From these results, we were able to evaluate the impact of, for example, Ohio’s total man-made SO2 and NOx 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 PM2.5 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 PM2.5 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 PM2.5 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 PM2.5 NAAQS, there are significant public health impacts associated with ambient PM2.5, 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 PM2.5 transport contribution threshold is appropriate.

Second, our analysis of "base case" PM2.5 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 PM2.5 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 PM2.5 transport contribution threshold is appropriate.

We adopted a similar approach for determining the significance level for ozone transport in the NOx SIP Call rulemaking, and the D.C. Circuit viewed this approach as reasonable when the Court generally upheld

the NOx 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 NOx 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 PM2.5 transport.

In applying this approach, we first considered a significance level of 0.10 μg/m^3. This is a small level, which is consistent with the factors described. Further, an increment of this size in the annual average PM2.5 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 PM2.5 NAAQS is 15.0 μg/m^3 (three significant figures), a concentration after rounding of 15.1 μg/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 an 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 PM2.5 significance level equal to 1 percent of the standard. We believe that contributions equal to or

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

greater than 0.15 μg/m^3 would reflect a reasonable threshold for determining significant levels of interstate transport.

Applying the proposed cutoff of 0.15 μg/m^3 or higher to the results of the transport impact assessment identifies SO2 and NOx 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 PM2.5 contributions, are listed in section V, Table V-5.

Although we are proposing to use 0.15 μg/m^3 as the air quality criteria, we have also analyzed the effects of using 0.10 μg/m^3. Based on our current modeling, two additional states, Oklahoma and North Dakota, would be included if we were to adopt 0.10 μg/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 μg/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.

b. Eight-hour Ozone

In assessing the role of interstate transport to 8-hour ozone nonattainment, we have followed the approach used in the NOx SIP Call, but have used an updated model and updated inputs that reflect current requirements (including the NOx 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 NOx 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 NOx SIP Call, we have concluded that, even with reductions from the NOx SIP Call and other control measures that will

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

reduce NOx and VOC emissions, interstate transport of NOx 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 NOx 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 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 PM2.5 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 SO2 and NOx 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 NOx SIP Call, in which we determined such controls by comparing the cost of recently required controls, and to apply it to the SO2 and NOx precursors of PM2.5 and 8-hour ozone nonattainment.

For today's proposal, EPA independently evaluated the cost effectiveness of strategies to reduce SO2 and NOx to address PM2.5 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 PM2.5 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 NOx SIP Call, we believe this is a reasonable amount of time. The NOx 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 NOx

SIP Call given the focus on a single pollutant, NOx, and the attainment deadlines facing downwind 1-hour ozone nonattainment areas. Since today's proposal requires affected States to control both SO2 and NOx emissions, and to do so for the purpose of addressing both the PM2.5 and 8-hour ozone NAAQS, we believe it is reasonable to allow affected States more time than was allotted in the NOx 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' PM2.5 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 PM2.5 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

[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 PM2.5 and 8-hour ozone NAAQS.

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 SO2 of 3.9 million tons together with a NOx 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 SO2 and NOx emissions reductions can be achieved by January 1, 2015, and will be helpful to areas with PM2.5 or 8-hour ozone attainment

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

dates approaching 2015. The EGU caps in the proposed control region would be lowered in the second phase to 2.7 million tons for SO2 and 1.3 million tons for NOx. 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. SO2 and NOx Regionwide Emissions Reductions and Emissions Caps

	2002 Emissions (tons)	2010 (tons)		2015 (tons)	
		Baseline Emissions	Cap	Baseline Emissions	Cap
SO2	9.4M	9.0M	3.9M	8.3M	2.7M
NOx	3.7M	3.1M	1.6M	3.2M	1.3M

We derived these amounts as follows: The SO2 emissions limitations correspond to 65 percent of the affected States' title IV allowances in 2015, and 50 percent in 2010. The NOx 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

[52] Excludes emissions from Connecticut.

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 SO2, 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 NOx, 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 PM2.5 transport, and 25 States and the District of Columbia for the purpose of addressing ozone transport. For States

required to reduce NOx emissions to address 8-hour ozone transport, the NOx reductions must be implemented at least during the ozone season. For States required to reduce SO2 and NOx emissions to address PM2.5 transport, the NOx and SO2 reductions must be achieved annually. For States affected for both PM2.5 and ozone, EPA is proposing that compliance with the PM2.5-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 NOx SIP Call and today's proposed action, while ensuring that the ozone benefits of the NOx SIP Call are not jeopardized. The EPA is proposing that States may choose to recognize compliance with the more stringent annual NOx reduction requirements contained in today's rulemaking as satisfying the original NOx SIP Call seasonal reduction requirements for sources that States cover under both the NOx 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 NOx emissions in 2010 and two-thirds of the man-made SO2 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 NOx and SO2 emissions from the EGU sector.

We are proposing that (as under the NOx 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 SO2 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 NOx 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 SO2 and NOx 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 SO2 and NOx emissions reduction requirements proposed in today's rule.

If a State imposes the full amount of SO2 and NOx 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 NOx 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 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 SO2 and NOx 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 Nox emission levels and two separate cap and trade zones for NOx. States included on the basis of their contribution to either ozone or PM2.5 nonattainment would be in one zone and would need to meet the NOx 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 SO2 and NOx 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

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[53] See 40 CFR 49.4(a).

> 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.

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 PM2.5 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 SO2 and NOx emissions from upwind States on downwind annual average PM2.5 concentrations, and the impacts of NOx 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 PM2.5 concentrations for future year scenarios. We also present the results of modeling locally applied control measures designed to reduce concentrations of PM2.5 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

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[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.

modeling platform will be made public in a Notice of Data Availability.

B. Ambient 8-Hour Ozone and Annual Average PM2.5 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,

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[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.

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 www.epa.gov/airtrends/values.html.

2. Annual Average PM2.5 Design Values

Future year levels of air quality are estimated by applying relative changes in model predicted PM2.5 to

current measurements of ambient PM2.5 data. Current measurements of ambient PM2.5 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 PM2.5, 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 PM2.5 is in the Air Quality Data Analysis Technical Support Document.

In analyzing the PM2.5 data across the United States, the raw monitoring data must be processed into a form pertinent for useful interpretations. For this action, the PM2.5 data have been processed consistent with the formats associated with the NAAQS for PM2.5. The resulting estimates are used to indicate the level of air quality relative to the NAAQS. For PM2.5, 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 PM2.5 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 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)(www.epa.gov/otaq/models/hd2007/r00020.pdf) and Land-based Non-road Diesel Engines (LNDE) (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 (NOx); volatile organic compounds (VOC); carbon monoxide (CO); sulfur dioxide (SO2); direct particulate matter with an aerodynamic diameter less than 10 micrometers (PM10) and less than 2.5 micrometers (PM2.5); and ammonia (NH3). 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 PM2.5. 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 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 PM2.5 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 NOx SIP Call as remanded (excludes controls in Georgia and Missouri), and Reasonably Available Control Techniques (RACT) for NOx 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 SO2 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 NOx 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 NOx 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 PM2.5 nonattainment status were obtained from version 2.1.6 of the Integrated Planning Model (IPM) (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

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

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 SO2 and NOx, 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 SO2 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
KS	71,500	63,500	16,000	300	800	3,500	84,100
KY	393,300	363,100	42,900	500	1,800	58,000	466,400
LA	96,300	112,500	193,600	400	21,100	94,000	421,700
ME	4,700	3,200	22,200	200	200	10,800	36,600
MD	261,400	232,200	22,500	600	8,100	900	264,300
MA	17,700	15,600	15,300	600	1,200	61,300	94,000
MI	375,800	387,600	135,000	1,000	1,300	32,700	557,600
MN	94,200	91,600	41,200	500	1,100	5,700	140,000
MS	84,600	73,500	77,500	400	2,000	82,700	236,100
MO	261,000	293,100	128,600	700	900	31,900	455,200
MT	17,700	17,900	34,700	100	300	1,400	54,400
NE	97,200	97,600	7,300	200	600	10,100	115,800
NV	56,700	16,400	3,500	200	400	3,900	24,300
NH	7,300	7,300	7,900	100	200	90,800	106,300
NJ	85,300	41,300	70,800	700	53,500	42,600	208,900
NM	48,300	48,600	115,200	300	200	9,400	173,700
NY	211,400	214,100	168,600	1,300	2,200	122,100	508,200
NC	221,500	219,400	95,400	1,000	1,200	33,800	350,800
ND	172,200	160,900	56,100	100	400	64,100	281,600
OH	979,300	1,258,700	337,600	1,200	5,700	63,300	1,666,40
OK	133,000	133,000	41,200	500	600	5,500	180,800
OR	15,200	15,200	6,600	400	800	20,900	43,800
PA	670,200	853,400	141,000	1,100	3,300	80,900	1,079,80
RI	0	0	2,400	100	2,900	4,100	9,500
SC	191,500	199,700	63,900	500	1,200	15,600	280,900
SD	42,100	36,300	1,400	100	200	23,800	61,800
TN	317,300	306,100	134,300	700	2,800	47,800	491,700
TX	539,900	487,700	318,600	2,300	33,400	9,600	851,700
UT	31,200	31,500	30,300	300	400	13,100	75,600
VT	0	0	2,000	100	100	13,000	15,100
VA	180,600	187,800	112,700	900	4,600	9,500	315,400
WA	6,000	6,000	51,600	600	9,500	3,700	71,400
WV	456,800	550,600	62,200	200	33,600	11,300	658,000
WI	217,200	214,100	88,500	600	800	45,900	349,800
WY	47,100	47,300	59,700	100	200	17,300	124,600
	9,435,400	9,856,900	3,799,200	29,800	236,400	1,367,600	15,290,0

[1] All values rounded to nearest 100 tons. EGU v216 emissions are latest version and are included in totals. EGU v21 emissions were used for the zero-out analysis.

Table IV-2. State NOx Emissions by Sector in the 2010 Base Case [1]

ST	EGU v21	EGU v216	Non-EGU	On-road	Non-road	Area	Total
AL	129,500	134,100	83,400	110,200	55,800	69,400	453,000
AZ	88,200	84,600	118,200	91,300	43,600	78,100	415,700
AR	52,600	52,500	23,500	64,900	35,400	44,800	221,100
CA	18,200	17,700	137,300	401,900	276,100	129,300	962,300
CO	87,000	82,700	44,900	80,600	57,000	59,900	325,100
CT	6,700	5,200	11,300	48,500	17,300	9,300	91,600
DE	11,500	10,300	8,500	17,400	16,800	6,900	59,900
DC	100	0	800	4,800	5,400	1,900	13,000
FL	162,900	161,800	59,000	293,900	147,900	53,200	716,000
GA	152,500	150,600	71,400	189,200	66,400	74,700	552,300
ID	1,400	1,200	6,600	32,700	17,300	29,400	87,200
IL	194,200	171,400	134,900	177,700	150,200	115,800	750,100
IN	223,300	239,700	45,400	142,900	90,400	37,900	556,300
IA	95,400	86,100	26,500	61,600	57,600	31,100	262,900
KS	101,400	100,900	108,800	59,100	79,500	74,300	422,600
KY	186,300	195,900	34,800	95,700	73,100	76,900	476,400
LA	64,700	49,800	297,100	89,300	205,000	103,500	744,700
ME	6,000	2,100	15,600	30,600	8,800	4,900	62,000
MD	60,500	60,600	19,100	73,100	38,900	15,900	207,700
MA	27,800	10,400	18,200	74,400	70,000	24,900	197,800
MI	126,200	125,400	161,000	171,400	63,200	115,600	636,500
MN	109,700	104,500	83,800	103,400	64,800	24,800	381,500
MS	49,700	43,200	74,400	68,800	44,800	56,700	287,800
MO	144,700	137,000	29,700	117,800	64,200	14,800	363,600
MT	38,500	38,500	20,800	24,800	34,000	18,400	136,400
NE	58,100	57,800	14,500	37,700	57,400	15,400	182,800
NV	44,800	37,400	6,000	36,300	25,400	8,500	113,500
NH	3,000	3,600	4,200	25,700	6,200	13,900	53,700
NJ	40,000	29,300	51,000	93,100	86,400	79,800	339,600
NM	77,300	76,400	68,700	54,500	10,700	32,400	242,800
NY	58,700	68,400	36,700	181,500	90,900	88,100	465,600
NC	64,700	62,100	63,300	150,000	60,100	37,000	372,400
ND	81,100	77,900	7,200	16,400	41,800	21,200	164,600
OH	249,100	266,800	77,500	201,300	116,900	82,200	744,700
OK	97,700	82,100	121,000	86,800	40,000	33,200	363,100
OR	18,000	13,300	16,800	67,400	52,600	39,900	190,000
PA	212,100	209,800	173,000	200,600	80,600	114,300	778,300
RI	1,300	1,400	900	12,300	5,600	2,800	23,000
SC	67,500	64,700	46,000	94,200	29,900	26,100	260,900
SD	13,800	11,700	4,700	20,200	24,400	7,900	69,000

TN	106,700	102,800	78,000	132,900	138,900	52,300	505,000
TX	246,200	200,900	523,800	399,600	432,100	43,100	1,599,50
UT	68,400	69,400	31,600	49,000	31,500	23,500	205,100
VT	0	0	800	16,000	3,900	11,500	32,100
VA	55,800	55,500	66,500	147,000	76,600	45,700	391,300
WA	26,600	28,400	47,000	114,600	78,800	23,000	291,800
WV	142,500	155,200	50,100	40,400	57,000	21,300	324,000
WI	116,200	111,500	54,300	109,600	51,000	58,700	385,100
WY	90,300	90,500	49,500	18,600	22,900	71,700	253,200
	4,079,200	3,943,400	3,228,200	4,931,900	3,405,000	2,225,900	17,734,4

[1] All values rounded to nearest 100 tons. EGU v216 emissions are latest version and are included in totals. EGU v21 emissions were used for the zero-out analysis.

b. Development of Emissions Inventories for On-road Vehicles

The 2001 base year inventory for the on-road vehicle sector was developed by applying State and pollutant specific adjustment ratios to each grid cell's emissions as found in the existing 1996 model-ready file for on-road sources. The adjustment ratios were created by dividing State-level emissions for each pollutant as estimated for the 2001 NEI using the MOBILE6 model by the State-level emissions for 1996 as estimated using the same MOBILE6 model.

The 1996 model-ready file, along with consistent files for 2007 and 2020 emissions, had been developed for previous EPA rulemakings using a version of the MOBILE5b model which had been adjusted to simulate the MOBILE6

model that was under development at that time. The 1996 and 2007 emissions files had been developed for the HDDE rule (www.epa.gov/otaq/models/hd2007/r00020.pdf) and the 2020 emissions file had been developed for the LNDE rule (www.epa.gov/nonroad/454r03009.pdf). Note that the 2020 on-road vehicle emissions file developed for the LNDE rule includes the reductions expected from implementation of the HDDE rule.

Application of the MOBILE6-based adjustment ratios to the 1996 MOBILE5b-based emission file allowed the resulting 2001 model-ready file to remain consistent in methodology with the existing 2007 and 2020 files. The 2010 and 2015 base case emissions files used for this proposal were then developed as straight-line interpolations between those 2007 and 2020 files, and they are therefore also consistent with the 2001 file.

c. Development of Emissions Inventories for Non-road Engines

For the non-road sector, the 2001 model-ready emissions file was developed in a manner similar to that described above for the on-road vehicle sector. State-level 2001 NEI emissions developed from the NONROAD2002 model were divided by a consistent set of emissions for

1996, also developed using the NONROAD2002 model, to produce a set of adjustment ratios for each State and pollutant. These adjustment ratios were applied to the existing 1996 model-ready emissions for each grid cell to produce a 2001 model-ready file that remains consistent with the 1996 file and the existing future projections that were based on that 1996 file.

For the future scenarios, the 2010 and 2020 emissions files developed for EPA's analysis of the preliminary controls of the LNDE rule were modified to reflect that rule as finally proposed (68 FR 28327, May 23, 2003) and to incorporate the effects of the Large Spark Ignition and Recreational Vehicle rules. These modifications were done using adjustment ratios developed from national-level estimates of the benefits of these two rules. A 2015 emissions file for this sector was then developed as a straight-line interpolation between the modified 2010 and 2020 files.

d. Development of Emissions Inventories for Other Sectors

The NEI estimates for 2001 were not available at the time modeling was begun for the remaining two man-made emission sectors: non-EGU point sources and area sources.

For these two sectors, linear interpolations were performed between gridded 1996 emissions and gridded projected 2010 base case emissions to produce gridded 2001 emissions files. The gridded emissions input files for 1996 and 2010 were available from previous EPA analyses. The interpolations were done separately for each of the two sectors, for each grid cell, and for each pollutant. The 2010 and 2015 emissions files for these sectors that were used as part of this interpolation to 2001 were themselves developed as straight-line interpolations between the 2007 and 2020 inventories described above for the on-road vehicle sector. The interpolated 2010 and 2015 emissions were adjusted to reflect the SO2, PM10, and PM2.5 co-control benefits of the proposed Industrial Boiler and Process Heater MACT (68 FR 1660, January 13, 2003). The 2007 and 2020 projection inventories had been developed by applying State- and 2-digit SIC-specific economic growth ratios to the 1996 NEI, followed by application of any emissions control regulations.

5. Preparation of Emissions for Air Quality Modeling

The annual and summer day emissions inventory files were processed through the Sparse Matrix Operator Kernel

Emissions (SMOKE) Modeling System version 1.4 to produce 36-km gridded input files for annual PM2.5 air quality modeling and 12-km input files for episodic ozone air quality modeling. In addition to the U.S. man-made emission sources described above, hourly biogenic emissions were estimated for individual modeling days using the BEIS model version 3.09 (ftp.epa.gov/amd/asmd/beis3v09/). Emissions inventories for Canada and for U.S. offshore oil platforms were merged in using SMOKE to provide a more complete modeling data set. The single set of biogenic, Canadian, and offshore U.S. emissions was used in all scenarios modeled. That is, the emissions for these sources were not varied from run to run. Additional information on the development of the emissions data sets for modeling is provided in the AQMTSD.

D. Ozone Air Quality Modeling

1. Ozone Modeling Platform

The CAMx was used to assess 8-hour ozone concentrations as part of this rulemaking. The CAMx is a publicly available Eulerian model that accounts for the processes that are involved in the production, transport, and destruction of ozone over a specified three-

dimensional domain and time period. Version 3.10 of the CAMx model was employed for this analyses. More information on the CAMx model can be found in the model user's guide.[57] The model simulations were performed for a domain covering the Eastern U.S. and adjacent portions of Canada.

Three episodes during the summer of 1995 were used for modeling ozone and precursor pollutants: June 12-24, July 5-15, and August 10-21. The start of each episode was chosen to correspond to a day with no ozone exceedances (an exceedance is an 8-hour daily maximum ozone concentration of 85 ppb or more). The first three days of each episode are considered ramp-up days and were discarded from analysis to minimize effects of the clean initial concentrations used at the start of each episode. In total, thirty episode days were used for analyzing interstate transport. As described in the AQMTSD, these episodes contain meteorological conditions that reflect various ozone transport wind patterns across the East. In general, ambient ozone concentrations during these episodes span the range of 2000-2002 8-hour ozone design

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[57] Environ, 2002: User's Guide to the Comprehensive Air Quality Model with Extensions (CAMx), Novato, CA.

values at monitoring sites in the East.

In order to solve for the change in pollutant concentrations over time and space, the CAMx model requires certain meteorological inputs for the episodes being modeled, including: winds, temperature, water vapor mixing ratio, atmospheric air pressure, cloud cover, rainfall, and vertical diffusion coefficient. Most of the gridded meteorological data for the three historical 1995 episodes were developed by the New York Department of Environment and Conservation using the Regional Atmospheric Modeling System (RAMS), version 3b. A model performance evaluation[58] was completed for a portion of the 1995 meteorological modeling (July 12-15). Observed data not used in the assimilation procedure were compared against modeled data at the surface and aloft. This evaluation concluded there were no widespread biases in the RAMS meteorological data. The remaining meteorological inputs (cloud fractions and rainfall rates) were developed based on observed data.

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[58] Hogrefe, C., S.T. Rao, P. Kasibhatla, G. Kallos, C. Tremback, W. Hao, D. Olerud, A. Xiu, J. McHenry, K. Alapaty, 2001. "Evaluating the performance of regional-scale photochemical modeling systems: Part-I meteorological predictions." *Atmospheric Environment*, vol. 35, No 34, 4159-4174.

2. Ozone Model Performance Evaluation

The CAMx model was run with Base Year emissions in order to evaluate the performance of the modeling platform for replicating observed concentrations. This evaluation was comprised principally of statistical assessments of paired model/observed data. The results indicate that, on average, the predicted patterns and day-to-day variations in regional ozone levels are similar to what was observed with measured data. When all hourly observed ozone values (greater than 60 ppb) are compared to their model counterparts for the 30 days modeled (paired in time and space), the mean normalized bias is -1.1 percent and the mean normalized gross error is 20.5 percent. As described in the AQMTSD, the performance for individual episodes indicates variations in the degree of model performance with a tendency for underprediction during the June and July episodes and overprediction during the August episode.

At present, there are no generally accepted statistical criteria by which one can judge the adequacy of model performance for regional scale ozone model applications. However, as documented in the AQMTSD, the base year modeling for today’s rule represents an

improvement in terms of statistical model performance when compared to prior regional modeling analyses (e.g., model performance analyses for OTAG, the Tier-2/Low Sulfur Rule, and the Heavy Duty Engine Rule).

3. Projection of Future 8-Hour Ozone Nonattainment

Ozone modeling was performed for 2001 emissions and for the 2010 and 2015 Base Cases as part of the approach for forecasting which counties are expected to be nonattainment in these 2 future years. In general, the approach involves using the model in a relative sense to estimate the change in ozone between 2001 and each future base case. Concentrations of ozone in 2010 were estimated by applying the relative change in model predicted ozone from 2001 to 2010 with present-day 8-hour ozone design values (2000-2002). The procedures for calculating future case ozone design values are consistent with EPA's draft modeling guidance[59] for 8-hour ozone attainment demonstrations, "Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS." The draft

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[59] U.S. EPA, 1999: Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

guidance specifies the use of the higher of the design values from (a) the period that straddles the emissions inventory Base Year or (b) the design value period which was used to designate the area under the ozone NAAQS. In this case, 2000-2002 is the design value period which straddles the 2001 Base Year inventory and is also the latest period which is available for determining designation compliance with the NAAQS. Therefore, 2000-2002 was the only period used as the basis for projections to the future years of 2010 and 2015.

The procedures in the guidance for projecting future 8-hour ozone nonattainment are as follows:

Step 1: Hourly model predictions are processed to determine daily maximum 8-hour concentrations for each episode day modeled. A relative reduction factor (RRF) is then determined for each monitoring site. First, the multi-day mean (excluding ramp-up days) of the 8-hour daily maximum predictions in the nine grid cells that include or surround the site is calculated using only those predictions greater than or equal to 70 ppb, as recommended in the guidance. This calculation is performed for the base year 2001 scenario and the future-year scenario. The RRF for a site is the ratio of the

mean prediction in the future-year scenario (e.g., 2010) to the mean prediction in the 2001 base year scenario. The RRFs were calculated on a site-by-site basis.

Step 2: The RRF for each site is then multiplied by the 2000-2002 ambient design value for that site, yielding an estimate of the future design value at that particular monitoring location.

Step 3: For counties with only one monitoring site, the value at that site was selected as the value for that county. For counties with more than one monitor, the highest value in the county was selected as the value for that county. Counties with projected 8-hour ozone design values of 85 ppb or more are projected to be nonattainment.

As an example, consider Clay County, Alabama which has one ozone monitor. The 2000-2002 8-hour ambient ozone design value is 82 ppb. In the 2001 base year simulation, 24 of the 30 episode modeling days have CAMx values of 70 ppb or more in one of the nine grid cells that include or surround the monitor location. The average of these predicted ozone values is 88.62 ppb. In 2010, the average of the predicted values for these same grid cells was 70.32 ppb. Therefore, the RRF for this

location is 0.79, and the projected 2010 design value is 82 multiplied by 0.79 equals 65.07 ppb. All projected future case design values are truncated to the nearest ppb (e.g., 65.07 becomes 65). Since there are no other monitoring locations in Clay County, Alabama, the projected 2010 8-hour design value for this county is 65 ppb.

The RRF approach described above was applied for the 2010 and 2015 Base Case scenarios. The resulting 2010 and 2015 Base Case design values are provided in the AQMTSD. Of the 287 counties that were nonattainment based on 2000-2002 design values, 47 are forecast to be nonattainment in 2010 and 34 in 2015. None of the counties that were measuring attainment in the period 2000-2002 are forecast to become nonattainment in the future. Those counties projected to be nonattainment for the 2010 and 2015 Base Cases are listed in Table IV-3.

Table IV-3. Counties Projected to be Nonattainment for the 8-hour Ozone NAAQS in the 2010 and 2015 Base Cases

State	2010 Base Case Projected Nonattainment Counties	2015 Base Case Projected Nonattainment Counties
AR	Crittenden	Crittenden
CT	Fairfield, Middlesex, New Haven	Fairfield, Middlesex, New Haven
DC	Washington, D.C.	Washington D.C.
DE	New Castle	None
GA	Fulton	None
IL	None	Cook

IN	Lake	Lake
MD	Anne Arundel, Baltimore, Cecil, Harford, Kent, Prince Georges	Anne Arundel, Cecil, Harford
MI	None	Macomb
NJ	Bergen, Camden, Cumberland, Gloucester, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean	Bergen, Camden, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean
NY	Erie, Putnam, Richmond, Suffolk, Westchester	Erie, Richmond, Suffolk, Westchester
NC	Mecklenburg	None
OH	Geauga, Summit	Geauga
PA	Allegheny, Bucks, Delaware, Montgomery, Philadelphia	Bucks, Montgomery, Philadelphia
RI	Kent	Kent
TX	Denton, Harris, Tarrant	Harris
VA	Arlington, Fairfax	Arlington, Fairfax
WI	Kenosha, Racine, Sheboygan	Kenosha, Sheboygan

The counties projected to be nonattainment for the 2010 Base Case are the nonattainment receptors used for assessing the contribution of emissions in upwind States to downwind nonattainment as part of today's proposal. It should be noted that the approach used to identify these nonattainment receptors differed from that used in the NOx SIP Call where we aggregated on a State-by-State basis all grid cells which were both (a) associated with counties that violated the 8-hour NAAQS (based on 1994-1996 data), and (b) had future base case predictions of 85 ppb or more. For this proposal, we have treated each individual county projected to be nonattainment in the

future as a downwind nonattainment receptor.

E. The PM2.5 Air Quality Modeling

1. The PM2.5 Modeling Platform

The REMSAD model version 7 was used as the tool for simulating base year and future concentrations of PM2.5 in support of today's proposed rule. The REMSAD is a publicly available model. An overview of the scientific aspects of this model is provided below. More detailed information can be found in the REMSAD User's Guide.[60] The basis for REMSAD is the atmospheric diffusion equation (also called the species continuity or advection/diffusion equation). This equation represents a mass balance in which all of the relevant emissions, transport, diffusion, chemical reactions, and removal processes are expressed in mathematical terms.

The REMSAD simulates both gas phase and aerosol chemistry. The gas phase chemistry uses a reduced-form version of Carbon Bond (CB4) chemical mechanism termed "micro-CB4" (mCB4). Formation of secondary PM species, such as sulfate[61] and nitrate, is simulated through

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[60] ICF Kaiser, 2002: User's Guide to the REgional Modeling System for Aerosols and Deposition (REMSAD) Version 7, San Rafael, CA.

[61] Ammonium sulfates are referred to as "sulfate" in sections IV and V of today's proposed rule.

chemical reactions within the model. Aerosol sulfate is formed in both the gas phase and the aqueous phase. The REMSAD also accounts for the production of secondary organic aerosols through atmospheric chemistry processes. Direct PM emissions in REMSAD are treated as inert species which are advected and deposited without any chemical interaction with other species.

The REMSAD was run using a latitude/longitude horizontal grid structure in which the horizontal grids are generally divided into areas of equal latitude and longitude. The grid cell size was approximately 36 km by 36 km. The REMSAD was run with 12 vertical layers extending up to 16,000 meters, with a first layer thickness of approximately 38 meters. The REMSAD modeling domain used for this analysis covers the entire continental United States.

The REMSAD requires input of winds, temperatures, surface pressure, specific humidity, vertical diffusion coefficients, and rainfall rates. The meteorological input files were developed from a 1996 annual MM5 model run that was developed for previous projects. The MM5 is a numerical meteorological model that solves the full set of physical and thermodynamic equations which govern

atmospheric motions. The MM5 was run in a nested-grid mode with 2 levels of resolution: 108 km, and 36km with 23 vertical layers extending from the surface to the 100 mb pressure level.[62] All of the PM2.5 model simulations were performed for a full year using the 1996 meteorological inputs.

2. The PM2.5 Model Performance Evaluation

An annual simulation of REMSAD was performed for 1996 using the meteorological data and emissions data for that year. The predictions from the 1996 Base Year modeling were used to evaluate model performance for predicting concentrations of PM2.5 and its related speciated components (e.g., sulfate, nitrate, elemental carbon, organic carbon). The evaluation was comprised principally of statistical assessments of model versus observed pairs.

The evaluation used data from the IMPROVE,[63] CASTNet[64]

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[62] Olerud, D., K. Alapaty, and N. Wheeler, 2000: Meteorological Modeling of 1996 for the United States with MM5. MCNC-Environmental Programs, Research Triangle Park, NC.

[63] IMPROVE, 2000. Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report III. Cooperative Institute for Research in the Atmosphere, ISSN: 0737-5352-47.

[64] U.S. EPA, Clean Air Status and Trends Network (CASTNet), 2001 Annual Report.

dry deposition, and NADP[65] monitoring networks. The IMPROVE and NADP networks were in full operation during 1996. The CASTNet dry deposition network was partially shutdown during the first half of the year. There were 65 CASTNet sites with at least one season of complete data. There were 16 sites which had complete annual data. The largest available ambient data base for 1996 comes from the IMPROVE network. The IMPROVE network is a cooperative visibility monitoring effort between EPA, Federal land management agencies, and State air agencies. Data is collected at Class I areas across the United States mostly at national parks, national wilderness areas, and other protected pristine areas. There were approximately 60 IMPROVE sites that had complete annual PM2.5 mass and/or PM2.5 species data for 1996. Forty-two sites were in the West[66] and 18 sites were in the East. The following is a brief summary of the model performance for PM2.5 and deposition. Additional details on model performance are provided in the AQMTSD.

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[65] NADP, 2002: National Acid Deposition Program 2002 Annual Summary.

[66] The dividing line between the West and East was defined as the 100th meridian (e.g., monitoring sites to the east of this meridian are included in aggregate performance statistics for the East).

Considering the ratio of the annual mean predictions to the annual mean observations (e.g., predicted divided by observed) at the IMPROVE monitoring sites REMSAD underpredicted fine particulate mass (PM2.5), by 18 percent. Specifically, PM2.5 in the East was underpredicted by 2 percent, while PM2.5 in the West was underpredicted by 33 percent. Sulfate in the East is slightly underpredicted and nitrate and largely crustal material are overestimated. Elemental carbon is neither overpredicted nor underpredicted in the East. Organic aerosols are slightly overpredicted in the East. All PM2.5 component species were underpredicted in the West.

The comparisons to the CASTNet data show generally good model performance for sulfate. Comparison of total nitrate indicate an overestimate, possibly due to overpredictions of nitric acid in the model.

Performance at the NADP sites for wet deposition of ammonium, sulfate, and nitrate was reasonably good. However, the nitrate and sulfate wet deposition were each underestimated compared to the corresponding observed values.

Given the state of the science relative to PM modeling, it is inappropriate to judge PM model

performance using criteria derived for other pollutants, like ozone. The overall model performance results may be limited by our current knowledge of PM science and chemistry, by the emissions inventories for direct PM and secondary PM precursor pollutants, by the relatively sparse ambient data available for comparisons to model output, and by uncertainties in monitoring techniques. The model performance for sulfate in the East is quite reasonable, which is key since sulfate compounds comprise a large portion of PM2.5 in the East.

Negative effects of relatively poor model performance for some of the smaller (i.e., lower concentration) components of PM2.5, such as crustal mass, are mitigated to some extent by the way we use the modeling results in projecting future year nonattainment and downwind contributions. As described in more detail below, each measured component of PM2.5 is adjusted upward or downward based on the percent change in that component, as determined by the ratio of future year to base year model predictions. Thus, we are using the model predictions in a relative way, rather than relying on the absolute model predictions for the future year scenarios. By using the modeling in this way, we are

reducing the risk that large overprediction or underprediction will unduly affect our projection of future year concentrations. For example, REMSAD may overpredict the crustal component at a particular location by a factor of 2, but since measured crustal concentrations are generally a small fraction of ambient PM2.5, the future crustal concentration will remain as a small fraction of PM2.5.

A number of factors need to be considered when interpreting the results of this performance analysis. First, simulating the formation and fate of particles, especially secondary organic aerosols and nitrates is part of an evolving science. In this regard, the science in air quality models is continually being reviewed and updated as new research results become available. Also, there are a number of issues associated with the emissions and meteorological inputs, as well as ambient air quality measurements and how these should be paired to model predictions that are currently under investigation by EPA and others. The process of building consensus within the scientific community on ways for doing PM model performance evaluations has not yet progressed to the point of having a defined set of common

approaches or criteria for judging model performance. Unlike ozone, there is a limited data base of past performance statistics against which to measure the performance of regional/national PM modeling. Thus, the approach used for this analysis may be modified or expanded in future evaluation analyses.

3. Projection of Future PM2.5 Nonattainment

As with ozone, the approach for identifying areas expected to be nonattainment for PM2.5 in the future involves using the model predictions in a relative way to forecast current PM2.5 design values to 2010 and 2015. The modeling portion of this approach includes annual simulations for 2001 emissions and for the 2010 and 2015 Base Case emissions scenarios. As described below, the predictions from these runs were used to calculate RRFs which were then applied to current PM2.5 design values. The approach we followed is consistent with the procedures in the draft PM2.5 air quality modeling guidance,[67] "Guidance for Demonstrating Attainment of Air Quality Goals for PM2.5 and Regional Haze." It should be

[67] U.S. EPA, 2000: Draft Guidance for Demonstrating Attainment of Air Quality Goals for PM2.5 and Regional Haze; Draft 1.1, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

noted that the approach for PM2.5 differs from the approach recommended for projecting future year 8-hour ozone design values in terms of the base period for design values. The approach for ozone uses the higher of the ambient design values for two 3-year periods, as described above. In contrast, the PM2.5 guidance recommends selecting the highest design value from among the three periods that straddle the base emissions year (i.e., 2001). The three periods that straddle this year are 1999-2001, 2000-2002, and 2001-2003. The data from the first two design value periods are readily available, but the data from the 2001-2003 period could not be used since the 2003 data were not yet available. Thus, we have relied on the data for the two periods 1999-2001 and 2000-2002. The design values from the period 2000-2002, which is the most recent period with available data, were used to identify which monitors are currently measuring nonattainment (i.e., annual average PM2.5 of 15.05 $\mu g/m^3$ or more). To be consistent with procedures in the modeling guideline, we selected the higher of the 1999-2001 or 2000-2002 design value from each nonattainment monitor for use in projecting future design values. The recommendation in the guidance for selecting the highest

values from among 3 periods is applicable for nonattainment counties, but not necessarily for attainment counties. Thus, for monitors that are measuring attainment (i.e., PM2.5 less than 15.05 μg/m^3) using the most recent 3 years of data, we used the 2000-2002 design values as the starting point for projecting future year design values. Note that none of the counties that are attainment for the period 2000-2002 are forecast to become nonattainment in 2010 or 2015.

The modeling guidance recommends that model predictions be used in a relative sense to estimate changes expected to occur in each major PM2.5 species. These species are sulfate, nitrate, organic carbon, elemental carbon, crustal and un-attributed mass. Un-attributed mass is defined as the difference between FRM PM2.5 and the sum of the other five components. The procedure for calculating future year PM2.5 design values is called the Speciated Modeled Attainment Test (SMAT). The following is a brief summary of those steps. Additional details are provided in the AQMTSD.

Step 1: Calculate quarterly mean concentrations (averaged over 3 years) for each of the six major components of PM2.5. This is done by multiplying the

monitored quarterly mean concentration of FRM-derived PM2.5 by the monitored fractional composition of PM2.5 species for each quarter in 3 consecutive years (e.g., 20 percent sulfate multiplied by 15 μg/m^3 PM2.5 equals 3 μg/m^3 sulfate).

Step 2: For each quarter, calculate the ratio of future (e.g., 2010) to current (i.e., 2001) predictions for each component specie. The result is a component-specific RRF (e.g., assume that 2001 predicted sulfate for a particular location is 10 :g/m^3 and the 2010 Base concentration is 8 :g/m^3, then RRF for sulfate is 0.8).

Step 3: For each quarter and each component specie, multiply the current quarterly mean component concentration (Step 1) by the component-specific RRF obtained in Step 2. This produces an estimated future quarterly mean concentration for each component (e.g., 3 :g/m^3 sulfate multiplied by 0.8 equals future sulfate of 2.4 :g/m^3).

Step 4: Average the four quarterly mean future concentrations to get an estimated future annual mean concentration for each component specie. Sum the annual mean concentrations of the 6 components to obtain an estimated future annual average concentration for PM2.5.

We are using the FRM data for projecting future design values since these data will be used for nonattainment designations. In order to apply SMAT to the FRM data, information on PM2.5 speciation is needed for the location of each FRM monitoring site. Only a small number of the FRM sites have measured species information. Therefore, spatial interpolation techniques were applied to the speciated component averages from the IMPROVE and Speciation Trends Network (STN) data to estimate concentrations of species mass at all FRM PM2.5 monitoring sites. Details on the procedures and assumptions used in mapping the IMPROVE and STN data to the locations of the FRM sites are described in the AQMTSD.

The preceding procedures for determining future year PM2.5 concentrations were applied for each FRM site. For counties with only one FRM site, the forecast design value for that site was used to determine whether or not the county will be nonattainment in the future. For counties with multiple monitoring sites, the site with the highest future concentration was selected for that county. Those counties with future year design values of 15.05 $\mu g/m^3$ or more are predicted to be nonattainment.

The result is that 61 counties in the East are forecast to be nonattainment for the 2010 Base Case. Of these, 41 are forecast to remain nonattainment for the 2015 Base Case. The PM2.5 nonattainment counties for the 2010 and 2015 Base Cases are listed in Table IV-4. These counties were used as receptors for quantifying the impacts of the SO2 and NOx emissions reductions in today's proposal, as presented in section IX.

Table IV-4. Counties Projected to be Nonattainment for the Annual Average PM2.5 NAAQS for the 2010 and 2015 Base Cases

State	2010 Base Case Projected Nonattainment Counties	2015 Base Case Projected Nonattainment Counties
AL	DeKalb, Jefferson, Montgomery, Russell, Talladaga	Jefferson, Montgomery, Russell, Talladaga
CT	New Haven	New Haven
DC	Washington, D.C.	None
DE	New Castle	None
GA	Clarke, Clayton, Cobb, DeKalb, Floyd, Fulton, Hall, Muscogee, Paulding, Richmond, Wilkinson	Clarke, Clayton, Cobb, DeKalb, Floyd, Fulton, Hall, Muscogee, Richmond, Wilkinson
IL	Cook, Madison, St. Clair, Will	Cook, Madison, St. Clair
IN	Clark, Marion	Clark, Marion
KY	Fayette, Jefferson	Jefferson
MD	Baltimore City	Baltimore City
MI	Wayne	Wayne
MO	St. Louis	None
NY	New York (Manhattan)	New York (Manhattan)
NC	Catawba, Davidson, Mecklenburg	None
OH	Butler, Cuyahoga, Franklin, Hamilton, Jefferson, Lawrence, Mahoning, Scioto, Stark, Summit, Trumbull	Butler, Cuyahoga, Franklin, Hamilton, Jefferson, Scioto, Stark, Summit

PA	Allegheny, Bucks, Lancaster, York	Allegheny, York
SC	Greenville	None
TN	Davidson, Hamilton, Knox, Roane, Sullivan	Hamilton, Knox
WV	Brooke, Cabell, Hancock, Kanawha, Marshal, Wood	Brooke, Cabell, Hancock, Kanawha, Wood

As noted above in section IV.C.4, the 2010 Base Case used for the zero-out PM2.5 modeling included EGU emissions from an earlier simulation of the Integrated Planning Model. Of the 61 2010 Base Case nonattainment counties listed in Table IV-4, 4 counties (i.e., Catawba Co., NC, Trumbull Co., OH, Greenville Co., SC, and Marshall Co., WV) were projected to be in attainment in the 2010 Base Case used for the zero-out modeling. Thus, 57 nonattainment counties (i.e., the 61 counties in Table IV-4 less these 4 counties) were used as downwind receptors in the air quality modeling assessment of interstate PM2.5 contributions described in section V.C.3.

F. Analysis of Locally-Applied Control Measures for Reducing PM2.5

We conducted two air quality modeling analyses to assess the probability that attainment of the PM standard could be reached with local measures only. The results

of these analyses, discussed in detail in the AQMTSD, support the need for today's rulemaking requiring reductions of transport pollutants. Both analysis were conducted by:

- Identifying a list of local control measures that could be applied in addition to those measures already in place or required to be in place in the near future;
- Determining the emissions inventory categories that would be affected by those measures, and the estimated percentage reduction;
- Applying those percentage reductions to sources within a selected geographic area; and
- Conducting regional large-scale air quality modeling using REMSAD to determine the ambient impacts those measures would have, and the degree to which those measures would reduce the expected number of nonattainment areas.

1. Control Measures and Percentage Reductions

For our analysis of PM2.5 attainment prospects, we developed a list of emissions reductions measures as a surrogate for measures that State, local and Tribal air quality agencies might include in their PM2.5

implementation plans. The list includes measures that such agencies might be able to implement to reach attainment in 2009 or as soon thereafter as possible. The measures address a broad range of man-made point, area, and mobile sources. In general, the measures represent what we consider to be a highly ambitious but achievable level of control.[68] We identified measures for direct PM2.5 and also for the following PM2.5 precursors: SO2, NOx, and VOC.[69] We did not attempt to address ammonia emissions, in part due to relatively low emissions of ammonia in urban areas and the likelihood of fewer controllable sources within the urban areas targeted for the analysis.

The percentage reductions were developed in two ways. First, we developed percentage reduction estimates for specific technologies when available. The available estimates were based on both the percentage control that might be achieved for sources applying that technology, and the percentage of the inventory the measures might be

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[68] Our assumptions regarding the measures for this analysis are not intended as a statement regarding the measures that represent RACT or RACM for PM2.5 nonattainment areas.

[69] Some VOCs are precursors to the secondary organic aerosol component of PM2.5.

applicable to. For example, if a given technology would reduce a source's emissions by 90 percent where it was installed, but would be reasonable to install for only 30 percent of sources in the category, that technology would be assigned a percentage reduction of 90 times 30, or 27 percent.

Second, there were some groups of control measures where data and resources were not available to develop technology-specific estimates in this manner. For these, we felt it preferable to make broad judgments on the level of control that might be achieved rather than to leave these control measures out of the analysis entirely. For example, the analysis reflects a reduction of 3 percent from on-road mobile source emissions relative to a 2010 and 2015 baseline. We judged this 3 percent estimate to represent a reasonable upper bound on the degree to which transportation control measures and other measures for reducing mobile source emissions could reduce the overall inventory of mobile source emissions in a given area.

Additionally, we believe that it may be possible for point source owners to improve the performance of emissions control devices such as baghouses and

electrostatic precipitators, and in some cases to upgrade to a more effective control device. In our current emissions inventories, we have incomplete data on control equipment currently in use. As a result, data are not available to calculate for each source the degree to which the control effectiveness could be improved. Nonetheless, we believed it important to include reasonable assumptions concerning controls for this category for direct PM2.5. For this analysis, we assumed across the board that all point sources of PM could reduce emissions by 25 percent.

Table IV-5 shows the control measures selected for the analysis, the pollutants reduced and the percentage reduction estimates.

2. Two Scenarios Analyzed for the Geographic Area Covered by Control Measures

We developed two scenarios for identifying the geographic area to which the control measures were applied. These two scenarios were intended to address two separate issues related to the effects of urban-based control measures.

The first scenario was intended to illustrate the effect of the selected local control measures within the

geographic area to which controls were applied. For this, we applied the control measures and associated emissions reductions to the inventories for three cities - Birmingham, Chicago, and Philadelphia. We selected these three urban areas because each area was predicted to exceed the PM2.5 standard in 2010, albeit to varying degrees. Additionally, the three urban areas were selected because they are widely separated. Accordingly, we were able to conduct a single air quality analysis with less concerns for overlapping impacts due to transport than if less separated cities were selected.

The control measures were applied to the projected 2010 baseline emission inventories for all counties within those Primary Metropolitan Statistical Areas (PMSAs).[70] Thus, for Chicago, measures were applied to the 10 counties in Illinois, but were not applied in northwest Indiana or Wisconsin. For Philadelphia, measures were applied to the New Jersey and Pennsylvania

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[70] For the three-city study, we chose the PMSA counties rather than the larger list of counties in the consolidated metropolitan statistical area (CMSA). Both the PMSA and the CMSA classifications for metropolitan areas are created by the Office of Management and Budget (OMB). For this study, we used the classifications of counties in place as of spring 2003, rather than the revised classifications released by OMB on June 6, 2003.

counties within the Philadelphia urban area. For Birmingham, measures were applied to four Alabama counties.

The second scenario was intended to address the cumulative impact of local control measures applied within nonattainment areas. Recognizing that PM2.5 nonattainment areas may be near enough to each other to have transport effects between them, we applied the control measures identified in Table IV-5, with some modifications discussed below, to all 290 counties of the metropolitan areas we projected to contain any nonattainment county in 2010 in the baseline scenario. Specifically, the control measures were applied to all counties in Consolidated Metropolitan Statistical Areas (CMSAs) for which any county in the CMSA contained a nonattainment monitor.

3. Results of the Two Scenarios

Table IV-6 shows the results of applying the control measures in each of the three urban areas addressed in the first scenario. The emissions reductions were estimated to achieve ambient PM2.5 reductions of about 0.5 $\mu g/m^3$ to about 0.9 $\mu g/m^3$, less than needed to bring any of the cities into attainment in 2010.

The SO2 reductions in Birmingham were large – 80 percent – because of the assumption that scrubbers would be installed for two large-emitting power plants within the Birmingham-area counties. Reductions of other pollutants in Birmingham, and of all pollutants in the two other cities, were 33 percent or lower. We note that despite the large reduction assumed for SO2 emissions in the Birmingham area, ambient sulfate in Birmingham declined only 7 percent, indicating that the large majority of sulfate in Birmingham is attributable to SO2 sources outside the metropolitan area.

Table IV-5. Control Measures, Pollutants, and Percentage Reductions for the Local Measures Analysis

Source Description	Control Measure	SO2	NOx			PM2.5			Tol+Xyl (VOC)		
		Eff	Eff	App	% Red	Eff	App	% Red	Eff	App	% Red
Utility boilers	FGD scrubber for some or all unscrubbed units	see foot-note 1									
Coal-fired industrial boilers > 250 mmBtu/hr	Coal switching	50									
Petroleum fluid catalytic cracking units	Wet gas scrubber	50									
Refinery process heaters - oil-fired	Switch to natural gas	50									
Sulfuric acid plants	Meet NSPS level	42-96									
Coal-fired industrial boilers	SNCR		50	20	10						
Gas-fired industrial boilers (large & medium)	SNCR		45	20	9						
Gas-fired industrial boilers (small)	Low NOx burner		50	20	10						
Gas-fired IC Engines (reciprocating)	NSCR		94	10	9.4						
Gas-fired turbine & cogeneration	SCR		90	10	9						
Asphalt Concrete, Lime Manufacture	Low Nox burner		27	50	14						
Cement Manufacturing	Tire derived fuel & mid-kiln firing		34	50	18						

Source Description	Control Measure	SO2	NOx			PM2.5			Tol+Xyl (VOC)		
		Eff	Eff	App	% Red	Eff	App	% Red	Eff	App	% Red
Petroleum Refinery Gas-fired Process Heaters	Ultra-low Nox burner & SNCR		93	50	46.5						
All direct PM2.5 points sources	Improve existing controls (baghouses, ESPs)							25			
Wood fireplaces [2]	Natural gas inserts					80	30	24			
	Replace with certified noncatalytic woodstove					71	30	21.4			
HDDV including buses	Engine Modifications, Diesel oxidation catalyst		40	5	2						
	Particulate filter					90	30	27			
	Idling reduction				1.7			1.7			1.7
Off-highway diesel construction and mining equipment	Engine modifcations, diesel oxidation catalyst		40	73	29						
	particulate filter					25	73	18			
Diesel Marine Vessels	SCR		75	5	4						
	Particulate filter					90	30	27			
Diesel locomotives	SCR		72	5	4						
	Electrification of yard	2.5	2.5	6	0.2	2.5	6	0.2	2.5	6	0.2
Unpaved roads	Gravel covering					60	30	18			
Construction road	Watering					50	30	15			
Open burning	Ban		100	75	75	100	75	75	100	75	75

Source Description	Control Measure	SO2	NOx			PM2.5			Tol+Xyl (VOC)		
		Eff	Eff	App	% Red	Eff	App	% Red	Eff	App	% Red
Agricultural tilling	Soil conservation measures, unspecified					20	30	6			
LDGV and LDGT1	Combination of unspecified measures to reduce highway vehicle miles and emissions				3			3			3

[1] For the three-city study, we assumed controls to an emission rate of 0.15 lb/mmBtu on all currently unscrubbed coal-fired utility boilers within the three metropolitan areas. For the second scenario, we applied a 50 percent reduction to all unscrubbed utility units within the 290 counties, as a surrogate for a strategy that applied FGD scrubbers to enough units to achieve a 50 percent reduction overall.

[2] For the 1996 inventory, woodstoves and fireplaces are combined into one SCC category. We assumed for the purpose of this analysis, that woodstoves and fireplaces each comprise half of the total wood burned for the category overall. Thus, the total percentage reduction is (24+21.4)/2 = 22.7 percent.

Table IV-6. Modeled PM2.5 Reductions From Application of Hypothetical Local Controls in 3 Urban Areas

Metro Area	2010 Base PM2.5 ($\mu g/m^3$)	PM2.5 Reduction ($\mu g/m^3$)	Final PM2.5 ($\mu g/m^3$)	Attainment Achieved?
Birmingham, AL	20.07	-0.84	19.23	No
Chicago, IL	18.01	-0.94	17.07	No
Philadelphia, PA	15.6	-0.52	15.08	No

Table IV-7 shows the results for the second scenario which, again, applied the same list of controls to 290 counties, resulting in local and transport reductions. These results show that some of the 2010 nonattainment areas would be projected to attain, but many are not. Accordingly, we concluded that for a sizable number of PM2.5 nonattainment areas it will be difficult if not impossible to reach attainment unless transport is reduced to a much greater degree than by the simultaneous adoption of controls within only the nonattainment areas.

Table IV-7. Modeled PM2.5 Reductions From Application of Hypothetical Local Controls in All Areas Predicted to Exceed the NAAQS in 2010

	Baseline	With Local Controls
Part A - Full Modeling Results Considering All Pollutants and Species		
Number of nonattainment counties	61	26
Average Reduction in PM2.5 Design Value ($\mu g/m^3$)	Not Applicable	1.26

Part B - Results Not Counting Reductions in Sulfate Component of PM2.5		
Number of nonattainment counties	61	48
Average Reduction in PM2.5 Design Value ($\mu g/m^3$)	Not Applicable	0.37

We were interested in what part of the PM2.5 improvement seen in this modeling run was attributable to SO2 reductions both locally and upwind. Part B of Table IV-7 shows a re-analysis of the modeling results in which the observed sulfate reductions were not considered in calculating the PM2.5 effects of the control package. If, as we expect, the observation from the earlier described modeling of Birmingham and two other cities that local SO2 reductions have relatively small local effects on sulfate applies more generally, then the difference between parts A and B of Table IV-7 would generally represent the effect of upwind reductions in SO2 from power plants and other sources in other urban areas.

The results of the two scenarios show that much of the difference between the baseline case and the local control case is due to the sulfate component.

4. Additional Observations on the Results of the Local Measures Analyses

The application of control measures for the local measures analyses (with the exception of sulfur dioxide for Birmingham as noted previously) results in somewhat modest percentage and overall tons/year reductions. This is because a substantial part of local emissions is attributable to mobile sources, small business, and household activities for which practical, large-reduction, and quick-acting emissions reductions measures could not be identified at this time. A list of the control measures and their reduction potential is contained in the AQMTSD.

Preliminary analysis indicates that the reductions in SO2 and NOx required by today's proposed rule, if achieved through controls on EGUs, will have a lower cost per ton than most of the measures applied in the local measures study.

The EPA recognizes that the above analysis of the possible results of local control efforts is uncertain. It is not feasible at this time to identify with certainty the levels of emissions reductions from sources of regional transport and reductions from local measures that will lead to attainment of the PM standards. Much technical work remains as States develop their SIPs,

including improvements in local emissions inventories, local area and subregional air quality analyses, and impact analysis of the effects and costs of local controls. At the same time, EPA believes that all of the available analyses of the effects of local measures support the reductions in transported pollutants that are addressed by today's proposal. Taken as a whole, the studies described above strongly support the need for the substantial reductions in transported pollutants that EPA is proposing.

At the same time, EPA believes that nothing in the local measures analysis should be interpreted as discouraging the development of urban-based control measures. Clearly, for many areas, attaining the PM2.5 standard will require measures to address both local and regional transport. We encourage the development of early reduction measures, and specifically we note that the CAA requires States to analyze the control measures necessary to attain the standard as soon as possible.

We also note that the baseline emissions inventory used for this analysis has some known gaps. For example, direct PM2.5 and VOC from commercial cooking (e.g., charbroiling) are not included because no robust

estimates were available for the 1996 base year used for this analysis. Also, excess PM2.5 due to deterioration of engines in service, and emissions from open burning of refuse, may not be well represented. The effect of these omissions on our estimates of the number of areas reaching attainment is uncertain, but we do not believe the omissions affect our preliminary conclusions that transport controls are less expensive on a per ton basis, and are beneficial for attainment.

V. Air Quality Aspects of Significant Contribution for 8-Hour Ozone and Annual Average PM2.5 Before Considering Cost

A. Introduction

In this section, we present the analyses of ambient data and modeling which support the findings in today's proposal on the air quality aspects of significant contribution (before considering cost) for 8-hour ozone and annual average PM2.5. The analyses for ozone are presented first, followed by the analyses for PM2.5. For both pollutants, we summarize information from non-EPA studies then present the procedures and findings from EPA's air quality modeling analyses of interstate transport for ozone and PM2.5.

B. Significant Contribution to 8-Hour Ozone Before Considering Cost

1. Findings from Non-EPA Analyses that Support the Need for Reductions in Interstate Ozone Transport

As discussed in section II, it is a long-held scientific view that ground-level ozone is a regional, and not merely a local, air quality problem. Ozone and its precursors are often transported long distances across State boundaries exacerbating the downwind ozone problem. This transport of ozone can make it difficult – or impossible – for some States to meet their attainment deadlines solely by regulating sources within their own boundaries.

The EPA participated with States in the Eastern U.S. as well as industry representatives and environmental groups in the Ozone Transport Assessment Group (OTAG), which documented that long-distance transport of NOx (a primary ozone precursor) across much of the OTAG study area contributed to high levels of ozone. For background on OTAG and the results from the study, see the following web site: http://www.epa.gov/ttn/naaqs/ozone/rto/otag/index.html.

The air quality and modeling analyses by OTAG

yielded the following major findings and technical conclusions relevant to today's proposed rulemaking:

- Air quality data indicate that ozone is pervasive, that ozone is transported, and that ozone aloft is carried over and transported from 1 day to the next.
- Regional NOx reductions are effective in producing ozone benefits; the more NOx reduced, the greater the benefit.
- Ozone benefits are greatest where emissions reductions are made; benefits decrease with distance.
- Elevated and low-level NOx reductions are both effective.
- Volatile organic compounds (VOC) controls are effective in reducing ozone locally and are most advantageous to urban nonattainment areas. The OTAG report also recognized that VOC emissions reductions do not play much of a role in long-range transport, and concluded that VOC reductions are effective in reducing ozone locally and are most advantageous to urban nonattainment areas.

These OTAG findings provide technical evidence that transport within portions of the OTAG region results in

large contributions from upwind States to ozone in downwind areas, and that a regional approach to reduce NOx emissions is an effective means of addressing interstate ozone transport.

2. Air Quality Modeling of Interstate Ozone Contributions

This section documents the procedures used by EPA to quantify the impact of emissions in specific upwind States on air quality concentrations in projected downwind nonattainment areas for 8-hour ozone. These procedures are the first of the two-step approach for determining significant contribution, as described in section III, above.

The analytic approach for modeling the contribution of upwind States to ozone in downwind nonattainment areas is described in subsection (a), the methodology for analyzing the modeling results is presented in subsection (b), and the findings as to whether individual States make a significant contribution (before considering cost) to 8-hour ozone nonattainment is provided in subsection (c).

The air quality modeling for the interstate ozone contribution analysis was performed for those counties

predicted to be nonattainment for 8-hour ozone in the 2010 Base Case, as described above in section IV.D. The procedures used by EPA to determine the air quality component of whether emissions in specific upwind States make a significant contribution (before considering cost) to projected downwind nonattainment for 8-hour ozone are the same as those used by EPA for the State-by-State determination in the NOx SIP Call.

a. Analytical Techniques for Modeling Interstate Contributions to 8-Hour Ozone Nonattainment

The modeling approach used by EPA to quantify the impact of emissions in specific upwind States on projected downwind nonattainment areas for 8-hour ozone includes two different techniques, zero-out and source apportionment. The outputs of the two modeling techniques were used to calculate “metrics” or measures of contribution. The metrics were evaluated in terms of three key contribution factors to determine which States make a significant contribution (before considering cost) to downwind ozone nonattainment. Details of the modeling techniques and metrics are described in this section.

The zero-out and source apportionment modeling techniques provide different technical approaches to

quantifying the downwind impact of emissions in upwind States. The zero-out modeling analysis provides an estimate of downwind impacts by comparing the model predictions from a base case run to the predictions from a run in which the base case man-made emissions are removed from a specific State. Zero-out modeling was performed by removing all man-made emissions of NOx and VOC in the State.

In contrast to the zero-out approach, the source apportionment modeling quantifies downwind impacts by tracking the impacts of ozone formed from emissions in an upwind source area. For this analysis, the source apportionment technique was implemented to provide the contributions from all man-made sources of NOx and VOC in each State. Additional information on the source apportionment technique can be found in the CAMx User's Guide.[71] There is currently no technical evidence showing that one technique is clearly superior to the other for evaluating contributions to ozone from various emission sources; therefore, both approaches were given equal consideration in this analysis.

The EPA performed State-by-State zero-out modeling

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[71] Environ, 2002: User's Guide to the Comprehensive Air Quality Model with Extensions (CAMx), Novato, CA.

and source apportionment modeling for 31 States in the East. These States are as follows: Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. In both types of modeling, emissions from the District of Columbia were combined with those from Maryland. For the source apportionment modeling, North Dakota and South Dakota were aggregated into a single source region. Because large portions of the six States along the western border of the modeling domain (i.e., Kansas, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas) are outside the domain, EPA has deferred analyzing the contributions to downwind ozone nonattainment for these States.

The EPA selected several metrics to quantify the projected downwind contributions from emissions in upwind States. The metrics were designed to provide information on three fundamental factors for evaluating whether emissions in an upwind State make large and/or frequent

contributions to downwind nonattainment. These factors are:

- the magnitude of the contribution,
- the frequency of the contribution, and
- the relative amount of the contribution.

The magnitude of contribution factor refers to the actual amount of ozone contributed by emissions in the upwind State to nonattainment in the downwind area. The frequency of the contribution refers to how often contributions above certain thresholds occur. The relative amount of the contribution is used to compare the total ozone contributed by the upwind State to the total amount of nonattainment ozone in the downwind area. The factors are the basis for several metrics that can be used to assess a particular impact. The metrics used in this analysis are the same as those used in the NOx SIP Call. These metrics are described below for the zero-out modeling and for the source apportionment modeling. Table V-1 lists the metrics for each factor. Additional details with examples of the procedures for calculating the metrics are provided in the AQMTSD. We solicit comment on other metrics including whether it would be appropriate to develop a metric based on annualized costs

for each State per ambient impact on each downwind nonattainment receptor.

Table V-1. Ozone Contribution Factors and Metrics

Factor:	Zero-out	Source Apportionment
Magnitude of Contribution	Maximum contribution	Maximum contribution; and Highest daily average contribution (ppb and percent)
Frequency of Contribution	Number and percent of exceedances with contributions in various concentration ranges	Number and percent of exceedances with contributions in various concentration ranges
Relative Amount of Contribution	Total contribution relative to the total exceedance ozone in the downwind area; and Population-weighted total contribution relative to the total population-weighted exceedance ozone in the downwind area	Total average contribution to exceedance hours in the downwind area

The values for each metric were calculated using only those periods during which model-predicted 8-hour average ozone concentration were of 85 ppb or more in at least one of the model grid cells that are associated with the receptor county. That is, we only analyzed interstate ozone contributions for the nonattainment receptor counties when the model predicted an exceedance in the 2010 Base Case. The procedures for assigning model grid cells to each nonattainment county are

described in the AQMTSD.

As in the NOx SIP Call, the ozone contribution metrics are calculated and evaluated for each upwind State to each downwind nonattainment receptor. These source-receptor pairs are referred to as “linkages.”

b. Zero-Out Metrics

A central component of several of the metrics is the number of predicted exceedances in the 2010 Base Case for each nonattainment receptor. The number of exceedances in a particular nonattainment receptor is determined by the total number of daily predicted peak 8-hour concentrations of 85 ppb or more across all the episode days for the model grid cells assigned to the receptor.

The Maximum Contribution Metric for a particular upwind State to an individual downwind nonattainment receptor linkage is determined by first calculating the concentration differences between the 2010 Base Case and the zero-out simulation for that upwind State. This calculation is performed for all 2010 Base Case exceedances predicted for the downwind receptor. The largest difference (i.e., contribution) for the linkage across all of the exceedances at the downwind receptor is the maximum contribution.

The Frequency of Contribution Metric for a particular linkage is determined by first sorting the contributions by concentration range (e.g., 2 to 5 ppb, 5 to 10 ppb, etc.). The number of impacts in each range is used to assess the frequency of contribution.

Determining the Total Ozone Contribution Relative to the Base Case Exceedance Metric for a particular linkage involves first calculating the total ozone of 85 ppb or more in the 2010 Base Case and in the upwind State's zero-out run. The calculation is performed by summing the amount of ozone above the NAAQS for each predicted exceedance at the downwind receptor area. Finally, the amount of ozone above the NAAQS from the zero-out run is divided by the amount of ozone above the NAAQS from the 2010 Base simulation to form this metric.

The Population-Weighted Relative Contribution Metric is similar to the total ozone contribution metric described in the preceding paragraph, except that during the calculation the amount of ozone above the NAAQS in both the base case and the zero-out simulation is weighted by (i.e., multiplied by) the 2000 population in the receptor county.

c. Source Apportionment Metrics

Despite the fundamental differences between the zero-out and source apportionment techniques, the definitions of the source apportionment contribution metrics are generally similar to the zero-out metrics. One exception is that all periods during the day with predicted 8-hour averages of 85 ppb or more are included in the calculation of source apportionment metrics, as opposed to just the daily peak 8-hour predicted values which are used for the zero-out metrics. Additional information on differences between the zero-out and source apportionment metrics calculations can be found in the AQMTSD.

The outputs from the source apportionment modeling provide estimates of the contribution to each predicted exceedance for each linkage. For a given upwind State to downwind nonattainment receptor linkage, the Maximum Contribution Metric is the highest contribution from among the contributions to all exceedances at the downwind receptor. The Frequency of Contribution Metric for the source apportionment technique is determined in a similar way to which this metric is calculated for the zero-out modeling.

The Highest Daily Average Contribution Metric is

determined for each day with predicted exceedances at the downwind receptor. The metric is calculated by first summing the contributions for that linkage over all exceedances on a particular day, then dividing by the number of exceedances on that day to produce a daily average contribution to nonattainment. The daily average contribution values across all days with exceedances are examined to identify the highest value which is then selected for use in the determination of significance (before considering cost). We also express this metric as a percent by dividing the highest daily average contribution by the corresponding ozone exceedance concentration on the same day.

The Percent of Total Nonattainment Metric is determined for each of the three episodes individually as well as for all 30 days (i.e., all three episodes) combined. This metric is calculated by first summing the contributions to all exceedances for a particular linkage to produce an estimate of the total contribution. Second, the total contribution is divided by the total ozone for periods above the NAAQS.

d. Evaluation of Upwind State Contributions to Downwind 8-Hour Ozone Nonattainment

The EPA compiled the 8-hour metrics by downwind area in order to evaluate the contributions to downwind nonattainment. The contribution data were reviewed to determine how large of a contribution a particular upwind State makes to nonattainment in each downwind area in terms of both the magnitude of the contribution, and the relative amount of the total contribution. The data were also examined to determine how frequently the contributions occur.

The first step in evaluating this information was to screen out linkages for which the contributions were very low. This initial screening was based on: 1) a maximum contribution of less than 2 ppb from either of the two modeling techniques and/or, 2) a percent of total nonattainment of less than 1 percent. Any upwind State that did not pass both of these screening criteria for a particular downwind area was considered not to make a significant contribution to that downwind area.

The finding of meeting the air quality component of significance (i.e., before considering cost) for linkages that passed the initial screening criteria was based on EPA’s technical assessment of the values for the three factors. Each upwind State that had large and/or

frequent contributions to the downwind area, based on these factors, is considered as contributing significantly (before considering cost) to nonattainment in the downwind area. For each upwind State, the modeling disclosed a linkage in which all three factors - high magnitude of contribution, high frequency of contribution, high relative percentage of nonattainment - are met. In addition, each upwind State contributed to nonattainment problems in at least two downwind States (except for Louisiana and Arkansas which contributed to nonattainment in only Texas).[72] There have to be at least two different factors that indicate large and/or frequent contributions in order for the linkage to be significant (before considering cost). In this regard, the finding of a significant contribution (before considering cost) for an individual linkage was not based on any single factor. For most of the individual linkages, the factors yield a consistent result (i.e., either large and frequent contributions and high relative contributions or small and infrequent contributions and low relative contributions). In some linkages, however, not all of

[72] In some cases, we determined the contribution of some States to downwind problems as significant (before considering cost) because it passed two, but not all three, factors.

the factors are consistent. The EPA believes that each of the factors provides an independent, legitimate measure of contribution.

The EPA applied the evaluation methodology described above to each upwind-downwind linkage to determine which States contribute significantly (before considering cost) to nonattainment in the 47 specific downwind counties. The analysis of the metrics for each linkage is presented in the AQMTSD. Of the 31 States included in the assessment of interstate ozone contributions, 25 States were found to have emissions which make a significant contribution (before considering cost) to downwind 8-hour ozone nonattainment. These States are listed in Tables V-2 and V-3. The linkages which EPA found to be significant (before considering cost) are listed in Tables V-2 (by upwind State) and V-3 (by downwind nonattainment county) for the 8-hour NAAQS. Of the 31 States included in the assessment of interstate ozone transport, the following six States are found to not make a significant contribution to downwind nonattainment: Florida, Maine, Minnesota, New Hampshire, Rhode Island, and Vermont.

Table V-2. Projected Downwind Counties to Which Sources

in Upwind States Contribute Significantly (Before Considering Cost) for the 8-hour NAAQS.

Upwind State	Downwind 2010 Nonattainment Counties
AL	Crittenden AR, Fulton GA, Harris TX
AR	Harris TX, Tarrant TX
CT	Kent RI, Suffolk NY
DE	Bucks PA, Camden NJ, Cumberland NJ, Delaware PA, Gloucester NJ, Hunterdon NJ, Mercer NJ, Middlesex NJ, Monmouth NJ, Montgomery PA, Morris NJ, Ocean NJ, Philadelphia PA, Richmond NY, Suffolk NY
GA	Crittenden AR, Mecklenburg NC
IA	Kenosha WI, Lake IN, Racine WI
IL	Allegheny PA, Crittenden AR, Erie NY, Geauga OH, Kenosha WI, Lake IN, Racine WI, Sheboygan WI, Summit OH
IN	Allegheny PA, Crittenden AR, Geauga OH, Kenosha WI, Racine WI, Sheboygan WI, Summit OH
KY	Allegheny PA, Crittenden AR, Fulton GA, Geauga OH
LA	Harris TX, Tarrant TX
MA	Kent RI, Middlesex CT
MD	Arlington VA, Bergen NJ, Bucks PA, Camden NJ, Cumberland NJ, Delaware PA, Erie NY, Fairfax VA, Fairfield CT, Gloucester NJ, Hudson NJ, Hunterdon NJ, Mecklenburg NC, Mercer NJ, Middlesex CT, Middlesex NJ, Monmouth NJ, Montgomery PA, Morris NJ, New Haven CT, Newcastle DE, Ocean NJ, Philadelphia PA, Putnam NY, Richmond NY, Suffolk NY, Summit OH, Washington DC, Westchester NY
MI	Allegheny PA, Anne Arundel MD, Baltimore MD, Bergen NJ, Bucks PA, Camden NJ, Cecil MD, Cumberland NJ, Delaware PA, Erie NY, Geauga OH, Gloucester NJ, Harford MD, Hudson NJ, Hunterdon NJ, Kenosha WI, Kent MD, Lake IN, Mercer NJ, Middlesex NJ, Monmouth NJ, Montgomery PA, Morris NJ, Newcastle DE, Ocean NJ, Philadelphia PA, Prince Georges MD, Racine WI, Richmond NY, Suffolk NY, Summit OH
MO	Crittenden AR, Geauga OH, Kenosha WI, Lake IN, Racine WI, Sheboygan WI
MS	Crittenden AR, Harris TX
NC	Anne Arundel MD, Baltimore MD, Camden NJ, Cecil MD, Cumberland NJ, Fulton GA, Gloucester NJ, Harford MD, Kent MD, Newcastle DE, Ocean NJ, Philadelphia PA, Suffolk NY
NJ	Bucks PA, Delaware PA, Erie NY, Fairfax VA, Fairfield CT, Kent RI, Middlesex CT, Montgomery PA, New Haven CT, Philadelphia PA, Putnam NY, Richmond NY, Suffolk NY, Westchester NY
NY	Fairfield CT, Hudson NJ, Kent RI, Mercer NJ, Middlesex CT, Middlesex NJ, Monmouth NJ, Morris NJ, New Haven CT
OH	Allegheny PA, Anne Arundel MD, Arlington VA, Baltimore MD, Bergen NJ, Bucks PA, Camden NJ, Cecil MD, Cumberland NJ,

	Delaware PA, Fairfax VA, Fairfield CT, Gloucester NJ, Harford MD, Hudson NJ, Hunterdon NJ, Kenosha WI, Kent MD, Kent RI, Lake IN, Mercer NJ, Middlesex CT, Middlesex NJ, Monmouth NJ, Montgomery PA, Morris NJ, New Haven CT, Newcastle DE, Ocean NJ, Philadelphia PA, Prince Georges MD, Racine WI, Richmond NY, Suffolk NY, Washington DC, Westchester NY
PA	Anne Arundel MD, Arlington VA, Baltimore MD, Bergen NJ, Camden NJ, Cecil MD, Cumberland NJ, Erie NY, Fairfax VA, Fairfield CT, Gloucester NJ, Harford MD, Hudson NJ, Hunterdon NJ, Kenosha WI, Kent MD, Kent RI, Lake IN, Mecklenburg NC, Mercer NJ, Middlesex CT, Middlesex NJ, Monmouth NJ, Morris NJ, New Haven CT, Newcastle DE, Ocean NJ, Prince Georges MD, Putnam NY, Racine WI, Richmond NY, Suffolk NY, Summit OH, Washington DC, Westchester NY
SC	Fulton GA, Mecklenburg NC
TN	Crittenden AR, Fulton GA, Lake IN, Mecklenburg NC, Tarrant TX
VA	Anne Arundel MD, Baltimore MD, Bergen NJ, Bucks PA, Camden NJ, Cecil MD, Cumberland NJ, Delaware PA, Erie NY, Fairfield CT, Gloucester NJ, Harford MD, Hudson NJ, Hunterdon NJ, Kent MD, Kent RI, Lake IN, Mecklenburg NC, Mercer NJ, Middlesex CT, Middlesex NJ, Monmouth NJ, Montgomery PA, Morris NJ, New Haven CT, Newcastle DE, Ocean NJ, Philadelphia PA, Prince Georges MD, Putnam NY, Richmond NY, Suffolk NY, Summit OH, Washington DC, Westchester NY
WI	Erie NY, Lake IN
WV	Allegheny PA, Anne Arundel MD, Baltimore MD, Bucks PA, Camden NJ, Cecil MD, Cumberland NJ, Delaware PA, Fairfax VA, Fairfield CT, Fulton GA, Gloucester NJ, Harford MD, Hunterdon NJ, Kent MD, Mercer NJ, Middlesex NJ, Monmouth NJ, Montgomery PA, Morris NJ, New Haven CT, Newcastle DE, Ocean NJ, Philadelphia PA, Prince Georges MD, Suffolk NY, Summit OH, Washington DC, Westchester NY

Table V-3. Upwind States that Contain Emissions Sources that Contribute Significantly (Before Considering Cost) to Projected 8-hour Nonattainment in Downwind States.

Downwind Nonattainment Counties	Upwind States								
Crittenden AR	AL	GA	IL	IN	KY	MO	MS	TN	
Fairfield CT	MD	NJ	NY	OH	PA	VA	WV		
Middlesex CT	MA	MD	NJ	NY	OH	PA	VA		
New Haven CT	MD	NJ	NY	OH	PA	VA	WV		
Washington DC	MD	OH	PA	VA	WV				
Newcastle DE	MD	MI	NC	OH	PA	VA	WV		
Fulton GA	AL	KY	NC	SC	TN	WV			
Lake IN	IA	IL	MI	MO	OH	PA	TN	VA	WI

Anne Arundel MD	MI	NC	OH	PA	VA	WV			
Baltimore MD	MI	NC	OH	PA	VA	WV			
Cecil MD	MI	NC	OH	PA	VA				
Harford MD	MI	NC	OH	PA	VA	WV			
Kent MD	MI	NC	OH	PA	VA	WV			
Prince Georges MD	MI	OH	PA	VA	WV				
Mecklenburg NC	GA	MD	SC	TN	VA				
Bergen NJ	MD	MI	OH	PA	VA				
Camden NJ	DE	MD	MI	NC	OH	PA	VA	WV	
Cumberland NJ	DE	MD	MI	NC	OH	PA	VA	WV	
Gloucester NJ	DE	MD	MI	NC	OH	PA	VA	WV	
Hudson NJ	MD	MI	NY	OH	PA	VA			
Hunterdon NJ	DE	MD	MI	OH	PA	VA	WV		
Mercer NJ	DE	MD	MI	NY	OH	PA	VA	WV	
Middlesex NJ	DE	MD	MI	NY	OH	PA	VA	WV	
Monmouth NJ	DE	MD	MI	NY	OH	PA	VA	WV	
Morris NJ	DE	MD	MI	NY	OH	PA	VA	WV	
Ocean NJ	DE	MD	MI	NC	OH	PA	VA	WV	
Erie NY	IL	MD	MI	NJ	PA	VA	WI		
Putnam NY	MD	NJ	PA	VA					
Richmond NY	DE	MD	MI	NJ	OH	PA	VA		
Suffolk NY	CT	DE	MD	MI	NC	NJ	OH	PA	VA
	WV								
Westchester NY	MD	NJ	OH	PA	VA	WV			
Geauga OH	IL	IN	KY	MI	MO				
Summit OH	IL	IN	MD	MI	PA	VA	WV		
Allegheny PA	IL	IN	KY	MI	OH	WV			
Bucks PA	DE	MD	MI	NJ	OH	VA	WV		
Delaware PA	DE	MD	MI	NJ	OH	VA	WV		
Montgomery PA	DE	MD	MI	NJ	OH	VA	WV		
Philadelphia PA	DE	MD	MI	NC	NJ	OH	VA	WV	
Kent RI	CT	MA	NJ	NY	OH	PA	VA		
Denton TX	None of the upwind States examined in this analysis were found to make a significant contribution (before considering cost) to this nonattainment receptor								
Harris TX	AL	AR	LA	MS					
Tarrant TX	AR	LA	TN						
Arlington VA	MD	OH	PA						
Fairfax VA	MD	NJ	OH	PA	WV				
Kenosha WI	IA	IL	IN	MI	MO	OH	PA		
Racine WI	IA	IL	IN	MI	MO	OH	PA		

Sheboygan WI	IL IN MO

C. Significant Contribution for Annual Average PM2.5 Before Considering Cost

1. Analyses of Air Quality Data that Support the Need to Reduce Interstate Transport of PM2.5

a. Spatial Gradients of Pollutant Concentrations

Daily maps of PM2.5 mass concentrations from EPA's national monitoring network show large areas of elevated PM2.5 occurring over monitoring locations in urban areas as well as rural areas. The fact that many of the rural monitors are not located near emissions sources, or at least not near large emission sources, and yet the rural concentrations are elevated like the neighboring urban concentrations, provides evidence that PM2.5 is being transported to the rural areas.

When the daily maps of PM2.5 mass concentrations are viewed in sequence, they show the large areas of elevated PM2.5 moving from one area to another, suggesting that PM2.5 is being transported not just from urban areas to neighboring rural areas, but also from one State to another and from one part of the country to another. The smoke from wildfires in southeastern Ontario reaching all

of the New England States in July of 2002 is but one well-publicized example of transported PM2.5.

It may be suggested that it is not PM2.5 that is being transported; rather, it is meteorological conditions conducive to PM2.5 formation that are being transported. However, the fact that the monitors located far from emission sources often report elevated PM2.5 just after the upwind monitors record high levels and just before the downwind monitors record high levels indicates strongly that it is PM2.5 that is being transported.

Episodes of movement of elevated PM2.5 have been seen in almost every direction in the Eastern United States, including in the west to east direction along the lower Great Lakes, in the south to north direction along the East Coast, in the south to north direction across the Midwestern States, in the north to south direction across the Midwestern States, and in the north to south direction along the East Coast. More information on episodes of movement of PM2.5 is contained in the Air Quality Data Analysis Technical Support Document.

Satellite data from Moderate Resolution Imaging Spectroradiomenter (MODIS) sensors, designed to retrieve

aerosol properties over both land and ocean, are strongly correlated with the ground-based monitors that measure PM2.5 concentrations below. The MODIS data provide a visual corroboration for the above described regional transport. Three examples follow:[73]

Midwest-Northeast Haze Event: June 20-28, 2002

During late June 2002, the Central and Eastern United States experienced a haze event from a combination of man-made air pollutants combined with some smoke. The MODIS images document the buildup of aerosols in the Midwest from June 20-22, then the transport of aerosols across the Northeast from June 23-26. Images from June 27 and 28 show the beginning of smoke transported from fires in Canada into the Northern Midwest. This series from June 20-26 qualitatively documents a haze transport event from the Midwest into the Northeast. The imagery also documents the geographical scale of the smoke transport on June 27-28.

Northeast Fire Event: July 4-9, 2002

In early July 2002, the MODIS imagery captured two events: an episodic widespread haze event in the East, Southeast, and Midwest; and an event directly related to

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[73] Battelle, Satellite Data for Air Quality Analysis. July 2003

major forest fires in Canada. On July 4 and 5, MODIS images show urban haze in the East, Southeast, and Midwest. This haze event persists in the Southeast and southern Midwest throughout the remaining days, July 7-9. At the same time, MODIS images for July 6 through July 8 document how the Northeast and mid-Atlantic become dominated by smoke transported into the region from Canada fires. On July 9, MODIS images show the smoke and the southern haze has moved towards the east while dissipating over the Atlantic. This series from July 6-8 qualitatively documents the smoke transport event from major fires in Canada. The imagery also documents the widespread geographical scale of haze, particularly from July 4-8, as well as the movement of the haze (along with smoke) across large distances.

Midwest-Southeast Haze Event: September 8-14, 2002

This imagery during September 2002 reveals the formation of a large-scale haze event over the lower Ohio River Valley that eventually transports over large portions of Southcentral and Southeastern United States. The MODIS images document the buildup of aerosols in the Midwest over September 8 and 9. Influenced by a strong low-pressure system off the mid-Atlantic seaboard on

September 10, the haze plume divides, with the majority traveling south and west toward Texas and a small remnant moving northeast. On September 11 and 12, the Midwest plume, combined with additional pollutants from Texas and the Southeast, is transported to the East. September 13 has another low pressure system, forcing collection of pollutants in Texas and Louisiana, which are obscured by cloud cover on September 14. This series reveals the geographic extent and the complexities that are possible with the transfer of pollutants. More information on the use of satellite data to observe the movement of PM2.5 is contained in the Air Quality Data Analysis Technical Support Document.

b. Urban vs. Rural Concentrations

Differences between concentrations at urban areas and nearby rural locations help indicate the general magnitudes of regional and local contributions to PM2.5 and PM2.5 species.[74] The differences indicate that in the Eastern United States, the regional contributions to the annual average concentrations at urban locations is 50 to

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[74] Rao, Tesh, Chemical Speciation of PM2.5 in Urban and Rural Areas, Published in the Proceedings of the Air and Waste Management Symposium on Air Quality Measurement Methods and Technology—2002, November 2002.

80 percent which, in terms of mass, is generally between 10 and 13 μg/m^3. For many rural areas, average PM2.5 concentrations exceed 10 μg/m^3 and are often not much below the annual PM2.5 NAAQS of 15 μg/m^3. These results are consistent with those found in the NARSTO Fine Particle Assessment.[75] More information on comparisons of urban and rural concentrations of PM2.5 is contained in the Air Quality Data Analysis Technical Support Document.

For the most part, sulfate is regionwide, as indicated by the rural sulfate concentrations being 80 to 90 percent of the urban sulfate concentrations. Total carbon is less of a regional phenomenon than sulfate, as evidenced by the rural total carbon concentrations being about 50 percent of the urban total carbon concentrations. Last, nitrate has a regional component; however, the local component can be as large as 2.0 μg/m^3.

c. Inter-site Correlation of PM2.5 Mass and Component Species

Correlation analysis provides further evidence for the transport of PM2.5 and its constituents. Analysis of the time series history of PM2.5 among different

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[75] North American Research Strategy for Tropospheric Ozone and Particulate Matter, Particulate Matter Science for Policy Makers – A NARSTO Assessment. February 2003.

monitoring locations indicates a strong tendency for PM2.5 concentrations to rise and fall in unison. Correlations of PM2.5 daily concentrations among stations separated by over 300 to 500 kilometers frequently have correlation coefficients that exceed 0.7. The correlation coefficient is a measure of the degree of linear association between two variables, and the square of the correlation coefficient, denoted R2, measures how much of the total variability in the data is explained by a simple linear model. For example, in the preceding case, approximately 50 percent, $(0.7)^2$, of the variability in PM2.5 concentrations at one site frequently can be explained by PM2.5 concentrations at a site over 300 kilometers away. These high correlations occur both in warm and cool seasons suggesting that large scale transport phenomenon in conjunction with large and small scale meteorological conditions play a major role in particle concentration changes over large geographic areas.

Correlation of major PM2.5 constituents among monitoring stations show differing patterns as distance separating monitors increases. For sulfate, the correlation among daily average concentrations remains

strong (above 0.7) at distances exceeding 300 kilometers. Correlation of nitrates among monitoring stations tends to be lower than for sulfate and also varies somewhat among seasons. Warm season correlations, when nitrates are lowest, tend to be relatively low (about 0.4) for stations separated by 300 kilometers or more. Cool season correlations for nitrates are larger than warm season correlations and range from about 0.5 to above 0.6 for stations near urban areas and separated by 300 kilometers or more. Correlation coefficients for organic carbon typically range from about 0.4 to above 0.6 for separation distances above 300 kilometers but appear to decrease more rapidly during the summer season compared with the other three seasons. For elemental carbon and crustal material, correlation with distance drops very rapidly to values below 0.2 or 0.3 for separation distances above 50 to 100 kilometers.

The formation rate and relative stability for the major PM2.5 species help explain the observed correlation patterns. For sulfate, conversion of SO2 to sulfate occurs slowly over relatively large distances downwind of major emission sources of SO2. Slow conversion of SO2 to sulfate over large travel distances promotes greater

spatial homogeneity and thus large correlation among distant monitoring stations. For nitrates, evidence suggests that higher inter-station correlations in winter are associated with increased stability of nitrate (longer travel distances) when conditions are cool compared with warm seasons when nitrates are much less stable. The formation of secondary organic carbon from natural sources helps maintain a relatively homogeneous regional component (higher correlation) that is offset somewhat by higher organic carbon in urban areas associated with local carbon sources. For elemental carbon and crustal material, almost all of the contributions come from nearby sources and hence the relatively low correlation among stations that are separated by even small distances. More information on inter-site correlation of PM2.5 and species is contained in the Air Quality Data Analysis Technical Support Document.

d. Ambient Source Apportionment Studies

Generally, sources emitting particulate matter, or precursors that later form particulate matter, emit multiple species of particulate matter simultaneously. Often, the proportions of the species are sufficiently

different from one source type to another that it is possible to determine how much each source type contributes to the PM2.5 mass observed at a monitoring location. This technique is called source apportionment or receptor modeling.

A review of nearly 20 recently published articles using source apportionment modeling at over 35 locations in the Eastern United States was conducted to understand commonalities and differences in source apportionment results.[76] A large sulfate dominated source was identified as the largest or one of the largest source types in nearly every study. Some studies labeled this source coal combustion, while others labeled it secondary sulfate and did not attribute it to an emission source. For many of the locations, over 50 percent of the PM2.5 mass is apportioned to this source type during some seasons. Summer is typically the season with the largest contributions. Most of the studies, by using back trajectory analysis, indicated that the probable location of the sulfate/coal combustion sources is in the Midwest. Also, studies with multiple years of data tended to

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[76] Battelle, Compliation of Existing Studies of Source Apportionment for PM2.5. August 2003.

identify a winter and summer signature of the sulfate source type, with more mass being apportioned to the summer version. Reasons cited in these studies for the two signatures included different types of coal being burned during the summer versus the winter or different atmospheric chemistry leading to different proportions of species at the monitoring location by season.

A nitrate-dominated source type was identified at approximately half the sites and contributes to between 10 and 30 percent of the annual PM2.5 mass. The source has seasonal variation with maxima in the cold seasons. The back trajectories sometimes point to areas with high ammonia emissions. However, the interpretation of this nitrate-dominated source type is not consistent from study to study. Some authors associate this source type with NOx point sources and motor vehicles from major cities that are sufficiently far from the receptor for the NOx to oxidize and react with ammonia. Other authors associate this source type with mobile emissions from nearby highways. One author does not interpret the source type since he believes it is artificially created by the meteorological conditions and atmospheric chemistry required for formation of ammonium nitrate.

Another major source type identified at nearly all the sites is one dominated by secondary organic matter. Some studies labeled this source motor vehicles, while other studies labeled it secondary organic matter and did not attribute it to an emission source. For several sites, this source type contributes more than 20 percent of the annual PM2.5 mass. Only a few studies separated the source type into the combustion of gasoline and diesel fuel, and this separation was generally accomplished by using the four organic carbon fractions and the three elemental carbon fractions available from the IMPROVE network. In Washington, DC, over 85 percent of the mobile source type contribution is associated with gasoline vehicles and less than 15 percent with diesel. This contrasts with Atlanta, where only 33 to 55 percent (depending on the study) of the mobile source type contribution is associated with gasoline vehicles.

Wood smoke and forest fires were identified as a significant source type at several sites. The magnitude of their contributions varies from site to site. For a rural site in Vermont, the magnitude of the contribution of this source type is approximately 1 $\mu g/m^3$, which is approximately 15 percent of the total PM2.5 mass. For

Atlanta, the magnitude of contribution ranged from 0.5 to 2.0 $\mu g/m^3$ depending on the study, which is approximately 3 to 11 percent of the total PM2.5 mass.

A crustal source category is identified for all sites and usually comprises 1 to 3 percent of the total PM2.5 mass.

In addition to reviewing the source apportionment results in the published literature, EPA conducted receptor modeling using the data from the EPA speciation network to identify and quantify major contributors to PM2.5 in eight urban areas: Houston, Birmingham, Charlotte, St. Louis, Indianapolis, Washington, DC, Milwaukee, and New York City.[77] The "8 city report" contains 2 general types of findings that provide evidence to support that interstate transport of fine particles occurs. First, the source apportionment analyses at the eight cities provides evidence of the types of sources that are most likely the major contributors to fine particle mass in each city. Second, linking wind trajectories with the source apportionment analyses provides evidence of the most likely locations

[77] Battelle, Eight Site Source Apportionment of PM2.5 Speciation Trends Data. September 2003.

of the source types that are the major contributors to fine particle mass in each city.

The source apportionment results identify the largest source type at each site to be coal combustion. The source type contains a large amount of sulfate and is a major source of selenium, a trace particle normally associated with the combustion of coal. The mass apportioned to this source type ranged from a low of 1 to 3 $\mu g/m^3$ in the lowest season to more than 10 $\mu g/m^3$ in the high seasons at 5 of the sites. The source type accounted for 30 to 50 percent of the overall mass, consistent with the proportions found in the published literature. The consistency in the relative and absolute magnitude in the contributions from the coal combustion source type in these eight cities, combined with the fact that the distance of major coal combustion sources from each city varies widely, indicates that it is most likely a regional source rather than a local source.

The second and third largest source types are an ammonium nitrate source type and mobile sources. As the name implies, the ammonium nitrate source type contains a large amount of both ammonium and nitrate. Association of actual emission sources with this source type is less

definitive, as was the case in the published literature. It is most likely that the source type originates from both coal combustion and mobile emissions. The mass apportioned to this source type ranged from 1 to 5 μg/m^3, which is 8 to 30 percent of the overall mass. This source type was identified in each city except Houston.

The absolute and relative magnitude of contribution from this source type showed much more variation than the coal combustion source type. It was highest in the Midwest in the winter, contributing between 7 and 10 μg/m^3, where the temperatures are cooler and there are more ammonia emissions. The summertime contributions of this source type are generally low, near 1 μg/m^3.

The mobile source type contains a large amount of organic carbon, some elemental carbon, very little sulfate and some metals (particularly barium from brake pads). The mass apportioned to this source type ranged from a low of 2.5 μg/m^3 at Milwaukee to a high of 6.5 μg/m^3 at Birmingham. This source type has the least seasonal variability of the largest source types. Contributions for the highest season, which varies from site to site but is generally fall or summer, are only 1.5 or 2 times higher than the contributions for the

lowest season. As a percentage of mass, the mobile source type accounts for 15 to 40 percent of the total mass. It is assumed that most of the mass apportioned to the mobile source type is associated with local sources.

Linking the wind trajectories with the source apportionment results allows us to develop source regions (i.e., geographic regions with a high probability of being the origin of the mass associated with a source profile). These source regions provide evidence that at least some of the particles associated with the source profiles are likely transported over long distances. For example, the highest probability source region for the coal combustion source profile for Birmingham includes parts of the following States: Missouri, Illinois, Indiana, Ohio, Kentucky, Virginia, North Carolina, South Carolina, Alabama, and Mississippi. Table V-4 lists the States included in the highest probability source regions for each of the three largest source profiles at each of the 8 sites.

The EPA compared the source regions for the coal combustion source (the largest source in each city) with the results from the zero-out modeling (described below) at the six cities in the 8 City Source Apportionment

Study that were projected to violate the PM2.5 standard in 2010. To perform these comparisons, for each city, the States in the highest probability source regions were compared to the States with a maximum contribution of 0.10 $\mu g/m^3$ or greater at the monitor in that city. These comparisons were generally good. At the Bronx site for instance, 8 of the 9 States with a maximum contribution of 0.10 $\mu g/m^3$ or greater were included in the highest probability source region for the coal combustion source. In 5 of the 6 cities for which the comparison was performed, at least two thirds of the States with a maximum contribution of 0.10 $\mu g/m^3$ were also in the highest probability source region for the coal combustion source. In the 6^{th} city, St. Louis, 7 of the 13 States with a maximum contribution of 0.10 $\mu g/m^3$ were the highest probability source region for the coal combustion source. In summary, the general agreement between these two independent methods (source apportionment linked with wind trajectories and zero-out modeling) produce similar results in determining what States impact downwind receptors.

Sulfate is generally formed in the atmosphere from SO2 (which is why the source is often referred to as

secondary sulfate). Since the major sources of SO2 emissions are utility plants, which are fairly well inventoried, the sulfate source locations have been compared to the utility plant SO2 emissions as a check on the source identifications. Similarly, much of the nitrate is formed from NOx reactions in the atmosphere with utility plants being a major source of NOx. Hence, the nitrate source locations have also been compared with utility plant NOx emissions inventories (although we do not expect the correlation to be as good because (a) nitrate is semi- volatile, (b) there are other significant sources of NOx, and (c) the nitrate formation is also dependent on NH3 emissions).

The comparisons of the sulfate source regions with the utility SO2 emissions were good for some of the sites. At the Bronx site for instance, the back trajectories do yield the expected source region associations with large utility emissions of SO2, namely the Ohio River Valley and the borders of Ohio, West Virginia, and Pennsylvania.

Comparisons of the contour maps of the various non-marine nitrate sources show a common pattern, namely Midwest farming regions. Illinois, in particular, stands

out. It has both NOx utility emissions and the farming regions for sources of ammonia.

More information on ambient source apportionment studies is contained in the Air Quality Data Analysis Technical Support Document.

Table V-4. Eight City Source Apportionment Study States in Highest Probability Regions for Largest Sources.

8 City Source Apportionment Study States in Highest Probability Regions for Largest Sources			
City	**Coal Combustion Source**	**Mobile Sources**	**Ammonium Nitrate Source**
Bronx	NY, PA, MD, VA, NC, WV, OH, KY, IN, MI, IL, WI	VT, MA, NY, NJ, PA, MD, VA, OH, IN, IL, WI, MN	NY, NJ, DE, MD, VA, NC, PA, OH, IL, WI, MN
Washington, DC	NY, PA, VA, NC, SC, GA, OH, KY, TN, IN, IL, AR	MD, DE, VA, NC, SC, WV, OH, KY, TN	NY, PA, MD, DE, KY, TN, IL
Charlotte	NY, CT, NJ, PA, MD, VA, NC, SC, GA, FL, WV, OH, KY, MI, IN, AL, MS	NC, SC, GA, TN, AR	PA, MD, VA, NC, SC, GA, FL, KY, TN, AR, MO, KS
Birmingham	VA, NC, SC, GA, FL, OH, KY, TN, AL, IN, IL, MO	NC, SC, GA, AL, MS, AR	IN, KY, TN, IL, MS, MN, IA, AR, LA, NE, OK, TX
Milwaukee	OH, MI, IN, KY, TN, AL, MS, IL, WI, IA, MO, AR, LA, SD, NE, KS, OK	AL, WI, YN, MS, MN, MO	MI, OH, IN, WI, IL, MN, IA, MO, AR, ND, KS, OK
Indianapolis	NC, KY, TN, AL, FL, IN, IL, IA, MO, AR, LA, TX, NE, KS	OH, KY, TN, NC, GA, IN, MI, WI, AR, LA	MI, OH, IN, WI, IL, MN, IA, MO, AR, ND, KS, OK
St. Louis	WV, MI, KY, TN, IL, MO, AR, LA, TX	MO, LA, NE, KS	OH, IN, KY, TN, IL, IA, KS
Houston[1]	SC, GA, FL, AL, MS, LA, TX, IN	KY, TN, AL, MS, IN, IL, AR, LA, TX	

[1] No ammonium nitrate source was identified in Houston.

2. Non-EPA Air Quality Modeling Analyses Relevant to PM2.5 Transport and Mitigation Strategies

Air quality modeling was performed as part of the Southern Appalachian Mountains Initiative (SAMI) to support an assessment of the impacts of aerosols, ozone, and acid deposition in Class I areas within an eight-State portion of the Southeast.[78] The results of the SAMI modeling[79] provide the following technical information on transport relevant to today's proposal:

- Emissions reductions strategies produce the largest changes in fine particle mass on days with the highest mass.
- Most of the reductions in fine particle mass are due to reductions in sulfate particles.
- Particle mass in Class I areas of the SAMI region are influenced most by SO2 emissions within the State and within adjacent States.
- SO2 emissions in other regions outside SAMI also contribute to particle mass at Class I areas in the SAMI States.

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[78] The eight States of the Southern Appalachians covered by SAMI are: Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.
[79] Southern Appalachian Mountains Initiative Final Report, August 2002.

- Specifically, in a 2010 baseline scenario, SO2 emissions reductions in States outside the SAMI region accounted for approximately 20 percent to as much as 60 percent of the modeled sulfate reduction in the 10 Class 1 areas in the SAMI region.
- The relative sensitivity of nitrate fine particle mass at the SAMI Class I areas to changes in NOx emissions from SAMI States and from other regions is similar to the above findings for sulfate fine particle mass.
- For SAMI to accomplish its mission, emissions reductions are essential both inside and outside the SAMI region.
- Formation of nitrate particles is currently limited in the rural southeastern U.S. by the availability of ammonia. As sulfate particles are reduced, more ammonia will be available to react with nitric acid vapor and form nitrate particles.

The findings of the air quality modeling performed by SAMI are very consistent and supportive of EPA's zero-out modeling, as described below. The findings indicate that interstate transport results in non-trivial contributions to PM2.5 in downwind locations. High concentrations of

PM2.5 at sensitive downwind receptors are not only influenced by emissions within that State, but are also heavily influenced by emissions in adjacent States as well as emissions from States in other regions. The SAMI results support a regional control approach involving SO2 emissions reductions in order to sufficiently reduce PM2.5 to meet environmental objectives. The SAMI also found that SO2 emissions reductions can lead to an increase in particle nitrate (i.e., nitrate replacement). As described in section II.B.3, any such increases could be mitigated through reductions in emissions of NOx.

3. Air Quality Modeling of Interstate PM2.5 Contributions

This section documents the procedures used by EPA to quantify the impact of emissions in specific upwind States on projected downwind nonattainment for annual average PM2.5. These procedures are part of the two-step approach for determining significant contribution, as described in section III, above.

The analytic approach for modeling the contribution of upwind States to PM2.5 in downwind nonattainment areas and the methodology for analyzing the modeling results are described in subsection (a) and the findings as to

whether individual States meet the air quality prong of the significant contribution test is provided in subsection (b). The air quality modeling for the interstate PM2.5 contribution analysis was performed for those counties predicted to be nonattainment for annual average PM2.5 in the 2010 Base Case, as described above in section IV.E.

a. Analytical Techniques for Modeling Interstate Contributions to Annual Average PM2.5 Nonattainment

The EPA performed State-by-State zero-out modeling to quantify the contribution from emissions in each State to future PM2.5 nonattainment in other States and to determine whether that contribution meets the air quality prong (i.e., before considering cost) of the "contribute significantly" test. As part of the zero-out modeling technique we removed the 2010 Base Case man-made emissions of SO2 and NOx for 41 States on a State-by-State basis in different model runs. The States EPA analyzed using zero-out modeling are: Alabama, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire,

New Mexico, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. Emissions from the District of Columbia were combined with those from Maryland.

The contribution from each State to PM2.5 at nonattainment receptors in other States was determined in the following manner:

Step 1: The PM2.5 species predictions from the zero-out run were applied using the SMAT to calculate PM2.5 at the 57 2010 Base Case nonattainment receptor counties. These receptors are identified in section IV.E.3, above.

Step 2: For each of the 57 receptors, we calculated the difference in PM2.5 between the 2010 Base Case and the zero-out run. This difference is the contribution from the particular State to the downwind nonattainment receptor.

As described above in section V.B.2., EPA used three fundamental factors for evaluating the contribution of upwind States to downwind 8-hour ozone nonattainment, i.e., the magnitude, frequency, and relative amount of contribution. One of these factors, the frequency of

contribution, is not relevant for an annual average NAAQS and thus, frequency was not considered in the evaluation of interstate contributions to nonattainment of the PM2.5 NAAQS.

The EPA considered a number of metrics to quantify the magnitude and relative amount of the PM2.5 contributions. All of the metrics are described in the AQMTSD. As discussed in section III, above, EPA is proposing to use the maximum downwind contribution metric as the means for evaluating the significance (before considering cost) of interstate PM2.5 transport. We solicit comment on other metrics including population-weighted metrics and whether it would be appropriate to develop a metric based on annualized costs for each State per ambient impact on each downwind nonattainment receptor.

The procedures for calculating the maximum contribution metric are as follows:

Step 1: Determine the contribution from each upwind State to PM2.5 at each downwind receptor;

Step 2: The highest contribution from among those determined in Step 1 is the maximum downwind contribution.

b. Evaluation of Upwind State Contributions to Downwind PM2.5 Nonattainment

The EPA is proposing to use a criterion of 0.15 μg/m^3 for determining whether emissions in a State make a significant contribution (before considering cost) to PM2.5 nonattainment in another State. The rationale for choosing this criterion is described in section III, above. The maximum downwind contribution from each upwind State to a downwind nonattainment county is provided in Table V-5. Of the States analyzed for this proposal, 28 States and the District of Columbia contribute 0.15 μg/m^3 or more to nonattainment in other States and therefore are found to make a significant contribution (before considering cost) to PM2.5. Although we are proposing to use 0.15 μg/m^3 as the air quality criterion, we have also analyzed the impacts of using 0.10 μg/m^3. Based on our current modeling, two additional States, Oklahoma and North Dakota, would be included if we were to adopt 0.10 ug/m3 as the air quality criterion. The contributions to PM2.5 from each of the 41 upwind States to each of the downwind nonattainment counties are provided in the AQMTSD. Table V-6 provides a count of the number of downwind counties

that received contributions of 0.15 μg/m^3 or more from each upwind State. This table also provides the number of downwind counties that received contributions of 0.10 μg/m^3 or more from each upwind State.

Table V-5. Maximum Downwind PM2.5 Contribution (μg/m^3) for each of 41 Upwind States.

Upwind State	Maximum Downwind Contribution	Downwind Nonattainment County of Maximum Contribution
Alabama	1.17	Floyd, GA
Arkansas	0.29	St. Clair, IL
Connecticut	0.07	New York, NY
Colorado	0.04	Madison, IL
Delaware	0.17	Berks, PA
Florida	0.52	Russell, AL
Georgia	1.52	Russell, AL
Illinois	1.50	St. Louis, MO
Indiana	1.06	Hamilton, OH
Iowa	0.43	Madison, IL
Kansas	0.15	Madison, IL
Kentucky	1.10	Clark, IN
Louisiana	0.25	Jefferson, AL
Maryland/District of Columbia	0.85	York, PA
Maine	0.03	New Haven,CT
Massachusetts	0.21	New Haven, CT
Michigan	0.88	Cuyahoga, OH
Minnesota	0.39	Cook, IL
Mississippi	0.30	Jefferson, AL
Missouri	0.89	Madison, IL

Montana	0.03	Cook, IL
Nebraska	0.08	Madison, IL
New Hampshire	0.06	New Haven, CT
New Jersey	0.45	New York, NY
New Mexico	0.03	Knox, TN
New York	0.85	New Haven, CT
North Carolina	0.41	Sullivan, TN
North Dakota	0.12	Cook, IL
Ohio	1.90	Hancock, WV
Oklahoma	0.14	Madison, IL
Pennsylvania	1.17	New Castle, DE
Rhode Island	0.01	New Haven, CT
South Carolina	0.72	Richmond, GA
South Dakota	0.04	Madison, IL
Tennessee	0.57	Floyd, GA
Texas	0.37	St. Clair, IL
Vermont	0.06	New Haven, CT
Virginia	0.67	Washington, DC
West Virginia	0.89	Allegheny, PA
Wisconsin	1.00	Cook, IL
Wyoming	0.05	Madison, IL

Table V-6. Number of Downwind PM2.5 Nonattainment Counties that Receive Contributions 0.15 µg/m³ or More and 0.10 µg/m³ or More from each Upwind State.

Upwind State	Number of Downwind Nonattainment Counties with Contributions of 0.10 µg/m³ or More	Number of Downwind Nonattainment Counties with Contributions of 0.15 µg/m³ or More
Alabama	43	32
Arkansas	27	4

Delaware	4	1
Florida	23	19
Georgia	38	27
Illinois	53	53
Indiana	54	53
Iowa	30	13
Kansas	4	2
Kentucky	52	50
Louisiana	33	25
Maryland/District of Columbia	9	7
Massachusetts	2	1
Michigan	55	39
Minnesota	18	8
Mississippi	28	18
Missouri	47	31
New Jersey	8	7
New York	16	12
North Carolina	35	28
North Dakota	4	0
Ohio	47	47
Oklahoma	3	0
Pennsylvania	52	46
South Carolina	23	19
Tennessee	50	43
Texas	48	36
Virginia	35	17
West Virginia	46	32
Wisconsin	48	29

VI. Emissions Control Requirements

This section describes the proposed criteria EPA used to establish these new SO2 and NOx control requirements, for the States with emissions sources contributing to nonattainment as described in section V. This section also explains how information on EGUs was used in proposing emissions control requirements for SO2 and NOx to address interstate pollution transport, and what source categories were also considered by the Agency. This includes consideration of the technologies available for reducing SO2 and NOx emissions and the methods that we used to evaluate the cost effectiveness of these emissions reductions. This section also discusses interactions of today's proposed action with the existing Acid Rain Program under title IV of the CAA. This section discusses the emission source categories that EPA considered for today's action, and explains that we assumed control on EGUs in developing this proposal. This section also describes the methodology used for developing State budgets from the proposed control requirements, with a step in the methodology based on regionwide targets. Further, this section presents the proposed State budgets for NOx and SO2 for EGUs. (More

details regarding requirements related to budget demonstrations can be found in section VII.) This section also discusses baseline inventories.

A. Source Categories Used for Budget Determinations

Today's action proposes requirements based on emissions reductions for EGUs. The EPA is examining potential pollution control approaches and the cost effectiveness of emissions reductions for other source categories. Today, EPA solicits comments on those other source categories, but is not proposing action on them.

1. Electric Generation Units

In developing today's proposal, we investigated various source categories to see which may be candidates for additional controls. Our attention focused on emission reductions from EGUs for several reasons. Electric Generating Units are the most significant source of SO2 emissions and a very substantial source of NOx in the affected region. For example, EGU emissions are projected to represent approximately one-quarter (23 percent) of the total NOx emissions in 2010 and over two-thirds (67 percent) of the total SO2 emissions in 2010 in the 28-State plus DC region that is being controlled for both SO2 and NOx after application of current CAA

controls. Furthermore, control technologies available for reducing NOx and SO2 from EGUs are considered highly cost effective and able to achieve significant emissions reductions.

The methodology for setting SO2 and NOx budgets described below under sections VI.B, VI.C, and VI.D applies to EGUs only. Electric Generating Units are defined as fossil-fuel fired boilers and turbines serving an electric generator with a nameplate capacity of greater than 25 megawatts (MW) producing electricity for sale. Fossil fuel is defined as natural gas, petroleum, coal, or any form of solid, liquid, or gaseous fuel derived from such material. The term “fossil fuel-fired” with regard to a unit means combusting fossil fuel, alone or in combination with any amount of other fuel or material. These definitions are the same as those used under the title IV Acid Rain program.

2. Treatment of Cogenerators

The EPA is proposing that the determination of whether a boiler or turbine that is used for cogeneration should be considered an EGU is dependent upon the amount

of electricity that the unit sells.[80]

We propose to treat a cogeneration unit as an EGU in this proposed rule if it serves a generator with a nameplate capacity of greater than 25 MW and supplies more than one-third of its potential electric output capacity and sells more than 25 MW electrical output to any utility power distribution system for sale in any of the years 1999 through 2002. If one-third or less of the potential electric output capacity or 25 MW or less is sold during all of those years, the cogeneration unit would be classified as a non-EGU. The definition of potential electrical output capacity proposed for this rule is the definition under part 72, appendix D of the Acid Rain regulations.

The definition of a cogeneration facility under the title IV Acid Rain program and the NOx SIP Call was based

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[80] The NOx SIP Call, as finalized in 1998, moved beyond the "utility unit" definition in the Acid Rain Program and treated as "EGUs" all fossil- fuel-fired units serving generators with a nameplate capacity exceeding 25 MW and producing any electricity for sale. This EGU definition, as applied to cogeneration units, was remanded to EPA as a result of litigation. Subsequently, EPA proposed to retain the approach in the 1998 rule, but in response to comments EPA received on that proposal, EPA is preparing to finalize a response to the court remand in which EPA will change the definition of EGU originally finalized in the NOx SIP Call to be very similar to the existing title IV definition.

on the Federal Energy Regulatory Commission Qualifying Facility definition. We propose to use this same definition with one change. We propose to apply the efficiency standards under title 18, section 292.205 to coal, oil, and gas-fired units instead of applying the efficiency standards only to oil and gas-fired units. The EPA believes this change would be more consistent with its fuel-neutral approach throughout this proposed rule. In addition, not applying an efficiency standard to coal-fired units would be counter productive to EPA's efforts to reduce SO2 and NOx emissions under this proposed rule because of the relatively high SO2 and NOx emissions from coal-fired units.

We solicit comment on use of this definition of cogeneration facility for purposes of developing emission budgets.

3. Non-EGU Boilers and Turbines

For several reasons, the approach we are proposing today would not require or assume additional emissions reductions from non-EGU boilers and turbines. First, compared to the information we have about emissions from EGUs and the costs of controlling those emissions, we have relatively little information about non-EGU boilers

and turbines.[81] In particular, we have limited information both about SO2 controls and the integration of NOx and SO2 controls. As a result, we are not able to determine that further emissions reductions from these sources would be highly cost effective. Second, based on the information we do have, projected emissions of NOx and SO2 from these sources in 2010 are much lower than those projected from EGUs. However, we invite information and comment on these source categories. In particular, we request comments on sources of emissions and cost information.

We recognize, for example, that some industrial boiler owners may prefer the certainty and flexibility of being included in a regional trading program, rather than facing the uncertainty of the SIP development process. In addition, many non-EGU boilers and turbines already are regulated under the NOx SIP Call and thus are part of a NOx trading program with EGUs. It is EPA's intent that, for EGUs, compliance with the more stringent annual NOx reduction requirement in today's proposed rule will be able to serve as compliance with the seasonal NOx SIP

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[81] See "Identification and Discussion of Sources of Regional Point Source NOx and SO2 Emissions Other Than EGUs (January 2004)".

Call limits. Therefore since EGUs will no longer be participating in the seasonal NOx SIP Call Trading Program, the cost of compliance for non-EGUs will likely increase.

4. Other Non-EGUs

We also evaluated the available information on SO2 and NOx emissions and control measures for source categories other than EGUs and large industrial boilers and turbines, in order to identify highly cost effective emission reductions. Our approach to considering these source categories is discussed in a technical support document available in the docket, entitled "Identification and Discussion of Sources of Regional Point Source NOx and SO2 Emissions Other Than EGUs (January 2004)". Based on this evaluation, we are not proposing to consider reductions from any of these source categories because we are unable to identify specific quantities of SO2 or NOx emissions reductions that would be highly cost effective. However, we invite information and comment on these sources categories. In particular, we request comment on sources of emissions and cost information.

The EPA did not identify highly cost-effective

controls on mobile or area sources that would achieve broad-scale regional emissions reductions relative to baseline conditions and fit well with the regulatory authority available under section 110(a)(2)(D). We observe that Federal requirements for new on-road and off-road engines and motor vehicles will substantially reduce emissions as the inventory of vehicles and engines turns over.

B. Overview of Control Requirements and EGU Budgets

This section explains how EPA developed State emissions reduction requirements for NOx and SO2 emissions that will lead to reductions of emissions associated with the interstate transport of fine particles and ozone. We seek to implement the section 110(a)(2)(D) requirement that upwind States act as "good neighbors" by eliminating the amount of their emissions that contribute significantly to the downwind nonattainment areas. The proposed requirements would apply to 29 Eastern States (and DC) that significantly contribute to fine particle and/or ozone nonattainment.

We propose to establish these emissions reduction requirements, for both SO2 and NOx purposes, based on assuming the application of highly cost-effective

controls to large EGUs. The approach of identifying highly cost-effective controls was the basis for developing the emissions budgets in the NOx SIP Call, and is the basis for developing the emissions budgets in today's action. Today's proposal bases its reduction and control requirements solely on controls for EGUs.

The States have full flexibility in choosing the sources that must reduce emissions. If the States choose to require EGUs to reduce their emissions, then the States must impose a cap on EGU emissions, which would, in effect, be an emissions budget. If a State chooses to control EGUs and elects to allow them to participate in the interstate cap and trade program, the State must follow EPA rules for allocating allowances to the individual EGUs. If a State wants to control EGUs but does not want to allow EGUs to participate in the interstate cap and trade program, the State has flexibility in allocating, but it must cap EGUs. The State must also assure that EGUs meet title IV requirements.

In 2010, the proposed requirements would effectively establish emissions caps for SO2 and NOx of 3.9 million tons and 1.6 million tons, respectively. The budgets

would be lowered in 2015 to provide SO2 and NOx emissions caps of 2.7 million tons and 1.3 million tons, respectively, in the proposed control region. An SO2 emissions cap of 2.7 million tons in 28 States will lead to nationwide emissions of approximately 3.5 million tons when the cap is fully implemented. This is significantly lower than the 8.95 million tons of SO2 emissions allowed from EGUs under the current title IV Acid Rain SO2 Trading Program. EPA expects that States will elect to join a regional cap and trade program for these pollutants that the Agency will administer similar to the NOx SIP Call. This is discussed in section VIII of this proposal.

If the States choose to control other sources, then they must employ methods to assure that those other sources implement controls that will yield the appropriate amount of reductions. This is discussed further in section VII, below.

The EPA believes that it will take substantial time (more than 3 years from completion of SIPs) to install all of the equipment necessary to meet the proposed control requirements. Thus, EPA is proposing that the required reductions be made in two phases, with annual

emissions caps for NOx and SO2 taking effect in 2010 and 2015.

Today's approach is similar to that of the NOx SIP Call. In that case, EPA required States that controlled emissions from large boilers (either EGUs or non-EGUs) to cap emissions from those source categories. In addition, EPA allowed States to meet part of their emissions budget requirements by participating in an interstate emissions cap and trade program. The cap and trade program in effect meant that the total amount of NOx emissions from EGUs and non-EGU boilers and turbines was limited on a regionwide basis, rather than on a State-specific basis. For other source categories, EPA did not require the State to cap emissions, as long as it demonstrated that it had enforceable measures that achieved the necessary emission reductions. We are proposing to take a similar approach in today's rulemaking.

For convenience, we use specific terminology to refer to certain concepts. "State budget" refers to the statewide emissions that may be used as an accounting technique to determine the amount of emissions reductions that controls may yield. It does not imply that there is a legally enforceable statewide cap on emissions from all

SO2 or NOx sources. “Regionwide budget” refers to the amount of emissions, computed on a regionwide basis, which may be used to determine State-by-State requirements. It does not imply that there is a legally enforceable regionwide cap on emissions from all SO2 or NOx sources. “State EGU budget” refers to the legally enforceable cap on EGUs a State would apply should it decide to control EGUs.

C. Regional Control Requirements and Budgets Based on a Showing of Significant Contribution

In determining States’ emissions reduction requirements, EPA considered both the level and timing of the emissions budgets for the electric power industry at a regional level and State level. The EPA wants to assist the States to attain the NAAQS for PM2.5 and 8-hour ozone in a way that is timely, practical, and cost effective.

For purposes of the PM2.5 and 8-hour ozone transport requirements, CAA section 110(a)(2)(D) requires that States submit SIPs than prohibit emissions in the amount that contributes significantly to nonattainment downwind. Our interpretation of the "contribute significantly" determination includes an air quality component and a

cost-effectiveness component. The air quality component is discussed in sections IV, V, and IX. As to the cost-effectiveness component, in the NOx SIP Call, we applied this component by employing "highly cost-effective" controls as the benchmark. We adopt that benchmark for today's proposal.

In determining the States' obligations under this rule, EPA considers a variety of factors. These include:

- the availability of information,
- the identification of source categories emitting relatively large amounts of the relevant emissions,
- the performance and applicability of control measures,
- the cost effectiveness of control measures, and
- engineering and financial factors that affect the availability of control measures.

We have relatively complete information with respect to these factors for the electric power industry. We do not have information to this degree of completeness for other sources.

The electric power industry emits relatively large amounts of the relevant emissions. This factor is particularly important in a case such as this when the

Federal government is proposing a multistate regional approach to reducing transported pollution.

We request comment on how to determine what constitutes “a relatively large amount” of the relevant emissions. One approach would be to consider the percent contribution the source category makes to the total inventory (e.g., 1 to 10 percent). Another approach, which some have suggested, would be to consider the contribution of a source category to the total NAAQS exceedance level. For example, this approach might consider a source category’s contribution to ambient concentrations above the attainment level in all nonattainment areas in affected downwind States for PM2.5. We request comment on both of these approaches as well as what the appropriate percent contribution under each approach might be.

Under the cost effectiveness component, we also take into account available information about the applicability, performance, and reliability of different types of pollution control technologies for different types of sources. Based on engineering judgement, we consider how many sources in a particular source category can install control technology, and whether such

technology is compatible with the typical configuration of sources in that category. As was done in the NOx SIP Call, and as proposed in today's rule we also evaluate the downwind impacts of the level of control that is identified as highly cost effective. The fact that a particular control level has a substantial downwind impact affirms the selection of that level as "highly cost effective." However, as noted above, we are requesting comment on an approach that would incorporate the effect on downwind States as part of the cost effectiveness component of significant contribution.

There are other practical considerations that we may also consider. For example, if we are aware that emissions from a particular source category will be controlled under an upcoming regulation (a MACT standard, for example), we would also take that fact into account.

We considered several additional factors, including the engineering factors concerning construction and installation of the controls when evaluating the time period needed to implement the controls. This analysis also involves consideration of the time period needed by sources to obtain the financing needed for the controls. Engineering and financial factors are discussed in this

section.

The EPA's approach to controls factored in the air quality improvements that could occur. Air quality modeling that is covered in section IX indicates that today's proposed transport reductions will bring many fine particle nonattainment areas and some ozone nonattainment areas into attainment by 2010 or 2015, and improve air quality in many downwind PM2.5 and ozone nonattainment areas. The modeling also shows more reductions will be needed for some areas to attain. We are striving in this proposal to set up a reasonable balance of regional and local controls to provide a cost effective and equitable governmental approach to attainment with the NAAQS for fine particles and ozone.

1. Performance and Applicability of Pollution Control Technologies for EGUs

In developing today's proposal, EPA focused on the utility industry as a potential source of highly cost effective reductions of both SO2 and NOx emissions. We began by reviewing the reliability, capability and applicability of today's SO2 and NOx pollution controls for this industry.

Both wet and dry flue gas desulfurization (FGD)

technologies for SO2 control, and the selective catalytic reduction (SCR) technology for NOx control on coal-fired boilers, are fully demonstrated and available pollution control technologies. The design and performance levels for these technologies were based on proven industry experience.[82]

For SO2 control, EPA has considered two wet FGD technologies, consisting of the limestone forced oxidation system (LSFO) with dibasic acid injection and the magnesium enhanced lime (MEL) system. In addition, a dry FGD technology, lime spray dryer (LSD) system, has also been considered. Of these, the LSFO system is generally used for installations firing high-sulfur (2 percent and higher) coals, LSD for low-sulfur (less than 2 percent) coals, and MEL for both low- and high-sulfur coals, depending on the overall economics of each application.

In EPA's analyses, the SO2 reduction capabilities considered are 95 percent for the LSFO system, 96 percent for the MEL system, and 90 percent for the LSD system. A significant amount of industry information is available on the use of these technologies. One reference shows

[82]References for this discussion are provided in the docket for today's rulemaking.

over 30 years of operating experience in U.S. electrical utility plants. The three FGD systems considered by EPA have been used in the majority of these plants. A significant number of the wet FGD systems, especially those installed in the last 10 years, have design SO2 removal efficiencies ranging from 95 to 99 percent. Also, there are several LSD installations designed for 90 percent or higher SO2 removal, supporting the performance levels selected by EPA.

The EPA has also identified several other references that support its FGD technology selections. These references report long-term operating experience with wet FGD systems, with and without dibasic acids, at SO2 removal rates of 95 to 99 percent. We also performed a study that lists in a greater detail the criteria and the references for selection of all three FGD technologies considered.

The NOx reduction capability considered by EPA for the SCR technology is 90 percent, with the minimum NOx emission rate limited to 0.05 lb/mmBtu. Because of this 0.05 lb/mmBtu limit, the actual NOx reduction requirement for SCR systems on the boilers with existing or future combustion controls is expected to be less than 90

percent. For example, the baseline NOx emissions on a large number of boilers with existing combustion controls are below 0.3 lb/mmBtu, requiring SCRs with NOx removal rates of approximately 83 percent or lower.

The first SCR application in the U.S. on a coal-fired boiler started operating in 1993. At the end of 2002, the number of operating SCR installations on U.S. boilers stood at 56. Another 85 SCR units are scheduled to go into operation in 2003. The design NOx reduction efficiencies of these SCR systems vary, but many of them are designed for 90 percent reduction. Operating data available from many plants indicate that the 90 percent NOx removal rate has been met or exceeded at these plants.

There is more long-term experience with coal-fired SCR applications in Europe and Japan. This experience includes high- and medium-sulfur coal applications and is directly applicable to the U.S. installations. The overall SCR experience both in the U.S. and abroad, therefore, supports the criteria EPA has used for this technology.

SCRs and scrubbers have been used in combination on most new coal-fired powered plants built in the U.S.

since the early 1990s. The combination has also been retrofit on a number of existing coal-fired units.

2. Evaluation of Cost Effectiveness

With effective, well-established controls available for both SO2 and NOx emissions from EGUs, EPA must determine what is the appropriate level of costs for these controls. In the NOx SIP Call rule, EPA defined the cost component of the "contribute significantly" test in terms of a level of cost effectiveness, that is, dollars spent per ton of emissions reductions. Specifically, in the NOx SIP Call, EPA defined the cost component in terms of "highly cost-effective" controls, a definition upheld by the D.C. Circuit in the Michigan case. Today, EPA proposes to use this approach.

We want to provide an emissions reductions program for SO2 and NOx that complements State efforts to attain the PM2.5 and ozone standards in the most cost-effective, equitable and practical manner possible. The objective of the analysis is to select from the spectrum of possible pollution controls the least expensive approaches available at the time the controls are selected.

To ensure that EPA's overarching goal of achieving the NAAQS in the most cost effective, equitable and practical manner possible is met by Federal and State actions, the Agency has decided to pursue emissions reductions that it considers are highly cost effective now before State plans for nonattainment are due. Proposing highly cost-effective controls also provides greater certainty that transport controls are not being overemphasized relative to local controls.

For today's proposal, EPA independently evaluated the cost effectiveness of strategies to reduce SO2 and NOx to address PM2.5 and ozone nonattainment. The results of EPA's analysis are summarized below. (All costs in this summary are rounded to the nearest hundred dollars, and are presented in 1999$.) It should be noted that the results of these analyses for SO2 controls are not relevant to NOx controls, and vice versa. Each pollutant has a different history of cost of controls, which makes cross-pollutant comparison inappropriate.

We note that comparisons of the cost per ton of pollutant reduced from various control measures should be viewed carefully. Cost per ton of pollutant reduction is

a convenient way to measure cost effectiveness, but it does not take into account the fact that any given ton of pollutant reduction may have different impacts on ambient concentration and human exposure, depending on factors such as the relative locations of the emissions sources and receptor areas. Thus, for example, an alternative approach might adopt the effect of emission reductions on ambient concentrations in downwind nonattainment areas as the measure of effectiveness of further control. The EPA solicits comment on whether to take such considerations into account and what, if any, scientifically defensible methods may be available to do so.

a. Cost Effectiveness of SO2 Emission Reductions

The EPA 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. 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. Moreover, this level of cost is consistent with SO2 and

NOx emissions reductions that yield substantial ambient benefits in downwind nonattainment areas, as discussed in section IX. For these reasons, EPA proposes today the costs identified below as highly cost-effective levels, and the associated set of SO2 and NOx emissions reductions and emissions budgets, as the basis for the SIP requirements.

Table VI-1 provides the average and marginal costs of annual SO2 reductions under EPA proposed controls for 2010 and 2015. Also, EPA considered the sensitivity of the marginal cost results to assumptions of higher electric growth and future natural gas prices than it used in its base case. These assumptions in the sensitivity analysis were based on the Energy Information Agency's *Annual Energy Outlook for 2003.*

Table VI-2 provides the average cost per ton of recent EPA, State, and local Best Available Control Technology (BACT) permitting decisions for SO2. These decisions reflect the application of BACT for SO2 to new sources and major modifications at existing sources. These decisions, which include consideration of average and incremental cost effectiveness, reflect the application of best available controls in attainment and

unclassified areas. These decisions do not reflect the application of lowest achievable emission rate, which is required in nonattainment areas and which does not directly consider cost in any form. The BACT decisions are relevant for present purposes because they comprise cost effective controls that have been demonstrated.

Table VI-3 provides the marginal cost per ton of recent State decisions for annual SO2 controls where marginal cost information was available. These include the WRAP Regional SO2 Trading Program and statewide rules that have required significant reductions of SO2 in North Carolina and Wisconsin.

The results of the sensitivity analysis of the marginal cost in Table VI-1 when compared to Table VI-3 results further supports that the SO2 controls are highly cost effective.

Additionally, the Agency further considered the cost effectiveness of alternative stringency levels for this regulatory proposal (examining changes in the marginal cost curve at varying levels of emissions reductions). Figure VI-1 shows that the “knee” in the marginal cost effectiveness curve - the point where the cost of control is increasing at a higher rate than the amount of SO2

removal for EGUs - appears to start above $1,200 per ton. The selected approach was well below the point at which there would be significant diminishing returns on the dollars spent for pollution control. The EPA used the Technology Retrofitting Updating Model (TRUM), a spreadsheet model based on the Integrated Planning Model (IPM), for this analysis. Details of this analysis can be found in "An Analysis of the Marginal Cost of SO2 and NOx Reductions" (January 2004) in the docket for today's rulemaking.

Table VI-1. Predicted Costs Per Ton of SO2 Controlled Under Proposed Control Strategy (1999$)/ton [1]

	2010	2015
Average Cost	$700	$800
Marginal Cost	$700	$1,000
Sensitivity Analysis: Marginal Cost, Assuming High Electric Demand and Natural Gas Price	$900	$1,100

[1] EPA IPM modeling; available in the docket.

Table VI-2. Average Costs Per Ton of Annual SO2 Controls

SO2 Control Action	Average Cost (1999$)/ton
Best Available Control Technology (BACT) determinations	$500-$2,100 [1]

[1] These numbers reflect a range of cost effectiveness data entered into EPA's RACT/BACT/LAER Clearinghouse (RBLC) for add-on SO2 controls.

Table VI-3. Marginal Costs Per Ton of Annual SO2 Control Actions

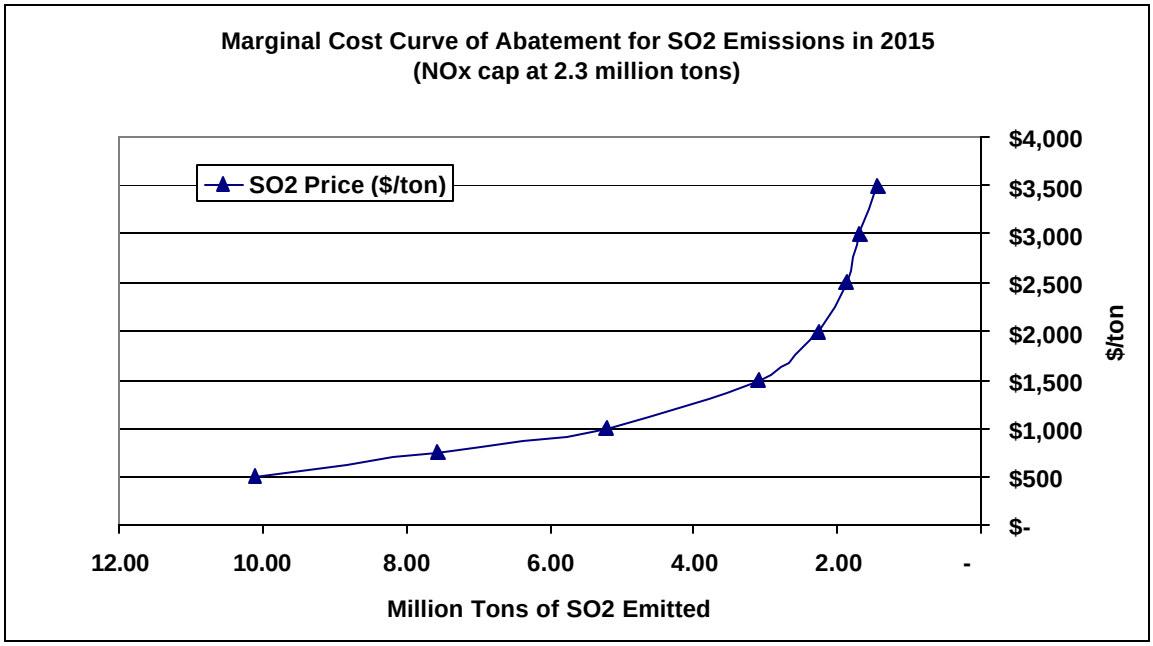
SO2 Control Action	Marginal Cost (1999$)/ton
Wisconsin Multi-pollutant rule	$1,400 [1]
North Carolina Multi-pollutant rule	$800 [2]
WRAP Regional SO2 Trading Program	$1,100-$2,200 [3]

[1] EPA's IPM Base Case run, available in the docket.

[2] EPA's IPM Base Case run, available in the docket.

[3] "An Assessment of Critical Mass for the Regional SO2 Trading Program," Prepared for Western Regional Air Partnership Market Trading Forum by ICF Consulting Group, September 27, 2002, available in the docket and at www.wrapair.org/forums/mtf/critical_mass.html. This analysis looked at the implications of one or more States choosing to opt-out of the WRAP regional SO2 trading program.

Figure VI-1



b. Cost Effectiveness of NOx Emission Reductions

In developing the NOx SIP Call, EPA determined that an average cost effectiveness of $2,500/ton (in 1999$, from original $2,000/ton in 1990$), or less, was highly cost effective for NOx reductions during the ozone season. This was based on review of other relevant actions EPA and others had recently taken. An updated summary of average costs of NOx control actions is in Table VI-4. Each of the programs in Table VI-4 cover annual NOx reductions, which makes comparison of these estimates to ozone season reductions a conservative comparison, as was done in the NOx SIP Call. The table's results are very similar to what EPA found in 1998 and reaffirm the Agency's earlier determination of what a highly cost-effective reduction of NOx emissions is.

Table VI-5 provides the results of EPA's analysis of the cost effectiveness of the proposed NOx control requirements for States contributing to downwind ozone nonattainment. The average costs are well below $2,500/ton. The marginal costs in 2010 are much lower than the benchmark, but in 2015 are above it by a modest amount. Notably, if the controls during the ozone season are then used for the remaining months of the year, their costs are very low. Table VI-6 provides these results.

These reductions are among the lowest cost EPA has ever observed in NOx control actions and are obviously highly cost effective.

Table VI-7 shows the average and marginal costs of year-round controls for EPA's proposed approach. When these costs are compared to the costs in Table VI-8, it is clear that in the States that control NOx for PM2.5 only, the controls are highly cost effective.

The Agency further considered the cost effectiveness of alternative stringency levels for this regulatory proposal (examining changes in the marginal cost curve at varying levels of emission reductions). Figure VI-2 shows that the knee in the marginal cost effectiveness curve for NOx appears to start above $2,000 per ton. The selected approach was well below the point at which there would be significant diminishing returns on the dollars spent for pollution control.

Table VI-4. Average Cost Per Ton of Existing and Proposed Annual NOx Rules

NOx Rule [1]	Average Cost (1999$)
Tier 2 Vehicle Gasoline Sulfur [2]	$1,300-$2,300
2004 Highway HD Diesel [2]	$200-$400
Off-highway Diesel Engine [2]	$400-$700
Tier 1 Vehicle Standards [2]	$2,100-$2,800

National Low Emission Vehicle [2]	$1,900
Marine SI Engines [2]	$1,200-$1,800
2007 Highway HD Diesel Stds [2]	$1,600-$2,100
On-board Diagnostics [2]	$2,300
Marine CI Engines [2]	up to $200
Revision of NSPS for New EGUs	$2,100 [3]

[1] Costs for rules affecting mobile sources presented here include a VOC component.
[2] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule (66 FR 5102; January 18, 2001). The values shown for 2007 Highway HD Diesel Stds are discounted costs.

Table VI-5. Predicted Costs Per Ton of OZONE SEASON-ONLY NOx Controlled Under Proposed Control Strategy (1999$)/ton [1]

	2010	2015
Average Cost	$1,000	$1,500
Marginal Cost	$2,200	$2,600

[1] EPA IPM modeling; available in the docket.

Table VI-6. Predicted Costs Per Ton of WINTER SEASON NOx Controlled Under Proposed Control Strategy (1999$)/ton [1]

	2010	2015
Average Cost	$700	$500

[1] EPA IPM modeling; available in the docket.

Table VI-7. Predicted Costs Per Ton of ANNUAL NOx Controlled Under Proposed Control Strategy (1999$)/ton [1]

	2010	2015
Average Cost	$800	$700
Marginal Cost	$1,300	$1,500

Sensitivity Analysis: of Marginal Cost, Assuming High Electricity Demand and Natural Gas Price	$1,300	$1,600
Sensitivity Analysis: of Marginal Cost, Assuming High Electricity Demand, Natural Gas Price and SCR Costs	$2,200	$2,000

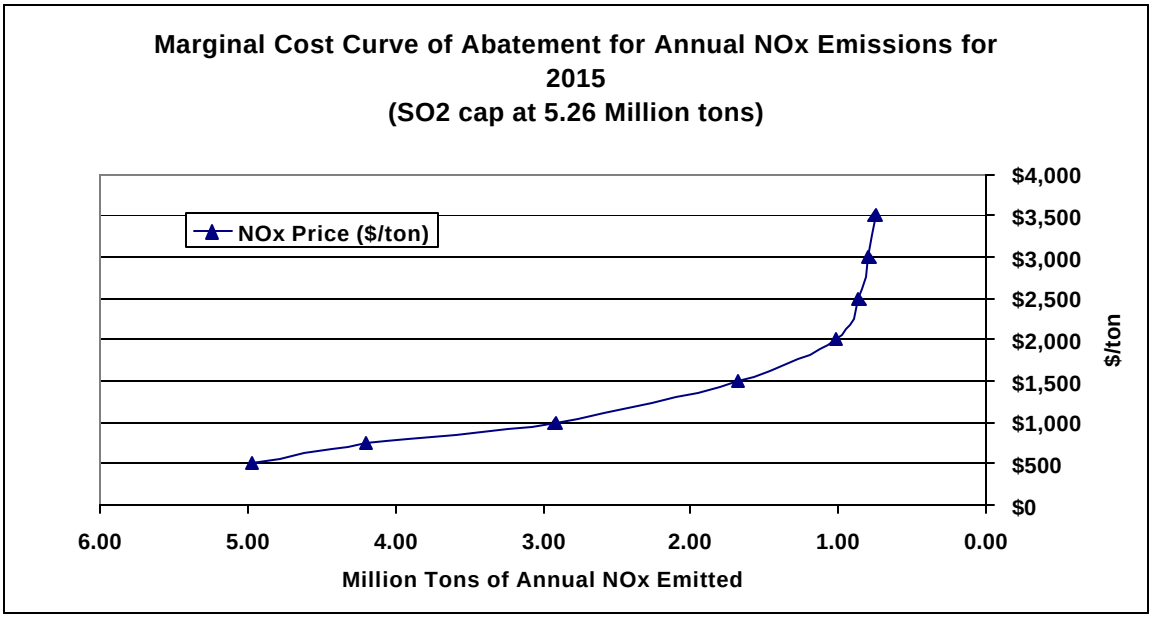
[1] EPA IPM modeling; available in the docket.

Table VI-8. Marginal Cost Per Ton of Reduction Recent NOx Rules

NOx Action	**Marginal Cost Per Ton (1999$)**
Wisconsin Rules - Annual Controls	$1,800 [1]
Texas Rules - Annual Controls	$1,400-$3,000 [1]

[1] EPA's IPM Base Case run, available in the docket. NOx control requirements in Texas vary regionally; the range of marginal costs here reflects the various requirements in the State.

Figure VI-2



c. EPA Cost Modeling Methodology

The EPA conducted analysis through the Integrated Planning Model (IPM) that indicates that its proposed SO2 and NOx control strategies are consistent with the level of controls proposed as highly cost effective. We use IPM to examine costs and, more broadly, analyze the projected impact of environmental policies on the electric power sector in the 48 contiguous States and the District of Columbia. The IPM is a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector. It provides forecasts of least-cost capacity expansion, electricity dispatch, and

emission control strategies for meeting energy demand and environmental, transmission, dispatch, and reliability constraints. We used IPM to evaluate the cost and emissions impacts of the policies to limit emissions of SO2 and NOx from the electric power sector that are proposed in today's rulemaking. The National Electric Energy Data System (NEEDS) contains the generation unit records used to construct model plants that represent existing and planned/committed units in EPA modeling applications of IPM. The NEEDS includes basic geographic, operating, air emissions, and other data on all the generation units that are represented by model plants in EPA's v. 2.1.6 update of IPM.

We used the IPM to conduct the cost effectiveness analysis for the emissions control program proposed in this action. The model was also used to derive the marginal cost of several State programs that EPA considers as part of its base case.

For the purpose of preliminarily evaluating today's proposal, EPA modeled a strategy that assumes SO2 controls in the 48 contiguous States in a manner that largely leads to a cap on Eastern States without leakage of emissions to nearby States. The modeled 48-State cap

simulates a control program that is very similar to the program we are now proposing to control SO2 in only the 28-State and DC region. Most of the SO2 emissions and reductions would occur in the 28-State and DC control region and therefore a very similar result is expected. Based on IPM modeling, the SO2 emissions in 2015 from the proposed 28-State and DC region would be 92 percent of national emissions under base case conditions (i.e., without implementation of today's proposed program). In addition, emissions reductions in the 28-State and DC region would be 96 percent of total national reductions, under the 48 State cap that was modeled. Thus, the 48-State cap that was modeled very closely represents the proposed 28-State and DC cap.

We modeled NOx controls in a 31 and one-half State region that includes Minnesota, Iowa, Missouri, Arkansas, Louisiana, Eastern Texas and all of the States to the east, and DC. The NOx control region proposed in today's action (28-States and the District of Columbia, plus ozone season only control in Connecticut) is very similar to this region used for modeling.

Because the regions used for modeling SO2 and NOx controls encompass a significant amount of the

electricity generation in the country, they provide information that could be applied to somewhat smaller or larger regions. We believe that costs (both marginal and average) in a somewhat smaller or larger region would be similar.[83]

In this modeling case, EPA assumes interstate emissions trading. While EPA is not requiring States to participate in an interstate trading program for EGUs, EPA believes it is reasonable to evaluate control costs assuming States choose to participate in such a program since the program will result in less expensive reductions.

The modeled case discussed below assumes a phased program, with the first set of reductions occurring in 2010 and the second phase occurring in 2015. For SO2 in particular, it should be noted that the regional reductions or budget levels are not actually achieved in the year that they are implemented. This is because of the existence of an SO2 emission bank. The availability

[83] We began our emissions and economic analysis for today's proposal before the air quality analyses, which affects the States we are proposing for control requirements, was completed. Thus, we modeled emissions and economic effects on regions that are similar but not identical to the region proposed today. We intend to publish revised emissions and economic modeling in a supplemental action.

of the SO2 emission bank allows sources to make emission reductions earlier and then use the allowances that are saved at a later date. Banking has less of an effect on NOx emissions because in the existing ozone-season only program, NOx allowances are more expensive than they are expected to be in an annual program. Thus, there is not an incentive to make early NOx emission reductions to create allowances to be used in the future.

3. Timing, Engineering and Financial Factor Impacts

While cost considerations are one of the primary components in establishing emission reduction requirements,

another important consideration is the time by which the emission reductions may be achieved. The EPA has determined that for engineering and financial reasons, it would take substantial time to install the projected controls that would be necessary to reach the ultimate control levels proposed. We seek to require implementation of the reductions on a schedule that will provide air quality benefits as soon as feasible to as many nonattainment areas as possible. Therefore, we propose to require the implementation of as much of the

reductions as possible by an early date and to set a later date for the remaining amount of reductions.

Specifically, EPA proposes that the first phase must be implemented by January 1, 2010. This date is based upon the following schedule: EPA finalizes today's proposed rule by mid-2005; States submit SIPs by the end of 2006; and sources install the first phase of required controls by January 1, 2010, and the second phase by January 1, 2015.

EPA recognizes that this two-phase approach assumes that States will achieve the reduction requirements imposed by the rules proposed today through controls on EGUs. Of course, States may choose to control different sources, and if so, the specific engineering constraints applicable to EGU compliance may not apply to these other sources.[84] Nevertheless, EPA believes it appropriate to authorize a two-phase approach for all States, regardless of how they choose to achieve the reduction requirements. This approach is consistent with the fact that EPA calculated the amount of reductions required on the basis of assumed controls on EGUs, as well as the fact that as a practical matter, most (if not all) States are likely

[84] Other sources may face similar or other timing constraints for implementation purposes.

to adopt EGU controls as their primary (if not exclusive) way to achieve the required reductions.

a. Engineering Assessment to Determine Phase 1 Budgets

When designing an emissions reductions program such as EPA is proposing in today's action, the Agency must consider the effect that the timing and reduction stringency of the program will have on the quantity of resources required to complete the control technology installation and the ability of markets to adjust and to provide more resources where needed. We used IPM to predict the number and size of facilities that would install new emissions control equipment to meet the implementation dates and emissions reductions in today's proposed rule. Then, we estimated the resources required for the installation of those control technologies.

Today's proposed rule does not require the imposition of controls on any particular source and instead leaves that matter to the affected States. However, the cost effectiveness of EGU controls makes it likely that many States will achieve reductions through EGU controls. Accordingly, EPA considers it appropriate to evaluate the timing of the reduction requirements with reference to the EGU control implementation schedule.

Therefore, today's proposed rule assumes the installation of significant numbers of SO2 and NOx controls on EGUs. To meet the existing Federal title IV program and NOx SIP Call requirements, there has been a reliance on low sulfur coal and limited use of scrubbers (also called FGD) for SO2 reductions and low NOx burners and post-combustion controls (*e.g.,* SCR) for NOx reductions, as well as shifting of dispatch to more efficient and less polluting units for each air pollutant. However, to meet the future requirements proposed in today's rule, for SO2 control we predict there will be heavy reliance on scrubbers in the decade following finalization of today's rule. For NOx control, we predict there will be heavy reliance on SCR and, to a much lesser degree, selective non-catalytic reduction (SNCR) and gas reburn.

The installation of the advanced post-combustion controls required under today's proposal will take significant resources and time. Installation of these controls are large-scale construction projects that can span several years, especially if multiple units are being installed at a single power plant. If EPA were to allow sources all of the time they needed to install controls to meet the ultimate cap levels without the

imposition of intermediate caps, the consequences for SO2 and NOx would be different. For SO2, the existence of the title IV program and the ability to bank would likely encourage sources to run their SO2 emission controls as soon as they were installed. While these early reductions would be environmentally beneficial, they would also allow sources to continue to increase their SO2 banks. By creating an intermediate cap, the ability to bank would be limited. For NOx, there would be little incentive to turn on controls and achieve additional reductions, particularly in the non-ozone season and in the States not affected by the NOx SIP Call. Therefore, in order to get any additional NOx reductions – either during the winter months from already installed SCRs or year-round from newly installed SCRs outside of the SIP Call region – it is necessary to impose an intermediate cap.

We believe that 3 years is a reasonable amount of time to allow companies to install emission controls that could be used to comply with the first phase reduction requirements of today's proposed rule. In certain circumstances, some individual units could install emissions reduction equipment in considerably less time

than 3 years.[85] In the report, "Engineering and Economic Factors Affecting the Installation of Control Technologies for Multi-pollutant Strategies" (October 2002), EPA projected that it would take on average about 21 months to install a SCR on one unit and about 27 months to install a scrubber on one unit. However, many times, companies must install controls on units at the same plant. To do so, companies will often stagger installations to minimize operational disruptions, thereby taking more time. We project that seven SCRs could be installed at a single facility in 3 years. Also, we project that three scrubber modules (scrubbing a total of six units) could be installed in 3 years. Since we believe that 3 years is enough time to install controls on all the units required at a large power plant, EPA believes that 3 years is a reasonable amount of time to allow for the first phase of compliance.

The availability of skilled labor – specifically, boilermakers – is an important constraint for the installation of significant amounts of emission controls. Boilermakers are skilled steel workers who are specially

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[85] For instance, a SCR was installed on a 675 MW unit in about 13 months (Engineering and Economic Factors, p. 21).

trained to install both NOx controls such as SCR and SO2 controls such as scrubbers.

Since the availability of boilermaker labor affects the installation of both SO2 controls and NOx controls, it is also necessary to decide what mix of pollution reductions is desired in the first phase. In today's rulemaking, EPA is proposing to require similar percentage reductions of both SO2 and NOx in the first phase. In developing the first phase control levels, we intended to maximize the total control installations possible (and thus total reductions) considering the constraint on boilermaker labor, while getting similar reductions for both pollutants. This results in predicted reductions of between 40 and 50 percent for both pollutants, in the first phase.

Based on all of these constraints, EPA is proposing a two-phase reduction requirement, with a first phase cap on SO2 in 2010 based on a 50 percent reduction from title IV levels. This represents about a 40 percent reduction in emissions from the Base Case. This strategy would require about 63 GW of scrubbers to be installed by 2010. Of these, 49 GW of scrubbers would be incremental to the

Base Case. (We based this analysis on the assumption that States choose to control EGUs.)

The EPA's proposed NOx reduction requirement would also be implemented in two phases, with a first phase cap based, in a comparable manner, on about a 49 percent decrease in emissions from the Base Case. (The calculation of this first phase cap is discussed more below.) This cap would require installation of about 39 GW of SCR between 2005 and 2010. Of this, 24 GW are incremental to the Base Case. (We based this analysis on the assumption that States choose to control EGUs.)

Since the NOx SIP Call experience showed that many power companies are averse to committing money to install controls until after State rules are finalized, EPA analyzed availability of boilermakers assuming companies did not begin installing controls until after the State rules were finalized. While boilermakers are one of the key components in building SCRs and scrubbers, most of their work cannot begin until well into the construction project. First, the power company must do preliminary studies to determine which controls to install, then jobs must be bid and design must begin. After the installation is designed, foundations must be poured and

pieces of the control equipment must be built in machine shops. It is only after all of this activity has taken place that the boilermakers can erect the control equipment.

We assumed, therefore, that most of the demand for boilermakers came in the last 21 months of the 3 year period to install controls. Furthermore, in order to have controls fully operational in time for the compliance deadline, companies would likely complete installation well before the deadline to allow for testing of the controls. Assuming that most companies would try to complete controls in time to provide for a 3-month testing period, most of the demand for boilermaker labor will come in an 18-month window.

It is EPA's projection that approximately 12,700 boilermaker years would be needed to install all of the required equipment for the first phase of compliance. We project that approximately 14,700 boilermaker years would be available during the time when first phase controls would be installed. This projected number of boilermakers is based on the assumption that all the boilermakers that EPA projects are available for work on power sector environmental retrofit projects would be

fully utilized (e.g., 40 hours a week for 50 weeks of the year). In reality, it would be difficult to achieve this full utilization of boilermakers. For instance, boilermakers will be unable to work when moving from job-site to job-site, during inclement weather, etc. We believe that the availability of approximately 15 percent more boilermaker years than are required assures that there are enough boilermakers available to construct all of the required retrofits.

b. Financial and Other Technical Issues Regarding Pollution Control Installation

The EPA recognizes that the power sector will need to devote large amounts of capital to meet the control requirements of the first phase. Controls installed by 2010 will generally be the largest and easiest to install. Subsequent controls will need to be installed at more plants and under more challenging circumstances. We believe that deferring the second phase to 2015 will provide enough time for companies to overcome these technical challenges and raise additional, reasonably-priced capital needed to install controls.

4. Interactions with Existing Title IV Program

As EPA developed this regulatory action, great consideration was given to interactions between the existing title IV program and today's proposed rule designed to achieve significant reductions in SO2 emissions beyond title IV. Requiring sources to reduce emissions beyond what title IV mandates has both environmental and economic implications for the existing title IV SO2 trading program. In the absence of a method for accounting for the statutory requirements of title IV, a new program that imposes a tighter cap on SO2 emissions for a particular region of the country would likely result in an excess supply of title IV allowances and the potential for increased emissions in the area not subject to the more stringent emission cap. The potential for increased emissions exists in the entire country for the years prior to the proposed implementation deadline and would continue after implementation for any areas not affected by the proposed rule. These excess emissions could negatively affect air quality, disrupt allowance markets, and erode confidence in cap and trade programs.

In view of the significant reductions in SO2 emissions under title IV of the CAA, the large

investments in pollution controls that firms have made under title IV that enable companies to sell excess emissions reductions, and the potential for emissions increases, it is necessary to consider ways to preserve the environmental benefits achieved through title IV and maintain the integrity of the title IV market for SO2 allowances. The EPA does not have authority to address this issue by tightening the requirements of title IV. In any event, title IV has successfully reduced emissions of SO2 using the cap and trade approach, eliminating millions of tons of SO2 from the environment. Building on this existing program to further improve air quality by requiring additional reductions of SO2 emissions is appropriate.

We have developed an approach to incorporate the title IV SO2 market to ensure that the desired reductions under today's action are achieved in a manner consistent with the previously stated environmental goals. Our proposed approach effectively reduces the title IV cap for SO2 and allows title IV allowances for compliance with this rule at a ratio greater than one-to-one. Section VIII provides more detail on our initial analysis of the interactions between the title IV Acid Rain

program and today's proposed cap and trade program and outlines a solution for creating a new rule that builds off of title IV.

D. Methodology for Setting SO2 and NOx Budgets

In section D, EPA describes in detail how it proposes to establish the reduction requirements and, to the extent applicable, budget requirements for EGUs. The first step for both SO2 and NOx was determining the total amount of emissions reductions that would be achievable based on the control strategy determined to be highly cost effective. Our evaluation of cost effectiveness for the proposed 2010 and 2015 emissions caps was explained in the preceding subsection as was the need to split these budget requirements into two phases to assure that emission reductions were achieved expeditiously considering factors that could limit the amount of emission controls that could be installed in a given time period.

There were then two more steps that followed. In the second step, EPA determined the amount of emissions reductions that were needed across the region covered by this proposal and, for EGUs, set annual emissions caps accordingly in 2010 and 2015. These caps remain at the

2015 levels thereafter, to maintain air quality in the downwind areas. In the third step, EPA partitioned the cap levels into State emissions budgets that they may use for granting allowances for SO2 and NOx emissions.

1. Approach for Setting Regionwide SO2 and NOx Emission Reductions Requirements

a. SO2 Budgets for EGUs

The EPA is proposing a two-phase SO2 reduction program. The first phase, in 2010, would reduce SO2 emissions in the 28-State and DC region by the amount that results from making a 50 percent reduction from title IV Phase II allowance levels. The second phase, in 2015, would further reduce SO2 emissions by the amount that results from making a 65 percent reduction from the title IV Phase II allowance level.

These amounts may be calculated in terms of regionwide EGU caps for the first and second phases, assuming that all the affected States control only EGUs. Similarly, it is necessary to calculate the amount of regionwide SO2 reductions for the first and second phase, for States that choose to control sources other than (or in addition to) EGUs. This calculation of the amount of the regionwide cap or emissions reductions is a useful

step because this amount may then be apportioned to individual State. In addition, the methodology for calculating regionwide amounts should accommodate revisions in the universe of States in the region – adding or subtracting individual States – based on refinement to the air quality modeling that EPA expects to complete and publish in the SNPR.

The EPA proposes that the regionwide SO2 budgets may be calculated by adding together the title IV Phase II allowances for all of the States in the control region, and making a 50 percent reduction for the 2010 cap and a 65 percent reduction for the 2015 cap. This results in a first phase SO2 cap of about 3.9 million tons and a second phase cap of about 2.7 million tons, in the 28-State and DC control region.

Modeling predicts nationwide SO2 emissions of about 5.4 million tons in 2015 with today's proposed controls. (This compares to approximately 9.1 million tons without today's proposed controls.) Predicted emissions in the 28-State and DC region that EPA is proposing to find significantly contribute to PM2.5 nonattainment are about 4.6 million tons in 2015. (These emission estimates are from modeling using the 48-State region as described

above.) The projected SO2 emissions are higher than the caps due to use of banked allowances resulting from the incentive for early reductions. Accordingly, the 2015 annual SO2 emissions reductions amount to about 3.7 million tons, and the 2010 annual SO2 emissions reductions amount to about 3.6 million tons.

b. NOx Budgets for EGUs

The EPA is proposing a two-phased annual NOx control program, with a first phase in 2010 and a second phase in 2015, which would apply to the same control region as the SO2 requirements, that is, 28-States and DC. In addition, Connecticut would be required to control NOx during the ozone season.

On a regionwide basis, the control requirements EPA is proposing would result in a total EGU NOx budget of about 1.6 million tons in 2010 and 1.3 million tons in 2015, in the 28-State and DC region that would be affected by today’s rulemaking (assuming each State controlled only EGUs and thereby subjected themselves to the proposed caps). In addition, the control requirements would lead to 2015 annual NOx emissions reductions of about 1.8 million tons from the base case,

and 2010 annual NOx emissions reductions of about 1.5 million tons from the base case.

Calculating the regionwide budget and emissions reductions requirements serve the same purposes as in the case of SO2, described above. Our methodology proposed today determines historical annual heat input data for Acid Rain Program units in the applicable States and multiplies by 0.15 lb/mmBtu (for 2010) and 0.125 lb/mmBtu (for 2015) to determine total annual NOx mass. For the annual heat input values to use in this formula, EPA proposes to take the highest annual heat input for any year from 1999 through 2002 for each applicable State. This proposed approach provides a regionwide budget for 2010 that is approximately 37,500 tons more than the budget that would result from using the highest annual regional heat input for any of the 4 years, and about 60,700 tons more than using the average regional heat input for the 4-year period. We believe that this cushion provides for a reasonable adjustment to reflect that there are some non-Acid Rain units that operate in these States that will be subject to the proposed budgets.

Note that EPA proposes today that Connecticut contributes significantly to downwind ozone nonattainment, but not to fine particle nonattainment. Thus, Connecticut would not be subject to an annual NOx control requirement, and is not included in the 28-State and DC region we are proposing for annual controls. Connecticut would be subject to an ozone season-only NOx cap.[86] Because Connecticut is required to make reductions only during the ozone season, compliance for sources would not be required to begin until May 1, 2010. If Connecticut chooses to participate in the regional trading program on an annual basis, compliance would begin on January 1, 2010.

Although EPA proposes to determine the regionwide amount of EGU NOx emissions by using historic heat input and emission rates of 0.15 lb/mmBtu and 0.125 lb/mmBtu, we take comment on using, instead, heat input projected to the implementation years of 2010 and 2015 and/or different emission rates. Under this approach, we take

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[86] If Connecticut, or any State subject to an existing NOx ozone season-only budget program, chooses to participate in the interstate NOx trading program proposed today, that State would need to operate under an annual NOx cap rather than ozone season only. Interstate trading is discussed in more detail in section VIII, below.

comment on whether to use the same method for projecting heat input as used in the NOx SIP Call, or a different method. The NOx SIP Call method is described in 67 FR 21868 (May 1, 2002).

2. State-by-State Emissions Reductions Requirements and EGU Budgets

This section describes the methodologies used for apportioning regionwide emission reduction requirements or budgets to the individual States. State budgets may be set with a methodology different from that used in setting the regionwide budgets, for reasons described in this section.

In practice, if States control EGUs and participate in the regional trading program, the choice of method used to impose State-by-State reduction requirements makes little difference in terms of total regionwide SO2 and NOx emissions. The cap and trade framework would encourage least-cost compliance over the region, an outcome that does not depend on the individual State budgets.

However, the distribution of budgets to the States is important in that it can have economic impacts on the State’s sources. Should a State receive a

disproportionate share of the regionwide budget, there would be fewer allowances to allocate to its sources. This may adversely affect compliance costs for sources within that State as they are forced to increase their level of emission control or became net buyers from sources in States that may have received a greater share of regionwide cap.

For SO2, we propose determining State SO2 budgets for EGUs on the basis of title IV allowances, which is in line with the planned interactions of this rule with title IV of the CAA Amendments. See section VIII for a more detailed discussion of interactions with title IV. Such budgets would be easy to understand, would be straightforward to set, would reflect previously implemented allocations and would allow for the smoothest transition to the new program proposed today.

For the proposed 28 State SO2 control region, the proposed annual State EGU SO2 budgets are presented in Table VI-9, below.

Table VI-9. 28-States and District of Columbia Annual EGU SO2 Budgets

State	28-State SO2 Budget 2010 (tons)	28-State SO2 Budget 2015(tons)
Alabama	157,629	110,340
Arkansas	48,716	34,101

Delaware	22,417	15,692
District of Columbia	708	495
Florida	253,525	177,468
Georgia	213,120	149,184
Illinois	192,728	134,909
Indiana	254,674	178,272
Iowa	64,114	44,879
Kansas	58,321	40,825
Kentucky	188,829	132,180
Louisiana	59,965	41,976
Maryland	70,718	49,502
Massachusetts	82,585	57,810
Michigan	178,658	125,061
Minnesota	50,002	35,001
Mississippi	33,773	23,641
Missouri	137,255	96,078
New Jersey	32,401	22,681
New York	135,179	94,625
North Carolina	137,383	96,168
Ohio	333,619	233,533
Pennsylvania	276,072	193,250
South Carolina	57,288	40,101
Tennessee	137,256	96,079
Texas	321,041	224,729
Virginia	63,497	44,448
West Virginia	215,945	151,162
Wisconsin	87,290	61,103
Total	3,864,708	2,705,293

If alternatively, EPA were to adopt an 0.10 $\mu g/m^3$ as the air quality criterion, Oklahoma and North Dakota

would also receive SO2 budgets. Oklahoma's 2010 State SO2 budget would be 63,328 tons and its 2015 SO2 budget would be 44,330 tons. North Dakota's 2010 SO2 budget would be 82,510 tons and its 2015 SO2 budget would be 57,757 tons.

If the State EGU SO2 budget is entirely based on the title IV retirement ratio, then the budget would equal the title IV allowances multiplied by the retirement ratio (as discussed earlier in this section). However, under the CAA, the title IV SO2 allowances are allocated on the basis of activity as of 1985, and as a result, they do not take into account any of the significant changes and growth in the sectors since that time.

An alternate method of determining State SO2 EGU budgets would consist of two parts:

1) The first part of the budget would be based on title IV allocations - but with a tighter title IV retirement ratio than that proposed for the region.

2) The tighter retirement ratio would result in some un-allocated EGU allowances (reflecting the difference between the regionwide budget and State budgets calculated based on part (1)). These could be allocated to States' budgets for their non-title IV EGUs, or as a

way to redistribute or update allowances to the title IV EGUs. This allocation could be done on the basis of methods discussed in more detail below. Such a two-part EGU budget would recognize the fact that the sector has grown and changed since title IV allocations were initially made.

For NOx, we propose determining State NOx budgets for EGUs on the basis of current/historic heat input rates. Regionwide budgets would be distributed to States based on an average of several years of historical data. We are proposing to use data from 1999 to 2002.

A similar approach was taken by the SO2 program under title IV of the CAA. As a result, States with significant projected increases in growth were required to either: (1) reduce their emissions further, or (2) burn fuel more efficiently in order to compensate. (For such States, the ability to trade emissions regionwide was particularly attractive because States with low increases or decreases in utilization could trade emissions with States having significantly increased utilization).

Most of the States within the proposed control region are part of the NOx SIP Call, with a regionwide

budget that on a seasonal basis constrains increases in NOx emissions for the region as a whole. States with high growth (measured from a historic baseline to the start of the new program) would already be provided incentives to control NOx emissions as they would need to use additional NOx SIP Call allowances to emit during the ozone season. Consequently, growth in generation in the years after the proposed State budgets have been set would not necessarily lead to increased emissions. Furthermore, the majority of the growth (of heat input, or output) through 2010 is expected to be met by recently built natural gas units, with no SO2 and very low NOx emissions.

Such an option is also appropriate to consider if it is decided that SO2 budgets for non-title IV sources should be developed as explained below.

Among the advantages of a budget methodology based on historic/current activity is that it is relatively simple to implement and would not need to be changed as a result of future data.

For the proposed 28 State Annual NOx control region, the proposed annual State EGU NOx budgets based on this methodology are presented in Table VI-10, below.

Table VI-10. 28-States and District of Columbia Annual EGU NOx Budgets

State	28-State NOx Budget 2010(tons)	28-State NOx Budget 2015(tons)
Alabama	67,414	56,178
Arkansas	24,916	20,763
Delaware	5,039	4,199
District of Columbia	215	179
Florida	115,489	96,241
Georgia	63,567	52,973
Illinois	73,613	61,344
Indiana	102,283	85,235
Iowa	30,454	25,378
Kansas	32,433	27,027
Kentucky	77,929	64,940
Louisiana	47,333	39,444
Maryland	26,604	22,170
Massachusetts	19,624	16,353
Michigan	60,199	50,165
Minnesota	29,300	24,417
Mississippi	21,930	18,275
Missouri	56,564	47,137
New Jersey	9,893	8,245
New York	52,448	43,707
North Carolina	55,756	46,463
Ohio	101,692	84,743
Pennsylvania	84,542	70,452
South Carolina	30,892	25,743
Tennessee	47,734	39,778
Texas	224,181	186,818
Virginia	31,083	25,903
West Virginia	68,227	56,856
Wisconsin	39,039	32,533

Total	1,600,392	1,333,660

If alternatively, EPA were to adopt an 0.10 μg/m^3 as the air quality criterion, Oklahoma and North Dakota would also receive annual NOx budgets. The proposed annual State EGU NOx budgets for all 30 States based on the proposed methodology are presented in Table VI-11 below.

Table VI-11. 30-State and District of Columbia Annual EGU NOx Budgets

State	30-State NOx Budget 2010 (tons)	30-State NOx Budget 2015 (tons)
Alabama	67,415	56,179
Arkansas	24,916	20,763
Delaware	5,039	4,199
District of Columbia	215	179
Florida	115,490	96,242
Georgia	63,568	52,973
Illinois	73,614	61,345
Indiana	102,283	85,236
Iowa	30,454	25,378
Kansas	32,433	27,027
Kentucky	77,929	64,941
Louisiana	47,333	39,445
Maryland	26,604	22,170
Massachusetts	19,624	16,353
Michigan	60,199	50,166
Minnesota	29,300	24,417
Mississippi	21,930	18,275
Missouri	56,565	47,137

New Jersey	9,894	8,245
New York	52,448	43,707
North Carolina	55,756	46,463
North Dakota	26,570	22,141
Ohio	101,693	84,744
Oklahoma	41,293	34,411
Pennsylvania	84,543	70,452
South Carolina	30,892	25,744
Tennessee	47,734	39,778
Texas	224,183	186,819
Virginia	31,083	25,903
West Virginia	68,227	56,856
Wisconsin	39,040	32,533
Total	1,668,268	1,390,223

There are two different metrics that EPA could use for determining alternate State EGU NOx budgets. These metrics include:

1) Pro-rated emissions levels (budgets based on reductions in emissions levels),

2) Pro-rated share of Output (kwh) (budgets based on their output (same lb/kwh rate)).

We solicit comment on the use of these different methods.

There are options for implementing the heat input-based budget and the two different metrics in determining actual State budgets. Budgets could be based on projected levels (calculated by taking historical level

and applying growth rates, or directly taking levels projected by IPM).

The methodology used in the NOx SIP Call (setting State budgets by applying State-specific growth rates for heat input) is an example of this approach. (67 FR 21868; May 1, 2002) Alternatively, it would be possible to use heat input or output as projected directly by IPM in the setting of budgets. This would have the benefit of being consistent with the methodology for determining cost. We would also have projections for relevant years, and there would be little disconnect between the years used to develop growth rates and the years to which growth rates are applied. However, under such a methodology, it would be difficult to adjust budgets if we receive comments about missing units. We solicit comment on these options.

As noted above, EPA proposes that Connecticut contributes significantly to ozone nonattainment areas, but not to fine particle nonattainment areas. Thus, Connecticut would not be subject to proposed annual SO2 and NOx controls, but would be subject to ozone season-only NOx control requirements. We propose an ozone-

season EGU NOx control level of 4,360 tons in 2010 and about 3,633 tons in 2015.

If Connecticut (or any State subject to an existing NOx ozone season-only budget program) chooses to participate in the interstate trading program proposed today, that State would need to operate under an annual NOx cap rather than ozone season only. Interstate trading is discussed in more detail in section VIII of this preamble. The EPA proposes an annual NOx control level of about 9,283 tons in 2010 and 7,735 tons in 2015, if Connecticut were to participate in today's proposed interstate trading program on an annual basis.

The EPA calculated these proposed levels using the 1999 Acid Rain Program reported heat inputs for Connecticut. The ozone-season level was calculated by multiplying the reported ozone-season heat inputs by 0.15 lb/mmBtu for 2010 and 0.125 lb/mmBtu for 2015. The proposed annual level was determined by multiplying the reported annual heat input by 0.15 lb/mmBtu for 2010 and 0.125 lb/mmBtu for 2015. We reviewed reported Acid Rain Program heat inputs for the years 1999 through 2002, and selected 1999 data for calculating these proposed levels because the 1999 Connecticut heat input was higher than

the other 3 years considered, and this is similar to the way the regionwide proposed control levels were calculated.

The EPA also takes comment on an alternate way to calculate a NOx budget for Connecticut that would be entirely consistent with the way that the budgets were calculated for other States. Under this methodology, EPA would calculate region wide NOx budgets for both the ozone season and non ozone season using State by State heat input data for the highest year between 1999 and 2002 and multiplying it by 0.15 lbs/mmBtu for 2010 and 0.125 lbs/mmBtu for 2015. Both ozone season and non-ozone season State budgets would be calculated by giving States their pro-rated share of the budget based on annual heat input from the years 1999 to 2002. For States required to make year-round reductions, their budgets would be based on the sum of their ozone-season and non-ozone season heat input. For a State such as Connecticut that was only required to make ozone-season reductions, its ozone-season budget would be based upon its share of the ozone-season budget. If Connecticut decided to participate on an annual basis, its budget would be calculated like all other States.

E. Budgets for Use By States Choosing to Control Non-EGU Source Categories

While EPA is not proposing to assume any emissions reductions from other source categories (e.g., non-EGU stationary sources, area sources and mobile sources), States may elect to obtain some or all of the required emissions reductions from other source categories. In this case, EGUs within the State would not be able to participate in the cap and trade programs.

If a State chooses to obtain some but not all of its required reductions from EGUs, it would set an EGU SO2 budget and/or an EGU NOx budget, at some level higher than shown in Tables VI-9 and VI-10. The State must also (1) develop baseline emissions sub-inventories for all non-EGU sectors for 2010 and 2015, (2) divide the portion of the required emissions reductions that it will not obtain from EGUs (i.e., the difference between its selected EGU budget for SO2 or NOx and the budget listed in Tables VI-9 or VI-10) among the non-EGU source sectors in any manner it chooses, (3) subtract these emissions reductions from the corresponding emissions sub-inventories to arrive at the emissions budget for each sector, and (4) adopt measures that are projected to

achieve those budgets. Compliance with all of these control measures would be enforceable. Section VII explains the role of emission budgets for non-EGU sectors in more detail. We plan to propose in the SNPR requirements to ensure the accuracy of the baseline emission sub-inventories.

We believe it is unlikely that any State will choose to obtain all or part of the required SO2 and NOx emission reductions from sources other than EGUs, but we do wish to offer States this alternative if equal reductions can be obtained. The SNPR will propose specific emission reductions for this purpose, or provisions for determining these emission reduction quantities. Once these are determined, the four steps described in the previous paragraph will apply.

F. Timing and Process for Setting Baseline Inventories and Sub-inventories

In the NOx SIP Call, EPA promulgated a NOx emission reduction requirement for each State (as we propose here for SO2 and NOx). We also promulgated baseline sub-inventories for each State for five sectors (EGU, non-EGU, area, non-road, and highway) which summed to an overall baseline inventory. Finally, the NOx SIP Call

rule contained a table of State-by-State NOx emissions budgets, developed by subtracting the required NOx emission reduction from the overall baseline NOx inventory.

Today, we are proposing specific EGU budgets for affected States for the purposes of the model trading program, but we are not proposing any baseline sub-inventories. There is no need for baseline sub-inventories to be established by rule for States choosing to participate in the model trading programs. As explained in section VI.E above, we propose that if a State chooses to obtain some of the required emission reductions from non-EGU sources, the baseline sub-inventories and the sector budgets should be developed by the State itself and be subject to EPA approval as part of the transport SIP. In this way, baseline sub-inventories and sector budgets will reflect updates to newer emission estimation methods, more recent data on current emissions, and updated projection methods. This will increase the certainty that the required emission reductions will be achieved in practice.

We invite comment at this time on what assumptions and methods for establishing sector inventories should be specified in the supplemental proposal and final rule. In the NOx SIP Call, for example, we said that emissions reductions from subsequent Federal rules must be incorporated into the baseline sector inventories. Clear rules regarding determination of historical emissions, development of growth factors, estimation of rule effectiveness, and credibility of State-adopted measures may also be needed.

Section IV, above, presents the baseline emission projections that have been used in the air quality modeling that supports today's proposal. We will be updating these baseline inventories for the final rule to incorporate newer data and methods.

G. Comment on Emissions Caps and Budget Program

While EPA’s analysis indicates that the availability of boilermaker labor will be a limiting factor in first phase scrubber installations, the Agency is soliciting comment on this analysis. In particular, we’re asking for comment on whether there might be alternative post-combustion technologies that could reduce SO2 emissions in a manner equally cost-effective as scrubbers, but that

wouldn’t require as much boilermaker labor. Examples might include multi-pollutant technologies (boilermaker labor might be less constrained if single technologies can be installed to reduce both SO2 and NOx). We also solicit comment on whether advanced coal preparation processes might provide highly cost effective emission reductions. We solicit comment on whether such alternative technologies will be commercialized by 2010, and what the costs will be.

In addition, EPA seeks comment on whether other factors such as other EPA regulatory actions will create an increase in boilermaker demand earlier than today’s proposal (pre-2007), resulting in growth in the number of boilermakers that could be used to install controls required under this program in 2007 and beyond. We solicit comments on whether other factors might increase demand for boilermakers in advance of 2007, and what these factors would be.

As noted above, EPA is proposing to require SO2 and NOx to be reduced by similar percentages in the first phase of today’s proposed rule, given the limited supply of labor to install controls at electric generating units. An alternative would be to give priority to SO2

control in the first phase, and postpone summertime NOx reductions for a couple of years. This would focus limited labor resources on SO2 control to reduce the sulfate component of PM2.5 as quickly as possible. This approach could achieve more early PM2.5 reductions and might help some PM2.5 nonattainment areas attain earlier. On the one hand, based on the analysis of section XI, the quantified benefits from PM2.5 control are generally larger than those for ozone. Nevertheless, the tradeoff would be that ozone reductions under the interstate air quality rule would be postponed. Because many ozone areas will be required to attain in 2010, fewer projected ozone nonattainment areas would be helped by the interstate air quality rule. A number of areas required to attain in 2010 (and perhaps some 2013 areas as well) would incur greater local control costs to attain on time, or achieve less improvement in ozone levels. We request comment on the relative merits of the proposed approach and this alternative, considering public health, costs, and equity. More generally, EPA seeks comment on the mix of first phase SO2 and NOx reductions that represents the proper balance between the goals of

reducing PM2.5 transport and ozone transport in the near term.

Additionally, EPA seeks comment on the level of the second phase caps and the resulting division of responsibility between local and interstate transport sources. Would a less stringent or more stringent level of transport control lower total costs of attainment, or better address equity issues? Has EPA identified the appropriate level of control as highly cost effective? Should the Agency reduce the second-phase reductions (or raise the second-phase caps) for NOx and SO2, and thereby leave more of the emissions reductions burden to the individual States preparing plans for meeting air quality standards in each nonattainment area? Or should the second-phase emissions reductions be increased (or the caps be made lower) in an effort to give more help to States through regional controls that achieve greater reductions and benefits while remaining cost effective? For example, rather than basing the 2015 caps on a 65 percent reduction from title IV levels, should they be based on a 55 percent reduction or a 75 percent reduction?

The EPA also requests comment on the timing of each phase of the cap and trade program. Regarding the first phase, EPA notes that the January 1, 2010 NOx compliance date occurs after the last ozone season that influences the attainment status of the “moderate” 8-hour ozone nonattainment areas that will receive an attainment date no later than April 2010. We also note that its analysis indicates that the level of control in the first phase is constrained by the amount of control equipment that can be installed by a limited labor force, and providing an earlier compliance deadline might reduce the reductions feasible in the first phase. We request comment on whether the first phase deadline should be as proposed, or adjusted earlier or later, in light of these competing factors.

For SO2, if States choose to control EGUs through the model cap and trade program, emissions banking provides incentives that lead to steadily declining emissions and thus results in additional benefits before the 2010 and 2015 reductions. However, it appears that it would help several States to reach attainment by CAA deadlines if the second phase emissions cap went into effect earlier, especially for NOx. This needs to be

balanced against the ability of the power industry to do substantially more at that time. The EPA is soliciting comment on the timing of the second phase.

The EPA strongly encourages each State to consider reserving a portion of its allowance budget for an auction. Proceeds from the auction would be fully retained by the State to be used as they see fit. Some possible suggestions for auction revenue that States may want to choose will be further explored in a supplemental notice. For example, a State could develop a program that uses the revenue to provide incentives for additional local reductions within nonattainment areas.

The EPA sees benefits in requiring States to reserve a portion of their budgets for auction, but has concerns about whether such a requirement would intrude on State prerogatives.[87] We solicit comment on this issue.

H. Budgets for Federally-Recognized Tribes

In the 1990 CAA amendments, Congress recognized our obligation to treat Tribes in a manner similar to States. Currently, we are not aware of any EGUs in Indian country in the eastern and central U.S. that could potentially be affected by the interstate air quality rule.

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[87] See Virginia v. EPA, 108 F.3d 1397 (D.C. Cir. 1997).

The Tribal air programs are relatively new and Tribes are just now establishing their capacity to develop air quality management plans and beginning to participate in national policy setting processes such as this rulemaking. In addition, past Federal policy limited the economic development and thus the number of emissions sources that might otherwise have been built on Tribal lands. However, many Tribes are currently encouraging economic development on their lands, particularly in the area of energy generation.

In the NOx SIP Call, EPA did not explicitly consider the issue of Tribal lands and we made no specific provisions for them. One consequence is that Tribal implementation plans – even ones that cover new or existing sources on Tribal lands – apparently are not subject to any of the requirements of the NOx SIP Call rule. We now realize that we should adopt specific provisions for Tribal lands in today's proposed rulemaking. For States, which have substantial emissions now and corresponding impacts on nonattainment in other States, we have focused in this proposal on what emissions reductions are needed to eliminate existing significant contributions to nonattainment. For Tribes,

since there are few sources on Tribal lands now and no EGUs, we should consider what increases are possible without causing significant contributions to nonattainment in State lands and other Tribal lands.

Title IV SO2 allowances have been provided to EGUs. Because there are no EGUs on Tribal lands, title IV allowances have not been awarded to any EGUs on Tribal lands. Additionally, without EGUs there is no historical heat input for use in calculating an allowance budget for NOx for Tribal lands. In our discussions prior to this proposal, Tribal representatives have expressed concern that budgets based on existing emissions effectively exclude them from the program unless Tribes buy allowances from the surrounding States. If Tribes do buy allowances, they will be effectively subsidizing the development and inadequate environmental planning of surrounding States. In this rulemaking, we are taking into consideration the past inequities created by Federal policy and traditionally depressed development in Indian country, as well as the need to make progress in air quality.

We are not proposing specific provisions for Tribal lands today. We invite comment generally and on the

following specific questions regarding allowance allocation to Tribes:

(1) Should allowance budgets for Tribes be created by the rule separately from State allowance budgets, or be deducted from the proposed State budgets? On what basis or criteria should either approach be implemented?

(2) Alternatively, should the rule set an allowance pool for Tribes in the aggregate with some further process by EPA or by the Tribes collectively to allocate the allowances to specific Tribes? Should the allowance allocation issues be deferred entirely to separate action(s) later? Should any immediate or eventual allocations to individual Tribes be based on current emissions, existing contracts for new sources, population, land base, or some other factor(s)? Some Tribes may have concerns that deferral of allowance allocations to individual Tribes does not adequately recognize the sovereignty of individual Tribal nations. There may also be concern that continued uncertainty in the allowances available to the individual Tribes may discourage planning for development.

(3) Should allowances be tradeable among Tribes once allocated? Should they be bankable?

(4) Because the SIPs do not generally apply in Indian country, the system for regulating sources on Tribal land for purposes of limiting transport will need to be implemented through either a Tribal implementation plan or a Federal implementation plan. We invite comment on the best mechanism to implement the budgets.

We recognize that information on economic development and potential for growth may be sensitive for the Tribes to share with EPA or a public docket. We request input from the Tribes on how to determine the allowance needs for the Tribes.

VII. State Implementation Plan Schedules and Requirements

This section describes the dates for submittal and implementation of the interstate transport SIPs that today we propose to require, and discusses those dates in the context of the attainment dates and SIP submittal requirements for the downwind nonattainment areas. In addition, this section describes the required SIP elements that we propose today.

A. State Implementation Plan Schedules

1. State Implementation Plan Submission Schedule

Clean Air Act section 110(a)(1) requires each State to submit a SIP to EPA "within 3 years ... after the promulgation of a [NAAQS] (or any revision thereof)." Section 110(a)(2) makes clear that this SIP must include, among other things, the "good neighbor" provisions required under section 110(a)(2)(D). These provisions may be read together to require that each upwind State submit, within three years of a NAAQS revision, SIPs that address the section 110(a)(2)(D) requirement.

The PM2.5 and 8-hour ozone NAAQS revisions were issued in July 1997. More than 3 years have already elapsed since promulgation of the NAAQS, and States have not submitted SIPs to address their section 110(a)(2)(D) obligations under the new NAAQS. We further recognize that until recently, there was substantial uncertainty as to whether each NAAQS would be remanded to EPA, and that this uncertainty would, as a practical matter, render more complex the upwind States' task of developing transport SIPs.

In addition, today's proposal makes available a great deal of data and analysis concerning air quality and control costs, as well as policy judgments from EPA concerning the appropriate criteria for determining

whether upwind sources contribute significantly to downwind nonattainment under section 110(a)(2)(D). We recognize that States would face great difficulties in developing transport SIPs without these data and policies. In light of these factors and the fact that States can no longer meet the original three-year submittal date, we are proposing that SIPs to reduce interstate transport, as required by this proposal, be submitted as expeditiously as practicable, but no later than 18 months from the date of promulgation. The EPA intends to promulgate today's proposed rule between approximately December 2004 and June 2005. In this case, the SIPs required today would be due between approximately July and December 2006.

By comparison, in the NOx SIP Call rulemaking, EPA provided 12 months for the affected States to submit their SIP revisions. One of the factors that we considered in setting that 12-month period was that upwind States had already, as part of the Ozone Transport Assessment Group process begun three years before the NOx SIP Call rulemaking, been given the opportunity to consider available control options.

Since today's proposal requires affected States to control both SO2 and NOx emissions, and to do so for the purpose of addressing both the PM2.5 and 8-hour ozone NAAQS, we believe it is reasonable to allow affected States more time than was allotted in the NOx 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' PM2.5 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 PM2.5 by January 2008.[88]

The SIP submittal date proposed today should be considered in the context of the downwind nonattainment area SIP submittal schedules and attainment dates. Under CAA section 172(b), the downwind nonattainment SIPs are due no later than three years after the designations. The EPA expects to designate PM2.5 areas by December 31,

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[88] 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 PM2.5 and 8-hour ozone NAAQS.

2004, and to require the nonattainment area SIPs by three years of the designation. The EPA is required to designate 8-hour ozone areas by April 15, 2004, with an effective date of May 2004, and to require the nonattainment area SIPs by three years of the designation.

Accordingly, today's proposal requires the submittal of the upwind transport SIPs before the downwind nonattainment area SIPs will be due. This sequence is consistent with the provisions of both section 110(a)(1)-(2), which provides that the submittal period for the transport SIPs runs from the earlier date of the NAAQS revision; and section 172(b), which provides that the submittal period for the nonattainment area SIPs runs from the later date of designation.

The earlier submittal date for transport SIPs is also consistent with sound policy considerations. The upwind reductions required today will facilitate attainment planning by the downwind States. Further, most of the downwind States that will benefit by today's rulemaking are themselves upwind contributors to problems further downwind, and, thus, are subject to the same requirements as the States further upwind. The

reductions these downwind States must implement due to their additional role as upwind States will help reduce their own PM2.5 and 8-hour ozone problems on the same schedule as emissions reductions for the upwind States.

2. Implementation Schedule

Section 110(a)(2)(D) requires SIPs to "contain adequate provisions ... prohibiting ... [emissions that] will ... contribute significantly to nonattainment in ... any other State...." The phrase "will ... contribute significantly" suggests that EPA should establish the significance of the emissions' contribution, and require their prohibition, as of a time in the future. However, the provision does not, by its terms, indicate the applicable date in the future; nor does it address the future period of time.

For today's proposal, EPA believes that determining significant contribution as of 2010, and requiring implementation of the reductions by January 1, 2010, is a reasonable application of the statutory provisions. As discussed in section VI, emissions controls for EGUs may be feasibly implemented by that time. As a result, January 1, 2010 is the date by which we can confidently predict that highly cost-effective emission reductions

from EGUs can begin, considering cost broadly to encompass many factors, including engineering feasibility and electricity supply reliability risks.

Emissions reductions by this date will also provide significant air quality benefits to the downwind nonattainment areas. We expect that the attainment date for numerous downwind areas will be 2010 or later, so that these reductions will facilitate attainment. For ozone nonattainment areas, the reductions will reduce the amount of nonattainment. For PM2.5 nonattainment areas, the reductions will have the same effect, and help bring those areas into attainment. Indeed, we believe that the anticipation of the optional trading program beginning in 2010 will create incentives for reductions in SO2 emissions prior to that date. Therefore, today's proposal will have benefits for progress towards attainment with the PM2.5 NAAQS in the years between finalization of this rule and 2010. Further discussion of these air quality benefits is included in section IX.

As discussed in section VI, feasibility considerations warrant deferring a portion of the emissions reductions to 2015. As discussed in section IX, these reductions will provide air quality benefits at

that time, as well, and, as in the case with the 2010 emission reductions, we expect that the anticipation of tighter controls will likely lead to SO2 emissions reductions prior to 2015.

B. State Implementation Plan Requirements

Today's proposal requires States to submit SIPs that contain controls sufficient to eliminate specified amounts of emissions. The EPA determined these amounts through the application of highly cost-effective controls to the EGU source category. The amount of the emissions reduction is determined by comparing the amount of EGU emissions in the base case – that is, in the absence of controls – to the amount of emissions after implementation of the controls. Section VI contains a more detailed discussion of the process for determining the amounts of emissions in the base case.

As noted elsewhere, EPA is gathering information concerning certain other source categories. However, EPA does not, at present, have information upon which to propose a determination that any other source categories may achieve specific emissions reductions at a cost that could be considered highly cost effective.

To achieve the required amount of emissions reductions, States may impose emission limits on other sources – in addition to EGUs – if they choose. The EPA is considering what additional requirements are needed to ensure that these limits are met. Overarching considerations include whether the requirements (i) provide certainty that all emissions that EPA determined to contribute significantly will be eliminated both at the State and regional level; (ii) ensure that contributions will continue to be eliminated in future years; and (iii) ensure that the control requirements can be feasibly implemented.

The EPA considered two main approaches to the SIP requirements: a budget (i.e., cap) approach, and an emission reduction approach. The EPA is proposing a hybrid approach that we believe incorporates the best elements of both approaches while minimizing the shortfalls of both approaches.

1. The Budget Approach

In its most rigorous form, a budget approach would require a statewide cap, that is, the capping of aggregate emissions from all source categories in each State. Mechanisms would be set up to ensure that the

overall budget was not exceeded. These mechanisms could require individual source categories to meet sub-budgets or could provide for emission shifting between source categories. Subjecting each State throughout the region to aggregate emissions budgets would provide great certainty that the amount of emissions identified as contributing significantly to nonattainment had been eliminated. This approach would also assure that the significant contribution was fully addressed for future years because any increase in activity across all emission sources would have to occur within the budget, that is, without generating additional emissions. If all States applied such an approach, it would also assure that emissions from a source within a given source category would be permanently reduced and not merely shifted to another source within the region, as could occur if sources in one State were controlled under a budget but similar sources in another State were not.

A less rigorous approach would require enforceable budgets for only some source categories, namely, those that were required to make the emissions reductions. Under this approach, there would be less certainty that all States will continue to not contribute significantly

(in terms of the air quality component) in future years because growth in overall emissions may still occur.

The U.S. EPA and State environmental agencies have successfully applied budget approaches to certain source categories and groups of source categories. For instance, the title IV requirements of the CAA applied a SO2 budget to most large EGUs. The Ozone Transport Commission (OTC) NOx budget trading program applied an ozone season NOx budget to large EGUs and non-EGU boilers and turbines, and many States have adopted the same approach to meet the requirements of the NOx SIP Call.[89] These successes demonstrate that budget programs can work for large stationary sources. These types of sources can accurately monitor emissions at the unit level, and these sources are manageable in number, so that overall emissions can be determined using this unit level data.

On the other hand, there has been virtually no experience with budget programs for mobile and area sources, due to challenges in accounting for emissions from these types of sources. Emissions from these

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[89] These budget approaches authorize trading among sources, but other control methodologies, such as emission rate controls, may also authorize trading. See U.S. EPA, "Improving Air Quality with Economic Incentive Programs," (January 2001).

sources are typically estimated using emission factors and estimated emission data, so that there is much less certainty about the accuracy of these amounts of emissions. Additionally, monitoring at the unit level and tracking unit level emissions would be much more difficult because of the large number of small sources involved.

As noted above, EPA believes that there are benefits from requiring a State to impose a cap on EGUs. We also believe that there would be benefits from requiring a State to impose a cap on any source category on which the State imposes controls. One benefit would be a permanent limit on the amount of emissions from that category to assure the reductions in emissions that significantly contribute to nonattainment in affected downwind States. We solicit comment on the approach of requiring States to impose caps on any source categories which the State chooses to regulate under the rule proposed today.

2. The Emissions Reduction Approach

Under the emissions reduction approach, SIPs must impose control requirements that typically consist of an emission rate limit or, possibly, application of a specified type of technology, but not an emissions cap.

These control requirements, when implemented by the affected sources in the implementation years, must result in the amount of emission reductions that EPA required through the highly cost-effective calculations described in section VI.

This approach is most useful when a State chooses to apply the control requirements to a source category for which current source-monitoring methods do not permit specific emissions quantification for each source, and for which shifts in emissions-generating activity are unlikely to result from the control program. This limitation in the methodology may result because, among other possible reasons, (i) the source's emissions generating activities are of a type for which no accurate quantification methodology exists; (ii) such a methodology would be unreasonably expensive to apply to the source; or (iii) the sources are too numerous.

Even so, to ensure that the desired emissions reductions are achieved, this methodology requires accurate baseline emission estimates, which, as a practical matter, may be difficult to develop in light of the uncertainties in estimating emissions from the affected source types. If the baseline estimates are

high, States may achieve credit for emissions reductions they will not in fact achieve (by reducing emissions to a certain emission rate from the incorrectly high baseline emission rate). Additionally, while this approach may assure similar emissions reductions to the budget approach in the early years following implementation, growth in activity levels in the controlled source categories would likely lead to growth in emissions in later years, which in turn may adversely affect downwind nonattainment areas.

Although the emissions reduction approach has limitations, EPA believes it is the most workable approach for some source categories, such as mobile and area sources, for which there is little or no experience in using the budget approach and for which the available emissions quantification techniques are too imprecise to support the budget approach.

3. The EPA's Proposed Hybrid Approach

The EPA proposes today to require each affected State to submit a SIP containing control requirements that will assure a specified amount of emissions reductions. These amounts would be computed with

reference to specified control levels for EGUs, which EPA has determined to be highly cost effective.

States may meet their emissions reduction requirements by imposing controls on any source category they choose. If they choose the EGU source category, they must impose a cap because this category may feasibly implement a cap. If States choose to get emissions reductions from other source categories, they may implement the emissions reduction approach, that is, they need not implement caps, but rather may implement other forms of controls. Even so, EPA strongly encourages States to control source categories for which workable budget programs can be developed, and to require the budget approach for those sources to which it can feasibly be applied.[90]

The EPA is proposing specific requirements that States must meet, depending on which source categories they choose to control. These requirements are intended to provide as much certainty as possible that the

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[90] It should be noted that even if a State uses a budget approach for a source category within the State, it is possible that production may shift to another part of the transport region, so that the State's claimed emission reductions may in fact simply represent emissions shifted to another part of the transport region.

controls will eliminate the amounts of significant contributions.

a. Requirements If States Choose to Control EGUs

As explained above, States must apply the budget approach if they choose to control EGUs. That is, they must cap EGUs at the level that assures the appropriate amount of reductions. We believe that this is the preferable approach for complying with today's proposed rule.

Moreover, as discussed in sections VI and VIII, States that choose to allow their EGUs to participate in EPA-administered interstate SO2 and NOx emissions trading program must adhere to EPA's model trading rules, which we intend to propose in the SNPR. For SO2 sources, these rules will require the States to allocate control obligations to sources in a manner that mirrors the sources' title IV allowance allocations, although EPA is considering certain variations that are described in section VI.

With respect to monitoring, recordkeeping, and reporting requirements, most EGUs are already subject to the requirements of 40 CFR part 75 to demonstrate compliance with the title IV SO2 provisions. In

addition, many EGUs are also subject to part 75 due to SIP requirements under the NOx SIP Call. The EPA believes that part 75 provides accurate and transparent accounting of emissions from this source category. Therefore, EPA proposes to require States, if they apply controls to EGUs, to subject EGUs to the requirements of part 75.

As explained in sections VI and VIII, today's proposed SO2 emissions reductions requirement, when applied to EGUs subject to the title IV allowance programs, would result in a cap that, in turn, would create surplus title IV allowances. These surplus allowances, if allowed to be traded, may have adverse impacts in and outside of the States directly affected by today's proposal. In particular, the large number of these allowances that become available may depress their price, which may lead to even more of them being purchased and used in States not affected by today's proposed rule.

To prevent these impacts, EPA is proposing that SIPs assure that the State's title IV allowances exceeding the emissions that the State's EGUs may emit under the rule proposed today are not used in a manner that undermines

the rule proposed today. As a practical matter, SIPs may need to require the retirement or elimination of certain of the title IV allowances. The number of retired or eliminated allowances may well equal the difference between the number of title IV allowances allocated to a State and the SO2 budget that the State sets for EGUs under today's proposed rule. For example, assume that a State's EGUs are allocated a total 5,000 SO2 allowances under title IV (each allowance authorizes one ton of SO2 emissions). Assume further that today's proposed rule requires the State to reduce its SO2 emissions by 2,500 tons. Assume even further that the State chooses to achieve all of the required reductions from EGUs, beginning January 1, 2010. Under these circumstances, the SIP must include a mechanism to retire or eliminate the remaining 2,500 allowances.

The EPA believes that this proposed requirement to retire or eliminate surplus allowances applies regardless of whether or not a State participates in the EPA-managed trading system. If the State does not participate in the EPA-managed trading system, it may choose the specific method to retire or eliminate surplus allowances from its sources. If it chooses the EPA-managed trading system,

it must adhere to the provisions of the model trading rule, which are broadly outlined in section VIII.

States may allow EGUs to demonstrate compliance with the State EGU SO2 emission budget by using (i) allowances that were banked (that is, issued for years earlier than the year in which the source is demonstrating compliance), or (ii) title IV allowances from the same year purchased from sources in other States.

b. Requirements if States Choose to Control Sources Other than EGUs

If a State chooses to require emissions reductions from only EGUs, then its SIP revision submitted under the rule proposed today need contain only provisions related to EGUs, as described above. The State need not adopt or submit, under the rule proposed today, any other provisions concerning any other source categories.[91]

On the other hand, if a State chooses to require emissions reductions from sources other than EGUs, the State must adopt and submit SIP revisions, and supporting documentation, designed to quantify the amount of

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[91] Of course, the State may be obligated to submit SIP revisions covering other source categories under applicable CAA provisions other than section 110(a)(2)(D).

reductions from the sources and to assure that the controls will achieve that amount of reductions. The EPA is not proposing today that the State be required to cap those sources. However, EPA solicits comment on whether to require States that choose to control sources other than EGUs to cap those sources.

To demonstrate the amount of emissions reductions from the controlled sources, the State must take into account the amount of emissions attributable to the source category both (i) in the base case – that is, in the implementation year (2010 and 2015) without assuming SIP-required reductions from that source category under today's proposed rule – and (ii) in the control case. Both scenarios (base case and control case) are necessary to determine the amount of emissions reductions that will result from the controls. As noted above, section VI contains a more detailed discussion of the process for determining the amounts of emissions in the base case.

The EPA intends to propose in the SNPR monitoring, recordkeeping, and reporting requirements for sources other than EGUs. Further, EPA intends to include proposed rule language for these requirements. Commenters will have an opportunity to comment following

publication of the SNPR. As a result, EPA is not soliciting comment on this subject now. Even so, EPA intends to consider any comments submitted on this subject that commenters may wish to submit.

VIII. Model Cap and Trade Program

In today's action, we are outlining multi-State cap and trade programs for SO2 and NOx that States may choose as a cost-effective mechanism to achieve the required air emissions reductions. Use of these cap and trade programs will not only ensure that emissions reductions under the proposed rulemaking are achieved, but also provide the flexibility and cost effectiveness of a market-based system. This section provides background information, a description of the cap and trade programs, and an explanation of how the cap and trade programs would interface with other State and Federal programs. It is EPA's intent to propose model SO2 and NOx cap and trade rules in a future SNPR that States could adopt.

By adopting the model rules, States choose to participate in the cap and trade programs, which are a fully approvable control strategy for achieving emissions reductions required under today's proposed rulemaking. Should a State choose to participate in the cap and trade

programs, EPA's authority to cooperate with and assist the State in the implementation of the cap and trade program(s) would reside in both State law and the CAA. With respect to State law, any State that elects to participate in the cap and trade programs as part of its SIP will be authorizing EPA to assist the State in implementing the cap and trade program with respect to the regulated sources in that State. With respect to the CAA, EPA believes that the Agency's assistance to those States that choose to participate in the cap and trade programs will facilitate the implementation of the programs and minimize any administrative burden on the States. One purpose of title I of the CAA is to offer assistance to States in implementing title I air pollution prevention and control programs (42 U.S.C. 101(b)(3)). In keeping with that purpose, section 103(a) and (b) generally authorize EPA to cooperate with and assist State authorities in developing and implementing pollution control strategies, making specific note of interstate problems and ozone transport. Finally, section 301(a) grants EPA broad authority to prescribe such regulations as are necessary to carry out its functions under the CAA. Taken together, EPA believes

that these provisions of the CAA authorize EPA to cooperate with and assist the States in implementing cap and trade programs to reduce emissions of transported SO2 and NOx that contribute significantly to ozone and PM2.5 nonattainment.

To inform the current rulemaking process, EPA recently hosted two workshops in July and August of 2003 to listen to States and multi-State air planning organization's experience with the NOx SIP Call program to date: what has worked well, what may not have worked well, and what could be improved. (The EPA web site[92] provides information on these workshops.) Workshops such as these have played an important role in the development and implementation of the NOx SIP Call and will help in the development of this rule.

This section in today's action describes, on a generally conceptual level, the cap and trade program. EPA will publish, in a future SNPR, a more detailed description of the proposed rules, as well as model rules. As a result, EPA is not soliciting comment on this section in today's action. Interested persons will

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92 http://www.epa.gov/airmarkets/business/noxsip/atlanta/atl03.html

have a full opportunity to comment on all aspects of this cap and trade program through the SNPR. Even so, EPA recognizes that continued stakeholder input on the cap and trade programs described in this section may be useful concerning the programmatic implications of addressing multiple environmental issues (i.e., PM2.5 and ozone) with synchronized cap and trade programs for SO2 and NOx. Accordingly, EPA intends to review comments that may be submitted on all of the program elements described in today's NPR.

A. Application of Cap and Trade Approach

1. Purpose of the Cap and Trade Programs and Model Rules

In the cap and trade programs, EPA is proposing to jointly implement with participating States a capped market-based program for EGUs to achieve and maintain an emissions budget consistent with the proposed rulemaking. Specifically, EPA has designed today's proposal to assist States in their efforts to: 1) improve air quality and achieve the emissions reductions required by the proposed rulemaking; 2) offer compliance flexibility for regulated sources; 3) reduce compliance costs for sources controlling emissions; 4) streamline the administration of programs to reduce multiple pollutants for States; and

5) ensure that emission reductions are occurring and that results are publicly available. In addition to realizing these benefits of a cap and trade program, EPA also seeks to create as simple a regulatory regime as possible by applying a single, comprehensive regulatory approach to controlling multiple pollutants across multiple jurisdictions.

Beyond choosing to use a cap and trade program, State adoption of the model rule would ensure consistency in certain key operational elements of the program among participating States. Uniformity of the key operational elements across the region is necessary to ensure a viable and efficient cap and trade program with low transaction costs and minimum administrative costs for sources, States, and EPA. (These necessary elements are discussed in section B.3.). States will continue to have flexibility in other important program elements (e.g., allowance allocations, inclusion of additional measures to address persistent local attainment issues).

2. Benefits of Participating in a Cap and Trade Program

a. Advantages of Cap and Trade Over Command-and-Control

When designed and implemented properly, a cap and trade program offers many advantages over traditional

command-and-control and project-by-project emission reduction credit trading programs. There are several advantages of a well-designed cap and trade system that include: 1) control of emissions to desired levels under a fixed cap that is not compromised by future growth; 2) high compliance rates; 3) lower cost of compliance for individual sources and the regulated community as a whole; 4) incentives for early emissions reductions; 5) promotion of innovative compliance solutions and continued evolution of generation and pollution control technology; 6) flexibility for the regulated community (without resorting to waivers, exemptions and other forms of administrative relief that can delay emissions reductions); 7) direct legal accountability for compliance by those emitting; 8) coordinated program implementation that efficiently applies administrative resources while enhancing compliance; and 9) transparent, complete, and accurate recording of emissions. These benefits result primarily from the rigorous framework established by a cap and trade program that provides flexibility in compliance options available to sources and the monetary reward associated with avoided emissions in a market-based system. The cost of compliance in a

market-based program is reduced because sources have the freedom to pursue various compliance strategies, such as switching fuels, installing pollution control technologies, or buying emission allowances from a source that has over-complied. Since reducing emissions to levels below the allocations for a source allows them to sell excess allowances on the market, this program promotes cost effective pollution prevention, and encourages innovations in less-polluting alternatives and control equipment.

A market-based system that employs a fixed, enforceable tonnage limitation (or cap) for a source or group of sources provides the greatest certainty that a specific level of emissions will be attained and maintained. With respect to transport of pollution, an emissions cap also provides assurance to downwind States that emissions from upwind States will be effectively managed over time. The capping of total emissions of pollutants over a region and through time ensures achievement of the environmental goal while allowing economic growth through the development of new sources or increased use of existing sources. In an uncapped system (where, for example, sources are required only to

demonstrate that they meet a given emission rate) the addition of new sources to the regulated sector or an increase in activity at existing sources can increase total emissions even though the desired emission rate control is in effect.

In addition, the reduced implementation burden for regulators and affected sources benefits taxpayers and those who must comply with the rules. This streamlined administration allows a relatively small number of government employees to successfully manage the emissions of many sources by (1) minimizing the necessity for case-by-case decisions, and (2) taking full advantage of electronic communication and data transfer to track compliance and develop detailed inventories of emissions and plant operations.

b. Application of the Cap and Trade Approach in Prior Rulemakings

i. Title IV

Title IV of the CAA Amendments of 1990 established the Acid Rain Program, a program that utilizes a market-based cap and trade approach to require power plants, to reduce SO2 emissions by 50 percent from 1980. At full implementation after 2010, emissions will be

limited, or capped, at 8.95 million tons in the contiguous United States. The Acid Rain SO2 Program is widely acknowledged as a model air pollution control program because it provides significant and measurable environmental and human health benefits with low implementation costs.

Individual units are directly allocated their share of the total allowances – each allowance is an authorization to emit a ton of SO2 – based upon historical records of the heat content of the fuel that they combusted in 1985-1987. Units that reduce their emissions below the number of allowances they hold, may trade excess allowances on the open market or bank them to cover emissions in future years. Allowances may be purchased through the open market or at EPA-managed auctions. Each affected source is required to surrender allowances to cover its emissions each year. Should any source fail to hold sufficient allowances, automatic penalties apply. In addition to financial penalties, sources either will have allowances deducted immediately from their accounts or, if this would interfere with electric reliability, may submit a plan to EPA that specifies when allowances will be deducted in the future.

The Acid Rain Program requires affected sources to install systems that continuously monitor emissions. The use of continuous emissions monitoring systems (CEMS) is an important component of the program that allows both EPA and sources to track progress, ensure compliance, and provide credibility to the cap and trade component of the program.

While title IV does provide for an Acid Rain Permit, this is a simple permit that does not incorporate source specific requirements, but rather requires the source to comply with the standard rules of the program. The Acid Rain Permit has been easily incorporated into the title V permit process and does not require the typically resource intensive, case-by-case review associated with other permits under command-and-control programs.

The Acid Rain Program has achieved major SO2 emissions reductions, and associated air quality improvements, quickly and cost effectively. In 2002, SO2 emissions from power plants were 10.2 million tons, 41 percent lower than 1980.[93] (2002 Acid Rain Progress

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[93] U.S. EPA, 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 .

Report.) These emission reductions have translated into substantial reductions in acid deposition, allowing lakes and streams in the Northeast to begin recovering from decades of acid rain. In addition, substantial improvements in air quality have occurred under the Acid Rain Program. Fine particle exposures have been reduced, providing significant benefits to public health. These benefits include the annual reduction of thousands of premature mortalities, thousands of cases of chronic bronchitis, thousands of hospitalizations for cardiovascular and respiratory diseases.

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 cap on emissions, automatic penalties for noncompliance, and 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, measuring over 99 percent.

ii. Ozone Transport Commission NOx Budget Program

The Ozone Transport Commission's (OTC) NOx Budget Program was a cap and trade program to reduce NOx emissions from power plants and other large combustion sources in the Northeast. The OTC was established under the CAA Amendments of 1990 to help States in the Northeast and Mid-Atlantic region meet the NAAQS for ground-level ozone. The NOx Budget Program set a regional budget on NOx emissions from power plants and other large combustion sources during the ozone season (from May 1 through September 30) beginning in 1999.

The OTC NOx Budget Program has significantly reduced NOx emissions from large combustion facilities in the Northeast and Mid-Atlantic region with total regional emissions in 2002 approximately 60 percent below 1990 levels; well under target levels. Significant reductions in ozone season NOx emissions have occurred in all States across the region. In addition, the emission reductions

have proven to be cost effective with the cost of NOx allowances stabilized below original projections.[94]

The OTC States generally folded their SIP requirements under the OTC NOx Budget Program into the SIP revisions they submitted with the NOx SIP Call. The NOx Budget Program was incorporated into the NOx SIP Call. The 2003 ozone season marked the first year of compliance with the NOx SIP Call for the OTC States.

iii. NOx SIP Call

The NOx SIP Call, finalized in 1998, requires ozone season (i.e., summertime) NOx reductions across a region which includes most of the OTC States and southeastern and midwestern States that were found by EPA to have sources that contribute significantly to another State's ongoing ozone NAAQS nonattainment problems. The NOx SIP Call proposed a cap and trade program as a way to make cost-effective NOx reductions. Each of the States required to submit a NOx SIP under the NOx SIP Call chose to adopt the cap and trade program regulating large boilers and turbines. Each State based its cap and trade program on a model rule developed by EPA. This model

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[94] Ozone Transport Commission. NOx Budget Program 1999-2002 Progress Report, March 2003. Available at http://www.epa.gov/airmarkets/otc/otcreport.pdf.

rule included key elements such as the use of continuous emissions monitoring (CEMS) and 40 CFR part 75 monitoring and reporting requirements, and a single party that is legally responsible for compliance. Some States essentially adopted the full model rule as is, while other States adapted the model rule with changes to the sections that EPA specifically identified as areas in which States may have some flexibility. The NOx SIP Call cap and trade program, modeled closely after the OTC NOx Budget Program takes effect in 2004. When it does so, it expands from the OTC States to eleven additional States in 2004. The EPA intends to draw heavily upon this and other experience in developing model SO2 and NOx cap and trade programs.

c. Regional Environmental Improvements Achieved Using Cap and Trade Programs

One concern with emissions trading programs is that the flexibility associated with trading might allow sources or groups of sources to increase emissions, resulting in areas of elevated pollution or “hot spots.” The environmental results observed under the Acid Rain Program have instead indicated that the combination of trading with a stringent emissions cap results in

substantial reductions throughout the region, with the greatest reductions achieved in the areas where pollution was originally the highest.

Since 1990, SO2 and sulfate concentrations at CASTNET sites have been reduced substantially in the areas where concentrations were highest before the Acid Rain Program. (Acid Rain Program Progress Report 2002). All sites in the East showed reductions in SO2 and sulfate 3 year average concentrations between 1990-1992 and 2000-2002. The largest decreases in SO2 concentrations were observed at sites where SO2 emissions and monitored SO2 concentrations were highest before the program (from Illinois, to northern West Virginia, across Pennsylvania, to western New York). CASTNET sites throughout the broader eastern region also show a substantial reduction in sulfate concentrations, with the largest decreases in sulfate levels occurring along the Ohio River Valley from Illinois to West Virginia, Pennsylvania, and the mid-Atlantic states.

Independent analyses, in addition to those conducted by EPA, have shown that emissions trading under this type of program has not resulted in the creation of "hot spots" because trading has resulted in emissions

reductions being achieved in areas where emissions were highest before the program.[95] The Environmental Law Institute , Environmental Defense, and the Massachusetts Institute of Technology's Center for Energy and Environmental Policy have all examined emissions trading under the Acid Rain Program and none have concluded that the program has resulted in hot spots of high emissions. To the contrary, the highest emitting sources have tended to reduce emissions by the greatest amount. This is the case, in part, because trading occurs under a nationwide cap that represents a reduction in total emissions and improvements in regional air quality. The flexibility of a cap and trade system provides a mechanism for achieving established emission goal(s)at lowest possible cost. The most cost effective opportunities for reductions are at the larger, more efficient coal-fired units that have modest (or no) controls and are geographically dispersed.

Further support for trading actually reducing "hot spots" was found by Resources for the Future. Resources

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[95] Environmental Law Institute (http://www.epa.gov/airmarkets/articles/so2trading-hotspots charts.pdf), Environmental Defense (http://www.environmentaldefense.org/documents/645 SO2.pdf), and MIT's Center for Energy and Environmental Policy Research (http://web.mit.edu/ceepr/www/2003-015.pdf)

for the Future, a non-partisan environmental advocacy group, modeled air quality and health benefits under the trading program and under a non-trading scenario and found that trading actually resulted in additional benefits because emissions reductions took place in areas where they were more environmentally effective.[96]

Cap and trade programs are designed to reduce emissions of numerous polluting sources by significant amounts over large geographic areas. The trading mechanism does not replace the requirement to meet the NAAQSs at the local level, but rather helps achieve this requirement through significant reductions in background pollution. Thus, State and local governments will continue to have the obligation and the authority under the CAA to assure that the NAAQS are met.

Nearly 10 years of experience with the Acid Rain Program for SO2 has clearly demonstrated that market-based cap and trade programs are an effective vehicle for achieving broad improvements in air quality by reducing emissions of a regionally transported air pollutant. More recently, the OTC's regional NOx program

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[96] http://www.rff.org/CFDOCS/disc papers/PDF files/9925.pdf

also has shown the value of a cap and trade approach for NOx reductions. The more stringent SO2 and NOx caps proposed in this rulemaking will build on this track record of success.

B. Considerations and Aspects Unique to the SO2 Cap and Trading Program

1. SO2 Cap and Trade Program Overview

This section of today's proposal outlines an SO2 cap and trade program which builds upon the concepts applied in the cap and trade programs described in section VIII.A. This section discusses elements unique to the proposed SO2 trading program, paying particular attention to those aspects that significantly differ from the corresponding provisions in existing programs. (Additional details on the SO2 and NOx trading program may be found in section VIII.D, which describes major program elements that must be consistent across States in order for EPA to implement a trading program.)

While key considerations and program elements are outlined in today's proposed rule, a complete model cap and trade rule will be proposed by EPA in a future SNPR. In addition to a model rule, the SNPR will address other

issues such as allocations and voluntary measures for States to address persistent local non-attainment issues.

The proposed SO2 cap and trade program would apply to the large power generators in the transport region. (See section VI of today's rule for a discussion of the emission budgets and the core sources.) States would have some flexibility to include other sources or source categories in the trading program should they demonstrate their ability to measure the emissions from these other sources to the same standards required of the core trading sources.

The units affected by today's SO2 rule are already regulated by EPA. EPA is committed to a transition that ensures continued environmental progress, preserves the integrity of existing emission trading markets, and minimizes confusion and cost for the public, sources and regulators. Section VIII.B.2 below discusses the interactions between today's proposal and existing programs by presenting analysis and implementation options. A discussion of the applicable sources is contained in section VIII.D.1.

2. Interactions with Existing Title IV Acid Rain SO2 Cap and Trade Program

As discussed above, title IV of the CAA requires reductions in SO2 emissions from power plants to abate acid rain and improve public health using a cap and trade approach. Further, title I of the CAA requires EPA to help States develop and design implementation plans to meet the NAAQS. To achieve that end, today's action proposes a regional rule to reduce ambient concentrations of PM2.5, as mandated by the CAA. The SO2 program establishes a model cap and trade system for reducing emissions that States can adopt in order to help meet the NAAQS.

As EPA developed this regulatory action, great consideration was given to interactions between the existing title IV program and a rulemaking designed to achieve significant reductions in SO2 emissions beyond title IV. Requiring sources to reduce emissions beyond the title IV mandates has implications for the existing title IV SO2 program which are both environmental and economic. In the absence of a method for incorporating the statutory requirements of title IV, a rule that imposes a tighter cap on SO2 emissions for a particular region of the country would likely result in an excess supply of title IV allowances and the potential for

increased emissions in the area not subject to the more stringent emission cap. The potential for increased emissions exists in the entire country for the years prior to the proposed implementation deadline and would continue after implementation for any areas not affected by the proposed rule. These excess emissions could negatively affect air quality, disrupt allowance markets, and erode confidence in cap and trade programs.

In view of the significant reductions in SO2 emissions under title IV of the CAA, the large investments in pollution controls that firms have made under title IV that enable companies to sell excess emissions reductions, and the potential for emissions increases, it became a priority to think of ways to preserve the environmental benefits achieved through title IV and maintain the integrity of the title IV market for SO2 allowances.

In addition, EPA does not have authority to remove the statutory requirements of title IV and must work within the context of the existing CAA to further reduce emissions of SO2 through a new rule. Title IV has successfully reduced emissions of SO2 using the cap and trade approach, eliminating millions of tons of SO2 from

the environment. Building off this existing program to further improve air quality by requiring additional reductions of SO2 emissions is appropriate.

The EPA has developed an approach to incorporate the title IV SO2 market to ensure that the desired reductions under this rule are achieved in a manner consistent with the previously stated environmental goals. The following sections provide more detail on EPA's initial analysis of the interactions between the title IV Acid Rain program and this proposal outlines a solution for creating a rule that builds off of title IV.

Initial Analysis

Initial analytical work shows that a more stringent cap on SO2 emissions in the eastern part of the country, that is separate from the title IV cap, would create an excess supply of title IV allowances nationwide as sources in that eastern region comply with a tighter requirement than title IV and no longer need as many title IV allowances. As a result of this excess supply, all title IV allowances would lose value. This impact on the title IV market results in (1) an incentive to use all banked title IV allowances prior to implementation of the rule as firms anticipate the value of allowances

dropping essentially to zero and (2) emission increases outside the region after rule implementation because those sources would be able to obtain title IV allowances at essentially no cost.

b. Emissions Increases Prior to Implementation of the Proposed Rule

The EPA expects that the number of banked (i.e., the retention of unused allowances from one calendar year for use in a later calendar year) title IV allowances will be in the millions of tons at the end of 2009 in the absence of the rule. The actual number of allowances banked will depend upon future economic growth and the independent decisions of the sources between now and 2010, and EPA will continue to evaluate emissions trends and the bank prior to finalizing the rule. Should the rule not permit the use of banked title IV allowances in the program, the banked allowances would likely be expended during the years prior to implementation of the rule. This could cause over 1 million tons per year of additional SO2 emissions, nationwide, that could be emitted above levels projected in the absence of a rule.

c. Consideration for Emissions Shifting Outside the Control Region

Title IV sources outside the more stringently regulated region would be able to obtain title IV allowances from sources affected by the rule at very low cost after the commencement of the program. The flow of inexpensive, abundant allowances out of an area with more stringent emission control requirements is referred to as "leakage" and would likely result in increased emissions outside the region. In essence, sources outside of the region would not face a binding title IV constraint on their emissions of SO2 due to the potential availability of abundant allowances provided by sources inside of the control region. Though certain State and local requirements or physical constraints would mitigate the problem of emissions increases outside the region, meaningful increases would be a possibility. Emissions increases outside the region would worsen air quality in those areas and could potentially negate some of the reductions achieved in the region.

The potential for leakage is dependent upon the size of the region. The large eastern trading region proposed in today's rule – which is based upon addressing PM2.5 – is not likely to result in significant leakage because the region is large enough to take advantage of the

physical limitations in the electricity grid that prevent large power movements from the East to the West (or vice versa) through the Western Interconnect.

d. Desired Outcomes in the Design of the Cap and Trade Rule

The proposed cap and trade program will be designed to meet three primary goals: 1) achieving environmental goals; 2) preserving and potential strengthening of allowance trading markets; and 3) providing the flexibility to incorporate additional jurisdictions and types of sources in the future, while maintaining the integrity of the cap and allowance markets.

First and foremost, the proposed cap and trade program must be designed to improve air quality to protect the public's health and the environment. To accomplish this, the program must address the potential for emission leakage, require credible emission monitoring and reporting, and provide for source accountability.

Preservation of the benefit of the title IV allowance market (i.e., a solution that would maintain or even increase the economic value of title IV allowances) would eliminate the incentive to increase emissions prior

to the start of the program and ease the administrative transition. Incorporating title IV creates incentives for earlier reductions by title IV sources and may create incentives for title IV sources not included in the rule to maintain, or even reduce, emissions of SO2 both before and after the rule goes into effect. In addition, it sends a clear signal to sources that have already made investments in pollution control equipment that the allowance market is sound and will continue to operate.

The proposed cap and trade solution must provide opportunities for incorporating additional sources (e.g., non-title IV sources, other source categories) and States, during promulgation and in the future. Designing a cap and trade program that can include these additional sources creates the potential to achieve additional environmental benefit and/or reduce the program's total cost.

e. Discussion of Possible Solutions

The EPA explored several options for addressing the coordination of title IV and the proposed rule consistent with the objective of minimizing emissions increases and providing a mechanism of allocating allowances to sources lacking any title IV allocations. One option would

establish a separate cap and trade program for SO2 that would require the retirement of surplus title IV allowances for the rule (i.e., the difference between total title IV allocations and the trading budget for a given State under the rule). Sources would have to comply with both programs independently, and States would have flexibility in allocating the newly created allowances to non-title IV sources. Although this option could be designed so as to maintain the value of title IV allowances once the new cap and trade program begins under the rule, thus minimizing leakage, it would not address banked title IV allowances accumulated before implementation of the program, resulting in possible emissions increases prior to rule implementation.

Another option would allow for conversion of title IV allowances into separate allowances under a new cap and trade program. This conversion would be applied at a specific ratio (e.g., two-to-one) that yields the desired emission reductions, and could be applied to both banked and current title IV allowances. By complying with the rule and submitting more than one title IV allowance for every ton emitted, a source would be in compliance with both programs. New allowances could be created to give

States flexibility with SO2 allocations, but the conversion ratio would need to be adjusted to incorporate these new allowances. This solution presents some challenges, such as establishing the proper conversion ratio and the need to adjust the cap under the rule to account for the converted allowances. In addition, the uncertainty surrounding how many banked allowances would be converted poses challenges when designing the cap and trade rule.

f. Proposed Approach

A third option and the approach proposed here best addresses the three principles identified above. It would require sources to use title IV allowances directly for compliance with the rule in a way that maintains the downward trend in emissions throughout the country, preserves the existing SO2 allowance market, and allows the inclusion of non-title IV sources, now and in the future.

Title IV sources in the region would be required to comply with the rule by using more than one title IV allowance for every ton emitted (e.g., a two-to-one ratio). EPA would propose to amend the title IV rules in a future SNPR so that sources that comply with the rule

would be deemed in compliance with title IV since by submitting allowances at a greater than one-to-one ratio, a source would be going beyond what title IV required. The requirement to submit more than one allowance for every ton emitted is, in effect, a reduction of the title IV cap. The specific ratio would be determined based on the amount of emissions to be allowed for the region. The ratio, in essence, would reflect the cap levels and determine the ultimate emissions in the region. Section VIII.B.3 below, discusses a methodology that could be used to provide allowances to EGUs that were not allocated allowances under title IV.

While EPA is not currently proposing to require sources other than EGUs to be part of the cap and trade program, EPA believes that this approach could also allow other sources to participate in the cap and trade program. States electing to include additional sources could develop mechanisms to provide them with access to allowances through auctions or direct allocations. (This is discussed in greater detail in section VIII.B.3.)

i. Using Pre-2010 Banked Title IV Allowances in Proposed SO2 Cap and Trade Program

Under the proposed approach, title IV allowances could be banked before the 2010 implementation date for use in the new program. Pre-2010 title IV allowances banked prior to 2010 could be used at a one-to-one ratio for compliance at any time. This provides incentives to reduce emissions before the 2010 implementation date because sources would want to ease the transition to the more stringent caps in 2010 and thereafter. However, it should be noted that these allowances could then be used in later years, delaying the amount of time until the ultimate cap level is achieved.

ii. Proposed Ratios and the Phasing of the Caps

The proposed SO2 program would allow: (1) Pre-2010 allowances to be used at a one-to-one ratio; (2) 2010 through 2014 allowances to be used at a two-to-one; and (3) 2015 and later allowances to be used at a three-to-one ratio. Since title IV allowances are already identified by serial numbers that indicate the year the allowance is first allowed to be used, it is possible to use different retirement ratios for allowances of different vintages. The progressively more stringent, phased-in nature of the rule will be reflected in the proposed cap and trade program by adjusting the ratio for

retiring allowances in each phase. EPA developed these ratios to achieve the emissions reductions as described in section VI with careful consideration given to the title IV bank, State EGU budgets, and phasing in order to create ratios that are consistent with the objectives of the rule. The ratios, in effect, tighten the existing title IV cap.

States choosing to participate in the cap and trade program must require sources to submit title IV allowances at the ratios set in the model rule.

The EPA projects that using 2010 to 2014 vingtage title IV allowances at a ratio of two-to-one and post 2014 allowances at a ratio of three-to-one in the second phase will produce the desired emission reductions for SO2. These ratios are projected to lead sources to bank roughly an additional 10.5 million allowances prior to 2010. Vintage year allowances 2009 and earlier are projected to be used starting in 2010 at an average rate of 1.3 million per year.

The value of title IV allowances is projected to increase to $400 during the first phase, and to fall to $330 during the second phase, according to EPA modeling. In other words, sources in the region would face a

marginal cost of $805 per ton of emissions in the first phase at a two-to-one ratio and $989 in the second phase at a three-to-one ratio. The marginal cost numbers presented here are generated from EPA modeling of this rule, looking specifically at the interactions with title IV.

3. Allowance Allocations

a. Statewide Cap and Trade Budgets

Today's rule proposes statewide EGU SO2 emission budgets (detailed in section VI) that States may allocate. Discretion in the allocation of this budget to title IV units (which constitute a majority of the EGUs) that already receive allowances under title IV is somewhat limited for States because the existing title IV SO2 allocation provisions explicitly allocate allowances to specific units. Therefore, as a practical matter, States that wish to participate in an EPA-managed interstate trading program will not have as much flexibility in developing their SO2 allocation methodology for title IV units that already receive allowances than they will with NOx allocations.

b. Determination of SO2 Allowance Allocations for EGUs not Receiving Title IV Allowances

As discussed in section VI (Statewide Emissions Budgets), States will have the flexibility to address equity issues for newer units that do not receive title IV allowances. However, as mentioned above, because title IV allocates virtually all of the Acid Rain Program allowances directly to individual sources, any State electing to provide allowances to newer sources would have to develop a mechanism that creates an excess of allowances after the initial allocation. One potential remedy is a mechanism that creates a State-managed pool of allowances from EGUs within that State by either: (1) requiring in-State EGUs that receive title IV allowances to surrender allowances at a rate tighter than today's rule retirement ratio and transferring this overage to the State (e.g., an EGU would retire 2 allowances and surrender 1 allowance for every ton emitted); or, (2) tightening the retirement ratio for in-State EGUs that receive title IV allowances and providing for EPA to create new SO2 allowances, the total being equal to or less than the overage, that are issued to the new sources (e.g., an EGU would retire 3 allowances for every ton emitted and EPA would issue a new SO2 allowance to the new source). EPA intends to assist States by providing a

more detailed discussion of allocation alternatives in a future SNPR.

Should States decide to allocate allowances to these newer EGUs, States would be given latitude in determining how they would distribute them from the pool of allowances for EGUs that receive title IV allowances. States may choose to hold an allowance auction or distribute allowances directly to sources. Should a State decide to allocate allowances, it would have flexibility in selecting the method upon which the allocation share is determined. Common methods for allocating allowances include:

1) actual emissions (in tons) from the unit,

2) actual heat input (in mmBtu) of the unit, and

3) actual production output (in terms of electricity generation and/or steam energy) of the unit.

Each of these options has variations, including the use of allowance set-asides, and may be implemented with allocations performed on a permanent or an updating basis.

The details of specific allocation options will be presented in greater detail in the future SNPR.

C. Consideration and Aspects Unique to the NOx Cap and Trade Program

1. NOx Cap and Trade Program Overview

The NOx cap and trade program would be substantially similar, in its basic requirements and procedures, to the SO2 cap and trade program described above. However, some components of a proposed NOx cap and trade program are unique to its implementation in the context of existing regional NOx control programs. This section describes those unique components. Because the authority for the existing NOx cap and trade programs exists at the State level and are not constrained by intricate title IV interactions, States may have more flexibility to revise their existing rules than they would have in complying with the proposed SO2 program. Section VIII.D discusses elements of the cap and trade programs that are common to both the SO2 and NOx programs.

2. Interactions with the NOx SIP Call Cap and Trade Program and the Title IV NOx Program

This section discusses specific implementation issues related to transitioning from existing regional NOx control programs to today’s proposed NOx cap and trade program.

a. Geographic Scope

States in the Proposed Region

Ideally, the NOx and SO2 cap and trade program regions would be identical. However, the geographic boundaries of the NOx cap and trade program must be related to the contribution made by emissions sources to the interstate transport of NOx as it affects non-attainment of PM2.5 and ozone standards. While the PM2.5 standard of most interest is annual, the ozone standard is an 8-hour duration with exceedances in the summer season. Therefore, EPA is proposing a NOx trading region that applies to those States affected by the PM2.5 finding; a region which encompasses virtually the same region as would be affected by the ozone findings with the exception of the State of Connecticut. Furthermore, EPA is proposing to allow the State of Connecticut, which is required to reduce only summertime NOx emissions to address ozone under today's action, to participate in the EPA-managed NOx cap and trade program on an annual basis. In addition, EPA proposes to allow other States currently participating in EPA-managed, ozone season, NOx cap and trade programs to join the year-round NOx cap and trade program on an annual basis. If States chose to

participate on an annual basis, EPA will determine corresponding annual budgets.

States Outside the Proposed Region with Existing Regional NOx Cap and Trade Programs

There are three States that participate in the existing regional NOx trading market that would not be affected by today's proposed ozone or PM2.5 rules: New Hampshire (as part of the OTC), and Massachusetts and Rhode Island (as part of the NOx SIP Call). These States would be allowed and encouraged to voluntarily participate in the NOx cap and trade program under today's rules in order to minimize administrative burden and simplify compliance for sources. Both the OTC and NOx SIP Call are ozone season only compliance programs. Any States choosing to participate in an EPA-managed program proposed today, would be required to participate on an annual basis if they choose to participate in the proposed NOx cap and trade program.

b. Seasonal-to-Annual Compliance Period

The NOx SIP Call regulates NOx emissions during an "ozone season" that lasts from May 1 through September 30. The proposed rule requires annual NOx reductions. As explained in section VI, EPA analysis shows that under

the proposed annual caps, EGUs in the NOx SIP Call region would emit less during the ozone season than they were allowed to emit under the NOx SIP Call.

c. Revision of Existing State NOx SIP Call Rules

The EPA plans to design the model cap and trade rule in such a way that States that are part of the NOx SIP Call will be able to modify their State rules to include the new provisions and new NOx caps, and States that are not currently part of the NOx SIP Call will be able to adopt the model rule language for the new program. Transition issues, such as new NOx caps and applicability will be discussed thoroughly in the SNPR.

d. Retention of Existing Title IV NOx Emission Rate Limits

Title IV requires coal-fired EGUs to meet average annual NOx emission rates. These requirements would remain in effect after the 2010 compliance deadline for this proposed rule. EPA analysis shows that under the more stringent NOx cap of today's rule, the title IV NOx limits would not be binding for most units. Therefore, the limits would not interfere with the ability of the NOx trading market to find the least-cost reductions. However, without a statutory change, the title IV NOx

program remains in effect and sources would have to continue to comply with its administrative requirements.

e. The NOx Allowance Banking

The NOx emission allowance trading market being administered by EPA for the NOx SIP Call States has been active and we wish to make the transition to the NOx program proposed today as simple as possible. For that reason, any entity holding existing NOx allowances will be able to bank them and carry them forward into the new, proposed cap and trade program. While EPA believes it is important to provide this compliance flexibility for sources, it is unlikely that many sources will take advantage of this mechanism because the projected future value of NOx allowances under the proposed cap and trade program is less than under the existing NOx cap and trade programs.

3. NOx Allocations

Within each State participating in the proposed NOx cap and trade program, the statewide EGU budget (described in section VI of today's proposal) would form the basis for NOx allocations. Unlike SO2 allocations that are heavily dictated by the interaction between the proposed SO2 cap and trade program and title IV, there

are many allocation options that States could consider for distributing NOx allowances.

There is a variety of allocation approaches that address equity issues and provide opportunities for States to encourage specific behaviors. This would include flexibility in how often the allocations are updated (i.e., a one-time permanent allocation or one that is periodically updated) and the process metric upon which the allocation share is determined. As described below in section VIII.D.4, States participating in an EPA-managed program would be required to be consistent in the deadline for finalizing their source-by-source allocation.

The details of specific allocation options will be more fully developed and presented in detail in the future SNPR.

4. Joining Both SO2 and NOx Cap and Trade Programs for States Voluntarily Participating

The participation by States in both the EPA-managed NOx cap and trade program and the EPA-managed SO2 program offers administrative advantages to EPA and, we think, maximizes cost-effectiveness to the sources. We encourage each State to participate in both programs, and

we think that, as a practical matter, many States will elect to do so.

We would like, in the SNPR, to propose to require that States that elect to participate in the EPA-managed NOx cap and trade program be required to participate in the EPA-managed SO2 program, and vice-versa. However, we are concerned that this requirement may be considered to intrude upon the prerogatives of the States in developing their SIPs.[97] We solicit comment on this question.

D. Cap and Trade Program Aspects that Are Common to Both the SO2 and NOx Programs

Sections VIII.B and VIII.C discussed key considerations that are unique to the proposed SO2 and NOx cap and trade programs, respectively. This section presents elements of a cap and trade program that must be a part of a State's rule – for both the SO2 and NOx programs – if it wishes to participate in the regional cap and trade program. As noted earlier, EPA intends to provide a detailed discussion and propose model rules in the future SNPR. Although EPA is not soliciting comment on the discussion in this section VIII, and instead will provide a full opportunity to comment on the SNPR, EPA

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[97] See Virginia v. EPA, 108 F.3d 1397 (D.C. Cir. 1997).

recognizes that some may wish to comment on today's discussion. As such, commenters are encouraged to focus on the implications of addressing multiple environmental problems (i.e., PM2.5 and ozone).

1. Applicability

Applicability, or the group of sources that the regulations will affect, must be similar from State-to-State to minimize confusion, administrative burdens, and emission leakage.

a. Core Applicability

As discussed in section VI, we have determined State EGU emission reduction requirements (which are sometimes referred to as "budgets") assuming reductions from large EGUs (e.g. boilers and turbines serving an electrical generator with a nameplate capacity exceeding 25MW and producing power for sale). States must include these core sources if they wish to participate in the regional cap and trade program. While States have discretion to achieve the required reduction levels by regulating other sources, EPA analysis identified EGUs as appropriate candidates for achieving the mandated reductions. If a State chooses to regulate other source categories, EPA is proposing that these source categories can be included in

the cap and trade program only if EPA and the State agree that each source category can meet all of the requirements that are mandated for EGUs (e.g., monitoring according to 40 CFR part 75 and the ability to clearly assign legal responsibility for compliance).

Once a unit is classified as an EGU for purposes of this rule, the unit will remain classified as an EGU regardless of any future modifications to the unit. If a unit serving a generator that initially does not qualify as an EGU (based on the nameplate capacity) is later modified to increase the capacity of the generator to the extent that the unit meets the definition of EGU, this unit shall be considered an EGU for purposes of this rule. This approach is proposed to prevent sources from derating units for the purpose of avoiding regulation.

2. Allowance Management System, Compliance, Penalties, and Banking

The allowance management system, compliance, penalties and banking are all components of the accounting system that enables the functioning of a cap and trade program. An accurate, efficient accounting system is critical to an emissions trading market. Transparency of the system, allowing all interested

parties access to the information contained in the accounting system, increases the accountability for regulated sources and contributes to reduced transaction costs of transferring allowances by minimizing confusion and making allowance information readily available.

In order to guarantee the equitable treatment of all affected sources across the trading region, the elements included in this section need to be incorporated in the same manner in each State that participates in the cap and trade program.

a. Allowance Management

The EPA intends to propose a model cap and trade rule that will be reasonably consistent with the existing allowance tracking systems that are currently in use for the Acid Rain Program under title IV and the NOx Budget Trading Program under the NOx SIP Call. These two systems are called the Allowance Tracking System (ATS) and the NOx Allowance Tracking System (NATS), respectively. Under the cap and trade rule, the SO2 program and the NOx program would remain separate trading programs maintained in ATS and NATS. Both ATS and NATS would remain as automated systems used to track SO2 and NOx allowances held by affected units under the cap and

trade program, as well as those allowances held by other organizations or individuals. Specifically, ATS and NATS would track the allocation of all SO2 and NOx allowances, holdings of SO2 and NOx allowances in accounts, deduction of SO2 and NOx allowances for compliance purposes, and transfers between accounts. The primary role of ATS and NATS is to provide an efficient, automated means of monitoring compliance with the cap and trade programs. ATS and NATS also provide the allowance market with a record of ownership of allowances, dates of allowance transfers, buyer and seller information, and the serial numbers of allowances transferred.

b. Compliance

Compliance in the cap and trade program consists of the deduction of allowances from affected facilities' accounts to offset the quantity of emissions at the facilities for each compliance period. Currently under the Acid Rain and regional NOx cap and trade programs, compliance is assessed at the unit level. Some flexibility is allowed in the NOx program through the use of overdraft accounts. Both EPA and the regulated community find that, in practice, overdraft accounts and their use can be quite complicated and do not

significantly reduce the burden of unit-level accounting. EPA is considering an approach that assesses compliance at the facility level in the proposed cap and trade program. More discussion of this option will be included in the future SNPR.

c. Penalties

The EPA plans to propose a system of automatic penalties should a facility not obtain sufficient NOx or SO2 allowances to cover emissions for the compliance period. In order to offset this deficiency in allowances, a facility must surrender allowances allocated for a future year equal in amount to the deficiency in allowances for the current compliance period. In addition, EPA will propose that an automatic penalty be imposed in addition to this offset in order to provide a strong incentive for facilities to hold sufficient allowances. The automatic penalty provisions will not limit the ability of the permitting authority or EPA to take enforcement action under State law or the CAA, but will establish for the regulated community the immediate, minimum economic consequences of noncompliance.

d. Banking

Banking is the retention of unused allowances from one calendar year for use in a later calendar year. Banking allows sources to make reductions beyond required levels and “bank” the unused allowances for use later. Generally speaking, banking has several advantages: it can encourage earlier or greater reductions than are required from sources, stimulate the market and encourage efficiency, and provide flexibility in achieving emissions reduction goals. On the other hand, it may result in banked allowances being used to allow emissions in a given year to exceed the cap and trade program budget. Banking of allowances from the Acid Rain and regional NOx cap and trade programs into the proposed cap and trade program is discussed above in section VIII.B.2.f(i) for Acid Rain and above in section VIII.C.2.e. for the NOx SIP Call.

Based on the experience of both the SO2 and NOx cap and trade programs, EPA plans to propose in the future SNPR that the banking of allowances after the start of the cap and trade program be allowed with no restrictions.

3. Accountability for Affected Sources

Key to the success of existing cap and trade programs and the integrity of the allowance trading markets has been clear accountability for unit emissions. This takes the form of affected units officially designating a specific person (and alternate) as responsible for the official certification of all allowance transfers and emissions monitoring and reporting as submitted to EPA in quarterly compliance reports. With each quarterly submission, this responsible party must certify that: the monitoring data were recorded in compliance with the monitoring and reporting requirements, including quality assurance testing and missing data procedures; and, the emission and operational reports are true, accurate, and complete.

The cap and trade program to be proposed in the future SNPR will include provisions to provide for the same strict standards for source accountability established in the Acid Rain Program and the NOx SIP Call. This will include provisions for the establishment of an Authorized Account Representative. Adoption of these provisions will be required by all States that wish to participate in the cap and trade program.

4. Allowance Allocation Timing

The SNPR will propose requirements for when a State would finalize allowance allocations for each control period in the cap and trade program and submit them to EPA for inclusion into the ATS and NATS. The timing requirements ensure that all units would have equal and sufficient time to plan for compliance for each control period and equal time to trade allowances. The requirement would also contribute to the efficient administration of the trading program. By establishing this schedule at the outset of the cap and trade program, both the States and EPA would be able to develop internal procedures for effectively implementing the allowance provisions of the trading program. The timing requirements would ensure that EPA would be able to record in the ATS and NATS the allowance allocations for the budget units in all participating States at the same time for each control period.

5. Emissions Monitoring and Reporting

Monitoring and reporting of an affected source’s emissions are integral parts of any cap and trade program. Consistent and accurate measurement of emissions ensures each allowance actually represents one ton of emissions and that one ton of reported emissions

from one source is equivalent to one ton of reported emissions from another source. This establishes the integrity of the allowance and instills confidence in the market mechanisms which are designed to provide sources with flexibility in achieving compliance. Given the variability in the type, operation and fuel mix of sources in the cap and trade program, EPA believes that to ensure the needed accuracy and consistency, emissions must be monitored continuously. For many sources, this accuracy and consistency is achieved through the use of continuous emissions monitors (CEMS); however, alternative monitoring methodologies are appropriate for certain types of sources. The continuous emissions monitoring methods must also incorporate rigorous quality assurance procedures (e.g., periodic testing to ensure continued accuracy of the measurement method). Additionally, in order to account for all emissions at all times, provisions for estimating emissions during times when monitors are unavailable because of planned and unplanned outages are also necessary. Part 75 of the Acid Rain regulations (40 CFR part 75) sets forth monitoring and reporting requirements for both SO2 and NOx mass emissions and includes the additional provisions

necessary for a cap and trade program. Part 75 is used in both the Acid Rain and NOx SIP Call programs.

In an effort to ensure program integrity, EPA proposes to require States to include year round part 75 monitoring and reporting for SO2 and NOx for all sources. Monitor certification deadlines and other details will be specified in the model cap and trade rule. The EPA believes that emissions will then be consistently and accurately monitored and reported from unit to unit and from State to State.

Part 75 also specifies reporting requirements. The EPA proposes to require year-round, quarterly reporting of emissions and monitoring data from each unit at each affected facility. The EPA proposes a single quarterly report. The single report will include hourly emissions information for both SO2 and NOx emissions on a quarterly basis in a format specified by the Agency. The reports must be in an electronic data reporting (EDR) format and be submitted to EPA electronically using EPA's Emissions Tracking System (ETS). This coordinated reporting requirement is necessary to ensure consistent review, checking, and posting of the emissions and monitoring

data at all affected sources, which contributes to the integrity and efficacy of the trading program.

Many sources affected by this rulemaking are already meeting the requirements of part 75. Impacts on different types of sources will be discussed thoroughly in the SNPR.

E. Inter-pollutant Trading

Cap and trade programs can incorporate mechanisms for interpollutant trading when more than one pollutant contributes to the same environmental problem. While the proposed cap and trade programs would control SO2 to address PM2.5 and NOx for both PM2.5 and ozone, EPA solicits comment on whether SO2 allowances and NOx allowances should be interchangeable, and if so, at what ratio should the allowances be interchangeable. The main advantage of inter-pollutant trading is that it presents regulated entities with more flexibility in meeting compliance, thus reducing the costs of compliance. If the relative air quality impact of the two pollutants on the environmental issue (i.e., PM2.5 or ozone)is known, then inter-pollutant trading set at this ratio will achieve the same total air quality impact. There are many technical difficulties involved with incorporating

an effective inter-pollutant trading mechanism, and EPA solicits opinions on the feasibility of addressing these concerns:

1) What should be the exchange rate (i.e., the transfer ratio) for the two pollutants?

2) How can this transfer ratio best reflect the goals of achieving PM2.5 and ozone attainment in downwind States?

3) How would inter-pollutant trading accommodate the different geographic regions covered for SO2 and NOx under the proposed rule?

IX. Air Quality Modeling of Emissions Reductions

A. Introduction

In this section, we describe the air quality modeling performed to determine the projected impacts on PM2.5 and 8-hour ozone of the regional SO2 and NOx emissions reductions in today’s proposal. The regional emissions reductions are associated with State emissions budgets in 2010 and 2015, as explained in section VI. The impacts of the regional reductions in 2010 and 2015 are determined by comparing air quality modeling results for each of these regional control scenarios to the modeling results for the corresponding 2010 and 2015 Base

Case scenarios. A description of the 2010 and 2015 Base Cases is provided in section IV. Note that neither the Base Cases nor the regional control strategy scenarios include any of the local control measures discussed in section IV. Also note that the 2015 Base Case does not include any 2010 emissions reductions from the regional strategy.

The 2010 and 2015 regional strategy budgets cover emissions from the power generation sector in 29 eastern States plus the District of Columbia that contribute significantly to both PM2.5 and ozone nonattainment in downwind States.[98] These annual SO2 and NOx budgets are provided in section VI.

As described in section VI, EPA modeled a two-phase cap and trade strategy for SO2 and for NOx using the IPM to assess the impacts of the budgets in today's proposal. For the purposes of air quality modeling, we used a scenario that assumes a 48-State SO2 trading area and SO2 allowances. Most of the SO2 emissions reductions in this scenario occur in the 28-State and DC control region; there are only small changes in nearly States not

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[98] In addition, summer season only EGU NOx controls are proposed for Connecticut which significantly contributes to ozone, but not PM2.5 nonattainment in other States.

affected by today's proposal.[99] We do not expect these latter changes to actually occur; but, because they are only small changes, the results of using this IPM scenario are expected to be very similar to the actual results of today's proposal. For NOx, EPA modeled a NOx trading scenario covering 31 States, DC, and the eastern half of Texas. The 31 States include Arkansas, Iowa, Louisiana, Minnesota, Missouri, and all other States to the east of these five States. Thus, the modeled strategy does not match the NOx reductions required in today's proposal for Kansas and western Texas. In addition, the modeled strategy includes NOx reductions in Maine, New Hampshire, Rhode Island, and Vermont which do not have any required reductions in today's proposal.

Phase 1 of the regional strategy is forecast to reduce total EGU SO2 emissions in the 28-States plus DC by 40 percent in 2010. Phase 2 is forecast to provide a 44 percent reduction in EGU SO2 emissions compared to the Base Case in 2015. When fully implemented, we expect today's proposed rule to result in more than a 70 percent

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[99] The modeled scenario reduces EGU emissions in the five New England States not covered by today's proposal by less than 3,000 tons per year. In the 15 States located to the west of the region covered by today's proposal, total EGU SO2 emissions decline by 17 percent.

reduction in EGU SO2 emissions compared to current emissions levels. The net effect of the strategy on total SO2 emissions in the 28-State plus DC region, considering all sectors of emissions, is a 27 percent reduction in 2010 and a 28 percent reduction in 2015. For NOx, Phase 1 of the strategy is forecast to reduce EGU emissions by 44 percent and total emissions by 10 percent in the 28-States plus DC region in 2010. In Phase 2, EGU NOx emissions are projected to decline by 53 percent in 2015. Total NOx emissions are projected to be reduced by 14 percent in 2015. The percent change in emissions by State for SO2 and NOx in 2010 and 2015 for the regional strategy are provided in the Air Quality Modeling Technical Support Document (AQMTSD).[100]

B. The PM2.5 Air Quality Modeling of the Proposed Regional SO2 and NOx Strategy

The PM modeling platform described in section IV was used by EPA to model the impacts of the proposed SO2 and NOx emissions reductions on annual average PM2.5 concentrations. In brief, we ran the REMSAD model for

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[100] "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.

the meteorological conditions in the year of 1996 using our nationwide modeling domain. Modeling for PM2.5 was performed for both 2010 and 2015 to assess the expected effects of the proposed regional strategy in each of these years on projected PM2.5 design value concentrations and nonattainment. The procedures used to project future PM2.5 design values and nonattainment are described in section IV. The projected design values for each nonattainment county for the 2010 and 2015 scenarios are provided in the AQMTSD. The counties that are projected to be nonattainment for the PM2.5 NAAQS are listed in Table IX-1 for the 2010 Base Case and the 2010 regional strategy scenario and in Table IX-2 for the 2015 Base Case and 2015 regional strategy scenario. The projected 2010 Base Case and control scenario PM2.5 design values are provided in Table IX-3. The projected 2015 Base Case and control PM2.5 design values are provided in Table IX-4. Concerning the future baseline concentrations, we expect improvement beyond 2015 based on the fact that the bank will be used up and further reductions are expected from the Heavy Duty Diesel Engines and Land-based Non-road Diesel Engines rules. Also, even those counties that remain nonattainment in

2015 after the controls in today's rule will benefit from air quality improvements and lower concentrations of fine particles as a result of the SO2 and NOx emissions reductions in this rule.

Table IX-1. Projected PM2.5 Nonattainment Counties for 2010 Base Case and Regional Strategy Scenarios

State	2010 Base Case Projected PM2.5 Nonattainment Counties	2010 Regional Strategy Case Projected PM2.5 Nonattainment Counties
AL	DeKalb, Jefferson, Montgomery, Russell, Talladaga	Jefferson, Russell, Talladaga
CT	New Haven	None
DC	Washington D.C.	None
DE	New Castle	None
GA	Clarke, Clayton, Cobb, DeKalb, Floyd, Fulton, Hall, Muscogee, Paulding, Richmond, Wilkinson	Clarke, Clayton, Cobb, DeKalb, Floyd, Fulton, Muscogee, Wilkinson
IL	Cook, Madison, St. Clair, Will	Cook, Madison, St. Clair
IN	Clark, Marion	None
KY	Fayette, Jefferson	None
MD	Baltimore City	None
MI	Wayne	Wayne
MO	St. Louis	None
NY	New York (Manhattan)	New York (Manhattan)
NC	Catawba, Davidson, Mecklenburg	None
OH	Butler, Cuyahoga, Franklin, Hamilton, Jefferson, Lawrence, Mahoning, Scioto, Stark, Summit, Trumbull	Cuyahoga, Hamilton, Jefferson, Scioto, Stark
PA	Allegheny, Berks, Lancaster, York	Allegheny
SC	Greenville	None
TN	Davidson, Hamilton, Knox, Roane, Sullivan	Knox
WV	Brooke, Cabell, Hancock, Kanawha, Marshal, Wood	None

Table IX-2. Projected PM2.5 Nonattainment Counties for 2015 Base Case and Regional Strategy Scenarios

State	2015 Base Case Projected PM2.5 Nonattainment Counties	2015 Regional Strategy Case Projected PM2.5 Nonattainment Counties
AL	Jefferson, Montgomery, Russell, Talladaga	Jefferson, Russell
CT	New Haven	None
GA	Clarke, Clayton, Cobb, DeKalb, Floyd, Fulton, Hall, Muscogee, Richmond, Wilkinson	Clayton, DeKalb, Fulton
IL	Cook, Madison, St. Clair	Cook
IN	Clark, Marion	None
KY	Jefferson	None
MD	Baltimore City	None
MI	Wayne	Wayne
NY	New York County (Manhattan)	None
OH	Butler, Cuyahoga, Franklin, Hamilton, Jefferson, Scioto, Stark, Summit	Cuyahoga, Hamilton, Jefferson, Scioto
PA	Allegheny, York	Allegheny
TN	Hamilton, Knox	Knox
WV	Brooke, Cabell, Hancock, Kanawha, Wood	None

Table IX-3. Projected PM2.5 Design Values for the 2010 Base Case and Regional Strategy Scenarios

State	County	2010 Base Case	2010 Regional Control Strategy
Alabama	DeKalb	15.22	13.92
Alabama	Jefferson	20.03	18.85
Alabama	Montgomery	15.69	14.60
Alabama	Russell	17.07	15.77
Alabama	Talladega	16.44	15.26
Connecticut	New Haven	15.43	14.50
Delaware	New Castle	15.43	14.12
District of Columbia	District of Columbia	15.48	13.70
Georgia	Clarke	17.04	15.56

Georgia	Clayton	17.73	16.43
Georgia	Cobb	16.80	15.56
Georgia	DeKalb	18.26	16.92
Georgia	Floyd	16.99	15.65
Georgia	Fulton	19.79	18.37
Georgia	Hall	15.62	14.24
Georgia	Muscogee	16.68	15.41
Georgia	Paulding	15.40	14.17
Georgia	Richmond	15.99	14.65
Georgia	Wilkinson	16.68	15.51
Illinois	Cook	17.90	16.90
Illinois	Madison	16.41	15.33
Illinois	St. Clair	16.31	15.11
Illinois	Will	15.21	14.25
Indiana	Clark	15.86	14.34
Indiana	Marion	15.89	14.39
Kentucky	Fayette	15.21	13.55
Kentucky	Jefferson	15.79	14.23
Maryland	Baltimore City	16.58	14.82
Michigan	Wayne	18.78	17.65
Missouri	St. Louis City	15.25	14.14
New York	New York	16.30	15.25
North Carolina	Catawba	15.26	13.87
North Carolina	Davidson	15.52	14.22
North Carolina	Mecklenburg	15.18	13.92
Ohio	Butler	16.01	14.53
Ohio	Cuyahoga	19.13	17.68
Ohio	Franklin	16.69	15.04
Ohio	Hamilton	17.75	15.96
Ohio	Jefferson	18.04	16.06
Ohio	Lawrence	15.48	13.67
Ohio	Mahoning	15.39	13.76
Ohio	Scioto	18.40	16.33
Ohio	Stark	17.09	15.19
Ohio	Summit	16.35	14.71
Ohio	Trumbull	15.13	13.56
Pennsylvania	Allegheny	19.52	16.92
Pennsylvania	Berks	15.39	13.84
Pennsylvania	Lancaster	15.46	13.71
Pennsylvania	York	15.68	13.93
South Carolina	Greenville	15.06	13.75
Tennessee	Davidson	15.36	13.92
Tennessee	Hamilton	16.14	14.74

Tennessee	Knox	18.36	16.60
Tennessee	Roane	15.18	13.69
Tennessee	Sullivan	15.24	13.77
West Virginia	Brooke	16.60	14.77
West Virginia	Cabell	16.39	14.41
West Virginia	Hancock	16.69	14.85
West Virginia	Kanawha	17.11	14.81
West Virginia	Marshall	15.53	13.25
West Virginia	Wood	16.30	14.15

Table IX-4. Projected PM2.5 Design Values for the 2015 Base Case and Regional Strategy Scenarios

State	County	2015 Base Case	2015 Regional Control Strategy
Alabama	Jefferson	19.57	18.11
Alabama	Montgomery	15.35	14.05
Alabama	Russell	16.68	15.05
Alabama	Talladega	15.97	14.57
Connecticut	New Haven	15.13	14.13
Georgia	Clarke	16.46	14.58
Georgia	Clayton	17.26	15.49
Georgia	Cobb	16.28	14.37
Georgia	DeKalb	17.93	16.22
Georgia	Floyd	16.51	14.71
Georgia	Fulton	19.44	17.62
Georgia	Hall	15.05	13.16
Georgia	Muscogee	16.31	14.71
Georgia	Richmond	15.51	13.82
Georgia	Wilkinson	16.40	14.88
Illinois	Cook	17.52	16.40
Illinois	Madison	16.03	14.88
Illinois	St. Clair	15.91	14.67
Indiana	Clark	15.40	13.69
Indiana	Marion	15.31	13.79
Kentucky	Jefferson	15.32	13.57
Maryland	Baltimore City	16.11	14.20
Michigan	Wayne	18.28	17.06
New York	New York (Manhattan)	15.82	14.69
Ohio	Butler	15.39	13.77
Ohio	Cuyahoga	18.58	17.05
Ohio	Franklin	16.18	14.46

Ohio	Hamilton	17.07	15.15
Ohio	Jefferson	17.49	15.51
Ohio	Scioto	17.62	15.49
Ohio	Stark	16.42	14.52
Ohio	Summit	15.78	14.14
Pennsylvania	Allegheny	18.64	16.09
Pennsylvania	York	15.13	13.26
Tennessee	Hamilton	15.63	13.91
Tennessee	Knox	17.73	15.59
West Virginia	Brooke	16.10	14.26
West Virginia	Cabell	15.70	13.71
West Virginia	Hancock	16.18	14.33
West Virginia	Kanawha	16.45	14.10
West Virginia	Wood	15.58	13.49

The results of the air quality modeling indicate that 61 counties in the East are expected to be nonattainment for PM2.5 in the 2010 Base Case. Of these 61 counties, 38 are projected to come into attainment in 2010 following the SO2 and NOx emissions reductions resulting from the regional controls in today's proposal. The 23 counties projected to remain nonattainment after the application of the regional strategy are expected to experience a sizeable reduction in PM2.5 from this strategy, which will bring them closer to attainment. Specifically, the average reduction in these 23 residual 2010 nonattainment counties is 1.50 $\mu g/m^3$ with a range of 0.93 to 2.60 $\mu g/m^3$.

In 2015, the SO2 and NOx reductions in today's proposal are expected to reduce the number of PM2.5

nonattainment counties in the East from 41 to 13. The regional strategy is predicted to provide large reductions in PM2.5 in those 13 residual nonattainment counties. Specifically, the average reduction in these 13 residual 2015 nonattainment counties is 1.70 μg/m^3 with a range of 1.00 to 2.54 μg/m^3.

Thus, the SO2 and NOx emissions reductions which will result from today's proposal will greatly reduce the extent of PM2.5 nonattainment by 2010 and beyond. These emissions reductions are expected to substantially reduce the number of PM2.5 nonattainment counties in the East and make attainment easier for those counties that remain nonattainment by substantially lowering PM2.5 concentrations in these residual nonattainment counties.

C. Ozone Air Quality Modeling of the Regional NOx Strategy

The EPA used the ozone modeling platform described in section IV to model the impacts of the proposed EGU NOx controls on 8-hour ozone concentrations. In brief, we ran the CAMx model for the meteorological conditions in each of the three 1995 ozone episodes using the Eastern U.S. modeling domain. Ozone modeling was performed for both 2010 and 2015 to assess the projected

effects of the regional strategy in each of these years on projected 8-hour ozone nonattainment.

The results of the regional strategy ozone modeling are expressed in terms of the expected reduction in projected 8-hour design value concentrations and the implications for future nonattainment. The procedures used to project future 8-hour ozone design values and nonattainment are described in section IV. The projected design values and exceedance counts for each nonattainment county for the 2010 and 2015 scenarios are provided in the AQMTSD. The counties that are projected to be nonattainment for the 8-hour ozone NAAQS are listed in Table IX-5 for the 2010 Base Case and the 2010 regional strategy scenario and in Table IX-6 for the 2015 Base Case and 2015 regional strategy scenario. The projected 2010 Base Case and control scenario 8-hour ozone design values are provided in Table IX-7. The projected 2015 Base and control 8-hour ozone design values are provided in Table IX-8.

Table IX-5. Projected 8-hour Ozone Nonattainment Counties for 2010 Base Case and Regional Strategy Scenarios

State	2010 Base Case Projected 8-Hour Ozone Nonattainment Counties	2010 Regional Strategy Case Projected 8-Hour Ozone Nonattainment Counties
AR	Crittenden	Crittenden

CT	Fairfield, Middlesex, New Haven	Fairfield, Middlesex, New Haven
DC	Washington D.C.	Washington D.C.
DE	New Castle	New Castle
GA	Fulton	Fulton
IL	None	None
IN	Lake	Lake
MD	Anne Arundel, Baltimore, Cecil, Harford, Kent, Prince Georges	Anne Arundel, Baltimore, Cecil, Harford, Kent, Prince Georges
MI	None	None
NJ	Bergen, Camden, Cumberland, Gloucester, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean	Bergen, Camden, Cumberland, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean
NY	Erie, Putnam, Richmond, Suffolk, Westchester	Erie, Putnam, Richmond, Suffolk, Westchester
NC	Mecklenburg	Mecklenburg
OH	Geauga, Summit	Geauga
PA	Allegheny, Bucks, Delaware, Montgomery, Philadelphia	Bucks, Delaware, Montgomery, Philadelphia
RI	Kent	Kent
TX	Denton, Harris, Tarrant	Denton, Harris, Tarrant
VA	Arlington, Fairfax	Arlington, Fairfax
WI	Kenosha, Racine, Sheboygan	Kenosha, Racine, Sheboygan

Table IX-6. Projected 8-Hour Ozone Nonattainment Counties for 2015 Base Case and Regional Strategy Scenarios

State	2015 Base Case Projected 8-Hour Ozone Nonattainment Counties	2015 Regional Strategy Case 8-Hour Ozone Projected Nonattainment Counties
AR	Crittenden	None
CT	Fairfield, Middlesex, New Haven	Fairfield, Middlesex, New Haven
DC	Washington D.C.	Washington D.C.
DE	None	None
GA	None	None
IL	Cook	None
IN	Lake	Lake
MD	Anne Arundel, Cecil, Harford	Anne Arundel, Cecil, Harford
MI	Macomb	None

NJ	Bergen, Camden, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean	Bergen, Camden, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Ocean
NY	Erie, Richmond, Suffolk, Westchester	Erie, Richmond, Suffolk, Westchester
NC	None	None
OH	Geauga	None
PA	Bucks, Montgomery, Philadelphia	Bucks, Montgomery, Philadelphia
RI	Kent	None
TX	Harris	Harris
VA	Arlington, Fairfax	Arlington
WI	Kenosha, Sheboygan	Kenosha

Table IX-7. Projected 8-hour Ozone Design Values for the 2010 Base Case and Regional Strategy Scenarios

State	County	2010 Base Case	2010 Regional Control Strategy
Arkansas	Crittenden	86	86
Connecticut	Fairfield	94	94
Connecticut	Middlesex	91	91
Connecticut	New Haven	92	92
District of Columbia	District of Columbia	88	88
Delaware	New Castle	87	86
Georgia	Fulton	86	85
Indiana	Lake	87	86
Maryland	Anne Arundel	91	91
Maryland	Baltimore	85	85
Maryland	Cecil	90	90
Maryland	Harford	93	93
Maryland	Kent	89	88
Maryland	Prince Georges	86	85
New Jersey	Bergen	88	87
New Jersey	Camden	93	92
New Jersey	Cumberland	86	85
New Jersey	Gloucester	95	95
New Jersey	Hudson	85	84
New Jersey	Hunterdon	89	89
New Jersey	Mercer	98	98
New Jersey	Middlesex	95	95
New Jersey	Monmouth	89	89

New Jersey	Morris	88	87
New Jersey	Ocean	105	104
New York	Erie	90	89
New York	Putnam	85	85
New York	Richmond	90	89
New York	Suffolk	90	90
New York	Westchester	86	85
North Carolina	Mecklenburg	85	86
Ohio	Geauga	88	88
Ohio	Summit	85	84
Pennsylvania	Allegheny	85	84
Pennsylvania	Bucks	97	97
Pennsylvania	Delaware	87	86
Pennsylvania	Montgomery	90	89
Pennsylvania	Philadelphia	92	92
Rhode Island	Kent	89	88
Texas	Denton	87	87
Texas	Harris	100	100
Texas	Tarrant	88	87
Virginia	Arlington	88	88
Virginia	Fairfax	87	87
Wisconsin	Kenosha	94	93
Wisconsin	Racine	86	85
Wisconsin	Sheboygan	90	89

Table IX-8. Projected 8-hour Ozone Design Values for the 2015 Base Case and Regional Strategy Scenarios

State	County	2015 Base Case	2015 Regional Control Strategy
Arkansas	Crittenden	85	83
Connecticut	Fairfield	94	93
Connecticut	Middlesex	89	88
Connecticut	New Haven	90	89
District of Columbia	District of Columbia	86	85
Illinois	Cook	85	84
Indiana	Lake	87	86
Maryland	Anne Arundel	87	86
Maryland	Cecil	86	85
Maryland	Harford	89	88
Michigan	Macomb	86	84
New Jersey	Bergen	87	86
New Jersey	Camden	91	90

New Jersey	Gloucester	93	92
New Jersey	Hunterdon	87	86
New Jersey	Mercer	96	95
New Jersey	Middlesex	92	92
New Jersey	Monmouth	87	86
New Jersey	Morris	85	83
New Jersey	Ocean	102	101
New York	Erie	88	86
New York	Richmond	87	87
New York	Suffolk	89	89
New York	Westchester	86	85
Ohio	Geauga	85	83
Pennsylvania	Bucks	95	94
Pennsylvania	Montgomery	89	88
Pennsylvania	Philadelphia	91	90
Rhode Island	Kent	85	84
Texas	Harris	99	98
Virginia	Arlington	87	86
Virginia	Fairfax	85	84
Wisconsin	Kenosha	93	91
Wisconsin	Sheboygan	86	84

In the 2010 Base Case (i.e., without the emissions reductions called for in today's proposal), 47 counties in the East are forecast to be nonattainment for ozone. With the implementation of the proposed regional NOx strategy, three of the 47 2010 Base Case nonattainment counties are forecast to come into attainment. Of the 44 counties that are projected to remain nonattainment in 2010 after the regional controls, 12 are projected to be within 2 ppb of attainment (i.e., counties that have design values of 85 or 86 ppb).

In 2015, the number of nonattainment counties is expected to decline from 34 counties in the Base Case to 26 counties after the NOx emissions reductions in today's proposal. The proposed regional NOx strategy is projected to reduce nonattainment ozone design values in the East by 1 to 2 ppb in all but three of the 34 2015 Base Case nonattainment counties. Of the 26 counties that are forecast to remain nonattainment in the control case, ten are projected to be within 2 ppb of attainment. Thus, our modeling indicates that by 2010 and 2015 the NOx controls in today's proposal will reduce ozone concentrations throughout the East and help bring areas into attainment with the 8-hour ozone NAAQS.

X. Benefits of Emissions Reductions in Addition to the PM and Ozone NAAQS

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. These other benefits occur both directly, from the reductions in NOx and SO2, and indirectly, through reductions in co-pollutants, such as mercury. For example, reductions in emissions of NOx and SO2 will contribute to substantial visibility improvements in many

parts of the eastern U.S. where people live, work, and recreate, including mandatory Federal Class I areas such as the Great Smoky Mountains. Reductions in NOx and SO2 emissions from affected sources will also reduce acidification and eutrophication of water bodies. The potential for reductions in nitrate contamination of drinking water is another possible benefit of the rule. This proposal will also reduce acid and particulate deposition that damages cultural monuments and other materials. Reduced mercury emissions will lessen mercury contamination in lakes that can potentially reduce both human and wildlife exposure through consumption of contaminated fish. In contrast to the benefits discussed, it is also possible that this proposal will lessen the benefits of passive fertilization for forest and terrestrial ecosystems where nutrients are a limiting factor and for some croplands.

This rule will improve visibility in the transport region. Visibility impairment is widespread and expected to continue (67 FR 68251, November 8, 2002) and this proposed rule will help to improve visibility. We provide a limited assessment of the economic value of

expected improvements in visibility at some Federal Class I areas in section XI.

The following section presents information on three categories of public welfare and environmental impacts related to reductions in emissions from affected sources: reduced acid deposition, reduced eutrophication of water bodies, and reduced human health and welfare effects due to deposition of mercury. A more thorough discussion of these effects is provided in "Benefits of the Proposed Interstate Air Quality Rule (January 2004)."

A. Atmospheric Deposition of Sulfur and Nitrogen – Impacts on Aquatic, Forest, and Coastal Ecosystems

Atmospheric deposition of sulfur and nitrogen, more commonly known as acid rain, occurs when emissions of SO2 and NOx react in the atmosphere (with water, oxygen, and oxidants) to form various acidic compounds. These acidic compounds fall to earth in either a wet form (rain, snow, and fog) or a dry form (gases and particles). Prevailing winds can transport acidic compounds hundreds of miles, often across State and national borders. Acidic compounds (including small particles such as sulfates and nitrates) cause many negative environmental effects,

including acidifying lakes and streams, harming sensitive forests, and harming sensitive coastal ecosystems.

1. Acid Deposition and Acidification of Lakes and Streams

Acid deposition causes acidification of lakes and streams. The effect of atmospheric deposition of acids on freshwater and forest ecosystems depends largely upon the ecosystem's ability to neutralize the acid. Acid Neutralizing Capacity (ANC), a key indicator of the ability of the water and watershed soil to neutralize the acid deposition it receives, depends largely on the watershed's physical characteristics: geology, soils, and size. Waters that are sensitive to acidification tend to be located in small watersheds that have few alkaline minerals and shallow soils. Conversely, watersheds that contain alkaline minerals, such as limestone, tend to have waters with a high ANC. Areas especially sensitive to acidification include portions of the Northeast (particularly the Adirondack and Catskill Mountains, portions of New England, and streams in the mid-Appalachian highlands) and Southeastern streams.

Quantitative impacts of this proposal on acidification of water bodies have been assessed.

Modeling for this proposed rule indicates lakes in the Northeast and Adirondack Mountains would improve in acid buffering capacity. Specifically, no lakes in the Andirondack Mountains are projected to be categorized as chronically acidic in 2030 as a result of this proposal. In contrast, twelve percent of these lakes are projected to be chronically acidic without the emissions reductions envisioned in this proposal. For Northeast lakes in general, 6 percent of the lakes are anticipated to be chronically acidic before implementation of this proposal. The IAQR is expected to decrease the percentage of chronically acidic lakes in the Northeast to 1 percent.

2. Acid Deposition and Forest Ecosystem Impacts

Current understanding of the effects of acid deposition on forest ecosystems focuses on the effects of ecological processes affecting plant uptake, retention, and cycling of nutrients within forest ecosystems. Research results from the 1990s indicate documented decreases in base cations (calcium, magnesium, potassium, and others) from soils in the northeastern and southeastern United States are at least partially attributable to acid deposition. Losses of calcium from

forest soils and forested watersheds have now been documented as a sensitive early indicator of soil response to acid deposition for a wide range of forest soils in the United States.

Although sulfate is the primary cause of base cation leaching, nitrate is a significant contributor in watersheds that are nearly nitrogen saturated. Base cation depletion is a cause for concern because of the role these ions play in surface water acid neutralization and their importance as essential nutrients for tree growth (calcium, magnesium and potassium).

In red spruce stands, a clear link exists between acid deposition, calcium supply, and sensitivity to abiotic stress. Red spruce uptake and retention of calcium is impacted by acid deposition in two main ways: leaching of important stores of calcium from needles and decreased root uptake of calcium due to calcium depletion from the soil and aluminum mobilization. These changes increase the sensitivity of red spruce to winter injuries under normal winter conditions in the Northeast, result in the loss of needles, slow tree growth, and impair the overall health and productivity of forest ecosystems in many areas of the eastern United States. In addition,

recent studies of sugar maple decline in the Northeast link low base cation availability, high levels of aluminum and manganese in the soil, and increased levels of tree mortality due to native defoliating insects. This proposal will improve acid deposition in the transport region, and is likely to have positive effects on the health and productivity of forest systems in the region.

3. Coastal Ecosystems

Since 1990, a large amount of research has been conducted on the impact of nitrogen deposition to coastal waters. Nitrogen is often the limiting nutrient in coastal ecosystems. Increasing the levels of nitrogen in coastal waters can cause significant changes to those ecosystems. In recent decades, human activities have greatly accelerated nitrogen nutrient inputs, causing excessive growth of algae and leading to degraded water quality and associated impairments of estuarine and coastal resources for human uses.

It is now known that nitrogen deposition is a significant source of nitrogen to many estuaries. The amount of nitrogen entering estuaries due to atmospheric deposition varies widely, depending on the size and

location of the estuarine watershed and other sources of nitrogen in the watershed. There are a handful of estuaries where atmospheric deposition of nitrogen contributes well over 40 percent of the total nitrogen load; however, in most estuaries for which estimates exist, the contribution from atmospheric deposition ranges from 15 to 30 percent. The area with the highest deposition rates stretches from Massachusetts to the Chesapeake Bay and along the central Gulf of Mexico coast.

In 1999, National Oceanic and Atmospheric Administration (NOAA) published the results of a 5-year national assessment of the severity and extent of estuarine eutrophication. An estuary is defined as the inland arm of the sea that meets the mouth of a river. The 138 estuaries characterized in the study represent more than 90 percent of total estuarine water surface area and the total number of U.S. estuaries. The study found that estuaries with moderate to high eutrophication conditions represented 65 percent of the estuarine surface area.

Eutrophication is of particular concern in coastal areas with poor or stratified circulation patterns, such

as the Chesapeake Bay, Long Island Sound, and the Gulf of Mexico. In such areas, the “overproduced” algae tends to sink to the bottom and decay, using all or most of the available oxygen and thereby reducing or eliminating populations of bottom-feeder fish and shellfish, distorting the normal population balance between different aquatic organisms, and in extreme cases causing dramatic fish kills. Severe and persistent eutrophication often directly impacts human activities. For example, fishery resource losses can be caused directly by fish kills associated with low dissolved oxygen and toxic blooms. Declines in tourism occur when low dissolved oxygen causes noxious smells and floating mats of algal blooms create unfavorable aesthetic conditions. Risks to human health increase when the toxins from algal blooms accumulate in edible fish and shellfish, and when toxins become airborne, causing respiratory problems due to inhalation. According to the NOAA report, more than half of the nation's estuaries have moderate to high expressions of at least one of these symptoms—an indication that eutrophication is well developed in more than half of U.S. estuaries.

This proposal is anticipated to reduce nitrogen deposition in the IAQR region. Thus, reductions in the levels of nitrogen deposition will have a positive impact upon current eutrophic conditions in estuaries and coastal areas in the region.

B. Human Health and Welfare Effects Due to Deposition of Mercury

Mercury emitted from utilities and other natural and man-made sources is carried by winds through the air and eventually is deposited to water and land. In water, Hg is transformed to methylmercury through biological processes. Methylmercury, a highly toxic form of Hg, is the form of Hg of greatest concern for the purpose of this rulemaking. Once Hg has been transformed into methylmercury, it can be ingested by the lower trophic level organisms where it can bioaccumulate in fish tissue (i.e., concentrations in predatory fish build up over the fish's entire lifetime, accumulating in the fish tissue as predatory fish consume other species in the food chain). Thus, fish and wildlife at the top of the food chain can have Hg concentrations that are higher than the lower species, and they can have concentrations of Hg that are higher than the concentration found in the water

body itself. Therefore, the most common form of exposure to Hg for humans and wildlife is through the consumption of contaminated predatory fish, such as: commercially consumed tuna, shark, or other saltwater fish species and recreationally caught bass, perch, walleye or other freshwater fish species. When humans consume fish contaminated with methylmercury, the ingested methylmercury is almost completely absorbed into the blood and distributed to all tissues (including the brain); it also readily passes through the placenta to the fetus and fetal brain.

Based on the findings of the National Research Council, EPA has concluded that benefits of Hg reductions would be most apparent at the human consumption stage, as consumption of fish is the major source of exposure to methylmercury. At lower levels, documented Hg exposure effects may include more subtle, yet potentially important, neurodevelopmental effects. Some subpopulations in the U.S., such as: Native Americans, Southeast Asian Americans, and lower income subsistence fishers, may rely on fish as a primary source of nutrition and/or for cultural practices. Therefore, they consume larger amounts of fish than the general

population and may be at a greater risk to the adverse health effects from Hg due to increased exposure. In pregnant women, methylmercury can be passed on to the developing fetus, and at sufficient exposure may lead to a number of neurological disorders in children. Thus, children who are exposed to low concentrations of methylmercury prenatally may be at increased risk of poor performance on neurobehavioral tests, such as those measuring attention, fine motor function, language skills, visual-spatial abilities (like drawing), and verbal memory. The effects from prenatal exposure can occur even at doses that do not result in effects in the mother. Mercury may also affect young children who consume fish contaminated with Hg. Consumption by children may lead to neurological disorders and developmental problems, which may lead to later economic consequences.

In response to potential risks of consuming fish containing elevated concentrations of Hg, EPA and FDA have issued fish consumption advisories which provide recommended limits on consumption of certain fish species for different populations. EPA and FDA are currently developing a joint advisory that has been released in

draft form. This newest draft FDA-EPA fish advisory recommends that women and young children reduce the risks of Hg consumption in their diet by moderating their fish consumption, diversifying the types of fish they consume, and by checking any local advisories that may exist for local rivers and streams. This collaborative FDA-EPA effort will greatly assist in educating the most susceptible populations. Additionally, the reductions of Hg from this regulation may potentially lead to fewer fish consumption advisories, which will benefit the fishing community.

We are unable to quantify changes in the levels of methylmercury in fish associated with reductions in mercury emissions for this proposal. While it is beneficial to society to reduce mercury, we are unable to quantify and provide a monetized estimate of benefits at this time due to gaps in available information on emissions, fate and transport, human exposure, and health impact models. However, this proposal is anticipated to decrease annual EGU mercury emissions by 10.6 tons in 2010 or approximately 23.5 percent, by 11.8 tons in 2015 or 26.3 percent, and by 14.3 tons or 32 percent in 2020. Emission reduction percentage decreases are based upon

expected mercury emissions changes from fossil-fired EGUs larger than 25 megawatt capacity.

XI. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

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

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

2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

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

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

In view of its important policy implications and potential effect on the economy of over $100 million, this action has been judged to be an economically "significant regulatory action" within the meaning of the Executive Order. As a result, today's proposal was submitted to OMB for review, and EPA has prepared documents entitled "Benefits of the Proposed Interstate Air Quality Rule" (January 2004), "Economic and Energy Impact of the Proposed Interstate Air Quality Rule" (January 2004), and other related technical support documents collectively referred to here as the "economic analyses."

1. Summary of Economic Analyses

The economic analyses provide several important analyses of impacts on public welfare. These include an analysis of the social benefits, social costs, and net benefits of the regulatory scenario. The economic analyses also address issues involving small business impacts, unfunded mandates (including impacts for Tribal governments), environmental justice, children's health,

energy impacts, and requirements of the Paperwork Reduction Act (PRA). Many of the analyses summarized below are preliminary. The EPA intends to update these analyses as part of the SNPR.

a. Benefit-Cost Analysis

The benefit-cost analysis concludes that substantial net economic benefits to society are likely to be achieved as a result of the reduction in emissions occurring as a result of this rulemaking. The results detailed below show that this rule would be highly beneficial to society, with annual net benefits in 2010 of approximately $55 billion, ($58 billion benefits compared to social cost of approximately $3 billion) and net benefits in 2015 of $80 billion ($84 benefits compared to social costs of $4 billion). All amounts are reflected in 1999$. As discussed in section IX, we did not complete air quality modeling that precisely matches the IAQR region. We anticipate that any differences in estimates due to the modeling region analyzed should be small.

i. Control Scenario

Today's proposed rulemaking sets forth requirements for States to eliminate their significant contribution to

down-wind State's nonattainment of the ozone and PM2.5 NAAQS. In order to reduce this significant contribution, EPA is proposing to require that certain States reduce their emissions of SO2 and NOx. Those quantities were derived by calculating the amount of emissions of SO2 and NOx that EPA believes can be controlled from large EGUs in a highly cost-effective manner. For a more complete description of the reduction requirements and how they were calculated, see section VI of today's rulemaking.

While the emission reduction requirements were developed assuming highly cost-effective controls on EGUs, States are free to obtain the emissions reductions from other source categories. For purposes of analyzing the impacts of the rule, EPA is assuming the application of the controls that it has identified to be highly cost effective on all EGUs in the transport region.

ii. Cost Analysis and Economic Impacts

For purposes of today's proposal, EPA analyzed the costs using the IPM. The IPM is a model that EPA has used to analyze the impacts of regulations on the power sector. A description of the methodology used to model the costs and the results can be found in section VI. More details can be found in "Economic and Energy Impact

of the Proposed Interstate Air Quality Rule" (January 2004).

iii. Human Health and Welfare Benefit Analysis

Our analysis of the health and welfare benefits anticipated from this proposed rule are presented in this section. Briefly, the analysis projects major benefits from implementation of the rule in 2010 and 2015. As described below, thousands of deaths and other serious health effects would be prevented. We are able to monetize annual benefits of approximately $58 billion in 2010 and $84 billion in 2015 (1999$) of those benefits.

Table XI-1 presents the primary estimates of reduced incidence of PM and ozone related health effects for the years 2010 and 2015 for the regulatory control strategy. In interpreting the results, it is important to keep in mind the limited set of effects we are able to monetize. Specifically, the table lists the PM and ozone related benefits associated with the reduction of ambient PM and ozone levels. These benefits are substantial both in incidence and dollar value. In 2010, we estimate that there will be approximately 9,600 fewer premature deaths annually associated with PM2.5, and the rule will result in 5,200 fewer cases of chronic bronchitis, 13,000 fewer

non-fatal heart attacks, 8,900 fewer hospitalizations (for respiratory and cardiovascular disease combined); and result in significant reductions in days of restricted activity due to respiratory illness (with an estimate of 6.4 million fewer cases). We also estimate substantial health improvements for children from reduced upper and lower respiratory illness, acute bronchitis, and asthma attacks. Ozone health related benefits are expected to occur during the summer ozone season (usually ranging from May to September in the Eastern U.S.). Based upon modeling for 2010, ozone-related health benefits are expected to include 1,000 fewer hospital admissions for respiratory illnesses, 120 emergency room admissions for asthma, 280,000 fewer days with restricted activity levels, and 180,000 fewer days where children are absent from school due to illnesses. While we did not include separate estimates of the number of premature deaths that would be avoided due to reductions in ozone levels, recent evidence has been found linking short-term ozone exposures with premature mortality independent of PM exposures. Recent reports by Thurston and Ito (2001) and the World Health Organization (WHO) support an independent ozone mortality impact, and the EPA Science

Advisory Board has recommended that EPA reevaluate the ozone mortality literature for possible inclusion in the estimate of total benefits. Based on these new analyses and recommendations, EPA is sponsoring three independent meta-analyses of the ozone-mortality epidemiology literature to inform a determination on inclusion of this important health endpoint. Upon completion and peer-review of the meta-analyses, EPA will make its determination on whether and how benefits of reductions in ozone-related mortality will be included in the benefits analysis for the final interstate air quality rule.

Table XI-2 presents the estimated monetary value of reductions in the incidence of health and welfare effects. PM-related health benefits and ozone benefits are estimated to be approximately $56.9 billion and $82.4 billion annually in 2010 and 2015, respectively. Estimated annual visibility benefits in Southeastern Class I areas brought about by the IAQR are estimated to be $880 million in 2010 and $1.4 billion in 2015. All monetized estimates are stated in 1999$. Table XI-3 presents the total monetized benefits for the years 2010 and 2015. This table also indicates with a "B" those

additional health and environmental effects that we were unable to quantify or monetize. These effects are additive to the estimate of total benefits, and EPA believes there is considerable value to the public of the benefits that could not be monetized. A listing of the benefit categories that could not be quantified or monetized in our estimate is provided in Table XI-4.

In summary, EPA's primary estimate of the annual benefits of the rule is approximately 58 + B billion in 2010. In 2015, total monetized benefits are approximately $84 + B billion annually. These estimates account for growth in real gross domestic product (GDP) per capita between the present and the years 2010 and 2015. As the table indicates, total benefits are driven primarily by the reduction in premature fatalities each year, which account for over 90 percent of total benefits.

TABLE XI-1. Estimated Reductions in Incidence of Health Effects

Endpoint	Constituent	2010 Estimated Reduction	2015 Estimated Reduction
Premature Mortality - Adult	PM2.5	9,600	13,000
Mortality - Infant	PM2.5	22	29
Chronic Bronchitis	PM2.5	5,200	6,900
Acute Myocardial	PM2.5	13,000	18,000

Infarction - Total			
Hospital Admissions - Respiratory	PM2.5, Ozone	5,200	8,100
Hospital Admissions - Cardiovascular	PM2.5	3,700	5,000
Emergency Room Visits - Respiratory	PM2.5, Ozone	7,100	9,400
Acute Bronchitis	PM2.5	12,000	16,000
Lower Respiratory Symptoms	PM2.5	140,000	190,000
Upper Respiratory Symptoms	PM2.5	490,000	620,000
Asthma Exacerbation	PM2.5	190,000	240,000
Acute Respiratory Symptoms (MRADs*)	PM2.5, Ozone	6,400,000	8,500,000
Work Loss Days	PM2.5	1,000,000	1,300,000
School Loss Days	Ozone	180,000	390,000

* MRADs = minor restricted activity days.

TABLE XI-2. Estimated Monetary Value of Reductions in Incidence of Health and Welfare Effects (Millions of 1999$)

Endpoint Group	Constituent	2010 Estimated Monetary Value of Reductions	2015 Estimated Monetary Value of Reductions
Premature Mortality -Adult	PM2.5	$53,000	$77,000
Mortality - Infant	PM2.5	$130	$180
Chronic Bronchitis	PM2.5	$1,900	$2,700
Acute Myocardial Infarction - Total	PM2.5	$1,100	$1,500
Hospital Admissions - Respiratory	PM2.5, Ozone	$85	$130
Hospital Admissions - Cardiovascular	PM2.5	$78	$110
Emergency Room Visits - Respiratory	PM2.5, Ozone	$2.0	$2.6
Acute Bronchitis	PM2.5	$4.3	$5.7
Lower Respiratory Symptoms	PM2.5	$2.3	$3.0

Upper Respiratory Symptoms	PM2.5	$13	$17
Asthma Exacerbation	PM2.5	$8.0	$10
Acute Respiratory Symptoms (MRADs*)	PM2.5, Ozone	$320	$440
Work Loss Days	PM2.5	$140	$170
School Loss Days	Ozone	$13	$28
Worker Productivity	Ozone	$8.0	$17
Visibility - Southeastern Class I Areas	Light Extinction	$880	$1,400
TOTAL + B**		$58,000	$84,000

B = non-monetized benefits
* MRADs = minor restricted activity days.
**Note total dollar benefits are rounded to the nearest billion and column totals may not add due to rounding.

2. Benefit-Cost Comparison

Based upon Table XI-3, the estimated social costs to implement the proposed rule emission reductions in 2010 and 2015 are $3 and $4 billion annually, respectively (1999$). Thus, the net benefit (social benefits minus social costs) of the program is approximately $55 + B billion annually in 2010 and $80 + B billion annually in 2015. Therefore, implementation of the proposed rule is expected to provide society with a net gain in social welfare based on economic efficiency criteria.

Table XI-3. Summary of Annual Benefits, Costs, and Net Benefits of the Interstate Air Quality Rule

Description	2010 (Billions of 1999 dollars)	2015 (Billions of 1999 dollars)

Social Costs [a]	$ 2.9	$ 3.7
Social Benefits [b,c]		
Ozone-related benefits	$ 0.1	$ 0.1
PM-related health benefits	$ 56.8 + B	$ 82.3 + B
Visibility benefits	$ 0.9	$ 1.4
Annual Net Benefits (Benefits-Costs) [b,c,d]	$55 + B	$80 + B

Notes:
[a] Note that costs are the estimated total annual costs of reducing pollutants including NOx and SO2 in the IAQR region.
[b] As the table indicates, total benefits are driven primarily by PM related health benefits. The reduction in premature fatalities each year accounts for over 90 percent of total benefits. Benefits in this table are associated with NOx and SO2 reductions.
[c] Not all possible benefits or disbenefits are quantified and monetized in this analysis. B is the sum of all unquantified benefits and disbenefits. Potential benefit categories that have not been quantified and monetized are listed in Table XI-4.
[d] Net benefits are rounded to nearest billion. Columnar totals may not sum due to rounding.

Every benefit-cost analysis examining the potential effects of a change in environmental protection requirements is limited to some extent by data gaps, limitations in model capabilities (such as geographic coverage), and uncertainties in the underlying scientific and economic studies used to configure the benefit and cost models. Deficiencies in the scientific literature often result in the inability to estimate quantitative changes in health and environmental effects, such as potential increases in premature mortality associated with increased exposure to carbon monoxide. Deficiencies

in the economics literature often result in the inability to assign economic values even to those health and environmental outcomes that can be quantified. While these general uncertainties in the underlying scientific and economics literatures (that can cause the valuations to be higher or lower) are discussed in detail in the economic analyses and its supporting documents and references, the key uncertainties which have a bearing on the results of the benefit-cost analysis of this proposed rule include the following:

- The exclusion of potentially significant benefit categories (such as health and ecological benefits of reduction in mercury);
- Errors in measurement and projection for variables such as population growth and baseline incidence rates;
- Uncertainties in the estimation of future year emissions inventories and air quality;
- Variability in the estimated relationships of health and welfare effects to changes in pollutant concentrations;
- Uncertainties in exposure estimation;
- Uncertainties in the size of the effect estimates linking air pollution and health endpoints;

- Uncertainties about relative toxicity of different components within the complex mixture of PM;
- Uncertainties associated with the effect of potential future actions to limit emissions.

Despite these uncertainties, we believe the benefit-cost analysis provides a reasonable indication of the expected economic benefits of the proposed rulemaking in future years under a set of reasonable assumptions.

There are a number of health and environmental effects that we were unable to quantify or monetize. A full appreciation of the overall economic consequences of the proposed rule requires consideration of all benefits and costs expected to result from the proposed rule, not just those benefits and costs which could be expressed here in dollar terms. A listing of the benefit categories that could not be quantified or monetized in our estimate are provided in Table XI-4. These effects are denoted by "B" in Table XI-3 above, and are additive to the estimates of benefits.

We are unable to quantify changes in levels of methylmercury contamination in fish associated with reductions in mercury emissions for this proposal. However, this proposal is anticipated to decrease annual

EGU mercury emissions nationwide by 10.6 tons in 2010 or approximately 23.5 percent, by 11.8 tons in 2015 or 26.3 percent, and by 14.3 tons or 32 percent in 2020. Emission reduction percentage decreases are based upon expected mercury emissions changes from fossil-fired EGUs larger than 25 megawatt capacity. In a separate action today, EPA is proposing to regulate mercury and nickel from certain types of electric generating units using the maximum achievable control technology (MACT) provisions of section 112 of the CAA or, in the alternative, using the performance standards provisions under section 111 of the CAA. This proposal will have implications for mercury reductions, and potential interactions may exist between the rulemakings.

Table XI-4. Additional Non-monetized Benefits of the Proposed Interstate Air Quality Rule

Pollutant	Unquantified and/or Nonmonetized Effects
Ozone Health	Premature mortality[a] Increased airway responsiveness to stimuli Inflammation in the lung Chronic respiratory damage Premature aging of the lungs Acute inflammation and respiratory cell damage Increased susceptibility to respiratory infection Non-asthma respiratory emergency room visits

Pollutant	Unquantified and/or Nonmonetized Effects
Ozone Welfare	Decreased yields for commercial forests Decreased yields for fruits and vegetables Decreased yields for commercial and non-commercial crops Damage to urban ornamental plants Impacts on recreational demand from damaged forest aesthetics Damage to ecosystem functions
PM Health	Low birth weight Changes in pulmonary function Chronic respiratory diseases other than chronic bronchitis Morphological changes Altered host defense mechanisms Non-asthma respiratory emergency room visits
PM Welfare	Visibility in many Class I areas Residential and recreational visibility in non-Class I areas Soiling and materials damage Damage to ecosystem functions
Nitrogen and Sulfate Deposition Welfare	Impacts of acidic sulfate and nitrate deposition on commercial forests Impacts of acidic deposition to commercial freshwater fishing Impacts of acidic deposition to recreation in terrestrial ecosystems Reduced existence values for currently healthy ecosystems Impacts of nitrogen deposition on commercial fishing, agriculture, and forests Impacts of nitrogen deposition on recreation in estuarine ecosystems Damage to ecosystem functions
Mercury Health	Neurological disorders Learning disabilities Developmental delays Potential cardiovascular effects* Altered blood pressure regulation* Increased heart rate variability* Myocardial infarction* Potential reproductive effects in adults*

Pollutant	Unquantified and/or Nonmonetized Effects
Mercury Deposition Welfare	Impact on birds and mammals (e.g., reproductive effects) Impacts to commercial, subsistence, and recreational fishing Reduced existence values for currently healthy ecosystems

Notes:
[a] Premature mortality associated with ozone is not separately included in this analysis.
* These are potential effects as the literature is either contradictory or incomplete.

B. Paperwork Reduction Act

The EPA intends to discuss the possible information collection burdens of this action in the SNPR. Assuming that States choose to use the optional trading program detailed in section VIII, the EPA anticipates that the impact on sources will be very small. Under these circumstances, the majority of the sources subject to today's rule are subject to the title IV Acid Rain Program and many sources are already subject to the NOx SIP Call. For sources subject to both of these programs, EPA does not anticipate any additional monitoring or reporting costs. For more detail on the monitoring and reporting costs for sources not currently subject to the title IV Acid Rain Program and or the NOx SIP Call see, "Monitoring and Reporting Costs Under the Proposed Interstate Air Quality Rule" (January 2004).

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An Agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR chapter 15.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. § 601 et seq.)(RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (Public Law No. 104-

121)(SBREFA), provides that whenever an agency is required to publish a general notice of proposed rulemaking, it must prepare and make available an initial regulatory flexibility analysis, unless it certifies that the proposed rule, if promulgated, will not have "a significant economic impact on a substantial number of small entities." 5 U.S.C. § 605(b). Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) a small business that is identified by the North American Industry Classification System (NAICS) Code, as defined by the Small Business Administration (SBA); (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less that 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. Table XI-5 lists entities potentially impacted by this proposed rule with applicable NAICS code.

XI-5. Potentially Regulated Categories and Entities

Category	NAICS code [1]	Examples of potentially regulated entities
Industry	221112	Fossil fuel-fired electric utility steam generating units.
Federal government	22112 [2]	Fossil fuel-fired electric utility steam generating units owned by the Federal government.
State/ local/ Tribal government	22112 [2] 921150	Fossil fuel-fired electric utility steam generating units owned by municipalities. Fossil fuel-fired electric utility steam generating units in Indian Country.

[1] North American Industry Classification System.
[2] Federal, State, or local government-owned and operated establishments are classified according to the activity in which they are engaged.

According to the SBA size standards for NAICS code 221112 Utilities-Fossil Fuel Electric Power Generation, a firm is small if, including its affiliates, it is primarily engaged in the generation, transmission, and or distribution of electric energy for sale and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours.

Courts have interpreted the RFA to require a regulatory flexibility analysis only when small entities will be subject to the requirements of the rule.[101] This

[101] See Michigan v. EPA, 213 F.3d 663, 668-69 (D.C. Cir. 2000), cert. den. 121 S.Ct. 225, 149 L.Ed.2d 135 (2001). An agency's certification need consider the rule's impact only on entities subject to the rule.

rule would not establish requirements applicable to small entities. Instead, it would require States to develop, adopt, and submit SIP revisions that would achieve the necessary SO2 and NOx emissions reductions, and would leave to the States the task of determining how to obtain those reductions, including which entities to regulate. Moreover, because affected States would have discretion to choose the sources to regulate and how much emissions reductions each selected source would have to achieve, EPA could not predict the effect of the rule on small entities. Although not required by the RFA, the Agency intends for the SNPR to conduct a general analysis of the potential impact on small entities of possible implementation strategies.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995(Public Law 104-4)(UMRA), establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector. Under section 202 of the UMRA, 2 U.S.C. 1532, EPA generally must prepare a written statement, including a cost-benefit analysis, for any proposed or final rule that “includes any Federal

mandate that may result in the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100,000,000 or more ... in any one year." A "Federal mandate" is defined under section 421(6), 2 U.S.C. 658(6), to include a "Federal intergovernmental mandate" and a "Federal private sector mandate." A "Federal intergovernmental mandate," in turn, is defined to include a regulation that "would impose an enforceable duty upon State, Local, or Tribal governments," section 421(5)(A)(i), 2 U.S.C. 658(5)(A)(i), except for, among other things, a duty that is "a condition of Federal assistance," section 421(5)(A)(i)(I). A "Federal private sector mandate" includes a regulation that "would impose an enforceable duty upon the private sector," with certain exceptions, section 421(7)(A), 2 U.S.C. 658(7)(A).

Before promulgating an EPA rule for which a written statement is needed under section 202 of the UMRA, section 205, 2 U.S.C. 1535, of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule.

The EPA intends to prepare a written statement for the SNPR consistent with the requirements of section 202 of the UMRA Furthermore, as EPA stated in the proposal, EPA is not directly establishing any regulatory requirements that may significantly or uniquely affect small governments, including Tribal governments. Thus, EPA is not obligated to develop under section 203 of the UMRA a small government agency plan. Furthermore, in a manner consistent with the intergovernmental consultation provisions of section 204 of the UMRA, EPA carried out consultations with the governmental entities affected by this rule.

For several reasons, however, EPA is not reaching a final conclusion as to the applicability of the requirements of UMRA to this rulemaking action. First, it is questionable whether a requirement to submit a SIP revision would constitute a Federal mandate in any case. The obligation for a State to revise its SIP that arises out of section 110(a) of the CAA is not legally enforceable by a court of law, and at most is a condition for continued receipt of highway funds. Therefore, it is possible to view an action requiring such a submittal as not creating any enforceable duty within the meaning of

section 421(5)(9a)(I) of UMRA (2 U.S.C. 658 (a)(I)). Even if it did, the duty could be viewed as falling within the exception for a condition of Federal assistance under section 421(5)(a)(i)(I) of UMRA (2 U.S.C. 658(5)(a)(i)(I)).

As noted earlier, however, notwithstanding these issues, EPA plans to prepare for the SNPR the statement that would be required by UMRA if its statutory provisions applied, and the EPA has consulted with governmental entities as would be required by UMRA. Consequently, it is not necessary for EPA to reach a conclusion as to the applicability of the UMRA requirements.

E. Executive Order 13132: Federalism

Executive Order 13132, entitled “Federalism” (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure “meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.” “Policies that have federalism implications” is defined in the Executive Order to include regulations that have “substantial direct effects on the States, on the relationship between the national government and the

States, or on the distribution of power and responsibilities among the various levels of government."

This proposed rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. The CAA establishes the relationship between the Federal government and the States, and this rule does not impact that relationship. Thus, Executive Order 13132 does not apply to this rule. In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed rule from State and local officials.

F. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments" (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by Tribal officials in the development of

regulatory policies that have Tribal implications." This proposed rule does not have "Tribal implications" as specified in Executive Order 13175.

This proposed rule concerns the implementation of the rules that address transport of pollution that causes ozone and PM2.5. The CAA provides for States and Tribes to develop plans to regulate emissions of air pollutants within their jurisdictions. The proposed regulations clarify the statutory obligations of States and Tribes that develop plans to implement this rule. The TAR gives Tribes the opportunity to develop and implement CAA programs, but it leaves to the discretion of the Tribe whether to develop these programs and which programs, or appropriate elements of a program, they will adopt.

This proposed rule does not have Tribal implications as defined by Executive Order 13175. It does not have a substantial direct effect on one or more Indian Tribes, since no Tribe has implemented an air quality management program at this time. Furthermore, this proposed rule does not affect the relationship or distribution of power and responsibilities between the Federal government and Indian Tribes. The CAA and the TAR establish the relationship of the Federal government and Tribes in

developing plans to attain the NAAQS, and this proposed rule does nothing to modify that relationship. Because this proposed rule does not have Tribal implications, Executive Order 13175 does not apply.

Assuming a Tribe is implementing such a plan at this time, while the proposed rule would have Tribal implications upon that Tribe, it would not impose substantial direct costs upon it, nor would it preempt Tribal law. As provided above, EPA has estimated that the total annual costs for the rule as implemented by State, Local, and Tribal governments is approximately $3 billion in 2010 and $4 billion in 2010 (1999$). There are currently very few emissions sources in Indian country that could be affected by this rule and the percentage of Tribal land that will be impacted is very small. For Tribes that choose to regulate sources in Indian country, the costs would be attributed to inspecting regulated facilities and enforcing adopted regulations.

Although Executive Order 13175 does not apply to this proposed rule, EPA consulted with Tribal officials in developing this proposed rule. The EPA has encouraged Tribal input at an early stage. Also, the EPA held

periodic meetings with the States and the Tribes during the technical development of this rule. In addition, EPA held three calls with Tribal environmental professionals to address concerns specific to the Tribes. These discussions have given EPA valuable information about Tribal concerns regarding the development of this rule. The EPA has provided briefings for Tribal representatives and the newly formed National Tribal Air Association (NTAA), and other national Tribal forums. Input from Tribal representatives has been taken into consideration in development of this proposed rule. The EPA specifically solicits additional comment on this proposed rule from Tribal officials.

G. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks

Executive Order 13045, “Protection of Children from Environmental Health Risks and Safety Risks” (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be “economically significant” as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria,

Section 5–501 of the Order directs the Agency to evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This proposed rule is not subject to the Executive Order because it does not involve decisions on environmental health or safety risks that may disproportionately affect children. The EPA believes that the emissions reductions from the strategies proposed in this rulemaking will further improve air quality and will further improve children's health.

H. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

Executive Order 13211 (66 FR 28355, May 22, 2001) provides that agencies shall prepare and submit to the Administrator of the Office of Regulatory Affairs, OMB, a Statement of Energy Effects for certain actions identified as "significant energy actions." Section 4(b) of Executive Order 13211 defines "significant energy actions" as "any action by an agency (normally published in the Federal Register) that promulgates or is expected

to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of final rulemaking, and notices of final rulemaking (1) (i) that is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a "significant energy action." This proposed rule is a significant regulatory action under Executive Order 12866, and this proposed rule may have a significant adverse effect on the supply, distribution, or use of energy. We have prepared a Statement of Energy Effects for this action, which may be briefly summarized as follows:

If States choose to obtain the emission reductions required by this rule by regulating EGUs, EPA projects that approximately 3100 MWs of coal-fired generation may be retired earlier than the generation would have been retired absent today's proposed rule-making. We do not believe that this rule will have any other impacts that exceed the significance criteria. The EPA projects that

the average annual electricity price will increase by about 2 percent in 2010, and about 3 percent in 2015.

The EPA believes that a number of features of today's rulemaking serve to reduce its impact on energy supply. First, by allowing the use of a trading program, overall cost and thus impact on energy supply is reduced. Second EPA has provided adequate time for EGUs to install the required controls.

The use of a capped trading program to reduce emissions of SO2 and NOx is also consistent with the President's National Energy Policy.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise practical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency

decides not to use available and applicable voluntary consensus standards.

In the SNPR, EPA will include regulatory language concerning monitoring, recordkeeping, and recording provisions that will apply to certain source categories if States choose to require reductions from them. These provisions may involve technical standards that may implicate the use of voluntary consensus standards. Therefore, EPA will address the NTTAA in the SNPR.

J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires Federal agencies to consider the impact of programs, policies, and activities on minority populations and low-income populations. According to EPA guidance,[102] agencies are to assess whether minority or low-income populations face risk or a rate of exposure to hazards that is significant and that "appreciably exceeds or is likely to appreciably exceed

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[102] U.S. Environmental Protection Agency. "Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses" (Review Draft). Office of Federal Activities. July 12, 1996.

the risk or rate to the general population or to the appropriate comparison group.”

In accordance with Executive Order 12898, the Agency has considered whether this proposed rule may have disproportionate negative impacts on minority or low income populations. Because the Agency expects this proposed rule to reduce pollutant loadings and exposures generally, negative impacts to these sub-populations which appreciably exceed similar impacts to the general population are not expected.

List of Subjects in 40 CFR Part 51

Administrative practice and procedure, Air pollution control, Intergovernmental relations, Nitrogen dioxide, Ozone, Particulate matter, Reporting and recordkeeping requirements, Sulfur oxides, Volatile organic compounds

List of Subjects in 40 CFR Part 72

Acid rain, Administrative practice and procedure, Air pollution control, Electric utilities, Intergovernmental

relations, Nitrogen oxides, Reporting and recordkeeping requirements, Sulfur oxides

List of Subjects in 40 CFR Part 75

Acid rain, Air pollution control, Electric utilities, Nitrogen oxides, Reporting and recordkeeping requirements, Sulfur oxides

List of Subjects in 40 CFR Part 96

Administrative practice and procedure, Air pollution control, Nitrogen oxides, Reporting and recordkeeping requirements

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Dated:

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Michael O. Leavitt
Administrator