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Acronyms and Abbreviations

Acronyms

BART	Best Available Retrofit Technology
BOTW	Beyond On The Way
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CEM	Continuous Emissions Monitoring
CERR	Consolidated Emission Reporting Rule
CFR	Code of Federal Regulations
CMAQ	Community Multi-scale Air Quality modeling system
CMU	Carnegie Mellon University
EGU	Electricity Generating Unit
EPA	U.S. Environmental Protection Agency
ESFF	Electrostatic Stimulation of Fabric Filtration
ESP	Electro Static Precipitator
FF	Fabric Filters (also known as baghouses)
FGD	Flue Gas Desulfurization (also known as scrubbers)
FLM	Federal Land Managers
GCVTC	Grand Canyon Visibility Transport Commission
HAA	Maryland Healthy Air Act
HAP	Hazardous Air Pollutant
ICI	Industrial, Commercial, and Institutional boilers
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPM	Integrated Planning Model
MACT	Maximum Achievable Control Technology
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association
MDE	Maryland Department of the Environment
MM5	Mesoscale Model
NCAR	National Center for Atmospheric Research
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NSPS	New Source Performance Standard
OTB/W	On-The-Books/On-The-Way
OTB/OTW	On-The-Books/On-The-Way
OTC	Ozone Transport Commission
OTR	Ozone Transport Region
PAG	Policy Advisory Group
PM	Particulate Matter
PS	Particulate Scrubber
Q/d	Emissions divided by distance
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
RACT	Reasonably Available Control Technology
RAVI	Reasonably Attributable Visibility Impairment
REMSAD	Regional Modeling System for Aerosols and Deposition
ROFA	Rotating Opposed Fire Air

Acronyms

RPG	Reasonable Progress Goals
RPO	Regional Planning Organization
SIP	State Implementation Plan
SCC	Source Category Code
SCR	Selective Catalytic Reduction
SLC	Independent/St. Lawrence Cement
SMOKE	Emission Processor Selection and Configuration
SNCR	Selective Non-Catalytic Reduction
SOA	Secondary Organic Aerosol
TBD	To be determined
TSC	Technical Support Committee
TSD	Technical Support Document
ULSD	Ultra-Low Sulfur Diesel
US EPA	United States Environmental Protection Agency
VISTAS	Visibility Improvement State and Tribal Association of the Southeast

Chemical Species

CO	carbon monoxide
HC	hydrocarbons
NO_X	oxides of nitrogen (NO and NO_2)
NH_3	ammonia
NMHC	non-methane hydrocarbons
OC	organic carbon
$PM_{2.5}$	particle matter up to 2.5 μm in size
PM_{10}	particle matter up to 10 μm in size
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SO_X	oxides of sulfur
VOC	volatile organic compounds

Units of Measure

Btu	British Thermal Unit (= 1055 Joules)
dv	deciview
km	kilometer (1000 x m; 10^3 m)
kW	kilowatt (1000 x W; 10^3 W)
MW	megawatt (1000000 x W; 10^6 W)
MMBtu	million Btu
ppm	parts per million
tpy	tons per year
W	watt (Joules/sec)
μm	micrometer (0.000001m; 10^{-6}m)

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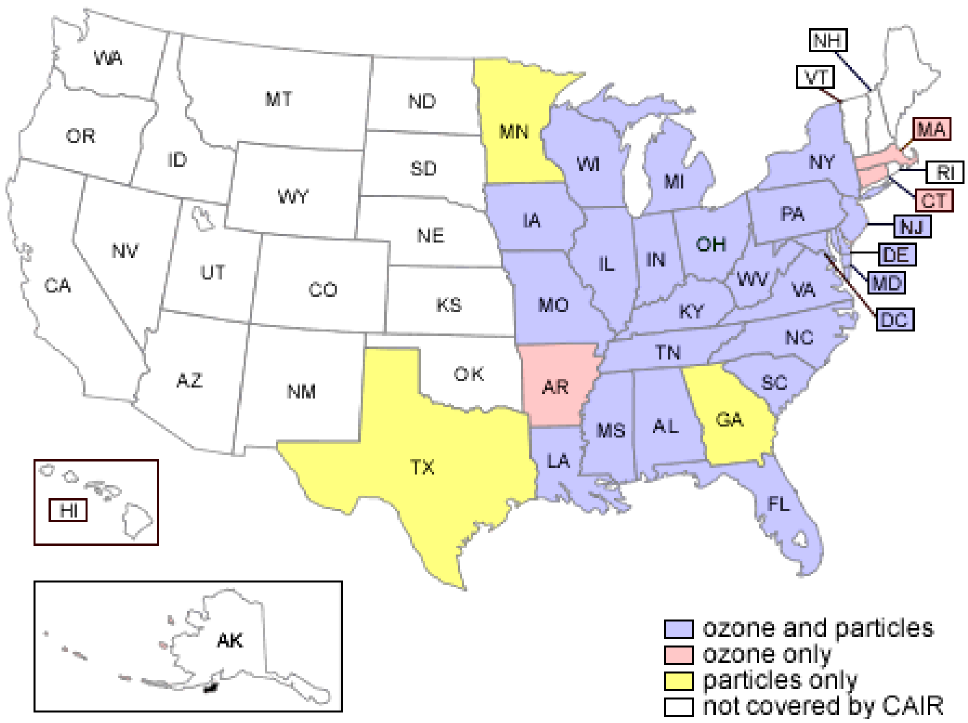
1.0 Background of the Federal Regional Haze Regulation

1.1 Regional Haze Planning after Vacatur of CAIR

On March 10, 2005, EPA issued the Clean Air Interstate Rule (CAIR). This important federal rule was designed to achieve major permanent reductions in sulfur dioxide (SO_2) and nitrogen oxides (NO_X) emissions in the eastern United States through a cap-and-trade system using emission allowances. CAIR would permanently cap emissions originating in 28 eastern states and the District of Columbia (Figure 1.1).

FIGURE 1-1: MAP OF CAIR STATES



http://www.epa.gov/cair/

According to EPA's CAIR website, SO_2 emissions in the affected states would be reduced by more than 70 percent from 2003 levels, and NO_X emissions by more than 60 percent from 2003 levels, upon full implementation of CAIR (see http://www.epa.gov/cair/). Resulting improvements in air quality would yield $85 to $100 billion in health benefits and nearly $2 billion in visibility benefits per year by 2015, and premature mortality would be substantially reduced across the eastern U.S.

This program came to an abrupt end, however, on July 11, 2008, when the U.S. Court of Appeals for the District of Columbia Circuit found that CAIR violated basic provisions of the Clean Air Act. The court vacated CAIR in its entirety and remanded to EPA to promulgate a new rule consistent with the court's opinion. EPA has appealed the decision – an action that prolongs the uncertainty as to the ultimate fate of CAIR and its possible succession.

Maryland, notwistanding the vacatur of CAIR, has implemented a State rule called the Maryland Healthy Air Act (HAA). This power plant rule stands as one of the nation's most aggressive rules at reducing NOx, SO2 and Mercury from older coal burning power plants. Maryland implemented the HAA in 2007 and emission reductions from the rule started in 2009.

The vacatur of CAIR still represents a major difficulty for the individual states in attempting to comply with the Regional Haze Rule. Because CAIR formed the regulatory underpinnings for most of the emission reductions that would produce visibility improvements in mandatory Class I areas, the probable demise of CAIR has left a structural void around which states must build their regional haze SIPs. While all states have depended in varying degree on CAIR in the preparation of their regional haze SIPs, some Southeast states have relied almost entirely on CAIR to demonstrate compliance with the rule. As a major ramification, EPA's determination that CAIR satisfies the requirements of BART is no longer valid.

The U.S. Congress and EPA are considering a number of possible short- and long-term regulatory or legislative fixes to replace CAIR. It is too early to know when this process will reach a conclusion and what the outcome will dictate for regional haze planning. Nevertheless, it is reasonable to assume that there will be some short-term slippage or loss in projected emission reductions.

The vacatur of CAIR calls into question the validity of MANE-VU's emission inventories and air quality modeling studies already completed for the member states' regional haze SIPs. Under the present schedule, there is insufficient time to redo the emissions inventories and air quality modeling to take into account the new, post-CAIR environment. As to the validity of the completed work, a number of mitigating circumstances apply:

- Application of BART provisions where CAIR would previously have sufficed is likely to yield even greater emission reductions from BART-eligible facilities.
- Maryland and many other states have instituted their own emission reduction programs through multi-pollutant legislation and other means.
- Strict adherence to the spirit of the Clean Air Act in future national initiatives will probably result in emission reductions exceeding those projected for CAIR. A major limitation of CAIR was that it relied on interstate emissions trading and did not respond to the specific language of the Clean Air Act, Section 110 a (2)(D), which prohibits *any* source or activity within a state from impairing the ability of another state to meet national air quality standards or visibility requirements. CAIR was only one tool, not an all-purpose remedy, for addressing the problem of interstate transport of pollutants.

For these reasons, MDE believes that future emissions and air quality levels under post-CAIR scenarios are not likely to be vastly different from values predicted by MANE-VU's completed modeling, even though that modeling was based on implementation of CAIR. Consequently, the reasonable progress goals and long-term strategy developed for Maryland's regional haze SIP still represent a defensible position from which to go forward with measures to improve visibility at MANE-VU's Class I Areas.

Maryland and the other MANE-VU states have maintained all along that the regional haze SIPs should look beyond the provisions of CAIR to identify additional emission control measures that could be effectively employed to mitigate regional haze. In this respect, Maryland and the rest of MANE-VU stand apart from some other states in asserting that additional measures beyond CAIR are essential to meeting established visibility goals at MANE-VU's Class I Areas.

In describing Maryland's present situation, it may be helpful to note that the vacatur of CAIR is a complicating factor but not an absolute impediment to making visibility progress in the near term. The salient points to consider are as follows:

- It should be noted that Maryland has gone beyond the CAIR reductions for SO_2 and NO_X, since CAIR is merely a cap-and-trade program, i.e. Maryland facilities could conceivably *increase* their emissions under CAIR. In going beyond the requirements of the Clean Air Interstate Rule (CAIR), Maryland has adopted the Healthy Air Act to significantly reduce emissions from EGUs (see Section 12.3.1).

- Because Maryland adopted the Healthy Air Act, the vacatur does not directly affect any of Maryland's proposed in-state control strategies for visibility improvement. The control measures identified in this regional haze SIP for in-state sources should be able to proceed without delay or obstruction.
- Maryland will meet its "fair share" of emissions in comparison with other MANE-VU states and the original CAIR states, as Maryland's long-term strategy demonstrates (see Section 12.0).
- By the time of the first regional haze SIP progress report, five years following our initial RH SIP submittal, the regulatory framework should be clearer; and new modeling results should be available. Maryland is committed to reviewing and updating its regional haze SIP as new information becomes available.

Rather than remove all references to the vacated CAIR rule, MDE has chosen to retain appropriate references to CAIR in the completion of Maryland's Regional Haze SIP. The decision to include references to the vacated rule serves two purposes: 1) The included references provide historical context, and 2) they help to maintain continuity with the large body of completed work – much of it based on CAIR – that serves as the foundation for regional haze planning in the MANE-VU states to date.

On August 2, 2010 EPA published the proposed Transport Rule (75 FR 45210), which is the proposed replacement for CAIR. CAIR will remain in effect until EPA finalizes the Transport Rule and CAIR is revoked.

1.2 General Background / History of Federal Regional Haze Rule

In amendments to the Clean Air Act (CAA) in 1977, Congress added Section 169 (42 U.S.C. 7491) setting forth the following national visibility goal:

> *Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from man-made air pollution.*

Over the following years modest steps were taken to address the visibility problems in Class I areas. The control measures taken mainly addressed Plume Blight from specific pollution sources and did little to address regional haze issues in the Eastern United States.

When the CAA was amended in 1990, Congress added Section 169B (42 U.S.C. 7492), authorizing further research and regular assessments of the progress made so far. In 1993, the National Academy of Sciences concluded that “current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility.”

In addition to authorizing creation of visibility transport commissions and setting forth their duties, Section 169B(f) of the CAA mandated creation of the Grand Canyon Visibility Transport Commission (GCVTC) to make recommendations to EPA for the region affecting the visibility of the Grand Canyon National Park. The Grand Canyon Visibility Transport Commission (Commission) submitted its report to EPA in June 1996, following four years of research and policy development. The Commission report, as well as the many research reports prepared by the Commission, contributed invaluable information to EPA in its development of the federal regional haze rule.

EPA’s Regional Haze Rule was adopted July 1, 1999, and went into effect on August 30, 1999. This rule seeks to address the combined visibility effects of various pollution sources over a wide geographic region. This wide reaching pollution net means that many states – even those without Class I Areas – are required to participate in haze reduction efforts.

In consultation with the states and tribes, EPA designated five Regional Planning Organizations (RPO) to assist with the coordination and cooperation needed to address the Haze issue. The Mid-Atlantic / Northeast states, including the District of Columbia, formed the Mid-Atlantic / Northeast Visibility Union (MANE-VU).[1]

EPA’s adoption of the Regional Haze Rule was not without much controversy and strife. On May 24, 2002 the U.S. Court of Appeals, D.C. District Court ruled on the challenge brought by the American Corn Growers Association against EPA’s Regional Haze Rule of 1999. The Court remanded to EPA the BART provisions of the rule, and denied industry’s challenge to the haze rule goals of natural visibility and no degradation requirements. On June 15, 2005, EPA finalized a rule addressing the court’s remand.

On February 18, 2005, the U.S. Court of Appeals for the District of Columbia Circuit issued another ruling vacating the Regional Haze Rule in part and sustaining it in part. For more information see *Center for Energy and Economic Development v. EPA*, no. 03-1222, (D.C. Cir. Feb. 18, 2005)(“*CEED* v. EPA”). In this case, the court granted a petition challenging provisions

1 A description of MANE-VU and a full list of its members is described in the Regional Planning Section of this SIP/TIP.

of the Regional Haze Rule governing the optional emissions trading program for certain Western States and Tribes (the WRAP Annex Rule).

EPA's subsequent final rulemaking provided the following changes to the Regional Haze Regulations:

1. Revised the regulatory text in Section 51.308(e)(2)(i) in response to the *CEED* court's remand, to remove the requirement that the determination of BART "benchmark" be based on cumulative visibility analyses, and to clarify the process for making such determinations, including the application of BART presumptions for EGUs as contained in Appendix Y to 40 CFR 51.
2. Added new regulatory text in Section 51.308(e)(2)(vi), to provide minimum elements for cap and trade programs in lieu of BART
3. Revised regulatory text in Section 51.309, to reconcile the optional framework for certain Western States and Tribes to implement the recommendations of the Grand Canyon Visibility Transport Commission (GCVTC) with the *CEED* decision.

Subsequent to the above described revisions to the Regional Haze Regulations, EPA issued a memorandum from William T. Harnett, Director, Air Quality Policy Division, Office of Air Quality Planning and Standards, U.S. EPA, entitled "Guidance for State Implementation Plan (SIP) Submissions to Under 110(a)(1) and (2) for the 2006 24-Hour fine Particle ($PM_{2.5}$) National Ambient Air Quality Standards (NAAQS),'' dated September 25, 2009. Through this guidance, EPA clarified that a State's obligation pursuant to CAA Section 110(a)(2)(D)(i)(II) can be satisfied by an approved SIP addressing regional haze. The State believes that this plan is sufficient for purposes of the State meeting its obligations related to visibility pursuant to § 110(a)(2) of the federal Clean Air Act, including but not limited to §§ 110(a)(2)(D)(i)(II) and 110(a)(2)(J) and the State intends to rely on this submittal to satisfy all applicable CAA Section 110(a)(2) obligations, including, but not limited to, section 110(a)(2)(D)(i)(II) and 110(a)(2)(J), for Maryland's 1997 ozone, 1997 PM2.5, and 2006 PM2.5 National Ambient Air Quality Standards (NAAQS).

1.3 Area of Influence for MANE-VU Class I Areas

Maryland contains no Class I Area(s).

In order to identify states whose emissions are most likely to influence visibility in MANE-VU Class I areas, MANE-VU prepared the *Contributions to Regional Haze in the Northeast and Mid-Atlantic United States* (Contribution Assessment). The full report can be found in Appendix A. Based on that work, MANE-VU concluded that it was appropriate to define an area of influence which includes all of the states participating in MANE-VU plus other states outside MANE-VU for which modeling indicated they contributed at least 2% of the sulfate ion at MANE-VU Class I areas in 2002.

Through participation in the MANE-VU regional haze planning process, the State of Maryland has been identified as contributing to visibility impairment in the following Class I areas: Acadia National Park, Brigantine Wildlife Refuge, and the Lye Brook Wilderness Area, as well as Dolly

Sods Wilderness, Otter Creek Wilderness and Shenandoah National Park which lie outside of the MANE-VU region.

The VISTAS Contribution Assessment states that the MANE-VU states contribute to SO_2 emissions in both the Dolly Sods Wilderness and Shenandoah National Park Class I areas. The Contribution Assessment states that reductions in SO_2 emissions from electric generating units would produce the greatest improvements in visibility. Maryland will fulfill its commitment to reduce SO_2 emissions through reductions from the Healthy Air Act (see section 12).

Table 1-1: States that Contribute to Visibility Impairment in the MANE-VU Class I Areas of Acadia, Moosehorn, Great Gulf, Lye Brook, and Brigantine

State	RPO
Connecticut	MANE-VU
Delaware	MANE-VU
Maine	MANE-VU
Maryland	MANE-VU
Massachusetts	MANE-VU
New Hampshire	MANE-VU
New Jersey	MANE-VU
New York	MANE-VU
Pennsylvania	MANE-VU
Rhode Island	MANE-VU
Vermont	MANE-VU
Georgia	VISTAS
Kentucky	VISTAS
North Carolina	VISTAS
South Carolina	VISTAS
Tennessee	VISTAS
Virginia	VISTAS
West Virginia	VISTAS
Illinois	MRPO
Indiana	MRPO
Michigan	MRPO
Ohio	MRPO
New Brunswick, Canada	N/A
Ontario, Canada	N/A
Quebec, Canada	N/A

2.0 Class I Areas Affected

In accordance with 40 CFR 51.308(d)(4)(iii) emissions sources within Maryland have or may have impacts on the Class I areas listed in Table 2-1 below. The magnitude of these impacts is described in detail in MANE-VU's Contribution Assessment (Appendix A). Table 2-1 briefly lists the affected Class I areas and Maryland's percent contribution to total annual sulfate at each area in the 2002 baseline year, as determined from the modeling.

Table 2-1: Maryland's Contributions to Total Annual Average Sulfate Impact (Percent, Mass Basis) at Eastern Class I Federal Areas in 2002

Class I Federal Area	State	Percent Contribution
Acadia National Park*	Maine	2.20
Brigantine Wildlife Refuge*	New Jersey	4.98
Dolly Sods Wilderness/Otter Creek	West Virginia	2.39
Great Gulf Wilderness Area* & Presidential Range-Dry River Wilderness Area*	New Hampshire	1.92
Lye Brook Wilderness Area*	Vermont	2.66
Moosehorn Wildlife Refuge* & Roosevelt Campobello International Park*	Maine/Canada	1.60
Shenandoah National Park	Virginia	4.84

* MANE-VU Class I Area

Information about procedures by which monitoring data and other information were used in determining the contribution of emissions from within these States to regional haze visibility impairment at MANE-VU Class I areas is included in the *MANE-VU Contribution Assessment* in Appendix A.

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3.0 General Planning Provisions and Commitment to Future Submittal

Pursuant to the requirements of 51.308(a) and (b), the Maryland Department of the Environment (MDE) submits this SIP/TIP to meet the requirements of EPA's Regional Haze rules that were adopted to comply with requirements set forth in the Clean Air Act. Elements of this Plan address the Core Requirements pursuant to 40 CFR 51.308(d) and the Best Available Retrofit Technology (BART) components of 40 CFR 50.308(e). In addition, this SIP/TIP addresses Regional Planning, State/Tribe and Federal Land Manager coordination, and contains a commitment to provide Plan revisions and adequacy determinations.

Section 51.308(f) requires MDE to submit its SIP revision by July 31, 2018 and every ten years thereafter.

Section 51.308(g) requires MDE to submit a report to EPA every 5 years evaluating progress towards the reasonable progress goal for each Class I Federal area located within the State and in each Class I Federal area located outside the State that may be affected by emissions from within the State. The first progress report is due 5 years from submittal of the initial implementation plan and must be in the form of implementation plan revisions.

Section 51.308(d)(4)(vi) requires MDE to periodically update the emissions inventory.

In accordance with Section 51.308(h), at the time the progress report is submitted, MDE will also submit a determination of the adequacy of its existing Regional Haze SIP revision.

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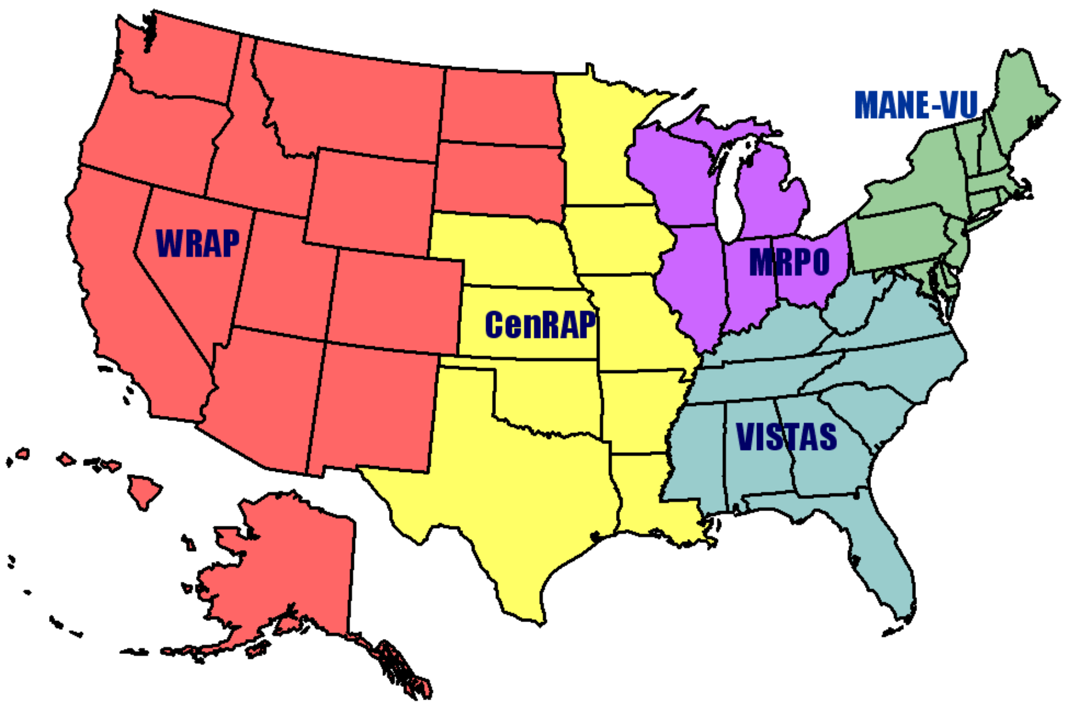
4.0 Regional Planning

In 1999, EPA and affected States/Tribes agreed to create five Regional Planning Organizations (RPOs) to facilitate interstate coordination on Regional Haze SIP/TIPs. The RPOs, and states/tribes within each RPO, are required to consult on emission management strategies toward visibility improvement in affected Class I areas. As shown in the accompanying map (Figure 4-1), the five RPOs are MANE-VU (Mid-Atlantic/Northeast Visibility Union), VISTAS (Visibility Improvement State and Tribal Association of the Southeast), MRPO (Midwest Regional Planning Organization), CenRAP (Central Regional Air Planning Association), and WRAP (Western Regional Air Partnership). Maryland is a member of MANE-VU.

Figure 4-1: EPA-Designated Regional Planning Organizations (RPOs).



4.1 Mid-Atlantic/Northeast Visibility Union (MANE-VU)

MANE-VU's work is managed by the Ozone Transport Commission (OTC) and carried out by OTC, the Mid-Atlantic Regional Air Management Association (MARAMA), and the Northeast States for Coordinated Air Use Management (NESCAUM). The State of Maryland is a member of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) RPO. Members of MANE –VU are listed in Table 4-1. Individuals from the member states, tribes, and agencies, along with professional staff from OTC, MARAMA, and NESCAUM, make up the various committees and workgroups. MANE-VU also established a Policy Advisory Group (PAG) to provide advice to decision-makers on policy questions. EPA, Federal Land Managers, states, and tribes are represented on the PAG, which meets on an as-needed basis.

Table 4-1: MANE-VU Members

Connecticut	Pennsylvania
Delaware	Penobscot Nation
District of Columbia	Rhode Island
Maine	St. Regis Mohawk Tribe
Maryland	Vermont
Massachusetts	U.S. Environmental Protection Agency*
New Hampshire	U.S. National Park Service*
New Jersey	U.S. Fish and Wildlife Service*
New York	U.S. Forest Service*

*Non-voting members

Since its inception on July 24, 2001, MANE-VU established an active committee structure to address both technical and non-technical issues related to regional haze. The primary committees are the Technical Support Committee (TSC) and the Communications Committee. While the work of these committees is instrumental to policies and programs, ultimately, decisions are made by the MANE-VU Board.

The TSC is charged with assessing the nature and magnitude of the regional haze problem within MANE-VU, interpreting the results of technical work, and reporting on such work to the MANE-VU Board. The TSC has evolved to function as a valuable sounding board for all the technical projects and processes of MANE-VU. The TSC has established a process to ensure that important regional haze related projects are completed in a timely fashion, and members are kept informed of all MANE-VU tasks and duties.

The Communications Committee is charged with developing approaches to inform the public about the regional haze problem in the region and making any recommendations to the MANE-VU Board to facilitate that goal. Ultimately, policy decisions are made by the MANE-VU Board. The Communications Committee oversees the development of MANE-VU's newsletter and outreach tools, both for stakeholders and the public, regarding regional issues affecting MANE-VU's members.

In addition to the formal working committees, there are three standing working groups of the TSC. They are broken down by topic area: Emissions Inventory, Modeling, and Monitoring/Data Analysis Workgroups.

This SIP/TIP utilizes data analysis, modeling results and other technical support documents prepared for MANE-VU members. By coordinating with MANE-VU and other RPOs, Maryland

Department of the Environment has worked to ensure that its long term strategy and BART determinations provide sufficient reductions to mitigate impacts of sources from Maryland on affected Class I areas. A copy of MANE-VU's *Final Interim Principles for Regional Planning* can be found in Appendix B.

The following points highlight many of the ways MANE-VU member states and tribes have cooperatively addressed regional haze.

- *Budget Prioritization:* MANE-VU developed a process to coordinate MARAMA, OTC and NESCAUM staff in developing budget priorities, project rankings, and the eventual federal grant requests.
- *Issue Coordination:* MANE-VU established a conference call and meeting schedule for each of its committees and workgroups. In addition, its MANE-VU Directors regularly discuss pertinent issues.
- *SIP Policy and Planning:* MANE-VU states/tribes collaborated on the development of a SIP Template.
- *Capacity Building:* To educate its staff and members MANE-VU included technical presentations on conference calls and organized workshops with nationally recognized experts. Presentations on data analysis, BART work, inventory topics, modeling, control measures etc. were an effective education, and coordination tool.
- *Routine Operations:* MANE-VU staff at OTC, MARAMA, and NESCAUM established a coordinated approach to: budget, grant deliverables/due-dates, workgroup meetings, inter-RPO feedback, etc.

4.2 Regional Consultation

40 CFR Section 51.308(d)(3)(i) requires Maryland to consult with other States/Tribes to develop coordinated emission management strategies. This requirement applies both where emissions from the State/Tribe are reasonably anticipated to contribute to visibility impairment in Class I areas outside the State/Tribe and when emissions from other States/Tribes are reasonably anticipated to contribute to visibility impairment in Class I areas within the State/Tribe.

4.2.1 Consultation on the Long Term Strategy

Maryland consulted with other States and tribes by participation in the MANE-VU and inter-RPO processes that developed technical information necessary for development of coordinated strategies.

On May 10, 2006, MANE-VU adopted the Inter-RPO State/Tribal and FLM Consultation Framework (Appendix Q). That document set forth the following principles:

1) All State, Tribal, RPO, and Federal participants are committed to continuing dialogue and information sharing in order to create understanding of the respective concerns and needs of the parties.
2) Continuous documentation of all communications is necessary to develop a record for inclusion in the SIP submittal to EPA.

3) States alone have the authority to undertake specific measures under their SIP. This inter-RPO framework is designed solely to facilitate needed communication, coordination and cooperation among jurisdictions but does not establish binding obligation on the part of participating agencies.

4) There are two areas which require State-to-State and/or State-to-Tribal consultations ("formal" consultations): (i) development of the reasonable progress goal for a Class I area, and (ii) development of long-term strategies. While it is anticipated that the formal consultation will cover the technical components that make up each of these policy decision areas, there may be a need for the RPOs, in coordination with their State and Tribal members, to have informal consultations on these technical considerations.

5) During both the formal and informal inter-RPO consultations, it is anticipated that the States and Tribes will work collectively to facilitate the consultation process through their respective RPOs, when feasible.

6) Technical analyses will be transparent, when possible, and will reflect the most up-to-date information and best scientific methods for the decision needed within the resources available.

7) The State with the Class I area retains the responsibility to establish reasonable progress goals. The RPOs will make reasonable efforts to facilitate the development of a consensus between the State with a Class I area and other States affecting that area. In instances where the State with the Class I area can not agree with such other States that the goal provides for reasonable progress, actions taken to resolve the disagreement must be included in the State's regional haze implementation plan (or plan revisions) submitted to the EPA Administrator as required under 40 CFR Section 51.308(d)(1)(iv).

8) All States whose emissions are reasonably anticipated to contribute to visibility impairment in a Class I area, must provide the Federal Land Manager ("FLM") agency for that Class I area with an opportunity for consultation, in person, on their regional haze implementation plans. The States/Tribes will pursue the development of a memorandum of understanding to expedite the submission and consideration of the FLM's comments on the reasonable progress goals and related implementation plans. As required under 40 CFR Section 51.308(i)(3), the plan or plan revision must include a description of how the State addressed any FLM comments.

9) States/Tribes will consult with the affected FLMs to protect the air resources of the State/Tribe and Class I areas in accordance with the FLM coordination requirements specified in 40 CFR Section 51.308(i) and other consultation procedures developed by consensus.

10) The consultation process is designed to share information, define and document issues, develop a range of options, solicit feedback on options, develop consensus advice if possible, and facilitate informed decisions by the Class I States.

11) The collaborators, including States, Tribes and affected FLMs, will promptly respond to other RPO's/States'/Tribes' requests for comments.

The document also describes a process primarily applicable to formal consultation with states in other RPOs concerning regional haze SIP elements. Although other RPOs did not formally adopt the same process, in general, the process was followed and provided significant opportunities for consultation with other states concerning the long term strategy as well as reasonable progress goals. Information and a description of the processes used to consult regarding baseline determinations, natural background levels, and reasonable progress goal development is available in later sections of this SIP/TIP.

MANE-VU consultation meetings and conference calls included those held on the following dates:

- MANE-VU Intra-Regional Consultation, March 1, 2007
  - At this meeting, MANE-VU members reviewed the requirements for regional haze plans, preliminary modeling results, the work being done to prepare the MANE-VU report on reasonable progress factors, and control strategy options under review.
- MANE-VU Intra-State Consultation, June 7, 2007
  - At this meeting the MANE-VU Class I states adopted a statement of principles, and all MANE-VU members discussed draft statements concerning reasonable controls within and outside of MANE-VU. Federal Land Managers also attended the meeting, which was open to stakeholders.
- MANE-VU Conference Call, June 20, 2007
  - On this call, the MANE-VU states concluded discussions of statements concerning reasonable controls within and outside MANE-VU and agreed on the statements called the MANE-VU "Ask," including a statement concerning controls within MANE-VU, a statement concerning controls outside MANE-VU, and a statement requesting a course of action by the U.S. EPA. Federal Land Managers also participated in the call. Upon approval, all statements as well as the statement of principles adopted on June 7 were posted and publicly available on the MANE-VU web site.
- MANE-VU Class I States' Consultation Open Technical Call, July 19, 2007
  - On this call, the MANE-VU "Ask" was presented to states in other RPOs RPO staff, and Federal Land Managers, and an opportunity was provided to request further information. This call was intended to provide information to facilitate informed discussion at follow-up meetings.
- MANE-VU Consultation Meeting with MRPO, August 6, 2007
  - This meeting was held at LADCO offices in Chicago, Illinois and was attended by representatives of both MANE-VU and MRPO states as well as staff. The meeting provided an opportunity to formally present the MANE-VU "Ask" to MRPO states and to consult with them regarding the reasonableness of the requested controls. Federal Land Manager agencies also attended the meeting.
- MANE-VU Consultation Meeting with VISTAS, August 20, 2007
  - This meeting was held at State of Georgia offices in Atlanta and was attended by representatives of both MANE-VU and VISTAS states as well as staff. The meeting provided an opportunity to formally present the MANE-VU "Ask" to

VISTAS states and to consult with them regarding the reasonableness of the requested controls. Federal Land Manager agencies also attended the meeting.

- MANE-VU – Midwest RPO Consultation Conference Call, September 13, 2007
  - This call was a follow-up to the meeting held on August 6 in Chicago and provided an opportunity to further clarify what was being asked of the MRPO states. The flexibility in the Ask was explained. Both MRPO and MANE-VU staff agreed to work together to facilitate discussion of further controls on ICI boilers and EGUs.
- MANE-VU Air Directors' Consultation Conference Call, September 26, 2007
  - This call allowed MANE-VU members to clarify their understanding of the "Ask" and to provide direction to modeling staff as to how to interpret the "Ask" for purposes of estimating visibility impacts of the requested controls.
- MANE-VU Air Directors' Conference Call, February 28, 2008
  - On this call, NESCAUM presented the results of the final 2018 modeling and described the methods used to represent the impacts of the measures agreed to by the Class I States. Federal Land Manager agencies also attended this call.
- MANE-VU Air Directors' Conference Call, March 21, 2008
  - On this call, MANE-VU states discussed the process for establishing Reasonable Progress Goals for MANE-VU Class I areas

4.2.2 Consultation with the Commonwealth of Virginia

On November 2, 2007, the State of Maryland and the Commonwealth of Virginia conducted a consultation conference call concerning the regional haze SIPs. The purpose of this conference call was to gather information regarding six units at three different facilities located in the state of Maryland that may contribute to poor visibility in Virginia Class I areas, specifically Shenandoah National Park. An outline of the conference call is included in Appendix Q.

The list of facilities and units discussed are as follows:

Plant Name	Plant ID	Point ID	2002 SO_2 TPY	2018 SO_2 TPY	Percent Contribution
New Page/ Westvaco/Luke Plant	24-001-0011	1	10,160	9,610	4.14%
		2	8,923	8,441	3.64%
Eastalco Aluminum	24-021-0005	28	1,506	2,652	1.74%
		29	1,506	2,652	1.74%
Mirant Mid-Atlantic Morgantown	24-017-0014	14	37,757	3,037	1.48%
		15	32,587	2,987	1.45%

- Eastalco Aluminum
  - Since having discussions with Virginia, the plant at Eastalco Aluminum ceased all operations and subsequently shut down. Therefore this facility and its related emissions are no longer considered for this SIP submission.

- New Page/Westvaco/Luke Paper
    - Westvaco Unit #2 is BART eligible. The Luke Company worked with MANE-VU to establish presumptive levels of control for industrial boilers, which are 90% control for SO_2, NO_X emissions between 0.1 to 0.4 lb/mmbtu, and PM emissions between 0.02 to 0.07 lb/mmbtu. Based on these levels of control the Luke Company proposes that they will, on a yearly basis, reduce emissions to the equivalent levels of 90% control of SO_2 emissions, reduce NO_X emissions to the level of 0.4 lb/MMBtu, and control PM emissions to 0.7 lb/MMBtu for No. 25 Power Boiler. The understanding is that these reductions will be in place within five years of EPA approval of the Maryland SIP. The BART analysis for this facility is included in Appendix G-2.

- Mirant Mid-Atlantic Morgantown, Units #14 and #15
    - Both units are subject to the Maryland Healthy Air Act. Both units will be equipped with SCR for NO_X control by 2009, and a scrubber for SO_2 control by 2010. Additionally, both units are scheduled to be equipped with a polishing baghouse for additional mercury and particulate matter control.

4.2.3 Consultation with the State of West Virginia

On October 18, 2007, the State of Maryland and the State of West Virginia conducted a consultation conference call concerning the regional haze SIPs. The purpose of this conference call was to gather information regarding facilities located in the state of Maryland that may contribute to poor visibility in West Virginia Class I areas, specifically Dolly Sods Wilderness Area and the Otter Creek Wilderness Area. An outline of the conference call is included in Appendix Q.

- New Page/Westvaco/Luke Paper
    - Westvaco Unit #2 is BART eligible. The Luke Company worked with MANE-VU to establish presumptive levels of control for industrial boilers, which are 90% control for SO_2, NO_X emissions between 0.1 to 0.4 lb/mmbtu, and PM emissions between 0.02 to 0.07 lb/mmbtu. Based on these levels of control the Luke Company proposes that they will, on a yearly basis, reduce emissions to the equivalent levels of 90% control of SO_2 emissions, reduce NO_X emissions to the level of 0.4 lb/MMBtu, and control PM emissions to 0.7 lb/MMBtu for No. 25 Power Boiler. The understanding is that these reductions will be in place within five years of EPA approval of the Maryland SIP. The BART analysis for this facility is included in Appendix G-2.

- Mettiki Coal
    - Mettiki Coal is not a BART facility. It was identified as BART-eligible and later re-classified as not BART because the date operations began post-dates the BART qualifying timeframe.

- Mirant Mid-Atlantic Morgantown, Units #14 and #15

  - Both units are subject to the Maryland's Healthy Air Act. Both units were equipped with SCR for NO_X control by 2009, and a scrubber for SO_2 control by 2010. Additionally, both units are scheduled to be equipped with a polishing baghouse for additional mercury and particulate matter control.

- AES Warrior Run
  - AES Warrior Run is not a BART facility.

- R. Paul Smith
  - R. Paul Smith is not BART eligible but it is subject to the Maryland Healthy Air Act.

4.3 State/Tribe and Federal Land Manager Coordination

Section 51.308(f) requires the State of Maryland to submit its SIP revision by July 31, 2018 and every ten years thereafter.

Section 51.308(i) requires coordination between States/Tribes and the Federal Land Managers (FLMs). Opportunities have been provided by MANE-VU for FLMs to review and comment on each of the technical documents developed by MANE-VU and included in this SIP/TIP. Maryland has provided agency contacts to the FLMs as required. In the development of this Plan, the FLMs were consulted in accordance with the provisions of 51.308(i)(2). The State of Maryland has provided the FLMs an opportunity for consultation, in person and at least 60 days prior to holding any public hearing on the SIP. This SIP was submitted to FLMs on September 22, 2008 for review and comment.

In accordance with 40 CFR 51.308(i)(3) the State of Maryland has received comments regarding the SIP from FLMs. Comments received from the Federal Land Managers on the Plan were addressed. The comments and responses are included in Appendix Q of this plan.

Section 51.308(i)(4) requires procedures for continuing consultation between the State/Tribe and FLMs on the implementation of the visibility protection program. The State of Maryland will consult with the Federal Land manager(s) on the status of the following implementation items:

1. Implementation of emissions strategies identified in the SIP as contributing to achieving improvement in the worst-day visibility
2. Summary of major new source permits issued
3. Status of State/Tribe actions to meet commitments for completing any future assessments or rulemakings on sources identified as likely contributors to visibility impairment, but not directly addressed in the most recent SIP revision
4. Any changes to the monitoring strategy or monitoring stations status that may affect tracking of reasonable progress
5. Work underway for preparing the 5-year review and / or 10-year revision
6. Items for FLMs to consider or provide support for in preparation for any visibility protection SIP revisions (based on a 5-year review or the 10-year revision schedule under EPA's RHR)

7. Summary of topics discussion (meetings, emails, other records) covered in ongoing communications between the State/Tribe and FLMs regarding implementation of the visibility program.

The consultation will be coordinated with the designated visibility protection program coordinators for the National Park Service, U. S. Fish and Wildlife Service and the U.S. Forest Service.

Section 51.308(g) requires the State of Maryland to submit a report to the EPA every 5 years evaluating progress towards the reasonable progress goal for each Class I Federal area located within the State and in each Class I Federal area located outside the State that may be affected by emissions from within the State. The first progress report is due 5 years from submittal of the initial implementation plan and must be in the form of implementation plan revisions.

The State of Maryland will continue to coordinate and consult with the FLMs during the development of future progress reports and plan revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas.

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5.0 Assessment of Baseline, Natural, and Current Conditions

There are no Class I areas within the State of Maryland. The Regional Haze SIP requirement to assess baseline, natural, and current conditions of Class I areas is limited to the states/tribal regions where the Class I areas are located. The process used by MANE-VU to develop baseline, natural background conditions and uniform rates of progress is clearly outlined in Appendix H of this SIP.

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6.0 Monitoring Strategy

In the mid-1980's, the IMPROVE program (Interagency Monitoring of Protected Visual Environments) was established to measure visibility impairment in mandatory Class I areas throughout the United States. The monitoring sites are operated and maintained through a formal cooperative relationship between the U.S. EPA, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and U.S. Forest Service. In 1991, several additional organizations joined the effort. These included: State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control (which now goes by The National Association of Clean Air Agencies) Officials, Western States Air Resources Council, Mid-Atlantic Regional Air Management Association, and Northeast States for Coordinated Air Use Management.

IMPROVE Program Objectives

Data collected at these sites are used by land managers, industry planners, scientists, public interest groups, and air quality regulators to understand and protect the visual air quality resource in Class I areas. Most importantly, the IMPROVE program scientifically documents for American citizens, the visual air quality of their wilderness areas and national parks. A Quality Assurance Project Plan (QAPP) for the IMPROVE program, dated March 2002, can be found at: http://vista.cira.colostate.edu/improve/Publications/QA_QC/IMPROVE_QAPP_R0.pdf

Program objectives include:

- Establish current visibility and aerosol conditions in mandatory Class I areas,
- Identify chemical species and emission sources responsible for existing anthropogenic visibility impairment,
- Document long-term trends for assessing progress towards the national visibility goals,
- Provide regional haze monitoring representing all visibility-protected federal Class I areas where practical, as required by EPA's Regional Haze Rule.

6.1 States/Tribes without Class I Areas

Section 51.308(d)(4)(iii) of EPA's Regional Haze Rule requires the inclusion of procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I Federal areas both within and outside the State. MANE-VU and the State of Maryland accept the contribution assessment analysis completed by NESCAUM entitled, *Contributions to Regional Haze in the Northeast and Mid-Atlantic States* (see appendix A). Methods of visibility and emissions data analysis used in preparing the Contribution Assessment include source apportionment analysis (see Appendix B), trajectory analysis (see Chapter 5), emissions divided by distance (see Chapter 4), emissions times upwind probability (see Chapter 4), chemical transport models (see Chapter 6), and Lagrangian dispersion modeling (see Chapter 7). The many techniques used provided a stronger weight of evidence for the assessment of contribution by source types and regions.

We agree that NESCAUM is providing quality technical information by using the IMPROVE program data and the VIEWS site. Information about the use of the default and alternative approaches to the calculation of baseline and natural background conditions can be found in Appendix H Assessment of Baseline and Natural Conditions of this SIP.

Maryland does not contain any Class I Areas; therefore no monitoring plan is required under Section 51.308(d)(4) or Section 51.30 of EPA's Regional Haze Rules.

6.2 Monitoring Information for MANE-VU Class I Areas

6.2.1 Acadia National Park, Maine - Monitor Location

The IMPROVE monitor for the Acadia National Park (indicated as ACAD1) is located at Acadia National Park Headquarters in Maine at an elevation of 157 meters, a latitude of 44.38˚ and a longitude of -68.26˚.

Acadia National Park - Monitoring Strategy

The haze data for Acadia National Park is collected by an IMPROVE monitor (ACAD1) that is operated and maintained by the National Park Service. The State considers the ACAD1 site as adequate for assessing reasonable progress goals of the Acadia National Park and no additional monitoring sites or equipment are necessary at this time. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-1. MAP OF ACADIA NATIONAL PARK

(source: Tom Downs of Maine DEP, http://www.maine.gov/dep/air/meteorology/images/Acadia.jpg)

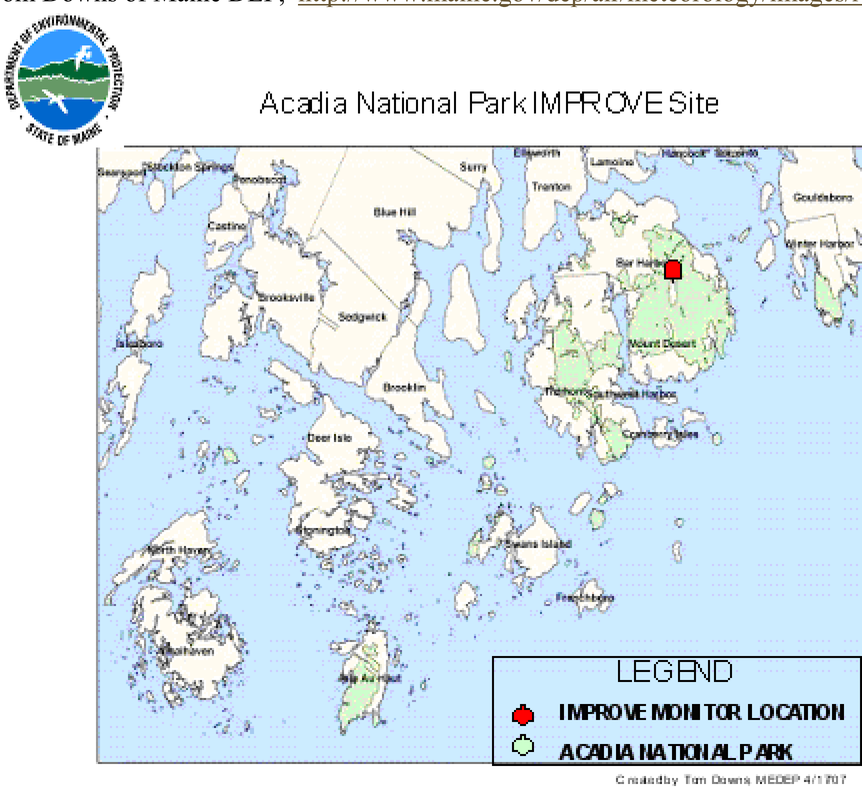


FIGURE 6-2. ACADIA NATIONAL PARK ON A CLEAR DAY
(source: http://www.hazecam.net/class1/acadia.html)

FIGURE 6-3. ACADIA NATIONAL PARK ON A HAZY DAY
(source: http://www.hazecam.net/class1/acadia.html)

6.2.2 Brigantine Wilderness Area, New Jersey - Monitor Location

The IMPROVE monitor for the Brigantine Wilderness Area (indicated as BRIG1) is located at the Edwin B. Forsythe National Wildlife Refuge Headquarters in Oceanville New Jersey at an elevation of 5 meters, a latitude of 39.47˚ and a longitude of -74.45˚.

6.2.2.1 Brigantine Wilderness Area - Monitoring Strategy

The haze data for Brigantine Wilderness Area is collected by an IMPROVE monitor (BRIG1) that is operated and maintained by the U.S. Fish & Wildlife Service. The State considers the BRIG1 site as adequate for assessing reasonable progress goals of the Brigantine Wilderness Area and no additional monitoring sites or equipment are necessary at this time. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-4. MAP OF EDWIN B. FORSYTHE NATIONAL WILDLIFE REFUGE
(source: http://www.fws.gov/northeast/forsythe/MAP.htm)

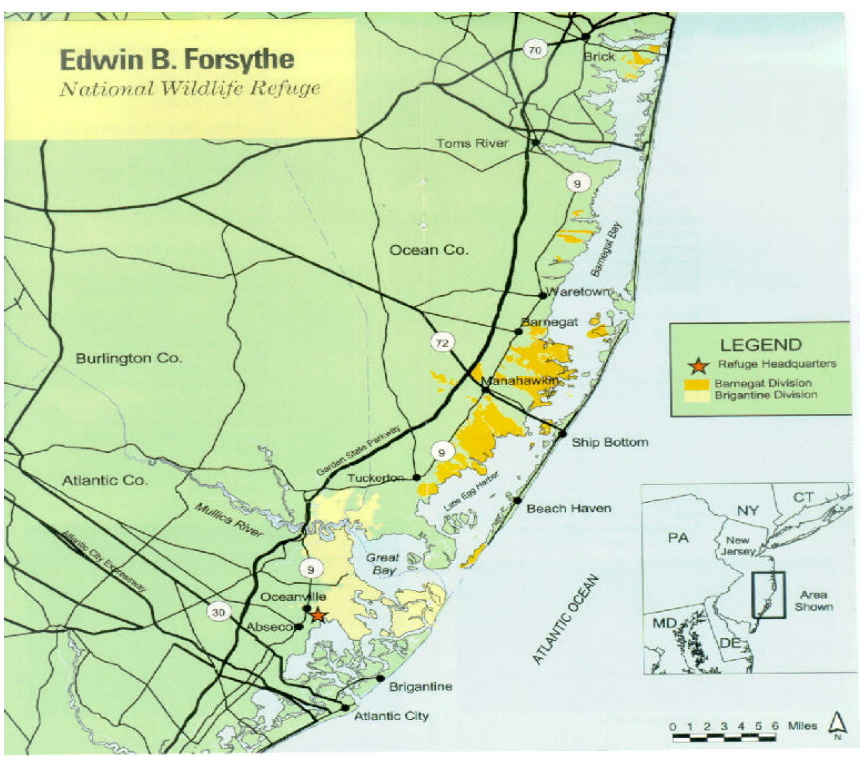


FIGURE 6-5. BRIGANTINE WILDERNESS AREA ON A CLEAR DAY
(source: http://www.hazecam.net/class1/brigantine.html)

FIGURE 6-6. BRIGANTINE WILDERNESS AREA ON A HAZY DAY
(source: http://www.hazecam.net/class1/brigantine.html)

6.2.3 Great Gulf Wilderness Area, New Hampshire - Monitor Location

The IMPROVE monitor for the Great Gulf Wilderness Area (indicated as GRGU1) is located at Camp Dodge, which is located in the mid northern area of Greens Grant, just east and south of where Route 16 crosses the Greens Grant/Martins Location boundary in the White Mountain National Forest, South of Gorham New Hampshire, at an elevation of 454 meters, a latitude of 44.31˚ and a longitude of -71.22˚. This monitor also represents the Presidential Range/Dry River Wilderness Area in New Hampshire.

Great Gulf Wilderness Area - Monitoring Strategy

The haze data for Great Gulf Wilderness Area is collected by an IMPROVE monitor (GRGU1) that is operated and maintained by the Forest Service. The State considers the GRGU1site as adequate for assessing reasonable progress goals of the Gulf Wilderness Area and no additional monitoring sites or equipment are necessary at this time. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-7. MAP OF GREAT GULF WILDERNESS AREA AND PRESIDENTIAL RANGE/DRY RIVER WILDERNESS AREA

(source: http://www.maine.gov/dep/air/meteorology/images/NHclass1.jpg)

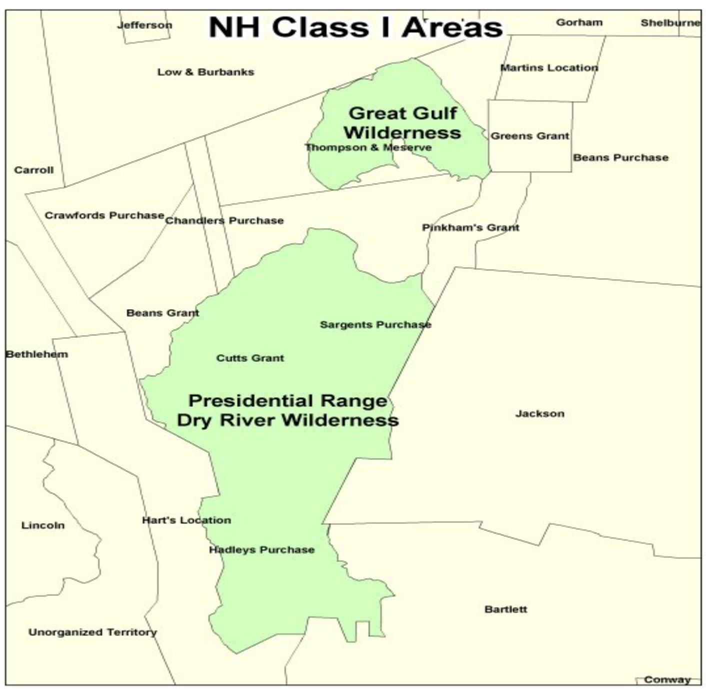


FIGURE 6-8. GREAT GULF WILDERNESS AREA ON A CLEAR DAY
(source: http://www.wilderness.net/)

FIGURE 6-9. GREAT GULF WILDERNESS AREA ON A HAZY DAY
(source: http://www.wilderness.net/)

6.2.4 Lye Brook Wilderness, Vermont - Monitor Location

The IMPROVE monitor for the Lye Brook Wilderness Area (indicated as LYBR1) is located on Mount Equinox at the windmills in Manchester Vermont. The monitor is not in the Wilderness Area but is located on a mountain peak across the valley to the west of the wilderness area. The Lye Brook Wilderness Area is at high elevation in the mountains and the IMPROVE site across the valley is at about the same height as the Wilderness Area at an elevation of 1015 meters, a latitude of 43.15˚ and a longitude of -73.13˚.

Lye Brook Wilderness -Monitoring Strategy

The haze data for Lye Brook Wilderness Area is collected by an IMPROVE monitor (LYBR1) that is operated and maintained by the Forest Service. The State considers the LYBR1 site as adequate for assessing reasonable progress goals of the Lye Brook Wilderness Area and no additional monitoring sites or equipment are necessary at this time. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-10. MAP OF LYE BROOK WILDERNESS AREA

(source: Paul Wishinski of Vermont, http://www.wilderness.net/index.cfm?fuse=NWPS&sec=stateView&state=NH&map=menhvt)

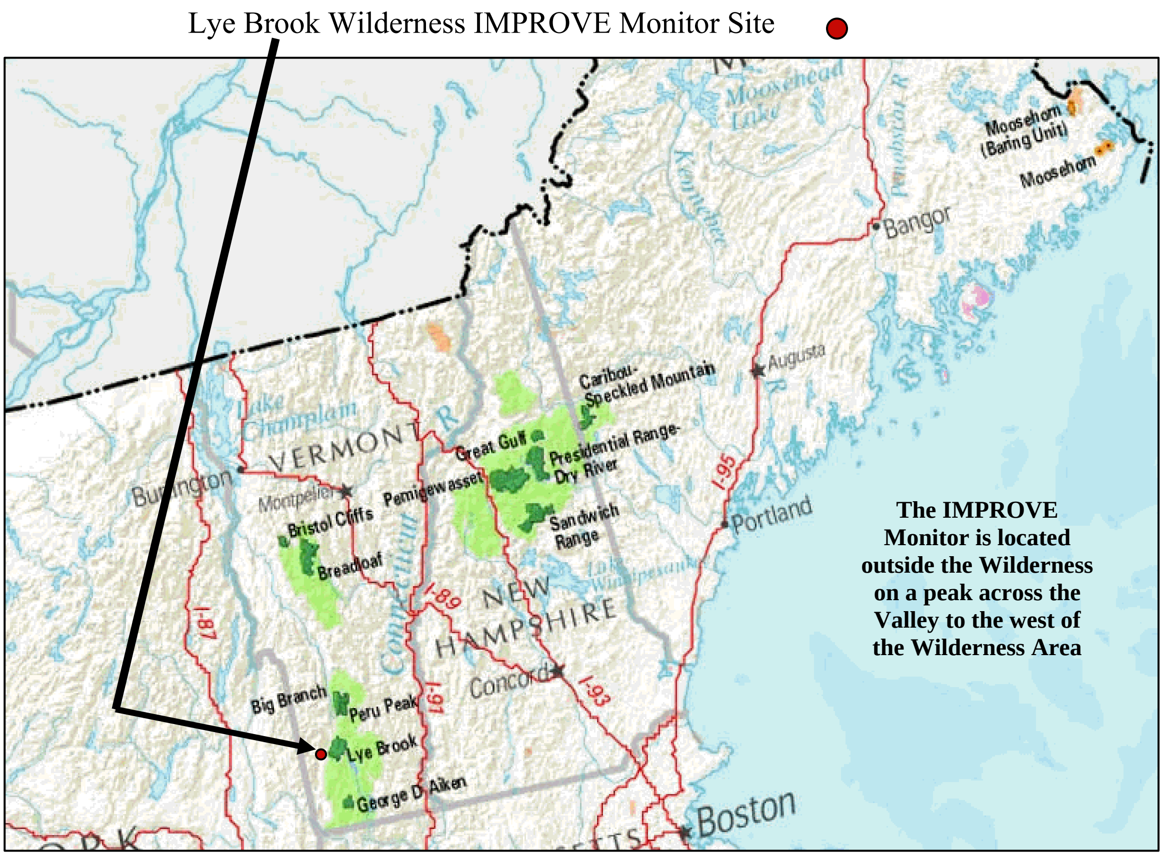


FIGURE 6-11. MAP OF LYE BROOK WILDERNESS AREA AND THE IMPROVE MONITORING SITE

(source: Paul Wishinski and GoogleEarth)

LYE BROOK WILDERNESS AREA LOCATION & IMPROVE MONITORING SITE

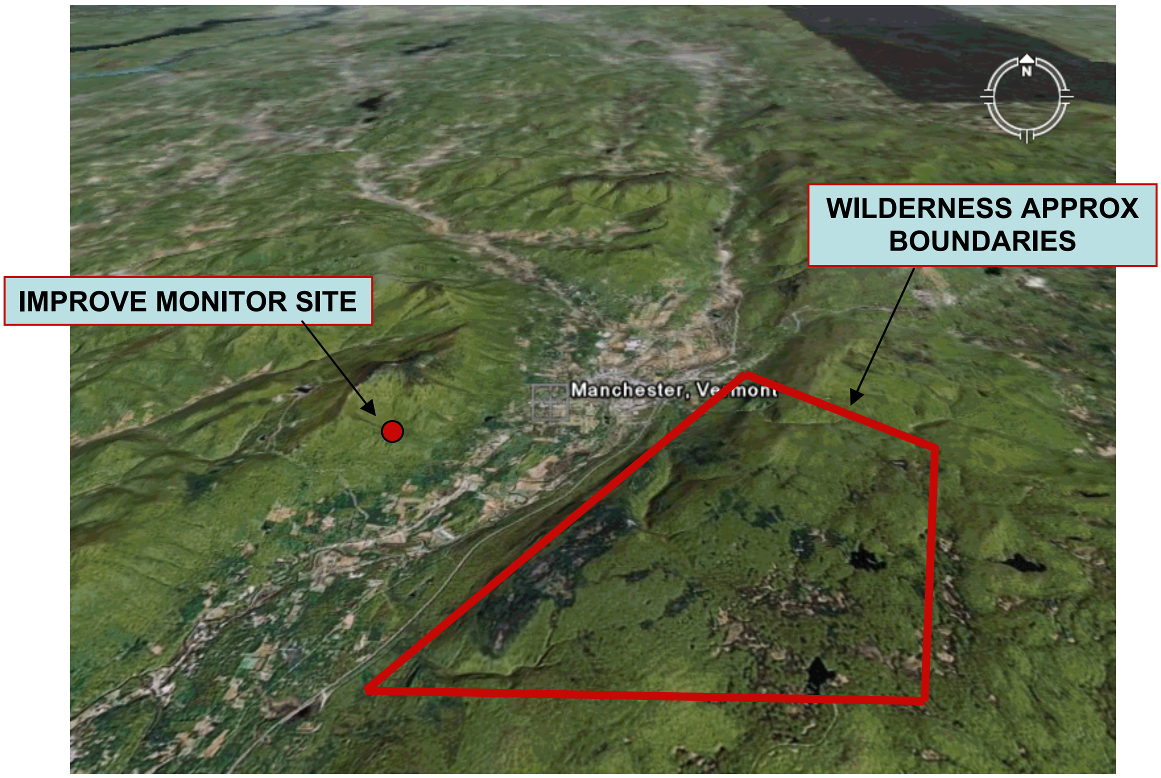


FIGURE 6-12. LYE BROOK WILDERNESS AREA ON A CLEAR DAY
(source: http://www.hazecam.net/class1/lye.html)

FIGURE 6-13. LYE BROOK WILDERNESS AREA ON A HAZY DAY
(source: http://www.hazecam.net/class1/lye.html)

6.2.5 Moosehorn Wilderness Area, Maine - Monitor Location

The IMPROVE monitor for the Moosehorn Wilderness Area (indicated as MOOS1) is located near McConvey Road, about one mile northeast of the National Wildlife Refuge Baring Unit Headquarters in Maine at an elevation of 78 meters, a latitude of 45.13˚ and a longitude of -67.27˚. This monitor also represents the Roosevelt/Campobello International Park in New Brunswick, Canada.

Moosehorn Wilderness Area -Monitoring Strategy

The haze data for Moosehorn Wilderness Area is collected by an IMPROVE monitor (MOOS1) that is operated and maintained by the Fish & Wildlife Service. The State considers the MOOS1 site as the only current IMPROVE monitoring site in Maine adequate for assessing reasonable progress goals of the Moosehorn Wilderness Area and no additional monitoring sites or equipment are necessary at this time. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-14. MAP OF MOOSEHORN WILDERNESS AREA AND WILDLIFE REFUGE

(source: Martha Webster-Maine Department of Environmental Protection-Bureau of Air Quality)
(note: the differentiation between Wilderness Area and Wildlife Refuge)

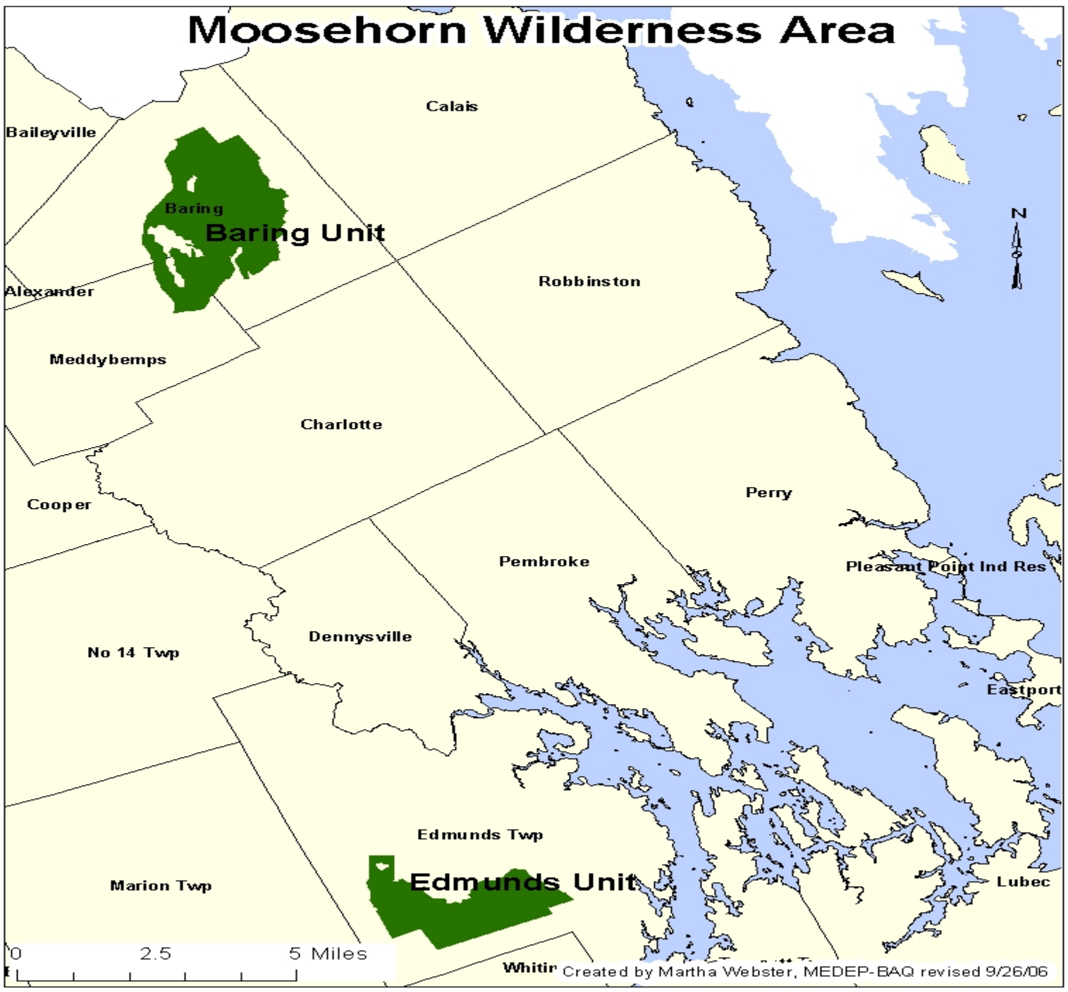


FIGURE 6-15. MAP OF THE BARING AND EDMUNDS DIVISIONS OF THE MOOSEHORN NATIONAL WILDLIFE REFUGE AND THE IMPROVE MONITOR
(source: The Refuge Manager at Moosehorn Wilderness Area)

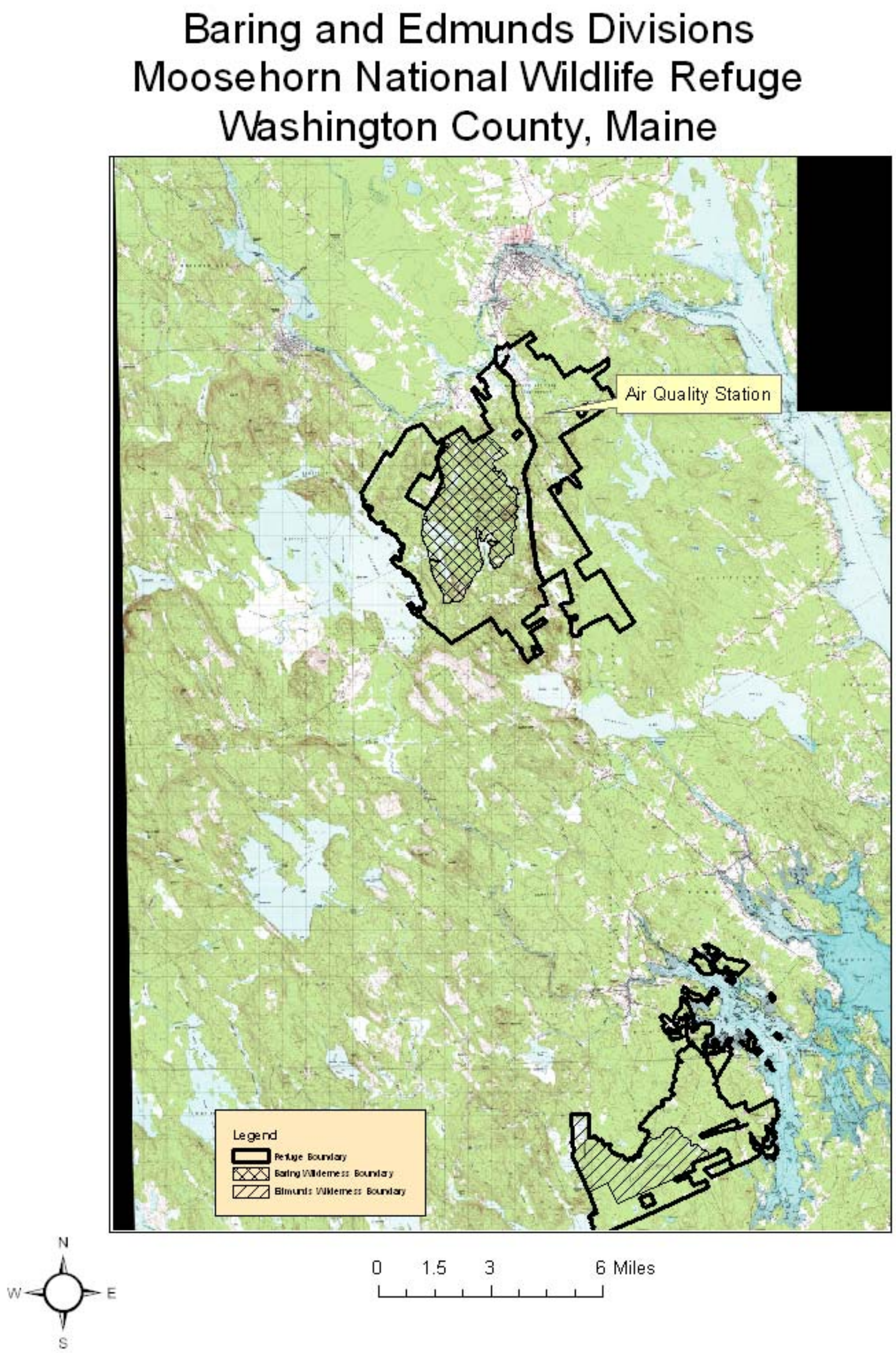
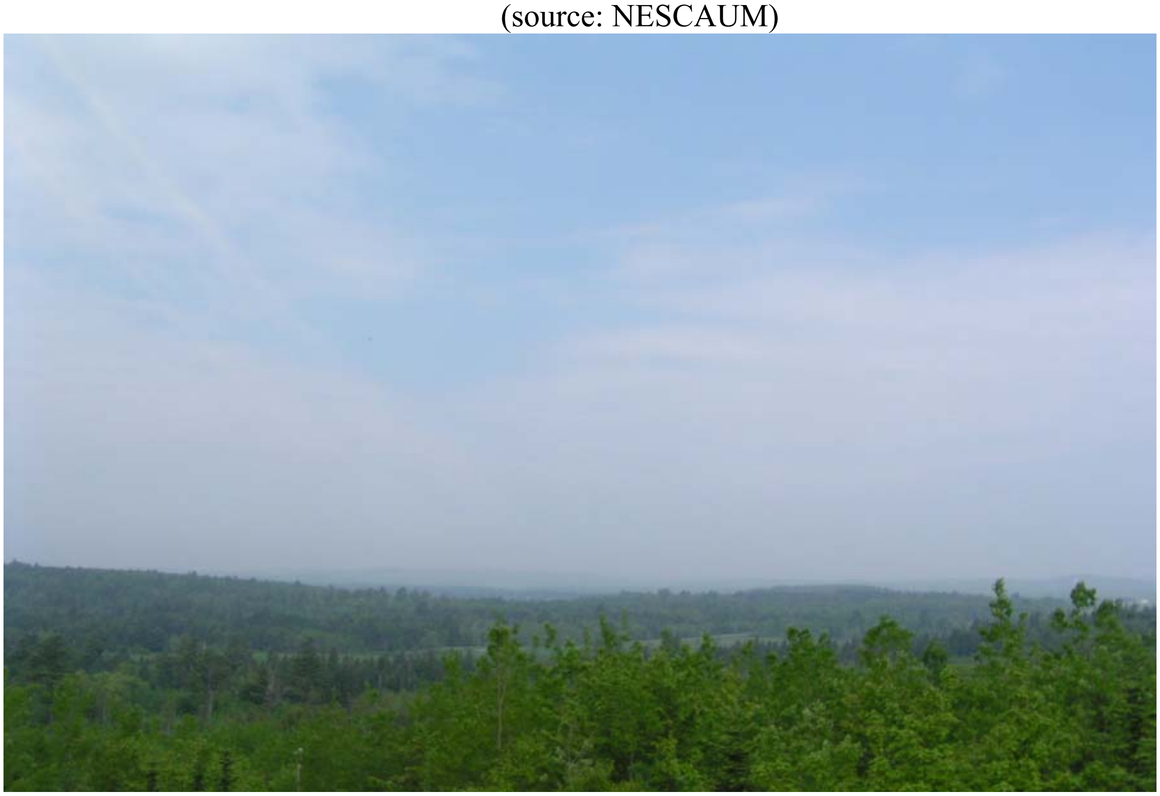


FIGURE 6-16. MOOSEHORN WILDERNESS AREA ON A CLEAR DAY
(source: NESCAUM)

FIGURE 6-17. MOOSEHORN WILDERNESS AREA ON A HAZY DAY
(source: NESCAUM)



6.2.6 Presidential Range/Dry River Wilderness Area, New Hampshire - Monitor Location

The IMPROVE monitor for the Great Gulf Wilderness Area also represents the Presidential Range/Dry River Wilderness Area (indicated as GRGU1). The Presidential Range/Dry River Wilderness Area monitor is located at Camp Dodge, White Mountain NF, South of Gorham New Hampshire, at an elevation of 454 meters, a latitude of 44.31˚ and a longitude of -71.22˚.

Presidential Range/Dry River Wilderness Area - Monitoring Strategy

The haze data Presidential Range/Dry River Wilderness Area is collected by an IMPROVE monitor (GRGU1) that is operated and maintained by the Forest Service. The State considers the GRGU1site as adequate for assessing reasonable progress goals of the Presidential Range/Dry River Wilderness Area and no additional monitoring sites or equipment are necessary. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-18. MAP OF GREAT GULF WILDERNESS AREA AND PRESIDENTIAL RANGE/DRY RIVER WILDERNESS AREA

(source: http://www.maine.gov/dep/air/meteorology/images/NHclass1.jpg)

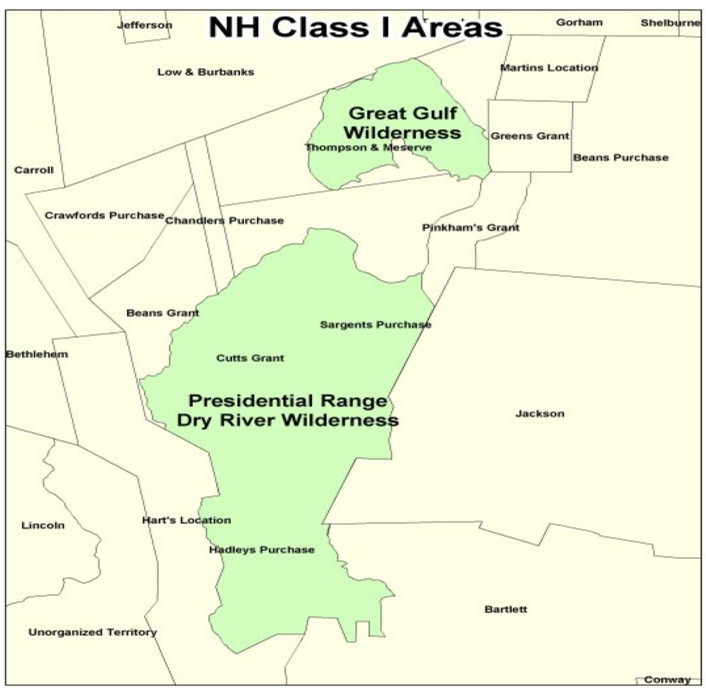


FIGURE 6-19. PRESIDENTIAL RANGE/DRY RIVER WILDERNESS AREA
camera scene shared with Great Gulf Wilderness Area. Since the pictures would be the same for both sites, below is a picture of Presidential Range/Dry River Wilderness Area in autumn (source: http://www.wilderness.net/)

6.2.7. Roosevelt/Campobello International Park, New Brunswick, Canada - Monitor Location

The IMPROVE monitor for the Moosehorn Wilderness Area is also the monitor for Roosevelt/Campobello International Park (indicated as MOOS1). The monitor is located near McConvey Road, about one mile northeast of the Moosehorn National Wildlife Refuge Baring Unit Headquarters in Maine at an elevation of 78 meters, a latitude of 45.13˚ and a longitude of -67.27˚.

Roosevelt/Campobello International Park -Monitoring Strategy

The haze data for Roosevelt/Campobello International Park is collected by the IMPROVE monitor (MOOS1) that is operated and maintained by the U.S. Fish & Wildlife Service. The State considers the MOOS1 site as the only current IMPROVE monitoring site in Maine or Canada adequate for assessing reasonable progress goals of the Roosevelt/Campobello International Park. No additional monitoring sites or equipment are necessary. The State routinely participates in the IMPROVE monitoring program by sending regional representatives to the IMPROVE meetings.

FIGURE 6-20. MAP OF ROOSEVELT/CAMPOBELLO INTERNATIONAL PARK
(source: http://www.maine.gov/dep/air/meteorology/images/rcip.jpg)

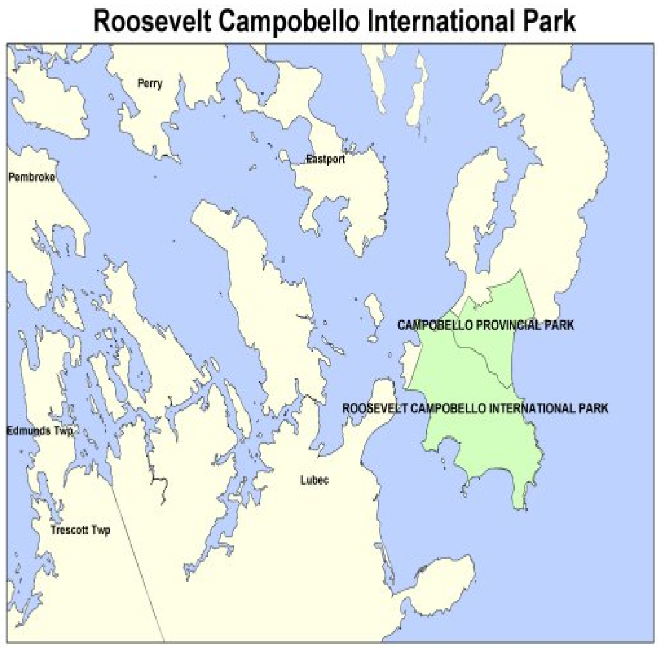


FIGURE 6-21. ROOSEVELT/CAMPOBELLO INTERNATIONAL PARK ON A CLEAR DAY
(source: Chessie Johnson)

FIGURE 6-22. ROOSEVELT/CAMPOBELLO INTERNATIONAL PARK ON A HAZY DAY
(source: Roosevelt Campobello International Park Commission)

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7.0 Emissions Inventory

Section 51.308(d)(4)(v) of EPA's Regional Haze Rule requires a statewide emission inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. The pollutants that affect fine particle formation, and thus contribute to regional haze, are sulfur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOC), ammonia (NH_3), and particles with an aerodynamic diameter less than or equal to 10 and 2.5 µm (i.e., primary PM_{10} and $PM_{2.5}$). The pollutants inventoried by the State of Maryland include volatile organic compounds, nitrogen oxides, fine particles ($PM_{2.5}$), coarse particles (PM_{10}), ammonia, and sulfur dioxides.

7.1 Emission Inventories for Modeling Overview

Section 51.308(d) (3) (iii) of EPA's Regional Haze Rule requires the State of Maryland to identify the baseline emission inventory on which control strategies are based. The baseline inventory is intended to be used to assess progress in making emission reductions. Based on EPA's guidance memorandum, entitled "*2002 Base Year Emission Inventory SIP Planning: 8-hour Ozone, PM $_{2.5}$, and Regional Haze Programs",* 2002 was identified as the anticipated baseline emission inventory year for regional haze.

The State of Maryland submitted their 2002 inventory to EPA on May 28, 2004. Emission inventories are not static documents, but are constantly revised and updated to reflect the input of better emission estimates as they become available. Therefore, even though the 2002 "SIP" inventories and the 2002 "modeling" inventories both represent emissions from 2002, they may contain slightly different emission estimates due to the different time frames they were made available, and the different purposes each serves. For example, the work undertaken by MARAMA noted in Section 7.2 of this document entailed, in some cases, making changes to the emission estimates provided by the states.

MANE-VU and the State of Maryland are using 2002 as the baseline year. Table 7-1 shows the MANE-VU Emissions Inventory Summary for 2002.

Future year inventories were developed for the years 2009 and 2018 based on the 2002 base year. These future year emission inventories include emissions growth due to projected increases in economic activity as well as the emissions reductions due to the implementation of control measures. Table 7-2 shows the MANE-VU Emissions Inventory Summary for 2018.

Accurate baseline and future-year emissions inventories are crucial to the analyses required for the regional haze SIP process. These emissions inventories were used to drive the air quality modeling simulations undertaken to assess the visibility improvements that would result from possible control measures. Air quality modeling was also used to perform a pollution apportionment, which evaluates the contribution to visibility impairment by geographic region and emission source sector.

To be compatible with the air quality modeling simulations, the baseline and future-year emissions inventories were processed with the Sparse Matrix Operator Kernel Emissions (SMOKE) emissions pre-processor for subsequent input into the CMAQ and REMSAD air quality models described in Subsection 8.3. Further description of the base and future-year emissions inventories is provided in the following sections.

7.2 Baseline 2002 Inventory

The 2002 emissions were first generated by the individual states in the MANE-VU area. MARAMA then coordinated and quality assured the 2002 inventory data, and projected it for the relevant control years. The 2002 emissions from non-MANE-VU areas within the modeling domain were obtained from other Regional Planning Organizations for their corresponding areas. These Regional Planning Organizations included the Visibility Improvement State and Tribal Association of the Southeast (VISTAS), the Midwest Regional Planning Organization and the Central Regional Air Planning Association.

Version 3.0 of the 2002 base year emission inventory was used in the regional modeling exercise. Technical support documentation for the MANE-VU 2002 base year modeling inventory is presented in Appendix D-1[2]. This document explains the data sources, methods, and results for preparing this version of the 2002 base year criteria air pollutant and ammonia modeling emissions inventory. MDE's official 2002 base year emission inventory and technical support documentation is presented in Appendix D-2. This document explains the data sources, methods, and results for preparing the 2002 base year regional haze emissions inventory.

The inventory and supporting data prepared includes the following:

1) Comprehensive, county-level, mass emissions and modeling inventories for 2002 emissions for criteria air pollutants and ammonia for the State and Local agencies included in the MANE-VU region.
2) The temporal, speciation, and spatial allocation profiles for the MANE-VU region inventories.
3) Inventories for wildfires, prescribed burning and agricultural field burning for the southeastern provinces of Canada;
4) Inventories for other Regional Planning Organizations, Canada, and Mexico.

The mass emissions Inventory files were converted to the National Emissions Inventory Input Format Version 3.0. As discussed in sub-section 7.4 of this chapter, the modeling inventory files were processed in Sparse Matrix Operator Kernel Emissions/Inventory Data Analyzer (SMOKE).

The inventories include annual emissions for oxides of nitrogen (NO_X), volatile organic compounds (VOC), carbon monoxide, ammonia, particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM10) and PM2.5. The inventories also included summer day, winter day, and average day emissions. However, not all states included daily emissions in their inventories. In these instances, temporal profiles prepared for MANE-VU were used to calculate daily emissions.

[2] "Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3." Pechan, November 2006

Work on Version 1.0 of the 2002 MANE-VU inventory began in April 2004. The consolidated inventory for point, area, onroad, and nonroad sources was prepared starting with the inventories that MANE-VU state/local agencies submitted to the EPA from May through July of 2004 as a requirement of the Consolidated Emissions Reporting Rule. The EPA's format and content quality assurance (QA) programs (and other QA checks not included in EPA's QA software) were run on each inventory to identify format and/or data content issues.[3] A contractor, E.H. Pechan & Associates, Inc. (Pechan), worked with the MANE-VU state/local agencies and the MARAMA staff to resolve QA issues and augment the inventories to fill data gaps in accordance with the Quality Assurance Project Plan prepared for MANE-VU.[4] The final inventory and SMOKE and input files were finalized during January 2005.

Work on Version 2.0 (covering the period from April through September 2005) involved incorporating revisions requested by some MANE-VU state/local agencies on the point, area, and onroad inventories. Work on Version 3.0 (covering the period from December 2005 through April 2007) included additional revisions to the point, area, and onroad inventories as requested by some states. Thus, the Version 3.0 inventory for point, area, and onroad sources was built upon Versions 1.0 and 2.0. This work also included development of the biogenics inventory. In Version 3.0, the nonroad inventory was completely redone because of changes that the EPA made to the NONROAD2005 model. Emissions inventory data files are available on the MARAMA website at: http://www.marama.org/visibility/EI_Projects/index.html

7.2.1 Base Year Emissions Inventory Characteristics

This section summarizes the base year inventory characteristics for emissions of SO_2, VOC, NO_X, PM and ammonia. The emission inventories presented here represent Version 3.0 of the 2002 MANE-VU inventory. The emission characteristics are described by pollutant and source type (e.g., point, area, and mobile).

[3] EPA. Basic Format & Content Checker 3.0 (Formerly known as the Quality Assurance / Quality Control Software 3.0) – March 2004. Extended Quality Control Tool – Updated May 18, 2004. United States Environmental Protection Agency. 2004.

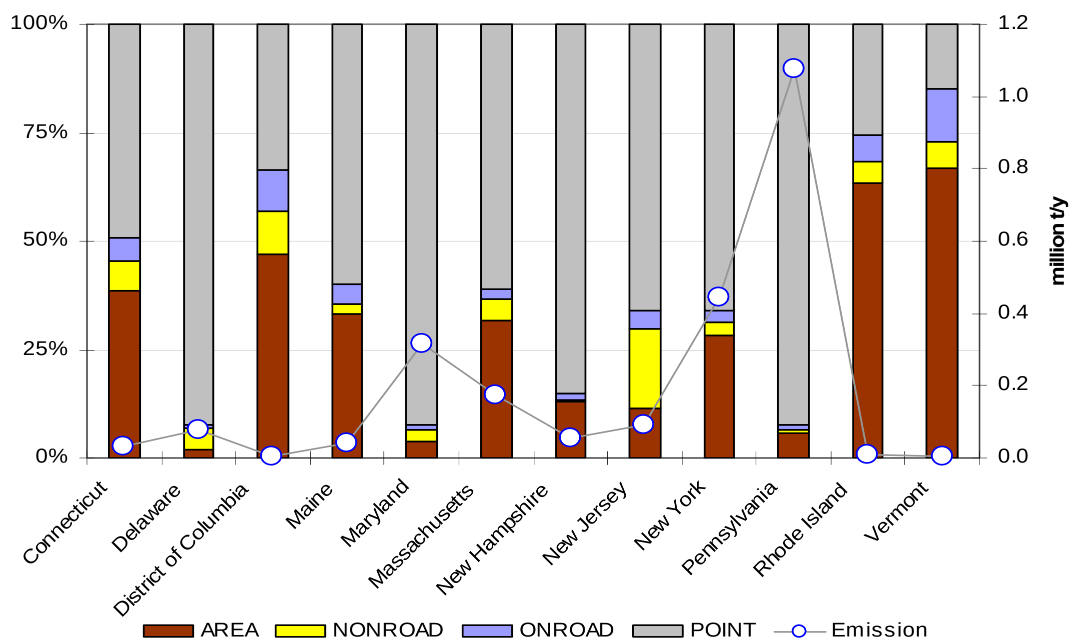
[4] MANE-VU. Quality Assurance Project Plan (QAPP) for Area and Point Source Emissions Modeling Inventory Project, Final. Prepared for the Mid-Atlantic/Northeast Visibility Union by E.H. Pechan & Associates, Inc. and Carolina Environmental Program, August 3, 2004.

7.2.1.1 Sulfur Dioxide (SO_2)

SO_2 is the primary precursor pollutant for sulfate particles. Sulfate particles commonly account for more than 50 percent of particle-related light extinction at northeastern Class I areas on the clearest days and for as much as or more than 80 percent on the haziest days. Hence, SO_2 emissions are an obvious target of opportunity for reducing regional haze in the eastern United States. Combustion of coal and, to a lesser extent, of certain petroleum products accounts for most anthropogenic SO_2 emissions. In fact, in 1998 a single source category, coal-burning power plants, was responsible for two-thirds of total SO_2 emissions nationwide (NESCAUM, 2001a).

Figure 7-1 shows the percent contribution from different source categories to overall, annual 2002 SO_2 emissions in the MANE-VU states. The chart shows that point sources dominate SO_2 emissions, which primarily consist of stationary combustion sources for generating electricity, industrial energy, and heat. Smaller stationary combustion sources called "area sources" (primarily commercial and residential heating, and smaller industrial facilities) are another important source category in the MANE-VU states. By contrast, on-road and non-road mobile sources make only a relatively small contribution to overall SO_2 emissions in the region (NESCAUM, 2001a).

FIGURE 7-1. 2002 SO_2 (BAR GRAPH: PERCENTAGE FRACTION OF FOUR SOURCE CATEGORIES, CIRCLE: ANNUAL EMISSIONS AMOUNT IN 10^6 TONS PER YEAR)



7.2.1.2 Volatile Organic Compounds (VOC)

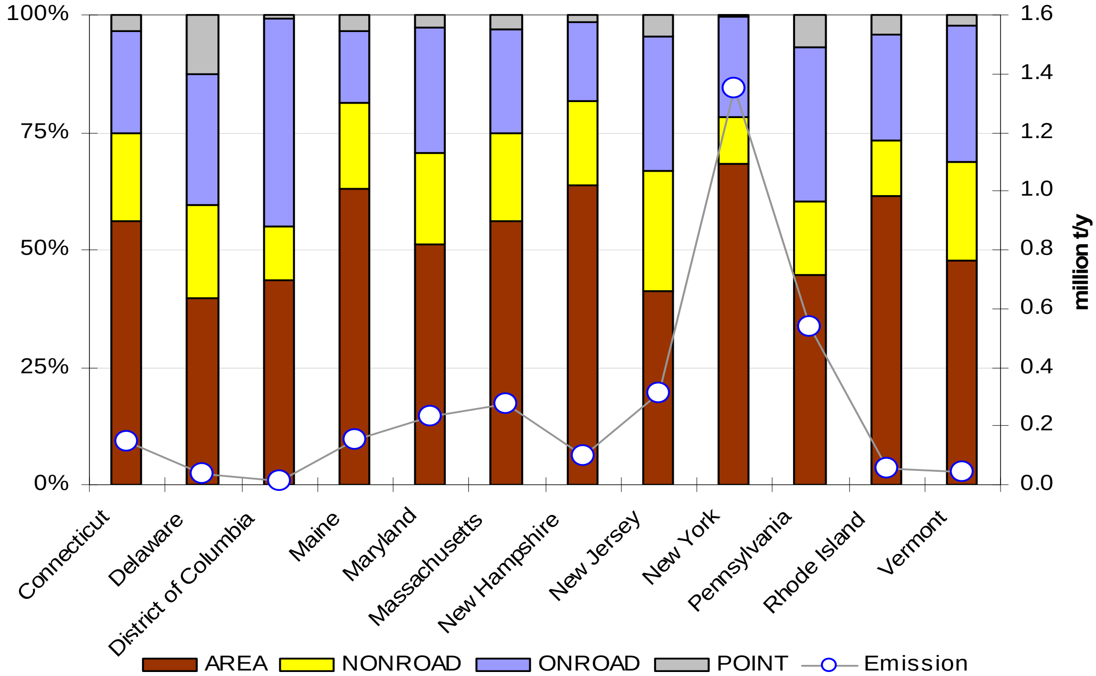
Existing emission inventories generally refer to "volatile organic compounds" (VOCs) for hydrocarbons whose volatility in the atmosphere makes them particularly important from the standpoint of ozone formation. From a regional haze perspective, there is less concern with the volatile organic gases emitted directly to the atmosphere and more with the secondary organic aerosol (SOA) that the VOCs form after condensation and oxidation processes. Thus the VOC inventory category is of interest primarily from the organic carbon perspective of $PM_{2.5}$. After sulfate, organic carbon generally accounts for the next largest share of fine particle mass and particle-related light extinction at northeastern Class I sites. The term organic carbon encompasses a large number and variety of chemical compounds that may come directly from emission sources as a part of primary PM or may form in the atmosphere as secondary pollutants. The organic carbon present at Class I sites includes a mix of species, including pollutants originating from anthropogenic (i.e., manmade) sources as well as biogenic hydrocarbons emitted by vegetation. Recent efforts to reduce manmade organic carbon emissions have been undertaken primarily to address summertime ozone formation in urban centers. Future efforts to further reduce organic carbon emissions may be driven by programs that address fine particles and visibility.

Understanding the transport dynamics and source regions for organic carbon in northeastern Class I areas is likely to be more complex than for sulfate. This is partly because of the large number and variety of OC species, the fact that their transport characteristics vary widely, and the fact that a given species may undergo numerous complex chemical reactions in the atmosphere. Thus, the organic carbon contribution to visibility impairment at most Class I sites in the East is likely to include manmade pollution transported from a distance, manmade pollution from nearby sources, and biogenic emissions, especially terpenes from coniferous forests.

As shown in Figure 7-2, the VOC inventory is dominated by mobile and area sources. On-road mobile sources of VOCs include exhaust emissions from gasoline passenger vehicles and diesel-powered heavy-duty vehicles as well as evaporative emissions from transportation fuels. VOC emissions may also originate from a variety of area sources (including solvents, architectural coatings, and dry cleaners) as well as from some point sources (e.g., industrial facilities and petroleum refineries).

Biogenic VOCs may play an important role within the rural settings typical of Class I sites. The oxidation of hydrocarbon molecules containing seven or more carbon atoms is generally the most significant pathway for the formation of light-scattering organic aerosol particles (Odum et al., 1997). Smaller reactive hydrocarbons that may contribute significantly to urban smog (ozone) are less likely to play a role in organic aerosol formation, though it was noted that high ozone levels can have an indirect effect on visibility by promoting the oxidation of other available hydrocarbons, including biogenic emissions (NESCAUM, January 2001). In short, further work is needed to characterize the organic carbon contribution to regional haze in the Northeast and Mid-Atlantic states and to develop emissions inventories that will be of greater value for visibility planning purposes.

FIGURE 7-2. 2002 VOC (BAR GRAPH: PERCENTAGE FRACTION OF FOUR SOURCE CATEGORIES, CIRCLE: ANNUAL EMISSIONS IN MILLION TONS PER YEAR)



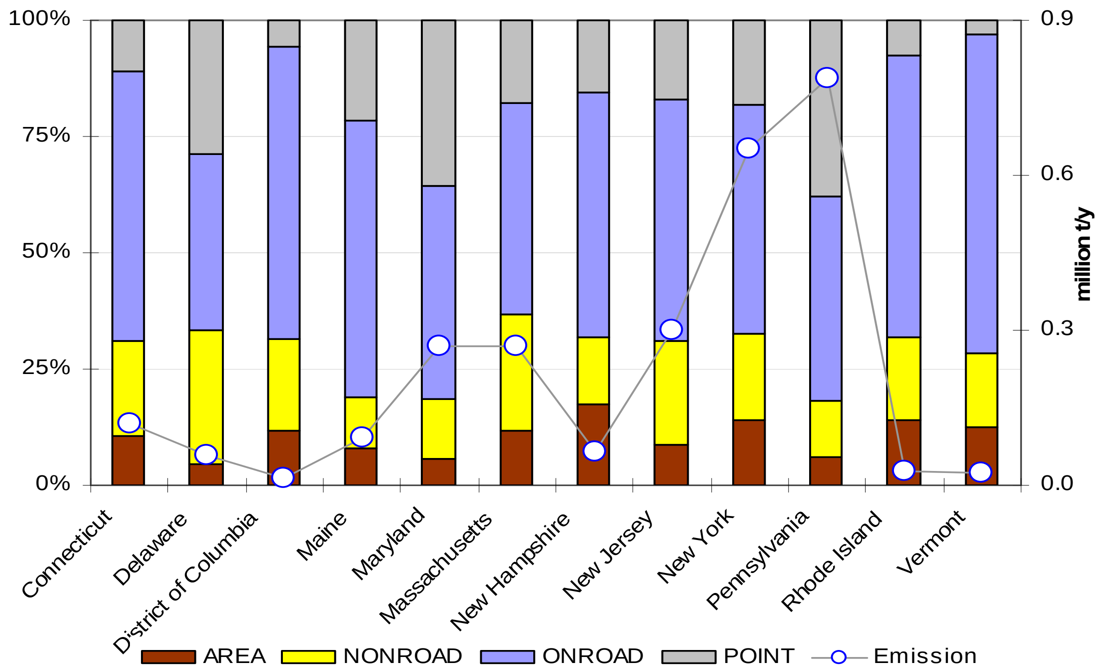
7.2.1.3 Oxides of Nitrogen (NO_X)

NO_X emissions contribute to visibility impairment in the eastern U.S. by forming light-scattering nitrate particles. Nitrate generally accounts for a substantially smaller fraction of fine particle mass and related light extinction than sulfate and organic carbon at northeastern Class I sites. Notably, nitrate may play a more important role at urban sites and in the wintertime. In addition, NO_X may have an indirect effect on summertime visibility by virtue of its role in the formation of ozone, which in turn promotes the formation of secondary organic aerosols (NESCAUM 2001a).

Power plants and mobile sources generally dominate state and national NO_X emissions inventories. Nationally, power plants account for more than one-quarter of all NO_X emissions, amounting to over six million tons. The electric sector plays an even larger role, however, in parts of the industrial Midwest where high NO_X emissions have a particularly significant power plant contribution. By contrast, mobile sources dominate the NO_X inventories for more urbanized Mid-Atlantic and New England states to a far greater extent, as shown in Figure 7-3. In these states, on-road mobile sources - a category that mainly includes highway vehicles - represent the most significant NO_X source category. Emissions from non-road (i.e., off-highway) mobile sources, primarily diesel-fired engines, also represent a substantial fraction of the inventory. While there are fewer uncertainties associated with available NO_X estimates than in the case of other key haze-related pollutants - including primary fine particle and ammonia emissions - further efforts could improve current inventories in a number of areas (NESCAUM, 2001a).

In particular, better information on the contribution of area and non-highway mobile sources may be of most interest in the context of regional haze planning. First, available emission estimation methodologies are weaker for these types of sources than for the large stationary combustion sources. Moreover, because SO_2 and NO_X emissions must mix with ammonia to participate in secondary particle formation, emissions that occur over large areas at the surface may be more efficient in secondary fine particulate formation than concentrated emissions from isolated tall stacks (Duyzer, 1994).

FIGURE 7-3. NO_X (BAR GRAPH: PERCENTAGE FRACTION OF FOUR SOURCE CATEGORIES, CIRCLE: ANNUAL EMISSIONS AMOUNT IN 10^6 TONS PER YEAR)



7.2.1.4 Primary Particle Matter (PM_{10} and $PM_{2.5}$)

Directly-emitted or "primary" particles (as distinct from secondary particles that form in the atmosphere through chemical reactions involving precursor pollutants like SO_2 and NO_X) can also contribute to regional haze. For regulatory purposes, a distinction is made between particles with an aerodynamic diameter less than or equal to 10 micrometers and smaller particles with an aerodynamic diameter less than or equal to 2.5 micrometers (i.e., primary PM_{10} and $PM_{2.5}$, respectively).

Crustal sources are significant contributors of primary PM emissions. This category includes fugitive dust emissions from construction activities, paved and unpaved roads, and agricultural tilling. Typically, monitors estimate PM_{10} emissions from these types of sources by measuring the horizontal flux of particulate mass at a fixed downwind sampling location within perhaps 10 meters of a road or field. Comparisons between estimated emission rates for fine particles using these types of measurement techniques and observed concentrations of crustal matter in the ambient air at downwind receptor sites suggest that physical or chemical processes remove a significant fraction of crustal material relatively quickly. As a result, it rarely entrains into layers of the atmosphere where it can transport to downwind receptor locations. Because of this discrepancy between estimated emissions and observed ambient concentrations, modelers typically reduce estimates of total $PM_{2.5}$ emissions from all crustal sources by applying a factor of 0.15 to 0.25 to the total $PM_{2.5}$ emissions before including it in modeling analyses.

From a regional haze perspective, crustal material generally does not play a major role. On the 20 percent best-visibility days during the baseline period (2000-2004), it accounted for six to eleven percent of particle-related light extinction at MANE-VU Class 1 sites. On the 20 percent worst-visibility days, however, crustal material generally plays a much smaller role relative to other haze-forming pollutants, ranging from two to three percent. Moreover, the crustal fraction includes material of natural origin (such as soil or sea salt) that is not targeted under the Haze Rule. Of course, the crustal fraction can be influenced by certain human activities, such as construction, agricultural practices, and road maintenance (including wintertime salting) — thus, to the extent that these types of activities are found to affect visibility at northeastern Class I sites, control measures targeted at crustal material may prove beneficial.

Experience from the western United States, where the crustal component has generally played a more significant role in driving overall particulate levels, may be helpful to the extent that it is relevant in the eastern context. In addition, a few areas in the Northeast, such as New Haven, Connecticut and Presque Isle, Maine, have some experience with the control of dust and road-salt as a result of regulatory obligations stemming from their past non-attainment status with respect to the NAAQS for PM_{10}.

Current emissions inventories for the entire MANE-VU area indicate residential wood combustion represents 25 percent of primary fine particulate emissions in the region. This implies that rural sources can play an important role in addition to the contribution from the region's many highly populated urban areas. An important consideration in this regard is that residential wood combustion occurs primarily in the winter months, while managed or prescribed burning activities occur largely in other seasons. The latter category includes agricultural field-burning activities, prescribed burning of forested areas and other burning activities such as construction waste burning. Limiting burning to times when favorable meteorological conditions can efficiently disperse resulting emissions can manage many of these types of sources.

Figure 7-4 and Figure 7-5 show that area and mobile sources dominate primary PM emissions. (The NEI inventory categorizes residential wood combustion and some other combustion sources as area sources.) The relative contribution of point sources is larger in the primary $PM_{2.5}$ inventory than in the primary PM_{10} inventory since the crustal component (which consists mainly of larger or "coarse-mode" particles) contributes mostly to overall PM_{10} levels. At the same time, pollution control equipment commonly installed at large point sources is usually more efficient at capturing coarse-mode particles.

FIGURE 7-4. PRIMARY PM_{10} (BAR GRAPH: PERCENTAGE FRACTION OF FOUR SOURCE CATEGORIES, CIRCLE: ANNUAL EMISSIONS AMOUNT IN 10^6 TPY)

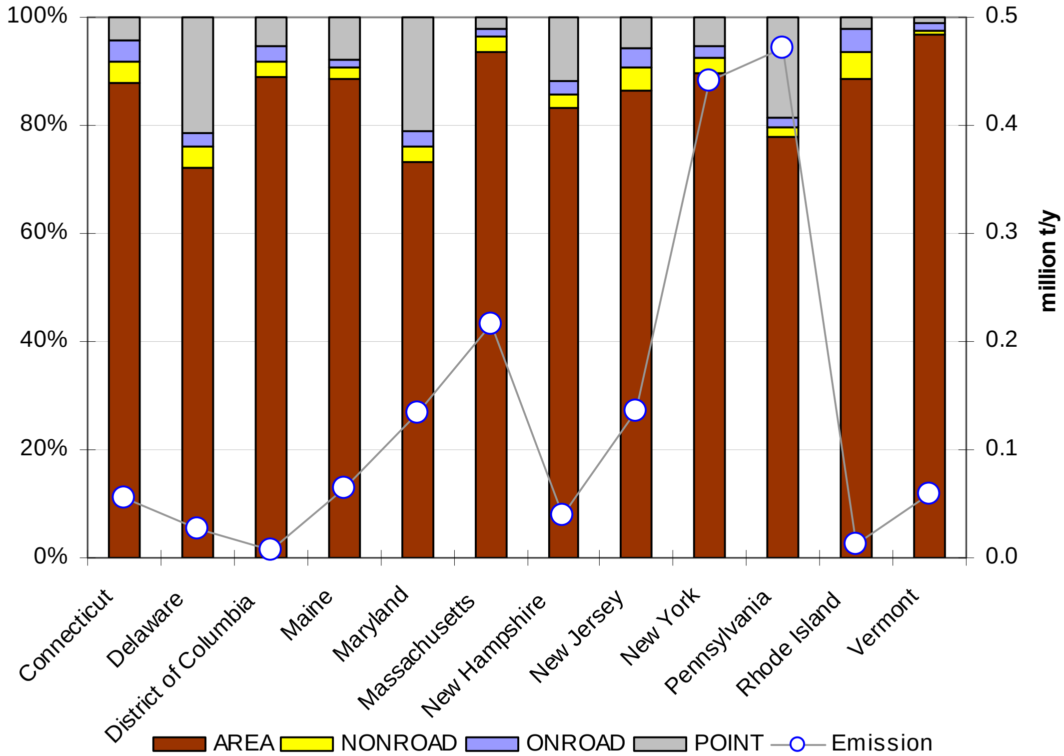
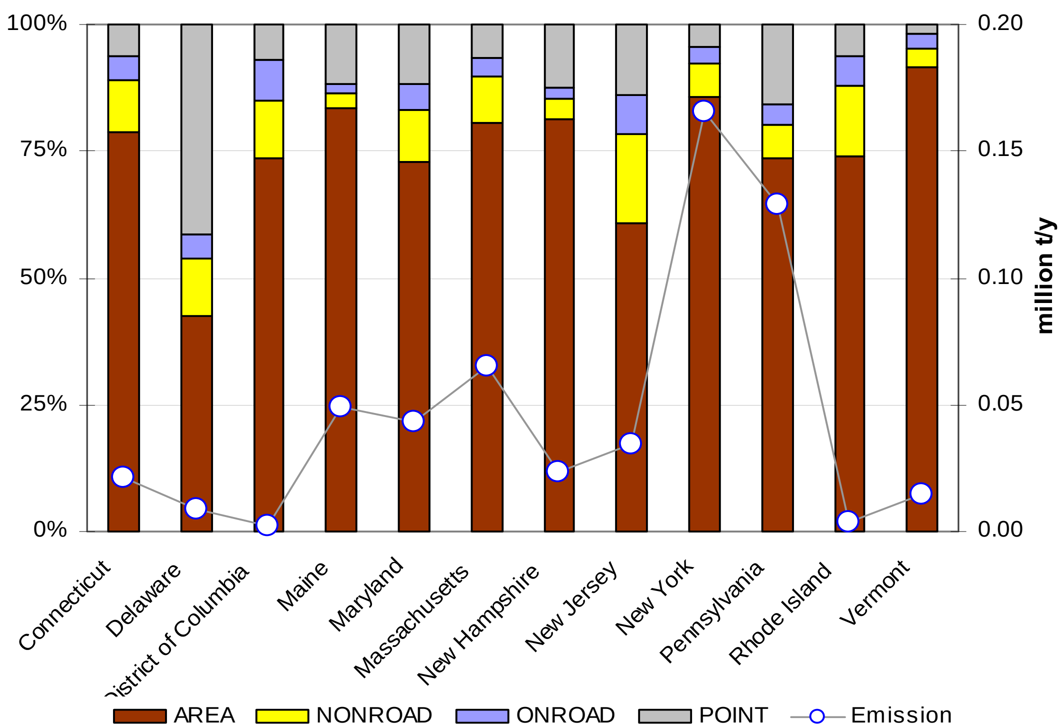


FIGURE 7-5. PRIMARY $PM_{2.5}$ (BAR GRAPH: PERCENTAGE FRACTION OF FOUR SOURCE CATEGORIES, CIRCLE: ANNUAL EMISSIONS AMOUNT IN 10^6 TPY)



7.2.1.5 Ammonia Emissions (NH_3)

Knowledge of ammonia emission sources will be necessary in developing effective regional haze reduction strategies because of the importance of ammonium sulfate and ammonium nitrate in determining overall fine particle mass and light scattering. According to 1998 estimates, livestock agriculture and fertilizer use accounted for approximately 86 percent of all ammonia emissions to the atmosphere (EPA, 2000b). However, better ammonia inventory data is needed for the photochemical models used to simulate fine particle formation and transport in the eastern United States. States were not required to include ammonia in their air emissions data collection efforts until fairly recently (see consolidated emissions reporting rule, 67 FR 39602; 6/10/2002), and so it will take time for the quality of ammonia inventory data to match the quality of the data for the other criteria pollutants.

Ammonium ion (formed from ammonia emissions to the atmosphere) is an important constituent of airborne particulate matter, typically accounting for 10–20 percent of total fine particle mass. Reductions in ammonium ion concentrations can be extremely beneficial because a more-than-proportional reduction in fine particle mass can result. Ansari and Pandis (1998) showed that a one $\mu g/m^3$ reduction in ammonium ion could result in up to a four $\mu g/m^3$ reduction in fine particulate matter. Decision makers, however, must weigh the benefits of ammonia reduction against the significant role it plays in neutralizing acidic aerosol.[5]

To address the need for improved ammonia inventories, MARAMA, NESCAUM and EPA funded researchers at Carnegie Mellon University (CMU) in Pittsburgh to develop a regional ammonia inventory (Davidson et al., 1999). This study focused on three issues with respect to current emissions estimates: (1) a wide range of ammonia emission factor values, (2) inadequate temporal and spatial resolution of ammonia emissions estimates, and (3) a lack of standardized ammonia source categories.

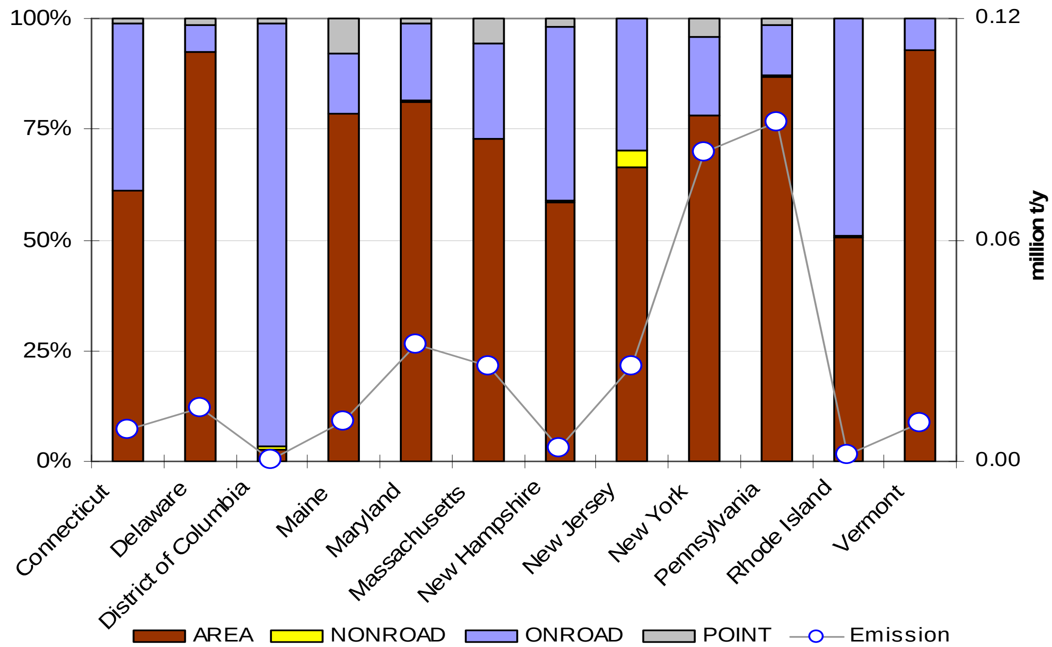
The CMU project established an inventory framework with source categories, emissions factors, and activity data that are readily accessible to the user. With this framework, users can obtain data in a variety of formats[6] and can make updates easily, allowing additional ammonia sources to be added or emissions factors to be replaced as better information becomes available (Strader et al., 2000; NESCAUM, 2001b).

Figure 7-6 shows that area and on-road mobile sources dominate ammonia emissions. Specifically, emissions from agricultural sources and livestock production account for the largest share of estimated ammonia emissions in the MANE-VU region, except in the District of Columbia. The two remaining sources with a significant emissions contribution are wastewater treatment systems and gasoline exhaust from highway vehicles.

[5] SO_2 reacts in the atmosphere to form sulfuric acid (H_2SO_4). Ammonia can partially or fully neutralize this strong acid to form ammonium bisulfate or ammonium sulfate. If planners focus future control strategies on ammonia and do not achieve corresponding SO_2 reductions, fine particles formed in the atmosphere will be substantially more acidic than those presently observed.

[6] For example, the user will have the flexibility to choose the temporal resolution of the output emissions data or to spatially attribute emissions based on land-use data.

FIGURE 7-6. NH3 (BAR GRAPH: PERCENTAGE FRACTION OF FOUR SOURCE CATEGORIES, CIRCLE: ANNUAL EMISSIONS AMOUNT IN 106 TPY)



7.3 Future Year Emission Control Inventories

An inventory technical support document for the MANE_VU future modeling inventories is included in Appendix E-1[7] and explains the data sources, methods, and results for future year emission forecasts for three years; four emission sectors; two emission control scenarios; seven pollutants; and eleven states plus the District of Columbia. The following is a summary of the future year inventories that were developed:

- ***Projection years:*** 2009, 2012, and 2018;
- ***Emission source sectors:*** The five source sectors are Point Source Electric Generating Units (EGUs), Point Source Non-electrical Generating Units (non EGUs), Area Sources, Non-road Mobile Sources and On-road Mobile Sources. MANE-VU prepared EGU projections using the Integrated Planning Model (IPM) and onroad mobile source projections using the SMOKE emission modeling system.
- ***Emission control scenarios:***
    - o A combined on-the-books/on-the-way (OTB/OTW) control strategy accounting for emission control regulations already in place as of June 15, 2005, as well as some emission control regulations that are not yet finalized but are expected to achieve additional emission reductions by 2009; and

[7] "Development of Emissions Projections For 2009, 2012, and 2018 for Non-EGU Point, Area, and Non-Road Sources in the MANE-VU Region." MACTEC, February 2007.

- A beyond-on-the-way (BOTW) scenario to account for controls from potential new regulations that may be necessary to meet attainment and other regional air quality goals, mainly for ozone.
- An updated scenario (sometimes referred to as "best-and-final") to account for additional potentially reasonable control measures. For the MANE-VU region, these include: SO_2 reductions at a set of 167 EGUs which were identified as contributing to visibility impairment at northeast Class I areas; implementation of a low-sulfur fuel strategy for non-EGU sources; and implementation of a Best Available Retrofit Technology (BART) strategy for BART-eligible sources not controlled under other programs.

(Note: Refer to Section 12, Long-Term Strategy, for detailed descriptions of specific control strategies.)

- ***Pollutants*****:** ammonia, carbon monoxide (CO), oxides of nitrogen (NO_X), sulfur dioxide (SO_2), volatile organic compounds (VOCs), fine particulate matter ($PM_{2.5}$, sum of filterable and condensable components), and coarse particulate matter (PM_{10}, sum of filterable and condensable components).
- ***States*****:** Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont, plus the District of Columbia (all members of the MANE-VU region).

7.4 Inventories for Specific Source Types

There are five emission source classifications in the emissions inventory as follows:

Stationary point,
Stationary area,
Off-road mobile,
Highway mobile, and
Biogenic.

Stationary point sources are large sources that emit greater than a specified tonnage per year. Stationary area sources are those sources whose emissions are relatively small but due to the large number of these sources, the collective emissions could be significant. (i.e., dry cleaners, service stations, agricultural sources, fire emissions, etc.) Off-road mobile sources are equipment that can move but do not use the roadways, i.e., lawn mowers, construction equipment, railroad locomotives, aircraft, etc. On-road mobile sources are automobiles, trucks, and motorcycles that use the roadway system. The emissions from these sources are estimated by vehicle type and road type. Biogenic sources are natural sources like trees, crops, grasses and natural decay of plants. Stationary point sources emission data is tracked at the facility level. For all other source types emissions are summed on the county level.

7.4.1 Stationary Point Sources

Point source emissions are emissions from large individual sources. Generally, point sources have permits to operate and their emissions are individually calculated based on source specific factors on a regular schedule. The largest point sources are inventoried annually. These are considered to be major sources having emissions of 100 tons per year (tpy) of a criteria pollutant, 10 tpy of a single hazardous air pollutant (HAP), or 25 tpy total HAP. Emissions from smaller sources are also calculated individually but less frequently. Point sources are grouped into EGU sources and other industrial point sources, termed as non-EGU point sources.

7.4.1.1 Electricity Generating Units

The base year inventory for EGU sources used 2002 continuous emissions monitoring (CEM) data reported to the EPA in compliance with the Acid Rain program or 2002 hourly emission data provided by stakeholders. These data provide hourly emissions profiles that can be used in the modeling of emissions of SO_2 and NO_X from these large sources. Emission profiles are used to estimate emissions of other pollutants (volatile organic compounds, carbon monoxide, ammonia, fine particles, soil) based on measured emissions of SO_2 and NO_X.

Future year inventories of EGU emissions for 2009 and 2018 were developed using the IPM model to forecast growth in electric demand and replacement of older, less efficient and more polluting power plants with newer, more efficient and cleaner units.

While the output of the IPM model predicts that a certain number of older plants will be replaced by newer units to meet future electric growth and State-by-State NO_X and SO_2 caps, the State of Maryland did not directly rely upon the closure of any particular plant in establishing the 2018 inventory upon which the reasonable progress goals were set.

The IPM model results are not the basis upon which to reliably predict plant closures. Specific plant closures in the State of Maryland are addressed in the “Reasonable Progress” section of this document.

7.4.1.2 Non-Electricity Generating Units

The non-EGU category used annual emissions as reported for the Consolidated Emission Reporting Rule (CERR) for the base year 2002. These emissions were temporally allocated to month, day, and source category code (SCC) based allocation factors.

The general approach for estimating future year emissions was to use growth and control data consistent with EPA protocols. This data was supplemented with site-specific growth factors as appropriate.

7.4.2 Quasi-Point Sources

The Maryland Department of the Environment Air and Radiation Management has identified several facilities that do not meet standard criteria for point sources but due to size and/or function are considered point sources. These establishments contain a wide variety of air emission sources, including traditional point sources, on-road mobile sources, off-road mobile sources and area sources. For each particular establishment, the emissions from these sources are totaled under a single point source and summary documents include these "quasi-point" sources as point sources. Quasi-point sources in Maryland include:

- Aberdeen Proving Grounds (military base),
- Andrews Air Force Base (military base),
- Baltimore/Washington International airport, and the
- Port of Baltimore.

7.4.3 Stationary Area Sources

Stationary area sources include sources whose individual emissions are relatively small but due to the large number of these sources, the collective emissions are significant. Some examples include the combustion of fuels for heating, dry cleaners, and service stations. Emissions are estimated by multiplying an emission factor by some known indicator of collective activity, such as fuel usage, or number of households or population.

The general approach for estimating future year emissions was to use growth and control data consistent with EPA's protocols. This data was supplemented with state specific growth factors as appropriate.

7.4.4 Off-Road Mobile Sources

Non-road mobile sources are equipment that can move but do not use the roadways, such as construction equipment, aircraft, railroad locomotives, lawn and garden equipment. For the majority of the non-road mobile sources, the emissions for base year 2002 were estimated using the EPA's Non-Road model. The Non-Road model considers that a certain number of non-road sources will be replaced every year by newer, less polluting vehicles that meet the new EPA standards for off-road sources.

These lower emissions have been built into the 2018 inventory as well as the benefits received from lower sulfur gasoline in off-road vehicles. Aircraft engine, railroad locomotives and commercial marine are not included in Mobile6. For these sources growth and control data consistent with EPA's protocols were used. This data was supplemented with state specific growth factors as appropriate.

7.4.5 Highway Mobile Sources

For on-road vehicles, MOBILE6.2 was used to estimate emissions. For future year emissions the model considers that a certain number of the vehicle fleet in each State will be replaced every year by newer, less polluting vehicles that meet the EPA Tier II motor vehicle standards. These lower emissions have been built into the 2018 inventory as well as the benefits received from lower sulfur gasoline in on-road diesel and gasoline vehicles and the 2007 heavy-duty diesel standards. All new mobile source measures and standards, as well as any benefits from implementation of individual State Inspection and Maintenance programs, were used in developing the 2018 inventory.

7.4.6 Biogenic Emission Sources

Biogenic emissions were estimated using SMOKE-BEIS3 (Biogenic Emission Inventory System 3 version 0.9) preprocessor. Further information on Biogenic emissions estimation is contained in the modeling section of this document.

7.5 Emission Processor Selection and Configuration (SMOKE)

The mass emissions inventory files were converted to the National Emissions Inventory Input Format Version 3.0. As discussed in great detail in Chapters 9 and 10 and Appendix F [8] the modeling inventory files were processed in Sparse Matrix Operator Kernel Emissions/Inventory Data Analyzer (SMOKE).

The SMOKE Processing System is principally an emissions processing system, as opposed to a true emissions inventory preparation system, in which emissions estimates are simulated from "first principles." This means that, with the exception of mobile and biogenic sources, its purpose is to provide an efficient, modern tool for converting emissions inventory data into the formatted emissions files required for a photochemical air quality model.

Inside the MANE-VU region, the modeling inventories were processed by the NYSDEC using the SMOKE (Version 2.1) processor to provide inputs for the CMAQ model.

A detailed description of all SMOKE input files such as area, mobile, fire, point and biogenic emissions files and the SMOKE model configuration are provided in Appendix F [9].

The MANE-VU member states selected several control strategies for inclusion in the modeling demonstration. Emission reduction requirements mandated by the Clean Air Act were also included in projecting future year emissions.

[8] This is the Final Modeling Documentation that NESCAUM is working on. It should be completed by late Spring 2008

7.6 Summary of Emissions Inventories

Table 7-1 MANE-VU 2002 Emissions Inventory Summary

Source Sector	VOC	NO_X	PM2.5-FIL	PM2.5-PRI	PM10-FIL	PM10-PRI	NH3	SO_2
Point	97,300	673,660	17,083	55,447	38,654	89,150	6,194	1,907,634
Area	1,528,141	262,477	153,243	332,729	1,172,909,	1,455,311	249,795	316,357
On-Road	788,560	1,308,233	-	22,107	-	31,561	52,984	40,091
Non-Road Mobile	572,751	431,632	-	30,084	-	40,114	287	57,257
Biogenics	2,575,232	28,396	-	-	-	-	-	-
TOTAL	5,561,985	2,704,397	170,326	440,367	1,211,563	1,616,136	309,260	2,321,338

Source: Pechan, 2006. "Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3.0." November 20, 2006.
*FIL: Filterable PM
**PRI: Primary PM
Available online: http://www.marama.org/visibility/Inventory%20Summary/2002EmissionsInventory.htm

Table 7-2 MANE-VU 2018 OTB/OTW Emissions Inventory Summary

Source Sector	VOC	NO_X	PM2.5	PM10	NH3	SO_2
Non-EGU	110,524	237,802	41,220	63,757	4,986	270,433
EGU	4,528	175,219	65,558	52,360	6,148	320,651
Area	1,387,882	284,535	345,419	1,614,476	341,746	305,437
On-Road	269,981	303,955	9,189	9,852	66,476	5,757
Non-Road Mobile	380,080	271,185	23,938	27,059	369	8,643
Biogenics	2,575,232,	28,396	-	-	-	-
TOTAL	4,728,227	1,301,092	485,324	1,767,504	419,725	913,921

Source: MACTEC, 2007. "Development of Emission Projections for 2009, 2012, and 2018 for nonEGU Point, Area, and Nonroad Sources in the MANE-VU Region." February 28, 2007
EGU Point Emissions: VISTAS_PC_1f IPM Run (Alpine Geophysics, 2008)
Available online: http://www.marama.org/visibility/Inventory%20Summary/FutureEmissionsInventory.htm

Table 7-3 Maryland 2002 Base Year Emissions Inventory Summary

Source Sector	VOC	NO_X	PM2.5-FIL	NH3	SO_2
Point	6,189	95,343	7,594	305	290,975
Quasi-Point*	702	3,732	341	0	2,022
Area	91,535	15,336	25,251	25,628	12,343
Non-Road Mobile	2,289	6,178	1,349	0	1,299
Non-Road Mobile Model	53,270	27,862	2,958	29	2,427
On-road Mobile	61,084	146,126	2,397	5,537	4,901
TOTAL	215,069	294,576	39,890	31,500	313,968

*See section 7.4.2

Table 7-4 Maryland 2018 OTB/OTW Future Year Emissions Inventory Summary

Source Sector	VOC	NO_X	PM2.5-FIL	NH3	SO_2
Point	8,313	50,175	9,473	410	82,957
Quasi-Point*	1,084	5,495	618	0	2,860
Area	84,109	17,419	28,671	38,025	14,164
Non-Road Mobile	2,678	4,535	1,535	0	1,546
Non-Road Mobile Model	33,002	16,278	1,678	39	42
On-road Mobile	20,861	29,371	1,045	7,279	682
TOTAL	150,047	123,273	43,019	45,754	102,251

*See section 7.4.2

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EPA 2005, http://www.epa.gov/ttn/chief/eiinformation.html.

8.0 Air Quality Modeling

Air quality modeling to assess regional haze has been performed cooperatively between Maryland and its regional planning organization, MANE-VU, with major modeling being conducted by NESCAUM. The modeling efforts include emissions processing, meteorological input analysis, and chemical transport modeling to perform regional air quality simulations for calendar year 2002 and several future periods, including the primary target date, 2018, for this SIP. Modeling was conducted in order to assess contributions from upwind to the Class I areas as well as Maryland's contribution to Class I areas in downwind states. Further, the modeling evaluated visibility benefits of specific control measures being considered to achieve reasonable progress goals and establish a long-term emissions management strategy for MANE-VU Class I Areas.

Several modeling tools were utilized for these analyses:

- The Fifth-Generation Pennsylvania State University/National Center for Atmospheric Research (NCAR) Mesoscale Model (MM5) was used to derive the required meteorological inputs for the air quality simulations.
- The Sparse Matrix Operator Kernel Emissions (SMOKE) emissions modeling system was used to process and format the emissions inventories for input into the air quality models.
- The Community Mesoscale Air Quality model (CMAQ) was used for the primary SIP modeling.
- The Regional Modeling System for Aerosols and Deposition (REMSAD) was used during contribution apportionment.
- The California Puff Model (CALPUFF) was used to assess the contribution of individual states' emissions to sulfate levels at selected Class I receptor sites.

Each of these tools has been evaluated and found to perform adequately. The SIP-pertinent modeling underwent full performance testing, and the results were found to meet the specifications of EPA modeling guidance.

For more details on the regional haze modeling, refer to the NESCAUM report, "MANE-VU Modeling for Reasonable Progress Goals: Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits," February 7, 2008 (Appendix L). The detailed modeling approach for the most recent 2018 projections can be found in NESCAUM's "2018 Visibility Projections," May 13, 2008 (Appendix M).

8.1 Meteorology

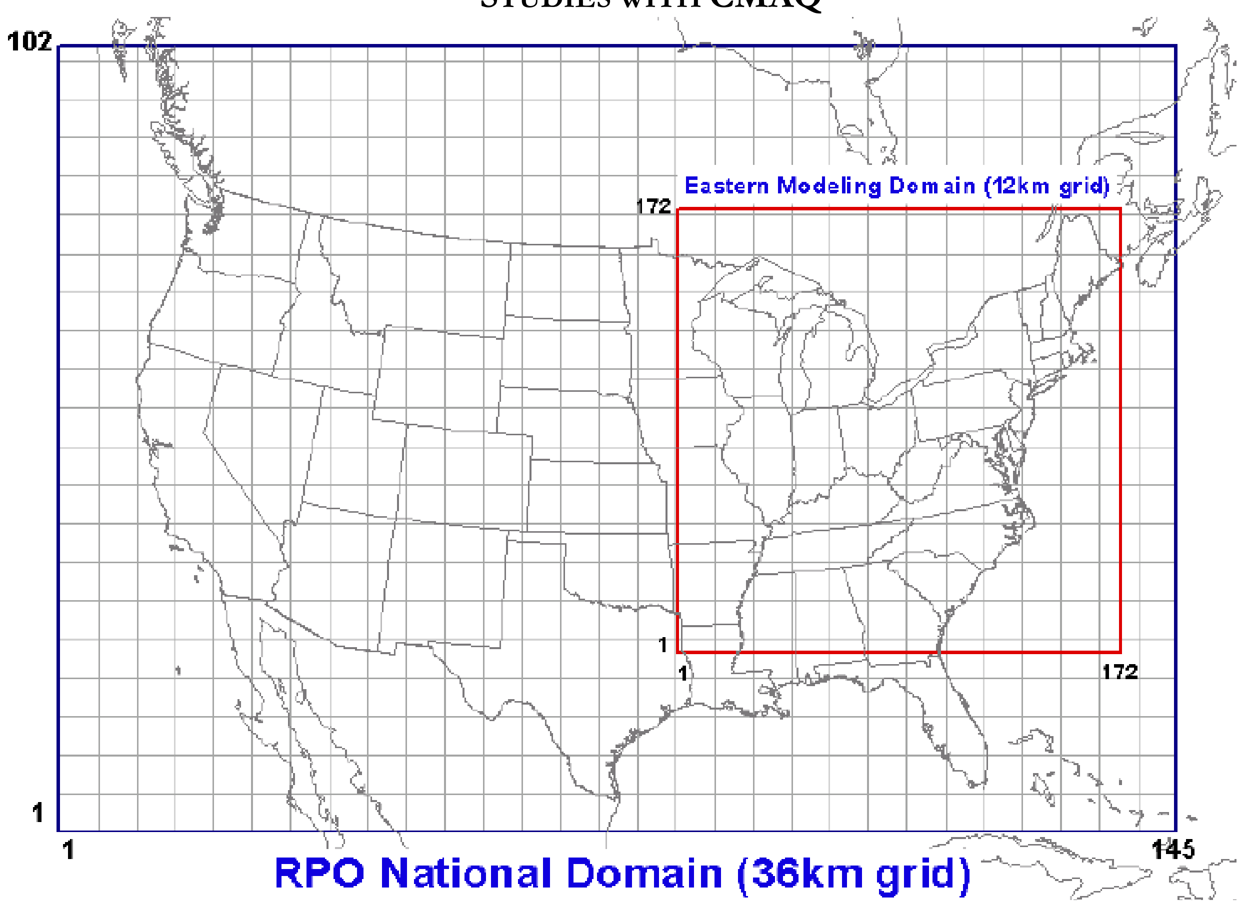
The meteorological inputs for the air quality simulations were developed by the University of Maryland (UMD) using the MM5 meteorological modeling system. Meteorological inputs were generated for 2002 to correspond with the baseline emissions inventory and analysis year. The MM5 simulations were performed on a nested grid (Figure 8.1). The modeling domain is composed of a 36-km, 145 x 102 continental grid and a nested 12-km, 172 x 172 grid encompassing the eastern United States and parts of Canada. In cooperation with the New York State Department of Conservation (NYSDEC), an assessment was made for the period of May-

September 2002 to compare the MM5 predictions with observations from a variety of data sources, including:

- Surface observations from the National Weather Service and the Clean Air Status and Trends Network (CASTNET),
- Wind-profiler measurements from the Cooperative Agency Profilers (CAP) network,
- Satellite cloud image data from the UMD Department of Atmospheric and Oceanic Science, and
- Precipitation data from the Earth Observing Laboratory at NCAR.

Further details regarding the MM5 meteorological processing and the modeling domain can be found in NYSDEC's technical support document TSD-1a, "Meteorological Modeling Using Penn State/NCAR 5th Generation Mesoscale Model (MM5)," February 1, 2006 (Appendix R), and in the NESCAUM report, "MANE-VU Modeling for Reasonable Progress Goals, Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits," February 7, 2008 (Appendix L).

FIGURE 8.1: MODELING DOMAINS USED IN MANE-VU AIR QUALITY MODELING STUDIES WITH CMAQ



Note: Outer (blue) domain is 36-km grid. Inner (red) domain is 12-km grid. Gridlines are shown at 180-km intervals (5×5 36-km cells and 15×5 12-km cells).

8.2 Data Preparations

Emissions data were prepared for input into the CMAQ and REMSAD air quality models using the SMOKE emissions modeling system. SMOKE supports point, area, mobile (both on-road and non-road), and biogenic emissions. The SMOKE emissions modeling system uses flexible processing to apply chemical speciation as well as temporal and spatial allocation to the emissions inventories. SMOKE incorporates the Biogenic Emission Inventory System (BEIS) and EPA's MOBILE6 motor vehicle emission factor model to process biogenic and on-road mobile emissions, respectively. Vector-matrix multiplication is used during the final processing step to merge the various emissions components into a single model-ready emissions file. Examples of processed emissions outputs are shown in Figure 8.12.

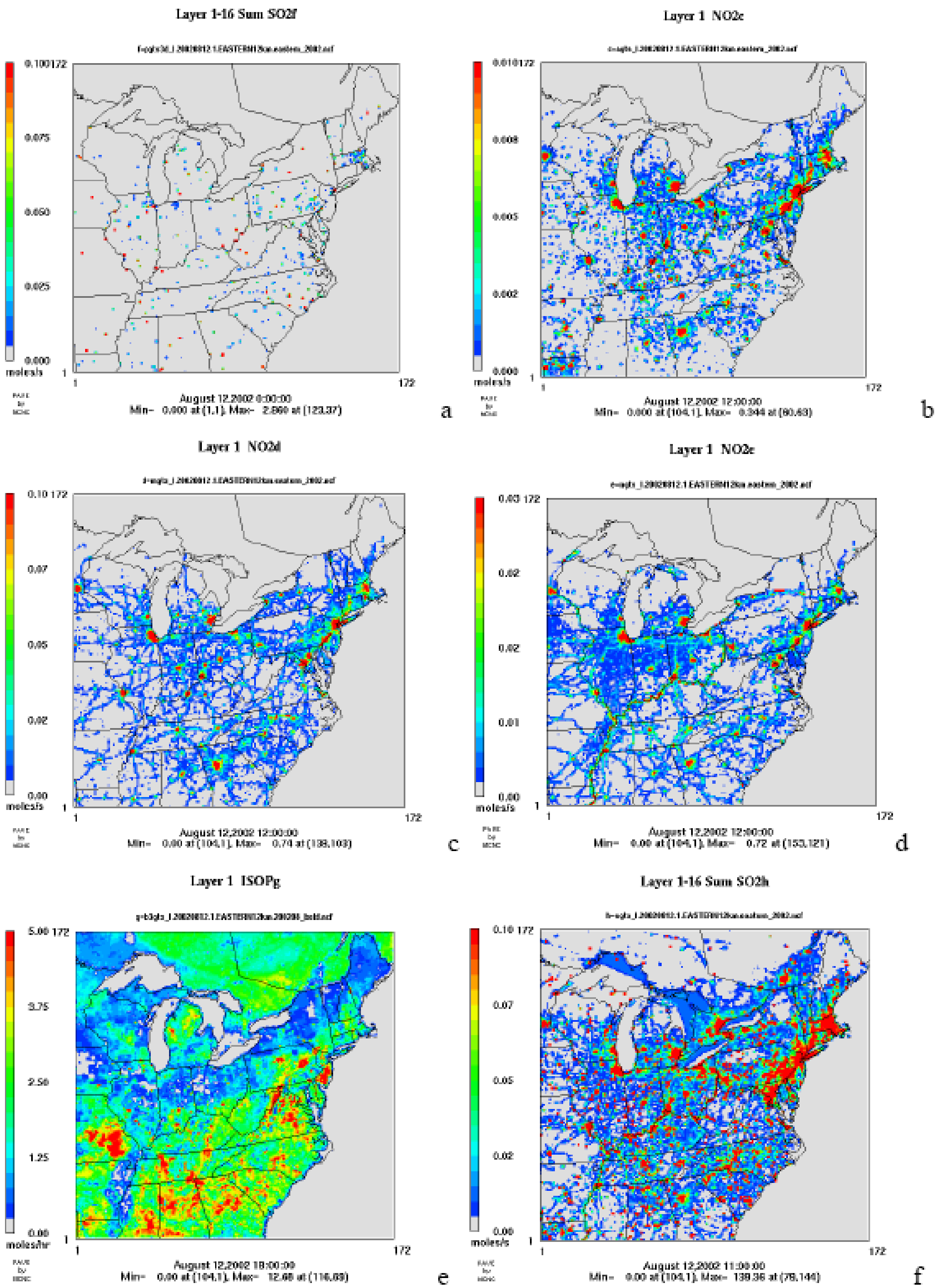
Further details on the SMOKE processing conducted in support of the air quality simulations is provided in NYSDEC's technical support document TSD-1c, "Emission Processing for the Revised 2002 OTC Regional and Urban 12 km Base Case Simulations," September 19, 2006 (Appendix P), and in NESCAUM's report, "MANE-VU Modeling for Reasonable Progress Goals, Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits," February 7, 2008 (Appendix L). Additional details on the emissions inventory preparation can be found in Section 7.0 of this report.

8.3 Model Platforms

Two regional-scale air quality models, CMAQ and REMSAD, were used for the air quality simulations that directly supported the regional haze SIP effort. CMAQ was developed by EPA and was used to perform the primary SIP-related modeling. The CMAQ modeling simulations were also an important tool for the 8-hour ozone SIP process. REMSAD was developed by ICF Consulting/Systems Applications International with support from EPA. REMSAD was used by NESCAUM to perform a source apportionment (contribution assessment) analysis. All of the air quality simulations that were used in the SIP efforts were performed on the 12-km eastern modeling domain shown in Figure 8.11 above.

NYSDEC performed an extensive model performance analysis to evaluate CMAQ model predictions against observations of ozone, $PM_{2.5}$, and other pollutant species. This model performance evaluation is described in detail in NYSDEC's technical support document TSD-1e, "CMAQ Model Performance and Assessment, 8-Hr OTC Ozone Modeling," February 23, 2006 (Appendix S). A model performance evaluation for $PM_{2.5}$ species, aerosol extinction coefficient, and the haze index is provided in NESCAUM's report, "MANE-VU Modeling for Reasonable Progress Goals, Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits," February 7, 2008 (Appendix L).

FIGURE 8.2: EXAMPLES OF PROCESSED MODEL-READY EMISSIONS: (A) SO_2 FROM POINT, (B) NO_2 FROM AREA, (C) NO_2 FROM ON-ROAD, (D) NO_2 FROM NON-ROAD, (E) ISOP FROM BIOGENIC, AND (F) SO_2 FROM ALL SOURCE CATEGORIES



8.3.1 CMAQ

The CMAQ air quality simulations were performed cooperatively among five modeling centers: NYSDEC, the New Jersey Department of Environmental Protection (NJDEP) in association with Rutgers University, the Virginia Department of Environmental Quality (VADEQ), UMD, and NESCAUM. NYSDEC also performed an annual 2002 CMAQ simulation on the 36-km domain shown in Figure 8.11; this simulation was used to derive the boundary conditions for the inner 12-km eastern modeling domain. Boundary conditions for the 36-km simulations were obtained from a run of the GEOS-Chem (Goddard Earth Observing System) global chemistry transport model that was performed by researchers at Harvard University. Technical details regarding the CMAQ model and its execution are provided in NESCAUM's report, "MANE-VU Modeling for Reasonable Progress Goals, Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits," February 7, 2008 (Appendix L).

8.3.2 REMSAD

The REMSAD modeling simulations were used to produce the contribution assessment required by the Regional Haze Rule. REMSAD's species tagging capability makes it an important tool for this purpose. The REMSAD model simulations were performed on the same 12-km eastern modeling domain as shown in Figure 8.1. NESCAUM's report, "MANE-VU Modeling for Reasonable Progress Goals, Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits," February 7, 2008 (Appendix L), further describes the REMSAD model and its application to the regional haze SIP efforts.

8.3.3 CALGRID

In addition to the SIP-quality modeling platforms described above, another modeling platform was developed for use as a screening tool to evaluate additional control strategies or to perform sensitivity analyses. The CALGRID model was selected as the basis for this platform. CALGRID is a grid-based photochemical air quality model that is designed to be run in a Windows environment. In order to make the CALGRID model the best possible tool to supplement the SIP-quality CMAQ and REMSAD modeling, the current version of the CALGRID platform was set up to be run with the same set of inputs as the SIP-quality models. The CALGRID air quality simulations were run on the same 12-km eastern modeling domain that was used for CMAQ and REMSAD. This model's performance was comparable to the performance of the already evaluated CMAQ and REMSAD models and was thus determined to perform adequately.

Conversion utilities were developed to reformat the meteorological inputs, the boundary conditions, and the emissions data for use with the CALGRID modeling platform. Pre-merged SMOKE emissions files were obtained from the modeling centers and reformatted for input into EMSPROC6, the emissions pre-processor for the CALGRID modeling system. EMSPROC6 allows the CALGRID user to adjust emissions temporally, geographically, and by emissions category for control strategy analysis. The pre-merged SMOKE files that were obtained from the modeling centers were broken down into the biogenic, point, area, non-road, and on-road emissions categories. These files by component were then converted for use with EMSPROC6, thus giving CALGRID users the flexibility to analyze a wide variety of emissions control strategies.

8.3.4 CALPUFF

CALPUFF is a non-steady-state Lagrangian puff model that simulates the dispersion, transport, and chemical transformation of atmospheric pollutants. Two parallel CALPUFF modeling platforms were developed by the Vermont Department of Environmental Conservation (VTDEC) and the Maryland Department of the Environment (MDE). The VTDEC CALPUFF modeling platform utilized meteorological observation data from the National Weather Service (NWS) to drive the CALMET meteorological model. The MDE platform utilized the same MM5 meteorological inputs that were used in the modeling done in support of the ozone and regional haze SIPs. These two platforms were run in parallel to evaluate individual states' contributions to sulfate levels at Northeast and Mid-Atlantic Class I areas. The CALPUFF modeling effort is described in detail in NESCAUM's report, "Contributions to Regional Haze in the Northeast and Mid-Atlantic United States," August 2006 (Appendix A).

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9.0 Best Available Retrofit Technology (BART)

As required by 40 CFR §51.308(e), the plan includes emission limitations representing Best Available Retrofit Technology (BART) and schedules for compliance with BART for each BART-eligible source that may reasonably be anticipated to cause or contribute to any impairment of visibility in any mandatory Class I Federal area.

The State of Maryland is required to submit an implementation plan containing emission limitations representing Best Available Retrofit Technology (BART) and schedules for compliance with BART for each BART-eligible source that may reasonably be anticipated to cause or contribute to any impairment of visibility in any mandatory Class I Federal area, unless Maryland Department of the Environment demonstrates that an emissions trading program or other alternative will achieve greater reasonable progress toward natural visibility conditions. MDE, with the help of the MANE-VU Regional Planning Organization, has developed a strategy to implement the requirements of BART.

A list of BART-eligible sources within the MANE-VU region and in Maryland is contained in Appendix G.

9.1 The BART Rule

The BART requirements pertain to large facilities in each of 26 source categories that meet certain criteria, including industrial boilers, paper and pulp plants, cement kilns, and other large stationary sources. The BART program applies to units installed and operated between 1962 and 1977 with the potential to emit more than 250 tons per year of a visibility impairing pollutant. Each BART eligible unit must undergo a case-by-case analysis to determine if new emission limits are appropriate to limit its impact on Class I areas. The BART requirements are intended to reduce emissions specifically from large sources that, due to age, were exempted from new source performance standards (NSPS) requirements of the Clean Air Act.

In June 2005, EPA adopted the final BART rule. The BART program requires states/tribes to develop an inventory of sources within each state or tribal jurisdiction that would be eligible for controls. The rule contains the following elements that:

- Outline methods to determine if a source is “reasonably anticipated to cause or contribute to haze”
- Defines the methodology for conducting BART control analysis
- Provides presumptive limits for electricity generating units (EGUs) larger than 750 Megawatts

Beyond the specific elements listed above, EPA provided the states with a great deal of flexibility in implementing the BART program.

9.1.1 Small Source Exemption

According to 40 CFR §51.308(e)(1)(ii)(C) of the Regional Haze Rule, a State is not required to make a determination of BART for SO_2 or for NO_X if a BART eligible source has the potential to emit less than 40 tons per year of such pollutants, or for PM_{10} if a BART eligible source emits less than 15 tons per year of such pollutant.

9.1.2 Large Electrical Generating Units

Under 40 CFR §51.308(e)(1)(i)(B) of the Regional Haze Rule, the determination of BART for fossil fuel fired power plants having a total generating capacity of greater than 750 megawatts must be made pursuant to the guidelines of Appendix Y of this part of the CFR (Guidelines for BART Determinations under the Regional Haze Rule). EPA adopted those guidelines on July 6, 2005. The guidelines provide a process for making BART determinations that States can use in implementing the regional haze BART requirements on a source-by-source basis, as provided in 40 CFR 51.308(e)(1). States must follow the guidelines in making BART determinations on a source-by-source basis for power plants of greater than 750 megawatts (MW) but are not required to use the process in the guidelines when making BART determinations for other types of sources.

Based on the collective importance of BART sources, in June 2004 the MANE-VU Board decided that no automatic exceptions would be given for sources within MANE-VU. Thus, a BART determination would be made by the state for each BART-eligible source.

According to Section III of the 2005 Regional Haze Rule, once the state has compiled its list of BART-eligible sources, it needs to determine whether to make BART determinations for all of the sources or to consider exempting some of them from BART because they may not reasonably be anticipated to cause or contribute to any visibility impairment in a Class I area.

Specific criteria for making the comparison to programs was proposed in the BART Guidelines (40 CRF 51 Appendix Y) in 2001. These criteria, sometimes referred to as the "better-than-BART-test", consist of the following. First, if the geographic distribution of emissions reductions from the two programs is expected to be similar, the comparison can be made based on emissions alone. Second, if the distribution of emissions reductions is anticipated to be significantly different, then a two-pronged visibility improvement test is employed. The first prong is that the alternative program must not result in a degradation of visibility at any Class I area. The second prong is that the alternative program must result in greater visibility improvement overall, based on an average across all affected Class I areas.

Section V of the Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations Preamble sets forth presumptive requirements for States to require EGUs to reduce SO_2 and NO_X emissions for units greater than 200 MW in capacity at plants greater than 750 MW in capacity that significantly contribute to visibility impairment in Federal Class I areas. The analysis conducted presents alternative control scenarios of possible additional controls for EGUs located at plants less than 750 MW in capacity. The EPA also calculated the amount of SO_2 and NO_X emissions reductions for several illustrative scenarios that reflect alternative State actions regulating industries with non-EGU sources. The analysis conducted includes three regulatory alternative scenarios that States may choose to follow to comply with BART. The alternatives include three scenarios of increasing stringency; Scenario 1, Scenario 2, and Scenario 3. A brief discussion of these alternatives for EGUs and all other sources is available in the Preamble.

The following sections provide information on the core requirements for state compliance with BART regulations.

9.2 Sources Subject to BART

9.2.1 Making BART determinations for all BART-eligible sources.

Based on the collective importance of BART sources, in June 2004 the MANE-VU Board decided that BART determination would be made by the state for each BART-eligible source. The process would include consideration of potential visibility impacts.

9.3 Anticipated Visibility Improvement as a result of BART

MANE-VU conducted modeling analyses of BART-eligible sources using CALPUFF in order to provide a regionally consistent foundation for assessing the degree of visibility improvement that could result from installation of BART controls. The state of Maryland considered the results of this analysis in its determination of BART for individual sources.

9.3.1 Reasonably Attributable Visibility Impairment

Section 31.302 (c) provides for general plan requirement in cases where the affected FLM has notified the State that Reasonably Attributable Visibility Impairment (RAVI) exists in a Class I Area in the state. There are no RAVI sources in MANE-VU.

9.4 BART-Eligible Sources in Maryland

The BART-eligible sources in Maryland are shown in Table 9-1. A detailed description of each BART-eligible source and the identification analysis is included in Appendix G.

The BART-eligible sources were identified using the methodology in the Guidelines for Best Available Retrofit Technology (BART) Determinations under the Regional Haze Rule, 40 CFR Part 51, Appendix Y.

Eastalco Aluminum was initially identified as a BART-eligible source. However, during the process of developing the Regional Haze SIP, Eastalco Aluminum ceased all operations and subsequently closed down.

Table 9-1: Bart-Eligible Sources in Maryland

Source	Unit MW	Unit/Point ID(s)	Pollutant	Location (County)	Facility I.D	Facility MW
EGU						
Mirant - Chalk Point	355 & 640	1, 2 & 3	NO_X , SO_X, PM	Prince George's	033-0014	2647
Mirant – Morgantown	630	1 & 2	NO_X , SO_X, PM	Charles	017-0014	1548
CPSG – Crane	200	2	NO_X , SO_X, PM	Baltimore	005-0079	415.8
CPSG – Wagner	350	3	NO_X , SO_X, PM	Anne Arundel	003-0014	1058.5
Non – EGU						
New Page/Westvaco/Luke Paper	n/a	25	NO_X , SO_X, PM	Allegany	001-0011	
Holcim (Independent/St. Lawrence Cement)	n/a	24	NO_X , SO_X, PM	Washington	043-0008	
Mettiki Coal	n/a	1	NO_X , SO_X, PM	Garrett	023-0042	

9.4.1 Cap-Outs and Shutdowns

Many BART-eligible facilities in the MANE-VU region that were potentially BART-eligible were relatively small emission sources with potential emissions that exceed the statutory threshold of 250 tons per year or more, but with actual emissions of visibility impairing pollutants of well under 250 tons in any year. Some of these facilities may have accepted a permit limitation, restricting their emissions by law to less than 250 tons per year. Any otherwise BART-eligible facility may "cap-out" of BART via a permit emission limit. No Maryland BART-eligible facility used a permit limit of less than 250 tons to meet BART.

9.5 Determination of BART Requirements for Identified BART-Eligible Sources and Analysis of Best System for Each Source

9.5.1 Five Factor Analysis for Each BART Source

The Maryland five-factor BART analyses are included in Appendix G-2. These analyses include consideration of the degree of improvement in visibility, which is determined in the BART Visibility Improvement Analysis, which is included in Appendix G-4.

9.5.2 Sources with De Minimus Impacts on Visibility

MANE-VU has identified a set of sources whose potential "degree of visibility improvement" is so small, that no reasonable weighting could justify additional controls under BART.

Maryland has determined that the visibility improvement achieved by the installation of the best system of continuous emission control technology identified in the BART analysis is not sufficient to justify the installation of these controls on the following BART-eligible sources in the State of Maryland:

Independent/St. Lawrence Cement
Mettiki Coal, LLC

9.6 Non-EGU BART Source Synopsis

States are required to determine BART for each BART-eligible source. According to 40 CFR 51.308(e)(1)(ii)(A) the determination of BART must be based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the following five factors for the technology available:

1) The costs of compliance,
2) The energy and non-air quality environmental impacts of compliance,
3) Pollution control equipment in use at the source,
4) The remaining useful life of the source, and
5) The degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

The Maryland Department of the Environment asked the facilities subject to BART to conduct BART determinations using the 5-Factor Analysis, for PM, NO_X and SO_2. Consistent with the MANE-VU Board (June, 2004) decision, this analysis would include consideration of potential visibility impacts as a result of installing various controls for primary particulate matter. This section provides a brief description of each unit, a summary of each facility's engineering analysis, and MDEs determination of BART. Further details can be found in facility BART analyses, in Appendix G-2.

9.6.1 Independent/St. Lawrence Cement

Independent/St. Lawrence Cement (SLC) believes that the Hagerstown cement kiln is already equipped with BART controls for NO_X, having implemented combustion optimization, low NO_X burners, mid-kiln firing of tires and flame shape controls. Regarding SO_2, no further controls are considered possible based on technological feasibility and unintended consequences of the use of wet scrubbers, i.e. production of wastewater and sludge. For PM control, BART controls have been implemented through the use of ESP on the kiln gas and baghouses on other non-kiln sources. Lastly, in regards to MANE-VU Class I areas, impacts of the facility are not expected to be significant. The BART analysis for this facility is included in Appendix G-2. In summary:

<u>Pollution control equipment in use at source:</u> PM controls include multiclones and an electrostatic precipitator; NO_X controls include mid-kiln tire firing with mixing air technology, upgraded kiln computer control system and low-NO_X type burner in kiln and SO_2 controls include the injection of mixing air and inherent dry scrubbing (efficiency 82%-96%).

<u>Costs of Compliance:</u>
Total capital investment for an SNCR system is estimated in Table 4.1 of the BART analysis as approximately $2,527,638, with total annual operating costs of $1,769,451.

Energy and non-air quality environmental impacts of compliance: Adding SNCR might result in ammonia slip from the stack which may combine with the SO_2 emissions from the stack gas or in the atmosphere to form condensable particulate emissions.

Remaining useful life of the source: Estimated life through 2021; Installed 1971 typical life for a cement plant is 50 years.

Degree of visibility improvement anticipated from use of technology: Based on CALPUFF modeling done for its PSD permit application process, the potential visibility degradation associated with proposed SO_2 emissions increase would be less than 5%. This is well below the significance impact for visibility in a Class I area. Greater detail of the visibility impact analysis may be found in Appendix A of the BART analysis.

Holcim (St Lawrence Cement) is required to install SNCR in order to comply with the Maryland ozone transport limit. Maryland considers the current controls and the future installation of SNCR as sufficient and considers them BART for this facility.

9.6.2 Mettiki Coal, LLC

James Ashby, Manager of Environmental Affairs at Mettiki Coal, states that Mettiki Coal is not a BART eligible source. He states that in NESCAUM's report, Mettiki is only "potentially BART eligible." In letters written on October 8th and October 26th, 2007 Ashby cites BART Applicability Qualifiers in reference to Mettiki. Regarding Qualifier #1 he states that "Mettiki Coal meets the first test under the source category of *Coal Cleaning Plants (thermal driers) 1100, 2999 3050 10xx 2.*" Applicability Qualifier #2 must be discussed in greater detail. Ashby points out that although the plant met the definition of "in existence" by August 7, 1977, it did not begin operations until March of 1978. Also, under the Haze Rule, BART is supposed to apply to sources "grandfathered" from the requirements of the 1977 Clean Air Act; according to Ashby and the PSC permit attached to his letter, the Mettiki Preparation Plant met the requirements of the EPA PSD regulations on June 19, 1978, which would post-date the 1977 CAA Amendments.

Maryland has concluded that this source is not BART-eligible because its start up date post-dates the BART timeframe of 1962-1977 and the source falls under PSD regulations.

9.6.3 New Page/Westvaco/Luke Paper

The BART-eligible emission unit at New Page/Westvaco/Luke Paper is: the coal-fired boiler (Power Boiler no. 25). Power Boiler no. 25 burns coal primarily with natural gas used as a secondary fuel. Built in 1965 it has a nominal rating of 785 MMBtu/hr. It is used as a backup system for incineration of emissions from non-condensable gas (NCG) and stripper off gas (SOG) systems. The source included boiler no. 26 and the no.3 recovery boiler in its BART analysis because they were installed within the BART timeframe. Power Boiler no. 26 was installed in 1970 but was converted to natural gas in 1982. This boiler has a nominal rating of 338 MMBtu/hr. This boiler is also used as a backup system for incineration of emissions from the NCG and SOG systems. The No. 3 Recovery Boiler is used to recover chemicals from spent pulping liquors and to produce steam for the mill. It fires black liquor as its primary fuel with no.4 fuel oil used for startup purposes. This boiler was installed in 1969 and has a nominal rating of 287,500 pounds of 50% black liquor solids per hour.

New Page/Westvaco/Luke Paper provided a "five-factor analysis" pursuant to the requirements of 40 CFR 51.308(e)1)(ii)(A). In summary:

Pollution control equipment in use at source: Currently the no. 25 boiler has a multi-cyclone mechanical collector in series with a baghouse for PM control. It is also equipped with an over fire air system, low NO_X burners and a selective non-catalytic reduction system for controlling NO_X emissions. Power boiler no. 26 operates using natural gas so has minimal haze contributing emissions. Emissions from power boiler no. 26 exhaust to a single stack that serves power boiler no. 25 as well. The combined stack is equipped with CEMS for NO_X, SO_2, and flow as well as a continuous opacity monitor. The no. 3 recovery boiler has two-level staged combustion air control system for the control of SO_2 and NO_X emissions. The boiler flue gases are routed through electrostatic precipitators (ESP1, ESP2, and ESP3) for control of particulates.

Costs of Compliance:
Power Boiler No. 25 - Installation of either a Spray Dryer Absorber or a Circulating Dry Scrubber would result in 90% reduction in SO_2 emissions. Since this SO_2 control measure has already been committed to be implemented at the facility, no further review of the performance and economic, energy, and environmental impacts of the control option was necessary. Power Boiler No. 25 has SNCR technology which reduces NO_X emissions by 60%. Continuous operation of the SNCR system with a rolling 30-day emission rate of 0.40 lb/MMBtu is recommended as BART for this boiler. PM emissions are sufficiently controlled by the existing multi-cyclones and baghouses therefore no further PM controls were considered. The Luke Paper Company has committed to reduce emissions to the equivalent levels of 90% of SO_2 emissions, reduce NOx emissions to the level of 0.4 lb/mmBTU, and control PM emissions level to 0.07 lb/mmBTU for Power Boiler No. 25 on a yearly basis.

Power Boiler No. 26 - Power Boiler No. 26 is a natural gas fired boiler and thus emits minimum SO_2 (less than 0.1 lb/hr). Therefore no other controls for SO_2 emissions were considered. The same can be said for the NO_X and PM emissions from unit no. 26. This boiler produces relatively small visibility impacts so no add-on controls were considered.

No. 3 Recovery Boiler – The recovery boiler uses black liquor as its main fuel. SO_2 emissions are controlled by proper operation of the recovery boiler which maximizes the conversion of sulfur compounds in the liquor to the principal constituents of pulping chemicals through capture of the compounds in the combustion zone of the boiler by sodium fume released from the smelt bed. The boiler is also equipped with a staged combustion system which further controls for SO_2 emissions. No additional controls are needed. NO_X emissions in recovery boilers are a result of flue NO_X oxidation. Conventional controls used on typical coal, oil and natural gas fired boilers cannot be used by recovery boilers. Therefore the current two-level staged combustion air control system with the three chamber ESPs is considered BART for the No. 3 Recovery Boiler.

Energy and non-air quality environmental impacts of compliance: n/a

Remaining useful life of the source: n/a

Degree of visibility improvement anticipated from use of technology: n/a

New Page has evaluated its BART eligible sources and concludes that the future controlled emissions level of Power Boiler No. 25 are on the order of 66-77% compared to the baseline. Therefore the recommended BART for Power Boiler No. 25 is the installation of an add-on SO_2 control (either a Spray Dryer Absorber or a Circulating Dry Scrubber), year-round operation of the existing SNCR for NO_X control and multicyclones and baghouse for PM control. Burning natural gas constitutes BART for Power Boiler No. 26 as natural gas is inherently low in sulfur, nitrogen and ash content. And BART for the No. 3 Recovery Boiler is the two-level staged combustion air control system with ESPs.

9.6.4 Non-EGU BART Emission Reduction Summary

BART determinations for the non-EGU BART-eligible sources in Maryland are shown in Tables 9-2 through 9-6 for each visibility impairing pollutant. BART is the emission limit for each pollutant based on the degree of reduction achievable through the application of the best system of continuous emission reduction, taking into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

BART for each BART-eligible source was determined using the methodology in the Guidelines for Best Available Control Retrofit Technology (BART) Determinations under the Regional Haze Rules 40 CFR Part 51, Appendix Y. The application of BART to all BART-eligible sources in the state provides an estimated emission reduction, from the baseline year 2002, of

- 8030.7 tons per year of sulfur dioxide,
- 461.15 tons per year of nitrogen oxides,
- 103.75 tons per year of $PM_{2.5}$,
- 103.75 tons per year of PM_{10}.

These reductions are shown in Tables 9-2 through 9-5 for each source.

Table 9-2: From 2002 Baseline SO_2 Emissions Reductions from non-EGU BART Sources

Source and Unit	ID #	County	Baseline Emissions (TPY)	Baseline Capacity %	Baseline Level of Control %	Emission at Maximum Utilization Capacity	BART Level of Control %	Emissions After Controls (TPY)	Emissions Reductions (TPY)	Emission Limit	Schedule of Compliance
New Page/ Westvaco/ Luke Paper Unit 2	001-0011	Allegany	8923	97.34	0	9166.84	90	892.3	8030.70	NA	Within 5 years of SIP approval

Table 9-3: From 2002 Baseline NO_X Emissions Reductions from non-EGU BART Sources

Source and Unit	ID #	County	Baseline Emissions (TPY)	Baseline Capacity %	Baseline Level of Control	Emission at Maximum Utilization	BART Level of Control	Emissions After Controls	Emissions Reductions (TPY)	Emission Limit	Schedule of Compliance

					%	Capacity	%	(TPY)			
New Page/ Westvaco/ Luke Paper Unit 2	001-0011	Allegany	1718.8	97.34	0	1765.77	26.83	1257.65	461.15	0.4 lb/MM BTU	Within 5 years of SIP approval

Table 9-4: From 2002 Baseline PM2.5 Emissions Reductions from non-EGU BART Sources

Source and Unit	ID #	County	Baseline Emissions (TPY)	Baseline Capacity %	Baseline Level of Control %	Emission at Maximum Utilization Capacity	BART Level of Control %	Emissions After Controls (TPY)	Emissions Reductions (TPY)	Emission Limit	Schedule of Compliance
New Page/ Westvaco/ Luke Paper Unit 2	001-0011	Allegany	323.8	97.34	0	332.65	32	220.05	103.75	0.07 lb/MM BTU	Within 5 years of SIP approval

Table 9-5: From 2002 Baseline PM10 Emissions Reductions from non-EGU BART Sources

Source and Unit	ID #	County	Baseline Emissions (TPY)	Baseline Capacity %	Baseline Level of Control %	Emission at Maximum Utilization Capacity	BART Level of Control %	Emissions After Controls (TPY)	Emissions Reductions (TPY)	Emission Limit	Schedule of Compliance
New Page/ Westvaco/ Luke Paper Unit 2	001-0011	Allegany	323.8	97.34	0	332.65	32	220.05	103.75	0.07 lb/MM BTU	Within 5 years of SIP approval

9.6.5 Non-EGU BART Exemption Requirements

Table 9-6: Summary of non-EGU BART Requirements

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	BART Emission Limit (TPY)	BART Control Efficiency	Permit/Regulation Requirements
New Page/Westvaco/Luke Paper 011-0011 2	SO_2	Multiple	8923	892.3	90%	Within 5 years of SIP approval
MRR Requirements	Compliance with the emission limits shall be demonstrated by annual emission certificates.					
Other Permit Requirements	Total SO_2 emissions shall not exceed the 10% of 2002 baseline emissions.					
Compliance Date	Within 5 years of SIP approval					

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	BART Emission Limit	Emission Reductions (TPY)	Permit/Regulation Requirements
New Page/Westvaco/Luke Paper 011-0011 2	NO_X	Multiple	1718.8	0.4 lb/MMBTU	461	Within 5 years of SIP approval

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	BART Emission Limit (TPY)	BART Control Efficiency	Permit/Regulation Requirements
MRR Requirements	Compliance with the emission limits shall be demonstrated by annual emission certificates.					
Other Permit Requirements	Total NO_X emissions shall not exceed the BART Emission Limit.					
Compliance Date	Within 5 years of SIP approval					

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	BART Control Level (Percent)	Emission Reductions (TPY)	Permit/Regulation Requirements
New Page/Westvaco/Luke Paper 011-0011 2	PM	Multiple	323.8	32	103.75	Within 5 years of SIP approval
MRR Requirements	Compliance with the emission limits shall be demonstrated by annual emission certificates.					
Other Permit Requirements	Total PM emissions shall not exceed the BART Emission Limit.					
Compliance Date	Within 5 years of SIP approval					

9.7 EGU BART Source Synopsis

States are required to determine BART for each BART-eligible source. According to 40 CFR 51.308(e)(1)(ii)(A) the determination of BART must be based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the following five factors for the technology available:

1) The costs of compliance,
2) The energy and non-air quality environmental impacts of compliance,
3) Pollution control equipment in use at the source,
4) The remaining useful life of the source, and
5) The degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

The Maryland Department of the Environment asked the facilities subject to BART to conduct BART analyses using the 5-Factor Analysis, for PM, NO_X and SO_2. Consistent with the MANE-VU Board (June, 2004) decision, this analysis would include consideration of potential visibility impacts as a result of installing various controls for primary particulate matter. This section provides a brief description of each unit, a summary of each facility's engineering analysis, and MDEs determination of BART. Further details can be found in facility BART analyses, in Appendix G-2.

9.7.1 Mirant Chalk Point

Chalk Point units 1, 2 and 3 are BART eligible. Units 1 and 2 were installed in 1964 and 1965 and are wall fired, dry bottom, supercritical boilers each rated at a nominal 355 MW. Primary fuel for the units is coal. Number 2 (#2) fuel oil or natural gas is used for ignition, warm-up and flame stabilization. Unit 3 was installed in 1964 and is a tangentially fired, sub-critical unit that fires residual fuel oil or natural gas. It is rated at a nominal 640 MW. It is a cycling unit and has operated at average annual capacity factor of 5% over the last four years.

Mirant – Chalk Point provided a "five-factor analysis" pursuant to the requirements of 40 CFR 51.308(e)(1)(ii)(A). In summary:

<u>Pollution control equipment in use at source:</u> Chalk Point's pollution control equipment along with their efficiencies is displayed in the table below.

Chalk Point Units 1, 2, and 3 EMISSION CONTROL EQUIPMENT

	POLLUTANTS/CONTROLS					
ID	**SO2**	**SO2 Control Effcy.**	**NOX**	**NOX Control Effcy.**	**PM**	**PM Control Effcy.**
Unit 1	Flue gas desulfurization system	98%	Low NOX burners and over fire air (OFA)	50%	Cold side electrostatic precipitator	99.5%
			selective catalytic reactor system	90%		
Unit 2			Low NOX burners and over fire air	50%	Cold side electrostatic precipitator	99.5%
			selective auto catalytic reactor system	35-45% (O_3 season)		
Unit 3	Fuel S-content limit		Low NOX burners and OFA			
	Operate 95% on Natural Gas during O_3 season and no less than 75% annually	95%+	Operate 95% on NG during O_3 season and no less than 75% annually	50%+	Operate 95% on NG during O_3 season and no less than 75% annually	90%

The remaining useful life of the Chalk Point Unit 2 and Unit 3 is projected to have no effect on the costing analyses for this facility. It is concluded that based on the control equipment and the units' existing emissions rates meeting or exceeding BART requirements, no additional BART analysis for SO_2 and PM is required. In 2009 Chalk Point Unit 1 installed an SCR system to control NO_X emissions reducing NO_X by up to 90%. In December 2009 Chalk Points Units 1 and 2 installed a common FGD system that reduces SO_2 emissions by up to 98%. The synopsis of the NO_X analysis for units 2 and 3 follows.

Costs of Compliance: Cost of compliance for SCR technology being installed at Unit 2 would be $14,288 per ton based on the EPA Control Cost Manual and the cost data for the installation of the SCR on Chalk Point Unit 1. That of Unit 3 is projected to be $95,066 per ton for the installation of SNCR technology because of its 5% average annual cycling usage. For Unit 2, installation of SCR would bring the emissions rate from 0.35 lb/mmBTU down to 0.10 lb/mmBTU and for unit 3 installation of SNCR would bring the emissions rate from 0.14 lb/mmBTU down to 0.10 lb/mmBTU.

Energy and non-air quality environmental impacts of compliance: Additional power required to operate SCR for Unit 2 is about 800kW and the additional power requirements for the operation of SNCR at Unit 3 is 150 kW; additionally for SNCR operation ammonia could be added to the fly ash through an ammonia slip of approximately 2 ppm. This would result in a fly ash ammonia concentration of about 100ppm. SCR technology at Unit 2 would result in spent catalyst and the urea to ammonia system would generate solid and wet residuals. The spent catalyst would be sent back to the manufacturer for reprocessing and the wet and solid residuals would be sent off-site for disposal.

Remaining useful life of the source: The remaining useful life of the Chalk Point Unit 2 and Unit 3 is projected to have no effect on the costing analyses for this facility.

Degree of visibility improvement anticipated from use of technology: Use of SCR on Unit 2 would reduce average annual NO_X emissions by 2,100 tons per year, bringing the emission rate below the BART presumptive 0.10 lb/mmBTU. Use of SNCR technology on Unit 3 would result in an average annual emission reduction of approximately 41 tons of NO_X per year. Unit 3 is a cycling unit and has operational restrictions and therefore operates primarily during the ozone season and is required to use natural gas for 95% of its operating time. This limits NO_X emissions by over 50% and SO_2 emissions by 95%. The facility is working with MDE on another consent decree to limit non-ozone season use of residual oil as well. Maryland Department of the Environment accepts the existing controls and emission limits as BART for Chalk Point.

9.7.2 Mirant Morgantown

Morgantown units 1 and 2 were installed in 1970 and 1971 and are tangentially fired, dry bottom, supercritical boilers each rated at a nominal 630 MW. The units are base loaded and have operated at average annual capacity factor of 64% over the last four years. The primary fuel used is coal with #2 oil for ignition, warm-up and flame stabilization.

Mirant - Morgantown provided a “five-factor analysis” pursuant to the requirements of 40 CFR 51.308(e)1)(ii)(A). In summary:

Pollution control equipment in use at source: The pollution control equipment and efficiencies thereof at Morgantown are displayed in the table below.

Morgantown Units 1 and 2 EMISSION CONTROL EQUIPMENT

<table>
<tr><th></th><th colspan="6">POLLUTANTS/CONTROLS</th></tr>
<tr><th>ID</th><th>SO2</th><th>SO2 (Control Effcy.)</th><th>NOX</th><th>NOX (Control Effcy.)</th><th>PM</th><th>PM (Control Effcy.)</th></tr>
<tr><td rowspan="2">Unit 1</td><td rowspan="4">Flue gas desulfurization system</td><td rowspan="4">98%</td><td>Low NOX burners (LNB) and over fire air (OFA)</td><td>50%</td><td rowspan="4">Cold side electrostatic precipitator</td><td rowspan="4">99%+</td></tr>
<tr><td>selective catalytic reactor system (SCR)</td><td>90%</td></tr>
<tr><td rowspan="2">Unit 2</td><td>LNB and OFA</td><td>50%</td></tr>
<tr><td>SCR system</td><td>90%</td></tr>
</table>

Based on the controls already in use it is concluded that, for Morgantown Units 1 and 2, “the control equipment installed and the units’ existing emission rates meet or exceed BART control requirements and presumptive emission limits. Therefore no additional BART analysis is required.

9.7.3 CPSG – Crane

The BART-eligible emissions unit at the Crane Generating Station is Unit 2. Installed in 1963, Unit 2 began operation during the time period targeted by the Regional Haze BART Rule. Unit 2 is a utility boiler fired by four cyclone burners. The boiler powers a Westinghouse turbine generator with a nominal rating of 200 MW gross. Natural gas is used as a start-up fuel.

CPSG – Crane provided a "five-factor analysis" pursuant to the requirements of 40 CFR 51.308(e)1)(ii)(A). In summary:

Pollution control equipment in use at source: Currently Crane Unit 2 has in place: an over-fire air system (OFA) for reduction of NO_X emissions, an add-on NO_X control system which is selective non-catalytic reactor (SNCR), low sulfur coal (2.58% by weight), a continuous emissions monitoring system(CEMS) for NO_X, CO_2 and SO_2 and a continuous opacity monitor (COM) for opacity. Additionally fabric filters are employed on unit 2 to control PM emissions.

Costs of Compliance: The technologies currently in use at the site are considered BART for the site. Since use of Powder River Basin (PRB) coal resulted in a control of ~88% of SO_2 emissions no add-on SO_2 controls were considered. Additionally Crane already has SNCR in place for controlling NO_X emissions which offers a control efficiency of 80% compared to baseline NO_X levels. Fabric filter are used on unit 2 to control PM emissions. There are no technologies that would be feasible to add at this time to further reduce emissions at the site.

Energy and non-air quality environmental impacts of compliance: Since use of PRB coal resulted in a control of ~88% of SO_2 emissions no add-on SO_2 controls were considered. Additionally Crane already has SNCR in place for controlling NO_X emissions which offers a control efficiency of 80% compared to baseline NO_X levels.

Remaining useful life of the source: This information was not provided in the BART analysis.

Degree of visibility improvement anticipated from use of technology: No new technology will be used since the existing technology serves the purpose of bringing the emissions to approvable BART levels.

9.7.4 CPSG – Wagner

The BART-eligible emission unit at the Wagner Generating Station is Units 3. Unit 3 was installed in August 1966 and began operation during the time period (1962-1977) targeted by the Regional Haze BART Rule. Unit 3 is a Babcock and Wilcox supercritical, once-through coal-fired boiler with a rated input capacity of 2,740 MMBtu/hr. The turbine generator is rated at 350 MW. Natural gas is used as a start-up fuel. Because the Wagner Station has a total rated capacity in excess of 750 MW, Unit 3 is subject to presumptive BART controls in accordance with the Regional Haze BART Rule.

CPSG – Wagner provided a "five-factor analysis" pursuant to the requirements of 40 CFR 51.308(e)1)(ii)(A). In summary:

Pollution control equipment in use at source: Over fire air (OFA), low NO_X burners and selective catalytic reduction (SCR) to control NO_X emissions and a cold-side electrostatic precipitator (ESP) to control PM emissions. . The Maryland Healthy Air Act mandates that the unit comply with the emission limitations of the regulation. Accordingly the control strategies must be operated continually. The unit currently burns low-sulfur Eastern bituminous coal. Based on historical (baseline) emissions, the sulfur content of the eastern bituminous coal is approximately 1% by weight. Unit 3 is equipped with continuous emissions monitoring system (CEMS) for NO_X, CO_2, and SO_2 and a continuous opacity monitor (COM) for opacity.

Costs of Compliance: Currently controls with high efficiencies are in place at Wagner so the cost of compliance was only considered for adding Wet Flue Gas Desulfurization (WFGD). The table in Wagner's report, Table 5-4, indicates the incremental cost effectiveness of proceeding with WFGD from the current emissions signature exceeds \$47 million/dv. Therefore, this option is not considered BART due to its high cost for a small visibility improvement.

Energy and non-air quality environmental impacts of compliance: Impacts from the use of Wet Flue Gas Desulfurization were evaluated by Wagner. Among the impacts were disposal of the sludge, high water consumption and water treatment costs, and a significant amount of electrical energy consumption.

Remaining useful life of the source: n/a

Degree of visibility improvement anticipated from use of technology: Along with costs, Table 5-4 in Wagner's 5-factor analysis shows the corresponding degree of visibility improvement. It is concluded that the current controls will satisfy BART for visibility improvement as the 3-year average eighth highest delta deciview impact is 1.24 dv at Shenandoah National Park and improves to 0.87 dv with the current controls.

9.8 EGU Alternative Measures to BART for SO_2 and NO_X

As shown in Table 9-1, several of the BART EGUs are above the BART threshold of 750 MW. The Maryland Healthy Air Act (HAA), which required extensive SO_2 and NO_X (and subsequent PM) controls on the facilities identified as containing BART units, went into effect in 2007. The emissions reductions the Healthy Air Act will yield far exceed the emissions reductions under BART. The intent of the BART rule, per the preamble of the rule itself, was to ensure that high efficiency controls were installed at large units that had an impact on any Class I area. Maryland strongly believes that excellent controls are indeed being installed at these facilities in a faster timeframe than actually required by the haze rule, under the HAA.

The haze rule presumes that facilities that have or will have SCR or SNCR technology for NO_X control should run these controls year-round. The annual NO_X caps set by the HAA require that all the EGU facilities listed above run year round SCR/SNCR.

The haze rule also seeks SO_2 controls with a presumption of 95% control efficiency. The Maryland HAA SO_2 caps seek Flue Gas Desulfurization (FGD) control technology installation at many of the facilities. However, Maryland seeks 85% removal efficiency as “cost effective”. Maryland makes this case in the technical support document for the Maryland Healthy Air Act (http://www.mde.maryland.gov/programs/air/pages/md_haa.aspx). As seen in the TSD for the Maryland HAA there are some facilities (Wagner and Crane) that are not able to install FGD technology due to space constraints and company decisions related to control costs. The MDE accepted that position in the development of the Maryland Healthy Air Act and this MDE position serves this SIP as well.

The emission reductions achieved from the HAA, (COMAR Title 26 Subtitle 11 Chapter 27) exceed the emission reductions under BART. The electric generating units controlled under the HAA are all within the areas of influence for regional haze; 300 km of Shenandoah National Park and Brigantine Wildlife Refuge; and are in close proximity to one another (within 200 km radius). The HAA reduces SO_2 and NO_X emissions from applicable units by 85% and 75%, respectively, from the 2002 baseline emissions. The overall reductions from Maryland’s Healthy Air Act exceed presumptive BART for SO_2 by 60,805 tons and presumptive BART for NO_X by 16,184 tons primarily because the HAA controls additional non-BART units.

Based on the analysis done as part of the Maryland Healthy Air Act, and the controls being installed due to the implementation of that regulation, Maryland is confident that all the listed EGU facilities will have state of the art control technology that will significantly reduce SO_2, NO_X, and $PM_{2.5}$ emissions (as identified in this SIP document). The purpose of BART was to ensure that quality controls were installed and operated on older EGU units and Maryland has achieved that through regulation.

PM emissions from Maryland’s BART EGUs are discussed in section 9.9.

9.8.1 Sulfur Dioxide and Nitrogen Oxides

The BART-eligible electricity generating units (EGUs) in MANE-VU represent the largest emissions reduction potential among the various BART-eligible source categories.

EPA demonstrated in a technical support document (TSD)[9], presented in Appendix G-3, that EGU emission levels predicted via federal statute satisfied the BART requirements. The table below shows the total Maryland EGU emission levels predicted by the TSD for 2015[10] and the corresponding EGU emission levels after the institution of the Healthy Air Act.

Pollutant	2015 MD EGU Emission EPA TSD	2015 MD EGU Emissions With HAA Caps
NO_X	24,000	23,000
SO_2	84,000	43,000

9 EPA Docket Number: OAR-2003-0053-YYYY, dated March, 2005
10 Table I-2 of the TSD

The HAA requires reductions in Nitrogen Oxide (NO_X), Sulfur Dioxide (SO_2) and Mercury emissions from large coal burning power plants. The expected emission reductions for 2015 were calculated using the emissions estimates consistent with annual allocations under the Healthy Air Act implementing regulation. The program does not allow trading of emission allowances.

Given the decision by EPA that the TSD emission levels will satisfy BART and that Maryland's Healthy Air Act reduces NO_X and SO_2 emissions far beyond the TSD; Maryland considers the Healthy Air Act and the resultant SO_2 and NO_X emissions rate limits/controls as representative of an alternative program to the Best Available Retrofit Technology for the EGUs affected by the Healthy Air Act which includes Maryland's BART eligible units.

Controls that are expected or existing at the Maryland EGU BART facilities are presented in Table 9-7.

Table 9-7: EGU BART Source Controls

Facility Name	BART Unit	Pollutant	Existing / 2013 Controls
Mirant - Chalk Point	1	NO_X	Low NO_X Burners with Overfire Air Selective Catalytic Reduction (SCR)
Mirant - Chalk Point	1	SO_2	Flue Gas Desulfurization (FGD)
Mirant - Chalk Point	1	PM	Electrostatic Precipitators
Mirant - Chalk Point	2	NO_X	Low NO_X Burners with Overfire Air Selective Catalytic Reduction (SCR)
Mirant - Chalk Point	2	SO_2	Flue Gas Desulfurization (FGD)
Mirant - Chalk Point	2	PM	Electrostatic Precipitators (ESP)
Mirant - Chalk Point	3	NO_X	Low NO_X Burners with Overfire Air
Mirant - Chalk Point	3	SO_2	Fuel Sulfur content limits
Mirant - Chalk Point	3	PM	Operational Limits (95% of time during O_3 season use Natural Gas as fuel)
Mirant – Morgantown	1	NO_X	Low NO_X Burners with Overfire Air Selective Catalytic Reduction (SCR)
Mirant – Morgantown	1	SO_2	Flue Gas Desulfurization (FGD)
Mirant – Morgantown	1	PM	Electrostatic Precipitators (ESP)
Mirant – Morgantown	2	NO_X	Low NO_X Burners with Overfire Air Selective Catalytic Reduction (SCR)
Mirant – Morgantown	2	SO_2	Flue Gas Desulfurization (FGD)
Mirant – Morgantown	2	PM	Electrostatic Precipitators
CPSG – Crane	2	NO_X	Low NO_X Burners with Overfire Air Rotamix, ROFA Selective Noncatalytic Reduction (SNCR)
CPSG – Crane	2	SO_2	Low Sulfur Coal Absorbent Technology
CPSG – Crane	2	PM	Baghouse/Fabric Filters
CPSG – Wagner	3	NO_X	Low NO_X Burners

Facility Name	BART Unit	Pollutant	Existing / 2013 Controls
			Selective Noncatalytic Reduction (SNCR) and/or Rotating Opposed Fired Air (ROFA)
CPSG – Wagner	3	SO_2	Low Sulfur Coal Absorbent Technology
CPSG – Wagner	3	PM	Baghouse/Fabric Filters

The emission reductions expected from the fully implemented Maryland Healthy Air Act are shown in Table 9-8 and Table 9-9.

Table 9-8: SO_2 Emission Reductions (from 2002 Baseline) from MD HAA Sources

Facility Name	Facility ID	Unit ID	Registration ID	Baseline Emissions (TPY)	Emission Limit (TPY)	Emission Reductions (TPY)	Schedule of Compliance
CPSG – WAGNER	003-0014	3	003-0014-3-0003	10,095.96	2490	7,605.96	2013
CPSG – WAGNER	003-0014	2	003-0014-4-0308	6,427.54 8	1239	5,188.55	2013
CPSG - WAGNER Total				16523.508	3729	12,794.51	
CPSG - BRANDON SHORES	003-0468	1	003-0468-3-0015	20,476.00	5,392	15,084.00	2013
CPSG - BRANDON SHORES	003-0468	2	003-0468-3-0016	19,498.00	5,627	13,871.00	2013
CPSG - BRANDON SHORES Total				39,974.00	11,019	28,955.00	
CPSG - CP CRANE	005-0079	1	005-0079-3-0108	17,971.00	1,532	16,439.00	2013
CPSG - CP CRANE	005-0079	2	005-0079-3-0109	14,415.00	1,646	12,769.00	2013
CPSG - CP CRANE Total				32,386.00	3,178	29,208.00	
MIRANT MID-ATLANTIC LLC - MORGANTOWN	017-0014	1	017-0014-3-0002	37,756.58	4,646	33,110.58	2013
MIRANT MID-ATLANTIC LLC - MORGANTOWN	017-0014	2	017-0014-3-0003	32,586.81	4,679	27,907.81	2013
MIRANT MID-ATLANTIC LLC - MORGANTOWN Total				70,343.38	9,325	61,018.38	
MIRANT MID-ATLANTIC - DICKERSON	031-0019	1	031-0019-3-0001	10,205.99	1,238	8,967.99	2013
MIRANT MID-ATLANTIC - DICKERSON	031-0019	2	031-0019-3-0002	11,061.66	1,355	9,706.66	2013
MIRANT MID-ATLANTIC - DICKERSON	031-0019	3	031-0019-3-0003	12,636.93	1,285	11,351.93	2013
MIRANT MID-ATLANTIC - DICKERSON Total				33,904.59	3,878	30,026.59	
PEPCO - CHALK POINT	033-0014	1	033-0014-3-0004	23,537.00	2,606	20,931.00	2013
PEPCO - CHALK POINT	033-0014	2	033-0014-3-0005	25,194.00	2,733	22,461.00	2013
PEPCO - CHALK POINT Total				48,731.00	5,339	43,392.00	
GRAND TOTAL				241,862.48	36,468	205,394.48	

Table 9-9: NO_X Emission Reductions (from 2002 Baseline) from MD HAA Sources

Facility Name	Facility ID	Unit ID	Registration ID	Baseline Emissions (TPY)	Emission Limit (TPY)	Emission Reductions (TPY)	Schedule of Compliance
CPSG – WAGNER	003-0014	3	003-0014-3-0003	1,718.0625	1,115	603	2012
CPSG - WAGNER	003-0014	2	003-0014-4-0308	2,232.063	555	1,677	2012
CPSG - WAGNER Total				3,950.1255	1,670	2,280	
CPSG - BRANDON SHORES	003-0468	1	003-0468-3-0015	6,329.00	2,414	3,915	2012
CPSG - BRANDON SHORES	003-0468	2	003-0468-3-0016	6,034.00	2,519	3,515	2012
CPSG - BRANDON SHORES Total				12,363.00	4,933	7,430	
CPSG - CP CRANE	005-0079	1	005-0079-3-0108	6,245.00	686	5,559	2012
CPSG - CP CRANE	005-0079	2	005-0079-3-0109	4,285.00	737	3,548	2012
CPSG - CP CRANE Total				10,530.00	1,423	9,107	
MIRANT MID-ATLANTIC LLC - MORGANTOWN	017-0014	1	017-0014-3-0002	10,013.87	2,079	7,935	2012
MIRANT MID-ATLANTIC LLC - MORGANTOWN	017-0014	2	017-0014-3-0003	8,605.34	2,094	6,511	2012
MIRANT MID-ATLANTIC LLC - MORGANTOWN Total				18,619.22	4,173	14,446	
MIRANT MID-ATLANTIC - DICKERSON	031-0019	1	031-0019-3-0001	2,176.54	554	1,623	2012
MIRANT MID-ATLANTIC - DICKERSON	031-0019	2	031-0019-3-0002	2,358.98	607	1,752	2012
MIRANT MID-ATLANTIC - DICKERSON	031-0019	3	031-0019-3-0003	2,694.92	575	2,120	2012
MIRANT MID-ATLANTIC - DICKERSON Total				7,230.44	1,736	5,494	
PEPCO - CHALK POINT	033-0014	1	033-0014-3-0004	6,327.60	1,166	5,162	2012
PEPCO - CHALK POINT	033-0014	2	033-0014-3-0005	6,773.10	1,223	5,550	2012
PEPCO - CHALK POINT Total				13,100.70	2,389	10,712	
GRAND TOTAL				65,793.49	16,324	49,469	

Table 9-10: Summary of HAA Requirements for BART facilities

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
CPSG – WAGNER 003-0014 3 003-0014-3-0003	SO2	Multiple	10,095.96	2490	7,605.96	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total SO_2 emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
CPSG - CP CRANE 005-0079 1 005-0079-3-0108	SO_2	Multiple	17,971.00	1,532	16,439.00	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total SO_2 emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT – MORGANTOWN 017-0014 1 0017-0014-3-0002	SO_2	Multiple	37,756.58	4,646	33,110.58	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total SO_2 emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT – MORGANTOWN 017-0014 2 017-0014-3-0003	SO_2	Multiple	32,586.81	4,679	27,907.81	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total SO_2 emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT – CHALK POINT 033-00149 1 033-0014-3-0004	SO_2	Multiple	23,537.00	2,606	20,931.00	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total SO_2 emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT – CHALK POINT 033-00149 2 033-0014-3-0005	SO_2	Multiple	25,194.00	2,733	22,461.00	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total SO_2 emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
CPSG – WAGNER 003-0014 3 003-0014-3-0003	NO_X	Multiple	1,718	1,115	603	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total NO_X emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
CPSG - CP CRANE 005-0079 1 005-0079-3-0108	NO_X	Multiple	6,245	686	5,559	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total NO_X emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT – MORGANTOWN 017-0014 1 0017-0014-3-0002	NO_X	Multiple	10,013	2,079	7,935	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total NO_X emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT – MORGANTOWN 017-0014 2 017-0014-3-0003	NO_X	Multiple	8,605	2,094	6,511	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total NO_X emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
MIRANT– CHALK POINT 033-00149 1 033-0014-3-0004	NO_X	Multiple	6,327	1,166	5,162	MD Healthy Air Act	26.11.27.03
MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E						
Other Permit Requirements	Total NO_X emissions shall not exceed the Healthy Air Act annual caps.						
Compliance Date	January 1, 2013						

Facility Name Facility ID Registration ID	Pollutant	Control Method	Baseline Emissions (TPY)	HAA Emission Limit (TPY)	Emission Reductions (TPY)	Permit/Regulation Requirements	COMAR Citation
Facility Name Facility ID Registration ID	**Pollutant**	**Control Method**	**Baseline Emissions (TPY)**	**HAA Emission Limit (TPY)**	**Emission Reductions (TPY)**	**Permit/Regulation Requirements**	**COMAR Citation**
MIRANT – CHALK POINT 033-00149 2 033-0014-3-0005	NO_X	Multiple	6,773	1,223	5,550	MD Healthy Air Act	26.11.27.03

MRR Requirements	Compliance with the Healthy Air Act emission limits shall be demonstrated in compliance with COMAR 26.11.27.03 E
Other Permit Requirements	Total NO_X emissions shall not exceed the Healthy Air Act annual caps.
Compliance Date	January 1, 2013

9.9 EGU Particulate Matter

Primary particulate matter (PM) emissions from coal-fired and oil-fired electric utility boilers consist primarily of fly ash. Fly ash from coal-fired boilers is the unburned carbon char and the mineral portion of combusted coal. Fly ash from oil-fired boilers also typically consists of unburned carbon char and the mineral portion of the fuel oil. The amount of ash in the fuel, which ultimately exits the boiler unit as fly ash, is a complex function of the fuel properties, furnace-firing configuration, and boiler operation.

For the dry-bottom, pulverized coal-fired boilers, approximately 80 percent of the total ash exits as fly ash. Wet-bottom, pulverized-coal-fired boilers emit significantly less fly ash. On the order of 50 percent of the total ash exits the boiler as fly ash. In a cyclone furnace boiler, most of the ash is retained as liquid slag; thus, the quantity of fly ash exiting the boiler is typically 20 to 30 percent of the total ash. However, the high operating temperatures unique to these designs may also promote ash vaporization and larger fractions of submicron fly ash compared to dry bottom designs. Fluidized-bed combustors emit high levels of fly ash since the coal is fired in suspension and the ash is present in dry form. Spreader-stoker-fired boilers can also emit high levels of fly ash. However, overfeed and underfeed stokers emit less fly ash than spreader stokers, since combustion takes place in a relatively quiescent fuel bed.

In addition to the fly ash, PM emissions from coal-fired and oil-fired EGUs result from reactions of the SO_2 and NO_X compounds as well as unburned carbon particles carried in the flue gas from the boiler. The SO_2 and NO_X compounds are initially in the vapor phase following coal combustion in the furnace chamber but can partially chemically transform in the stack, or near plume, to form fine PM in the form of nitrates, sulfur trioxide (SO_3), and sulfates. Firing configuration and boiler operation can affect the fraction of carbon (from unburned fuel) contained in the fly ash.

In general, the high combustion efficiencies achieved by pulverized coal-fired boilers and cyclone-fired boilers result in relatively small amounts of unburned carbon particles in the exiting combustion gases. Those pulverized-coal-fired electric utility boilers that use special burners for NO_X control tend to burn coal less completely; consequently, these furnaces tend to emit a higher fraction of unburned carbon in the combustion gases exiting the furnace. Similar issues exist for residual oil-fired boilers.

PM control technologies include electrostatic precipitators (ESPs), fabric filters (FFs) (also called baghouses.), and particulate scrubbers (PS). These technologies typically achieve greater than 95 percent removal of total particulate mass with over 80 percent removal of PM smaller than 0.3 um (with the exception of particulate scrubbers which achieve only 30-85 percent removal for this smaller size fraction). Mechanical collectors have even lower trapping efficiencies. PM controls are in place on virtually all EGUs already, including all of the Maryland BART EGU units; hence the issue that will be faced in conducting BART determinations is how these existing controls will interface with proposed controls for other pollutants.

Nationally, electrostatic precipitators are the predominant control type used on coal-fired electric utility boilers both in terms of number of units (84 percent) and total generating capacity (87 percent). Some oil-fired boilers also utilized ESPs. The second most common control device type used is a fabric filter. Fabric filters are used on about 14 percent of the coal-fired electric utility boilers. Particle scrubbers are used on approximately three percent of the boilers. The least used control device type is a mechanical collector. Less than one percent of the coal-fired electric utility boilers use this type of control device as the sole PM control. Other boilers equipped with a mechanical collector use this control device in combination with one of the other PM control device types.

Table 9-11: Comparison of PM collection efficiencies for different PM control devices [11]

PM Control Type	Representative PM Mass Collection Efficiency Range	
	Total PM	PM Less than 0.3 um
Electrostatic precipitator (Cold-side)	99 to 99.7 %	80 to 95 %
Electrostatic precipitator (Hot-side)	99 to 99.7 %	80 to 95 %
Fabric Filter	99 to 99.9%	99 to 99.8 %
Particle scrubber	95 to 99 %	30 to 85 %
Mechanical collector	70 to 90 %	0 to 15 %

9.9.1 Electrostatic Precipitators

Electrostatic precipitator (ESP) control devices have been used to control PM emissions from power plants since the early 1920's. These devices can be designed to achieve high PM collection efficiencies (greater than 99 percent). An ESP operates by imparting an electrical charge to incoming particles, and then attracting the particles to oppositely charged metal plates for collection. Periodically, the particles collected on the plates are dislodged in sheets or agglomerates (by rapping the plates) and fall into a collection hopper. The dust collected in the ESP hopper must be removed and may be treated as a solid waste or, in some instances, used for beneficial purposes such as in cement manufacture.

The effectiveness of particle capture in an ESP depends largely on the electrical resistance of the particles being collected. An optimum value exists for a given ash. Above and below this value, particles become less effectively charged and collected. Coal that contains a moderate to high amount of sulfur (more than approximately three percent) produces an easily collected fly ash. Low-sulfur coal produces a high-resistivity fly ash that is more difficult to collect. Resistivity of the fly ash can be changed by operating the boiler at a different temperature or by conditioning the particles upstream of the ESP with sulfur trioxide, sulfuric acid, water, sodium, or ammonia. In addition, collection efficiency is not uniform for all particle sizes. For coal fly ash, particles larger than about 1 to 8 μm and smaller than about 0.3 μm (as opposed to total PM) are typically collected with efficiencies from 95 to 99.9 percent. Particles near the 0.3 μm size are in a poor charging region that reduces collection efficiency to 80 to 95 percent.

An ESP can be used at one of two locations in a coal-fired electric utility boiler system. For many years, every ESP was installed downstream of the air heater where the temperature of the flue gas is between 130 and 180 °C (270 and 350 °F). An ESP installed at this location is referred to as a "cold-side" ESP. However, to meet SO_2 emission requirements, many electric utilities switched to

11 Buonicore and Davis, 1992

burning low-sulfur coal. These coals have higher electrical ash resistivity, making the fly ash more difficult to capture in an ESP downstream of the air heater. Therefore, to take advantage of the lower fly-ash resistivity at higher temperatures, some ESPs are installed upstream of the air heater, where the temperature of the flue gas is in the range of 315 to 400 °C (600 to 750 °F). An ESP installed upstream of the air heater is referred to as a "hot-side" ESP.

9.9.2 Fabric Filters

Fabric filters (FF) have been used for fly ash control from coal-fired electric utility boilers since the 1970s. This type of control device collects fly ash in the combustion gas stream by passing the gases through a porous fabric material. The buildup of solid particles on the fabric surface forms a thin, porous layer of solids or a filter cake, which further acts as a filtration medium. Gases pass through this cake/fabric filter, but the fly ash is trapped on the cake surface. The fabric material used is typically fabricated in the shape of long, cylindrical bags. Hence, fabric filters also are frequently referred to as "baghouses."

Gas flow through a FF becomes excessively restricted if the filter cake on the bags becomes too thick. Therefore, the dust collected on the bags must be removed periodically. The type of mechanism used to remove the filter cake classifies FF design types. Depending on the FF design type, the dust particles will be collected either on the inside or outside of the bag. For designs in which the dust is collected on the inside of the bags, the dust is removed by either mechanically shaking the bag (called a "shaker type" FF) or by blowing air through the bag from the opposite side (called a "reverse-air" FF). An alternate design mounts the bags over internal frame structures, called "cages" to allow collection of the dust on the outside of the bags. A pulsed jet of compressed air is used to cause a sudden stretching, then contraction, of the bag fabric dislodging the filter cake from the bag. This design is referred to as a "pulse-jet" FF. The dislodged dust particles fall into a hopper at the bottom of the baghouse. The dust collected in the hopper is a solid waste that must be must be removed and may be treated as a solid waste or, in some instances, used for beneficial purposed such as use in cement manufacture.

A FF must be designed and operated carefully to ensure that the bags inside the collector are not damaged or destroyed by adverse operating conditions. The fabric material must be compatible with the gas stream temperatures and chemical composition. Because of the temperature limitations of the available bag fabrics, location of an FF for use in a coal-fired electric utility boiler is restricted to downstream of the air heater. In general, fabric filtration is the best commercially available PM control technology for high-efficiency collection of small particles.

Electrostatic stimulation of fabric filtration (ESFF) involves a modified fabric filter that uses electrostatic charging of incoming dust particles to increase collection efficiency and reduce pressure drop compared to fabric filters without charging. Filter bags are specially made to include wires or conductive threads, which produce an electrical field parallel to the fabric surface. Conductors can also be placed as a single wire in the center of the bag. When the bags are mounted in the baghouse, the conductors are attached to a wiring harness that supplies electricity. As particles enter the field and are charged, they form a porous mass or cake of agglomerates at the fabric surface. Greater porosity of the cake reduces pressure drop, while the agglomeration increases efficiency of small particle collection. Cleaning is required less frequently, resulting in longer bag life. For felted or nonwoven bags, the field promotes collection on the outer surface of the fabric, which also promotes longer bag life. Filtration velocity can be increased so that less fabric area is required in the baghouse. The amount of reduction is based on an economic balance among desired performance, capital cost, and operating costs. A number of variations exist on the ESFF idea of combining particle charging with fabric filtration.

9.9.3 Particle Scrubbers and Mechanical Collectors

Particle scrubbers are generally much less efficient than ESPs and baghouses (especially in collecting finer fraction of PM). To achieve high collection efficiencies these devices will typically require relatively large amounts of water consumption and fan energy in the form of high pressure drops across the device. These devices are not largely used for particulate collection on EGUs.

Mechanical collectors have the least collection efficiency and are hardly used in the industry for modern coal-fired EGUs. However, mechanical collectors are frequently found on residual oil-fired EGUs. These devices remove particulate from the flue gas by centrifugal, inertial, and gravitational forces developed in a vortex separator, or grouping of vortex separators, sometimes referred to as cyclone separators or multi-cyclone separators. Because these collectors primarily rely on differential inertia, collection efficiencies vary with particle size, density, gas temperature, and pressure drop through the apparatus. Efficiencies are very high on material greater than 20 microns in size, but drop off rapidly as the particle sizes drop.

As shown in Table 9-12 below, all of the Maryland EGU BART sources have already installed effective PM control devices.

Table 9-12: PM Control Devices at Maryland EGU BART Sources

Facility Name Facility ID Unit ID Registration ID	Pollutant	Control Devices		Mane-VU Presumptive Control Technology [12]	Compliance Requirements Schedules
		Pre-BART Controls	BART Controls		
MIRANT – CHALK POINT 033-00149 1 033-0014-3-0004	PM	ESP	FGD	Baghouse ESP	FGD - 2010
MIRANT – CHALK POINT 033-00149 2 033-0014-3-0005	PM	ESP	FGD	Baghouse ESP	FGD - 2010
MIRANT – CHALK POINT 033-00149 3 033-0014-4-0998	PM	Operate 95% NG during O_3-Season			
MIRANT – MORGANTOWN 017-0014 1 0017-0014-3-0002	PM	ESP	FGD	Baghouse ESP	FGD - 2010
MIRANT – MORGANTOWN 017-0014 2 017-0014-3-0003	PM	ESP	FGD	Baghouse ESP	FGD - 2010
CPSG - CP CRANE 005-0079 2 005-0079-3-0109	PM	Baghouse		Baghouse ESP	
CPSG – WAGNER 003-0014 3 003-0014-3-0003	PM	Baghouse		Baghouse ESP	

12 Assessment of Control Technology Options for BART Eligible Sources, NESCAUM (March 2005)

9.9.4 Particulate Matter BART EGU Summary

40 CFR Part 51, 308(e)(1)(iii) states, "if the State determines in establishing BART that technological or economic limitations on the applicability of measurement methodology to a particular source would make the imposition of an emission standard infeasible, it may instead prescribe a design, equipment, work practice, or other operational standard, or combination thereof, to require the application of BART. Such standard, to the degree possible, is to set forth the emission reduction to be achieved by implementation of such design, equipment, work practice or operation, and must provide for compliance by means which achieve equivalent results." Maryland has determined that because Continuous Emission Monitors (CEMS) technology for PM is not yet on the market to determine emission limits (after current controls), BART should be prescribed as a combination of equipment and operational standards, as set forth in Table 9-11.

Table 9-13: Summary of BART PM Emission Standard

Facility Name Facility ID Registration ID	Pollutant	Controls (BART)	Operational Standard	COMAR Citation
CPSG – WAGNER 003-0014 3 003-0014-3-0003	PM	Fabric Filters (Baghouse)	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

Facility Name Facility ID Registration ID	Pollutant	Controls (BART)	Operational Standard	COMAR Citation
CPSG - CP CRANE 005-0079 3 005-0079-4-1227	PM	Fabric Filters (Baghouse)	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

Facility Name Facility ID Registration ID	Pollutant	Control Method	Operational Standard	COMAR Citation
MIRANT – MORGANTOWN 017-0014 1 0017-0014-3-0002	PM	ESP	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

Facility Name Facility ID Registration ID	Pollutant	Control Method	Operational Standard	COMAR Citation
MIRANT – MORGANTOWN 017-0014 2 017-0014-3-0003	PM	ESP	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

Facility Name Facility ID Registration ID	Pollutant	Control Method	Operational Standard	COMAR Citation
MIRANT – DICKERSON 031-0019 3 031-0019-3-0003	PM	ESP Fabric Filter (Baghouse)	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

Facility Name Facility ID Registration ID	Pollutant	Control Method	BART shall be the proper operation of the existing control device.	26.11.09.06 c
PEPCO – CHALK POINT 033-00149 1 033-0014-3-0004	PM	ESP	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

Facility Name Facility ID Registration ID	Pollutant	Control Method	BART shall be the proper operation of the existing control device.	26.11.09.06 c
PEPCO – CHALK POINT 033-00149 2 033-0014-3-0005	PM	ESP	BART shall be the proper operation of the existing control device.	26.11.09.06 c
MRR Requirements	Reporting, monitoring, and recordkeeping requirements to make the BART equipment and operational standard (i.e., proper operation of the existing control device) practically enforceable shall be imposed pursuant to COMAR 26.11.01.04			
Compliance Date	Existing			

9.10 Schedule for BART Implementation

As provided in 40 CFR §51.308(e)(1)(iv) BART must be in operation for each applicable source no later than five years after SIP/TIP approval. The State of Maryland is requiring that each source subject to BART shall install and operate BART as expeditiously as practicable but in no event later than five years after approval of the SIP/TIP or plan revision by EPA.

As provided in 40 CFR §51.308(e)(1)(v) the Title V operating permits for BART sources must include a requirement that each source maintain the control equipment and establish procedures to ensure such equipment is properly operated and maintained. This requirement will be enforceable by Maryland regulation.

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10.0 Reasonable Progress Goals

For each Class I area within a State/Tribe area, 40 CFR Section 51.308 (d)(1) requires the State/Tribe to establish reasonable progress goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility. In addition, U.S. Environmental Protection Agency (EPA) released guidance on June 7, 2007 to use in setting reasonable progress goals. The goals must provide improvement in visibility for the most impaired days, and ensure no degradation in visibility for the least impaired days over the State Implementation Plan (SIP) period. The State/Tribe must also provide an assessment of the number of years it would take to attain natural visibility condition if improvement continues at the rate represented by the reasonable progress goal.

Under 40 CFR Section 51.308 (d)(1)(iv) consultation is required in developing reasonable progress goals (RPG). The rule states:

In developing each reasonable progress goal, the State must consult with those States which may reasonably be anticipated to cause or contribute to visibility impairment in the mandatory Class I Federal area. In any situation in which the State cannot agree with another such State or group of States that a goal provides for reasonable progress, the State must describe in its submittal the actions taken to resolve the disagreement. In reviewing the State's implementation plan submittal, the Administrator will take this information into account in determining whether the State's goal for visibility improvement provides for reasonable progress towards natural visibility conditions.

In developing the RPG, the Class I state must also consider four factors (cost, time needed, energy and non-air quality environmental impacts, and remaining useful life). The state also must show that it considered the uniform rate of improvement and the emission reduction measures needed to achieve it for the period covered by the implementation plan, and if the state proposes a rate of progress slower than the uniform rate of progress, the state must assess the number of years it would take to attain natural conditions if visibility improvement continues at the rate proposed.

10.1 Consultation and Agreement with Other States' Goals

Maryland consulted with the following states having Class I areas as those states established reasonable progress goals for their Class I areas:

- Maine
- New Hampshire
- Vermont
- New Jersey
- West Virginia
- Virginia

10.2 Analysis of the Four Statutory Factors

40 CFR Section 51.308(d)(1), was promulgated under the authority of section 169A(b)(2) of the federal Clean Air Act and requires Class I states to consider the following four factors to determine which additional emission control measures are needed to make reasonable progress in improving visibility: 1) costs of compliance, 2) time necessary for compliance, 3) energy and non-air quality environmental impacts of compliance, and 4) remaining useful life of any existing source subject to such requirements. These are known as the four statutory factors. The plan must include reasonable measures and identify the visibility improvement that will result from those measures. Class I states also must show that it considered the uniform rate of improvement and the emission reduction measures needed to achieve it for the period covered by the implementation plan. If the state proposes a rate of progress slower than the uniform rate of progress, assess the number of years it would take to attain natural conditions if visibility improvement continues at the rate proposed.

10.3 Identification of Key Source Categories

Based on available information about emissions and potential impacts, the MANE-VU Reasonable Progress Workgroup selected the following source categories for detailed analysis of the four factors the Clean Air Act establishes as the basis for determining how much progress in visibility improvement is reasonable:

- Coal and oil-fired Electric Generating Units, (EGUs);
- Point and area source industrial, commercial and institutional boilers;
- Cement kilns;
- Lime kilns;
- The use of heating oil; and
- Residential wood combustion and open burning.

This analysis is described in detail in the *Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas* (MACTEC) (Appendix K). The *Reasonable Progress Report* summarizes MANE-VU's assessment of pollutants and associated source categories affecting visibility in Class I areas in and near MANE-VU, lists possible control measures for those pollutants and source categories, and develops the requisite four factor analysis. Table 10-1 presents a summary of the four factor analysis for the source categories analyzed in the Reasonable Progress Report.

Table 10-1: Summary of Results from the Four Factor Analysis

Source Category	Primary Regional Haze Pollutant	Control Measure(s)	Average Cost in 2006 dollars (per ton of pollutant reduction)	Compliance Timeframe	Energy and Non-Air Quality Environmental Impacts	Remaining Useful Life
Electric Generating Units	SO_2	Switch to a low sulfur coal (generally <1% sulfur), switch to natural gas (virtually 0% sulfur), coal cleaning, Flue Gas Desulfurization (FGD)-Wet, -Spray Dry, or -Dry.	IPM®* v.2.1.9 predicts $775-$1,690. $170-$5,700 based on available literature	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, reduction in electricity production capacity, wastewater issues	50 years or more
Industrial, Commercial, Institutional Boilers	SO_2	Switch to a low sulfur coal (generally <1% sulfur), switch to natural gas (virtually 0% sulfur), switch to a lower sulfur oil, coal cleaning, combustion control, Flue Gas Desulfurization (FGD)-Wet, -Spray Dry, or -Dry.	$130-$11,000 based on available literature. Depends on size.	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, control device energy requirements, wastewater issues	10-30 years

*Integrated Planning Model®

Source Category	Primary Regional Haze Pollutant	Control Measure(s)	Average Cost in 2006 dollars (per ton of pollutant reduction)	Compliance Timeframe	Energy and Non-Air Quality Environmental Impacts	Remaining Useful Life
Cement and Lime Kilns	SO_2	Fuel switching, Dry Flue Gas Desulfurization-Spray Dryer Absorption (FGD), Wet Flue Gas Desulfurization (FGD), Advanced Flue Gas Desulfurization (FGD).	\$1,900-\$73,000 based on available literature. Depends on size.	2-3 years following SIP submittal	Control device energy requirements, wastewater issues	10-30 years
Heating Oil	SO_2	Lower the sulfur content in the fuel. Depends on the state.	\$550-\$750 based on available literature. There is a high uncertainty associated with this cost estimate.	Currently feasible. Capacity issues may influence timeframe for implementation of new fuel standards	Increases in furnace/boiler efficiency, Decreased furnace/boiler maintenance requirements	18-25 years
Residential Wood Combustion	PM	State implementation of NSPS, Ban on resale of uncertified devices, installer training certification or inspection program, pellet stoves, EPA Phase II certified RWC devices, retrofit requirement, accelerated changeover requirement, accelerated changeover inducement.	\$0-\$10,000 based on available literature	Several years - dependent on mechanism for emission reduction	Reduce greenhouse gas emissions, increase efficiency of combustion device	10-15 years

10.4 The Four Reasonable Progress Goals

The reasonable progress goals adopted by the MANE-VU Class I States represent implementation of the regional course of action set forth by MANE-VU on June 20, 2007 in two Resolutions: "*Statement of the Mid-Atlantic/Northeast Visibility union (MANE-VU) Concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress*." and *The Resolution of the Commissioners of States with Mandatory Class I Federal Areas within the Mid-Atlantic Northeast Visibility Union (MANE-VU) Regarding Principles for Implementing the Regional Haze Rule* (Resolution).

The MANE-VU Class I states Reasonable Progress Goals are summarized as follows:

1. Timely implementation of BART requirements;

2. A 90 percent or greater reduction in sulfur dioxide (SO_2) emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU comprising a total of 167 stacks, dated June 20, 2007) as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and

3. A low sulfur fuel oil strategy[13] to reduce the sulfur content of:

    a. Distillate oil to 0.05 percent sulfur by weight (500 ppm) by no later than 2014,
    b. #4 residual oil to 0.25 percent-0.50 percent sulfur by weight by no later than 2018,
    c. #6 residual oil to no greater than 0.5 percent sulfur by weight by no later than 2018, and
    d. Further reduce the sulfur content of distillate oil to 15 ppm by 2018 depending on supply and availability, and

4. Continued evaluation of other control measures including energy efficiency, alternative clean fuels, and other measures to reduce SO_2 and nitrogen oxide (NO_X) emissions from all coal-burning facilities by 2018 and new source performance standards for wood combustion.

As stated in the Resolutions, this long-term strategy to reduce and prevent regional haze will allow each state up to 10 years to pursue adoption and implementation of reasonable and cost-effective NO_X and SO_2 control measures as appropriate and necessary.

13 MANE-VU established different timelines for the low-sulfur fuel strategy for MANE-VU states.

Item # 6 of the Class I States' Resolution states: *"The invitation to contributing States to review the proposed reasonable progress includes an option of flexibility*[14] *such that each contributing State could obtain its share of the emission reductions needed to meet the progress goals for the MANE-VU mandatory Class I Federal areas through implementation of other new or expanded rules or programs that will achieve a commensurate or equal level of emission reduction in their State and visibility benefit in the mandatory Class I Federal areas as would have been achieved through implementation of the reasonable measure in the same time frame requested by the MANE-VU States with mandatory Class I Federal areas"* . Item # 6 of the Class I States' Resolution supports the use of Maryland's Healthy Air Act to achieve the reasonable progress goals.

Maryland agrees to these four (4) reasonable progress goals, and demonstrates in the following section that we will achieve them.

14 This "option of flexibility" means that states can substitute SO_2 reductions from one RPG "ask" to another, i.e. surplus SO_2 reductions EGUs can substitute for SO_2 deficits in low-sulfur fuels.

11.0 Maryland Achievement of the Reasonable Progress Goals

The previous section discussed reasonable progress goals (RPG) agreed upon by MANE-VU Class I states. This section addresses the four (4) RPG, and how Maryland meets or exceeds them. Additional measures are also discussed.

11.1 Best Available Retrofit Technology (BART)

The Healthy Air Act (HAA) is better than BART for SO_2 and NO_X sources. It should be noted that Maryland has gone beyond the CAIR reductions for SO_2 and NO_X. In going beyond the requirements of the Clean Air Interstate Rule (CAIR), Maryland has adopted the Healthy Air Act to significantly reduce emissions from EGUs. As is demonstrated in Section 11.3.1 Maryland's Healthy Air Act will reduce SO_2 emissions from the 12 units identified under the MANE-VU list of 167 stacks as well as other EGUs in the state. Combined Maryland will reduce SO_2 emissions by 269,444 tons per year and yield a surplus of 57,552 tons per year beyond that of the 2018 RPG target.

11.2 90 Percent SO_2 Reductions from Maryland "Top 167" EGU Units

MANE-VU identified emissions from 167 stacks at EGU facilities as having visibility impacts in MANE-VU Class I areas that make controlling emissions from those stacks crucial to improving visibility at MANE-VU Class I areas.

MANE-VU's agreed regional approach for this source sector is to pursue a 90 percent control level on SO_2 emissions from these 167 stacks by 2018 as appropriate and necessary. MANE-VU has concluded that pursuing this level of sulfur reduction is both reasonable and cost-effective. Table 11.1 identifies the EGU facilities and units in Maryland included in the MANE-VU list of "167 units".

Table 11-1: Maryland's 12 EGU facilities identified in the MANE-VU list of "167 units"

State Name	Plant Name	Unit(s)
Maryland	Brandon Shores	1, 2
Maryland	CP Crane	1, 2
Maryland	Chalk Point	1, 2
Maryland	Dickerson	1, 2, 3
Maryland	Wagner	3
Maryland	Morgantown	1, 2

MANE-VU identified 167 stacks at EGU facilities that had the highest emissions in the eastern U.S. These had highest visibility impacts on MANE-VU Class I areas. Thus, controlling emissions from those stacks is crucial to improving visibility. Therefore, to meet the reasonable progress goals, SO_2 emissions from those units (or those units plus other sources[15]) must be

15 The MANE-VU Resolutions state that, "If it is infeasible to achieve that level of reduction from a 167 unit, alternative measures will be pursued in such State, which could include other point sources"

reduced by at least 90%. Table 11-2 shows the SO_2 emission reductions needed to meet the 90% RPG for those units. The required emission reductions are based on 90% of the 2002 emissions.

Table 11-2: RPG SO_2 Emission Reduction scenario

RPG "Ask" Emission Reduction Target	SO_2 (TPY)
All 12 of MD's "167 Units"	**211,892**

Table 11-3 shows the SO_2 emission reductions achieved by the Maryland Healthy Air Act (HAA). The reductions are based on the predicted 2018 emissions and the HAA caps. Maryland's Healthy Air Act will reduce SO_2 emissions from the 12 units identified under the MANE-VU list of 167 stacks as well as other EGUs in the state. Maryland will reduce SO_2 emissions by 269,444 tons per year and yield a surplus of 57,552 tons per year beyond that of the 2018 RPG target.

Table 11-3: 2018 MD Healthy Air Act SO_2 reductions

2018 reductions based on regulations (HAA) already in place	SO_2 (TPY)
HAA Reductions on the twelve MD "167 Units" [16]	*257,741*
HAA Reductions from remaining EGU Units in Maryland	11,703
Total Maryland Reductions	**269,444**
2018 RPG Target	**211,892**
"Surplus" *(Maryland reductions minus RPG [269,444 – 211,892])*	**57,552**

It is apparent from comparing Tables 11-2 and 11-3 that the reductions from the Maryland Healthy Air Act more than satisfy Reasonable Progress Goals. Thus, Maryland already fulfills its share of emission reductions under the RPG "ask" for EGUs. Furthermore, these control measures will be achieved well before the time frame requested by both the BART rule and the Reasonable Progress Goals.

11.3 Low Sulfur Fuel Oil Strategy

The assumption underlying the MANE-VU low-sulfur fuel oil strategy is that refiners can, by 2018, produce home heating and fuel oils that contain 50 percent less sulfur for the heavier

16 Based on the projected 2018 emissions from the Maryland "167 Units".

grades (#4 and #6 residual), and a minimum of 75 percent and maximum of 99.25 percent less sulfur in #2 fuel oil (also known as home heating oil, distillate, or diesel fuel) at an acceptably small increase in price to the end user. As much as 75 percent of the total sulfur reductions achieved by this strategy come from using the low-sulfur #2 distillate for space heating in the residential and commercial sectors. The MANE-VU Class I states agreed that a low-sulfur oil strategy is reasonable to pursue by 2018 *as appropriate and necessary*. Table 11-4 gives the TPY reductions by fuel type assuming RPG measures are in place by 2018.

Table 11-4: 2018 SO_2 reductions that would result from implementing a low sulfur fuel strategy (RPG)

Low-sulfur fuel RPG Reductions "asked"	**SO_2 (TPY)**
Residual and # 4 Fuel Oils (assumes 0.5 % sulfur)	1,344.1
Distillate (15 ppm sulfur)	6,129.3
Total	**7,473.4**

The MANE-VU area has not adopted a regional low-sulfur fuel oil measure. However, the Maryland EGU "surplus" of 57,552 TPY (Table 11.3) from the Healthy Air Act is greater than the entire benefit of 7,473.4 TPY from the low-sulfur fuel strategy. Therefore, Maryland meets Reasonable Progress Goal "ask" for low-sulfur fuels by implementing expanded regulations on EGUs[17], and thus achieved its fair share of SO_2 emission reductions.

Nonetheless, as agreed upon in the MANE-VU Resolutions, Maryland will pursue this measure *as appropriate and necessary*, and in five years at the time of our first periodic SIP report expects to report on progress toward adoption by 2018.

11.4 Continued Evaluation of Other Control Measures

- Maryland will continue to evaluate other control measures including energy efficiency and alternative clean fuels to reduce SO_2 and nitrogen oxide (NO_X) emissions from all coal-burning facilities by 2018 as well as new source performance standards for any wood combustion within the state. Accordingly, the Maryland Strategic Energy Investment Fund (SEIF) was established recently. The SEIF is a special, non-lapsing fund that is made up of the proceeds from the quarterly auction of carbon allowances to electric power plants under the Regional Greenhouse Gas Initiative (RGGI). Maryland joined RGGI in 2006 as part of the Healthy Air Act and the proceeds from the CO_2 allowance auctions are deposited in the Strategic Energy Investment Fund (SEIF) administered by the Maryland Energy Administration. The SEIF provides for significant investments in energy efficiency and renewable energy

17 The reasonable progress goals established in the Class I states Resolution includes an option of flexibility such states could obtain their share of the emission reductions needed to meet the progress goals through implementation of other new or expanded rules or programs that will achieve a commensurate or equal level of emission reduction in their State and visibility benefit in the Class I areas

technologies to reduce the state's emissions of greenhouse gases. It also provides short-term residential rate relief as well as a long-term strategy to promote energy efficiency and lower electricity costs by increasing overall supply and decreasing demand. The first RGGI auction was held on September 25, 2008 and generated $16.3 million for Maryland. A report on the expenditure of the SEIF will be prepared annually by the Maryland Energy Administration.

More information can be found at: www.energy.state.md.us.

11.5 Maryland Reductions vs. Regional Reductions Demonstrate Fair Share

As can be seen in Table 11-5, the average SO_2 percent reduction for all MANE-VU states is 68 percent. The 2018 projections for Maryland's SO_2 reductions are a 76 percent reduction (see Table 11-6). Maryland believes this SIP demonstrates the state will achieve its "fair share" of emissions reductions by 2018.

Table 11-5: SO_2 Emission Reductions from Point, Area and Mobile Sources in MANE-VU

Emissions Sector	Baseline 2002	2018*	Percent Reduction
Area	286,921	129,656	**55%**
Non-EGU	264,377	211,320	**20%**
EGU	1,643,257	386,584	**76%**
On-Road Mobile	40,090	8,757	**78%**
Non-Road Mobile	57,257	8,643	**85%**
Total	**2,321,338**	**744,960**	**68%**

* with additional measures for RPG

Table 11-6: SO_2 Emission Reductions from Point, Area and Mobile Sources in Maryland

Emissions Sector	Baseline 2002	2018*	Percent Reduction
Area	12,393	4,904	60%
Non-EGU	34,193	27,006	21%
EGU	256,734	43,764	83%
On-Road Mobile	4,058	656	84%
Non-Road Mobile	7,942	577	93%

Total	**315,319**	**76,907**	76%

* with additional measures for RPG

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12.0 Long Term Strategy

40 CFR Section 51.308(d)(3) requires the State of Maryland to submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I Federal area within and outside the State/Tribe which may be affected by emissions from within the State/Tribe. The long-term strategy must include enforceable emissions limitations, compliance schedules, and other measures necessary to achieve the reasonable progress goals established by States/Tribes where the Class I areas are located. The State must consult with other states affecting the Class I area to develop coordinated emission management strategies. The State must demonstrate that it has included all measures necessary to obtain its share of the emission reductions needed to meet the progress goal for the area. If the State has participated in a regional planning process, the State must include measures needed to achieve its obligations agreed upon through that process.

This section describes how the State of Maryland meets the long-term strategy requirements.

This long term strategy addresses visibility impairment for each of the following Class I areas which may be affected by emissions from within the State of Maryland:

- Acadia National Park,
- Brigantine Wilderness,
- Dolly Sods Wilderness and Otter Creek Wilderness,
- Lye Brook Wilderness,
- Shenandoah National Park.

As explained in Section 12.2.2, below, these are the Class I areas that are affected by emissions from within Maryland.

The long term strategy described below includes enforceable emissions limitations, compliance schedules, and other measures necessary to achieve the reasonable progress goals established for the above Class I areas to the extent that it is reasonable for the State of Maryland to adopt them before the date this SIP is submitted to EPA. Additional measures may be reasonable to adopt at a later date after further consideration and review.

12.1 Overview of the Long Term Strategy Development Process

As a participant in MANE-VU, the State of Maryland supported a regional approach towards deciding which control measures to pursue for regional haze that was based on technical analyses documented in the following reports:

- Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (called the Contribution Assessment, see Appendix A),
- Comparison of CAIR and CAIR Plus Proposal using the Integrated Planning Model® (called the CAIR+ Report, see Appendix J),
- Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas (called the Reasonable Progress Report, see Appendix K),

- Five-Factor Analysis of BART-Eligible Sources: Survey of Options for Conducting BART Determinations (see Appendix G-4), and
- Assessment of Control Technology Options for BART-Eligible Sources: Steam Electric Boilers, Industrial Boilers, Cement Plants and Paper and Pulp Facilities (see Appendix G-5).

The regional strategy development process identified reasonable measures that would reduce emissions contributing to visibility impairment at Class I areas affected by emissions from within the MANE-VU region by 2018 or earlier. The technical basis for the long term strategy is discussed in Section 10.2. This section describes the process of identifying potential emission reduction strategies.

12.1.1 Regional Process of Identifying Potential Strategies

MANE-VU reviewed a wide range of potential control measures to reduce emissions from sources contributing to visibility impairment in affected Class I areas. The process by which MANE-VU arrived at a set of proposed regional haze control measures to pursue for the 2018 milestone started in late 2005 in conjunction with efforts to identify measures to reduce ozone pollution. The Ozone Transport Commission (OTC) selected a contracting firm to assist with the analysis of ozone and regional haze control measure options. OTC provided the contractor with a "master list" of some 900 potential control measures, based on experience and previous state implementation plan work. With the help of an internal OTC control measure workgroup, the contractor also identified available regional haze control measures for MANE-VU's further consideration.

MANE-VU then developed an interim list of control measures, which for regional haze included: beyond-CAIR sulfate reductions from electricity generating units (EGUs), low-sulfur heating oil (residential and commercial), and controls on industrial, commercial, and institutional (ICI) boilers (both coal and oil-fired), lime and cement kilns, residential wood combustion, and outdoor burning (including outdoor wood boilers).

The next step in the regional haze control measure selection process was to further refine the interim list. The CAIR+ Report documents the analysis of the cost of additional SO_2 and NO_X controls at EGUs in the Eastern U.S. The Reasonable Progress Report documents the assessment of control measures for EGUs and the other source categories selected for analysis. Further analysis is provided in the NESCAUM document entitled, "Assessment of Control Technology Options for BART-Eligible Sources: Steam Electric Boilers, Industrial Boilers, Cement Plants and Paper and Pulp Facilities."

The beyond-CAIR EGU strategy continued to stay on the list since EGU sulfate emissions have, by far, the largest impact on visibility in the MANE-VU Class I areas. Likewise, a low-sulfur oil strategy gained traction after a NESCAUM-initiated conference with refiners and fuel-oil suppliers concluded that such a strategy could realistically be implemented in the 2014 timeframe. Thus the low-sulfur heating oil and the oil-fired ICI boiler sector control measures merged into an overall low-sulfur oil strategy for #2, #4, and #6 residual oils for both the residential and commercial heating and oil-fired ICI boiler source sectors.

During MANE-VU's internal consultation meeting in March 2007, member states reviewed the interim list of control measures to make further refinements. States determined, for example, that there may be too few coal-fired ICI boilers in the MANEVU states for that to be considered as a "regional" strategy, but could be a sector pursued by individual states. They also determined that lime and cement kilns, of which there are few in the MANE-VU region, would likely be handled via the BART determination process. Residential wood burning and outdoor wood boilers remained on the list for those states where localized visibility impacts may be of concern even though emissions from these sources are primarily organic carbon and direct particulate matter. Finally, outdoor wood burning was determined to also be better left as a sector to be examined further by individual states, due to issues of enforceability and penetration of existing state regulations.

12.2 Technical Basis for Emission Reduction Obligations

40 CFR Section 51.308(d)(3)(iii) requires states/tribes to document the technical basis for the state's/tribe's apportionment of emission reductions necessary to meet reasonable progress goals in each Class I area affected by the state's/tribe's emissions.

The State of Maryland relied on technical analyses developed by MANE-VU to demonstrate that the Maryland's emission reductions, when coordinated with those of other States and Tribes are sufficient to achieve reasonable progress goals in Class I areas affected by Maryland.

MANE-VU's technical documentation of the emission reductions necessary to meet reasonable progress goals in each Class I area affected by the State of Maryland is summarized in the following sections of this SIP and in additional documentation referenced in those sections and below:

- Baseline and Natural Background Visibility Conditions—Considerations and Proposed Approach to the Calculation of Baseline and Natural Background Visibility Conditions at MANE-VU Class I Areas (NESCAUM, December 2006) (Appendix H)
- The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description (NESCAUM, November 2006)(Appendix I)
- Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (NESCAUM, August 2006)(called the Contribution Assessment) (Appendix A)
- Comparison of CAIR and CAIR Plus Proposal using the Integrated Planning Model® (called the CAIR+ Report) (ICF, May 2007)(Appendix J)
- Assessment of Reasonable Progress for Regional haze in MANE-VU Class I Areas (MACTEC, July 2007)(called the Reasonable Progress Report) (Appendix K)
- Five-Factor Analysis of BART-Eligible Sources: Survey of Options for Conducting BART Determinations (June, 2007)(Appendix G-4)
- Assessment of Control Technology Options for BART-Eligible Sources: Steam Electric Boilers, Industrial Boilers, Cement Plants and Paper and Pulp Facilities (NESCAUM, March 2005)(Appendix G-5)
- MANE-VU Modeling for Reasonable Progress Goals: Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits (NESCAUM, February 2008)(Appendix L)

- 2018 Visibility Projections (NESCAUM, March 2008)(Appendix M)

In addition, the State of Maryland relied on analysis conducted by neighboring RPOs, including the following documents, which are available upon request but are not incorporated into this SIP:

- VISTAS Reasonable Progress Analysis Plan by VISTAS, dated September 18, 2006
- Reasonable Progress for Class I Areas in the Northern Midwest-Factor Analysis, by EC/R, dated July 18, 2007

The following sections discuss the pollutants, source regions, and types of sources considered in developing this long term strategy.

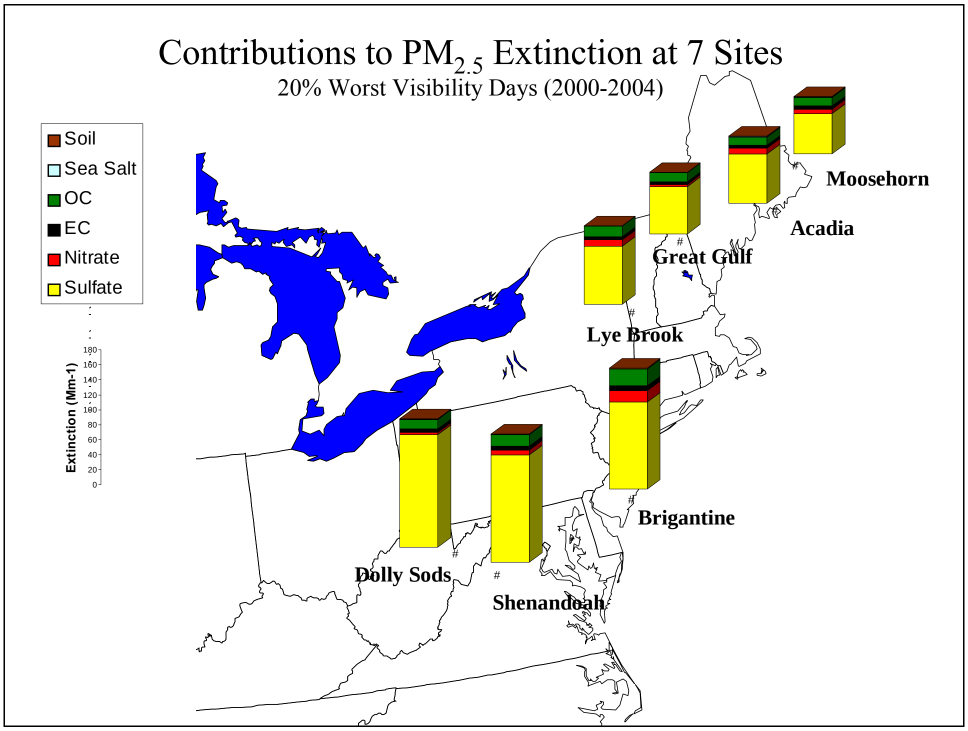
12.2.1 Visibility Impairing Pollutants

40 CFR Section 51.308(d)(3)(iv) requires each state to identify all anthropogenic sources of visibility impairment considered by the state in developing its long-term strategy. EPA's *Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program* (June, 2007) notes that this process begins with the identification of key pollutants and source categories that contribute to visibility impairment at the Class I area(s) affected by emissions from the state.

Finalized in August 2006, the MANE-VU Contribution Assessment reflects a conceptual model in which sulfate emerges as the most important single constituent of haze-forming fine particle pollution and the principle cause of visibility impairment across the region. Sulfate alone accounts for anywhere from one-half to two-thirds of total fine particle mass on the 20 percent haziest days at MANE-VU Class I sites. Organic carbon was shown to be the second largest contributor to haze. As a result of the dominant role of sulfate in the formation of regional haze in the Northeast and Mid-Atlantic region, MANE-VU concluded that an effective emissions management approach would rely heavily on broad-based regional SO_2 control efforts in the eastern United States.

The following figure shows the dominance of sulfate in the extinction calculated from the 2000-2004 baseline data.

FIGURE 12.1. CONTRIBUTIONS TO $PM_{2.5}$ EXTINCTION AT SEVEN CLASS I SITES



12.2.2 Contributing States and Regions

The MANE-VU Contribution Assessment used various modeling techniques, air quality data analysis, and emissions inventory analysis to identify source categories and states that contribute to visibility impairment in MANE-VU Class I areas. With respect to sulfate, based on estimates from four different techniques, the Contribution Assessment estimated emissions from within MANE-VU in 2002 were responsible for about 25-30 percent of the sulfate at MANE-VU and nearby Class I areas. (See Chapter 8 of the Contribution Assessment.) Emissions from other regions, Canada, and outside the modeling domain were also important.

Table 12-1, below, shows the results of one of the four methods of assessing state-by-state contributions to sulfate impacts (the REMSAD model). This table highlights the importance of emissions from outside the MANE-VU region. Note that percentage contributions differ between methods. This is one example.

Table 12-1: Percent of Modeled Sulfate Due to Emissions from Listed States[18]

Contributing States or Areas	Acadia, Maine (%)	Brigantine, New Jersey (%)	Dolly Sods and Otter Creek, West Virginia (%)	Great Gulf and Presidential Range Dry River, New Hampshire (%)	Lye Brook, Vermont (%)	Moosehorn and Roosevelt Campobello, Maine (%)	Shenandoah, Virginia (%)
Connecticut	0.76	0.53	0.04	0.48	0.55	0.56	0.08
Delaware	0.96	3.20	0.30	0.63	0.93	0.71	0.61
District of Columbia	0.01	0.04	0.01	0.01	0.02	0.01	0.04
Maine	6.54	0.16	0.01	2.33	0.31	8.01	0.02
Maryland	2.20	4.98	2.39	1.92	2.66	1.60	4.84
Massachusetts	10.11	2.73	0.18	3.11	2.45	6.78	0.35
New Hampshire	2.25	0.60	0.04	3.95	1.68	1.74	0.08
New Jersey	1.40	4.04	0.27	0.89	1.44	1.03	0.48
New York	4.74	5.57	1.32	5.68	9.00	3.83	2.03
Pennsylvania	6.81	12.84	10.23	8.30	11.72	5.53	12.05
Rhode Island	0.28	0.10	0.01	0.11	0.06	0.19	0.01
Vermont	0.13	0.06	0.00	0.41	0.95	0.09	0.01
MANE-VU	36.17	34.83	14.81	27.83	31.78	30.08	20.59
Midwest RPO	11.98	18.16	30.26	20.10	21.48	10.40	26.84
VISTAS	8.49	21.99	36.75	12.04	13.65	6.69	33.86
Other	43.36	25.02	18.18	40.03	33.09	52.83	18.71

The following two figures are from the Contribution Assessment and show another method used to identify and rank states' contributions to sulfate at MANE-VU and nearby Class I areas using 2002 data. One simple technique for deducing the relative impact of emissions from specific point sources on a specific receptor site involves calculating the ratio of annual emissions (Q) to source-receptor distance (d). This ratio (Q/d) is then multiplied by a factor designed to account for the effects of prevailing winds and to convert units. The use of this technique is explained in the Contribution Assessment. (See pages 4-13 and following.)

Based on the results of the Q/d technique, the following figures show the resulting rankings across a set of northern and southern Class I areas in or near MANE-VU. The first figure covers the four northern Class I areas in MANE-VU. The second figure covers one Class I area in the

18 Percentages based on 2002 annual average sulfate impact estimated with REMSAD model as described in MANE-VU Contribution Assessment Chapter 4 and summarized on page 8-2 of the Contribution Assessment.

southern part of MANE-VU as well as two neighboring Class I areas in the VISTAS region. For more details about the methods used to identify contributing states and regions, please see the Contribution Assessment document. Note the importance of emissions from Canada and from various states outside of the MANE-VU region.

FIGURE 12.2. RANKED STATE PERCENT SULFATE CONTRIBUTIONS TO NORTHEAST CLASS I RECEPTORS BASED ON EMISSIONS DIVIDED BY DISTANCE (Q/D) RESULTS

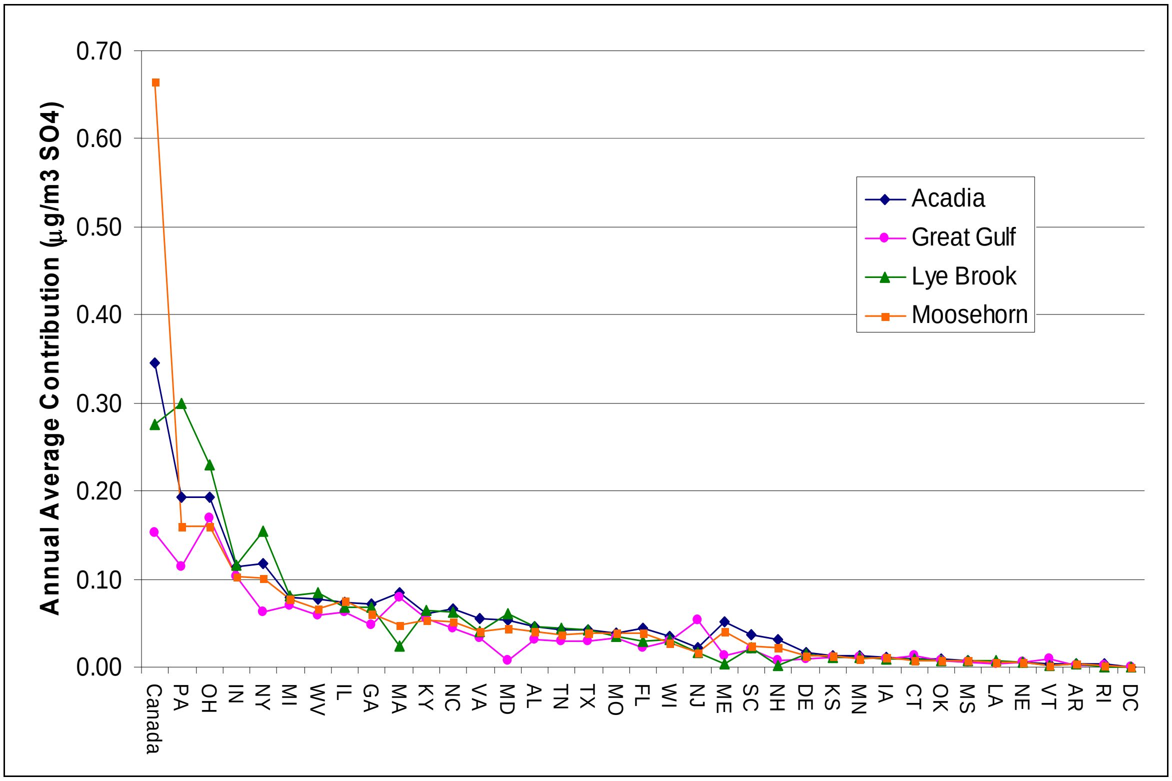
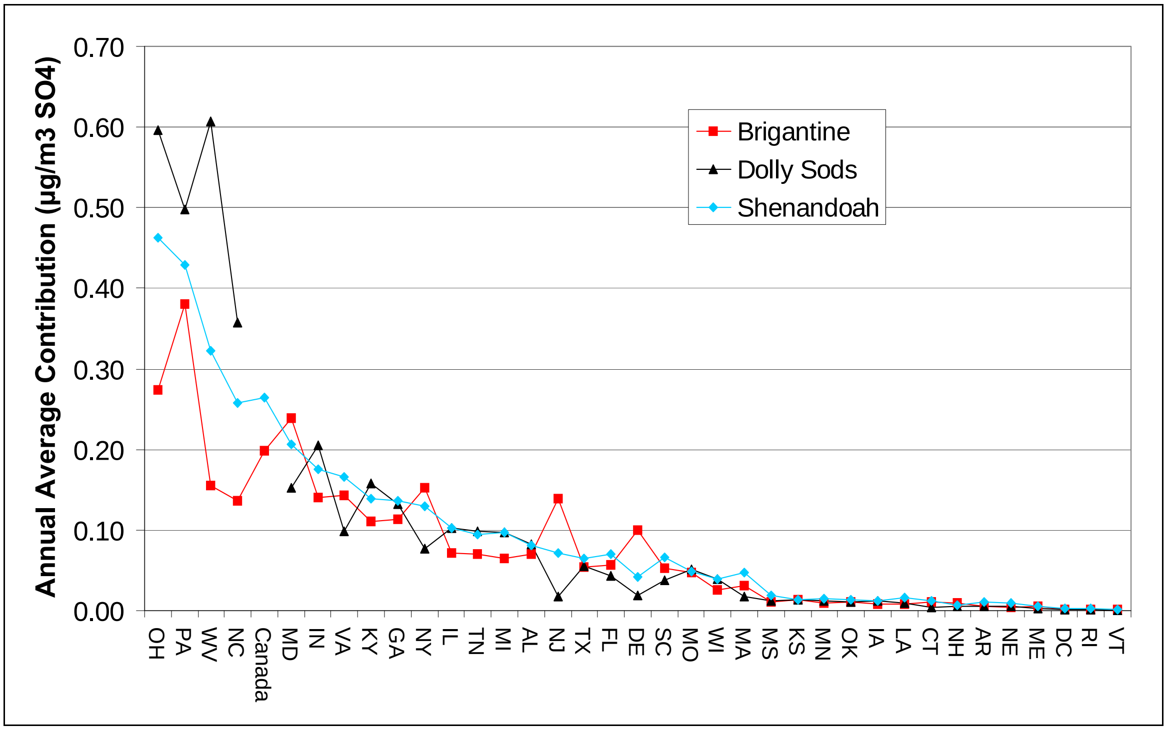


FIGURE 12.3. RANKED STATE PERCENT SULFATE CONTRIBUTIONS TO MID-ATLANTIC CLASS I RECEPTORS BASED ON EMISSIONS DIVIDED BY DISTANCE (Q/D) RESULTS



MANE-VU considered modeling results documented in the Contribution Assessment to determine which states should be consulted in developing the long term strategy for improving visibility in MANE-VU Class I areas. Because sulfate was the primary pollutant of concern and the REMSAD model results quantified sulfate impacts, three methods of evaluating states' impacts using REMSAD results were considered:

- States/regions that contributed 0.1 ug/m^3 sulfate or greater on the 20 percent worst visibility days in the base year (2002)
- States/regions that contributed at least 2 percent of total sulfate observed on 20 percent worst visibility days in 2002
- The top ten contributing states on the 20 percent worst visibility days in 2002.

Each of the following seven figures shows on the left side the IMPROVE monitored $PM_{2.5}$ mass data by species for 2000-2004 (the baseline years). The yellow, bottom portion of the bar chart is the measured sulfate concentration.

The second part of each figure, in the center, shows the REMSAD sulfate modeling results for 2002. The middle bar chart indicates contributions of states and regions to the total modeled sulfate concentrations.

Finally, on the right, are three maps indicating which states met the criteria identified above as the three potential methods for identifying states with the greatest contribution to sulfates in MANE-VU Class I areas in 2002. The top map shows states contributing at least 0.1 ug/m^3 of sulfate. The middle map shows states contributing at least 2 percent of total sulfate. The bottom map highlights the ten states contributing the greatest amount of the sulfate in 2002.

Shenandoah, Dolly Sods and Otter Creek are Class I areas in the VISTAS region that are impacted by emissions from MANE-VU states. The IMPROVE monitor at Dolly Sods also represents Otter Creek. The other five Class I areas are in MANE-VU. The IMPROVE monitor at Great Gulf also represents the Presidential Range/Dry River Wilderness and the IMPROVE monitor at Moosehorn also represents Roosevelt Campobello International Park.

FIGURE 12.4 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT BRIGANTINE

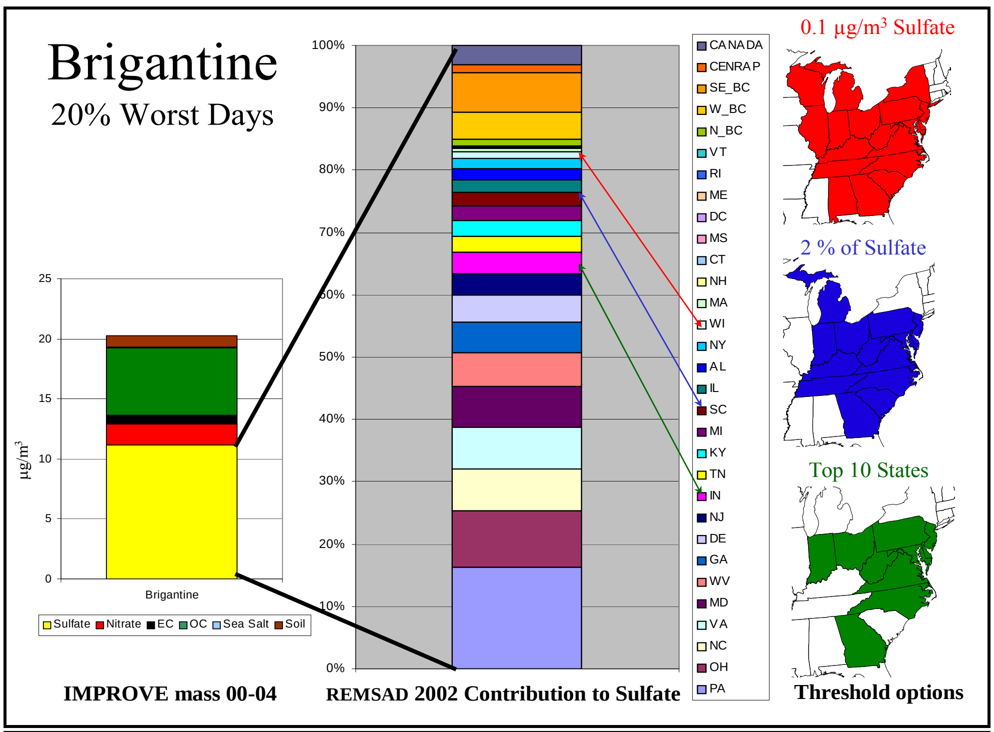


FIGURE 12.5 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT LYE BROOK

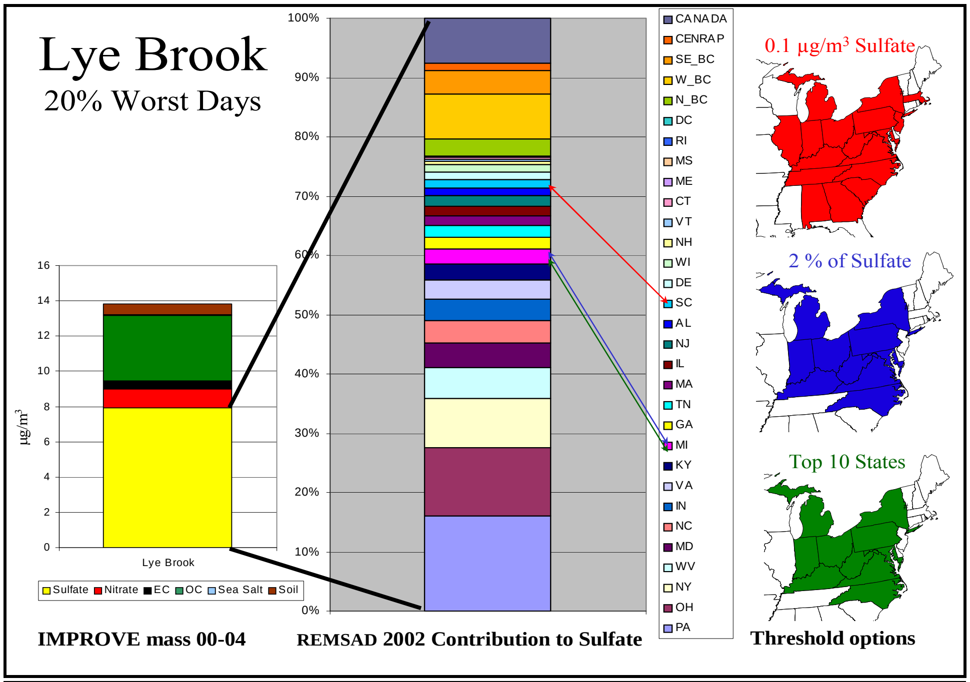


FIGURE 12.6 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT GREAT GULF

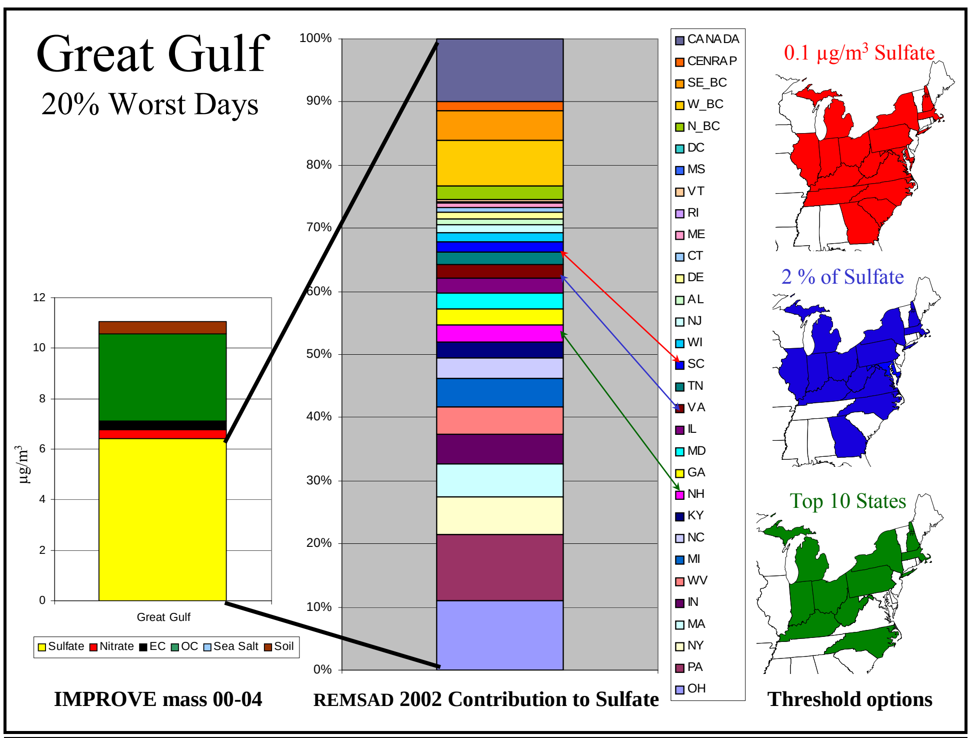


FIGURE 12.7 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT ACADIA

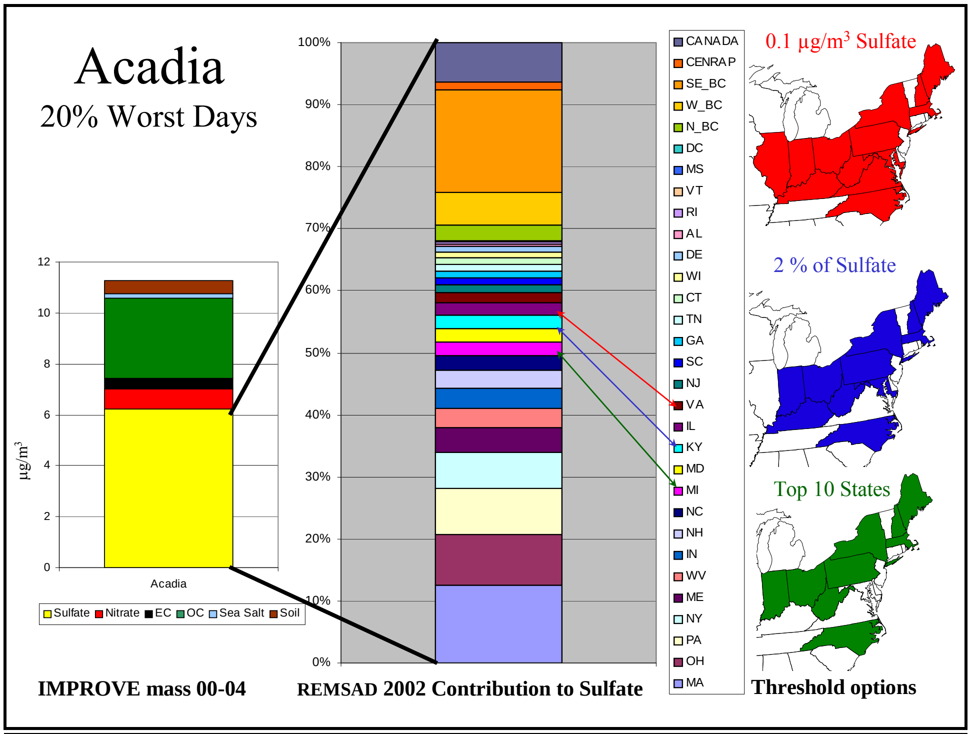


FIGURE 12.8 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT MOOSEHORN

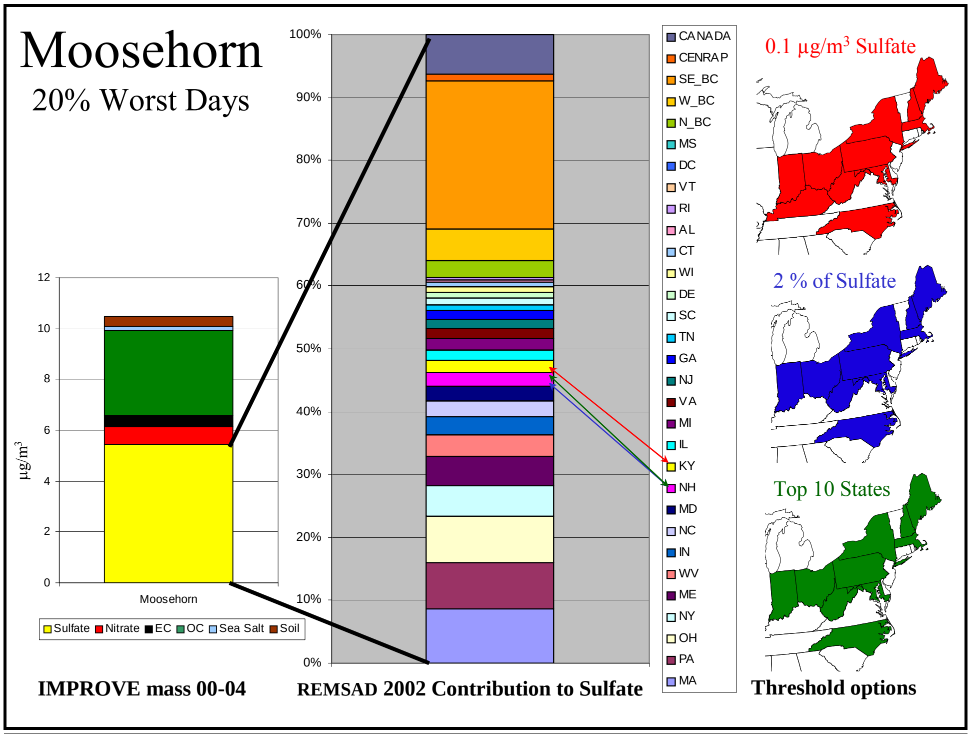


FIGURE 12.9 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT

SHENANDOAH

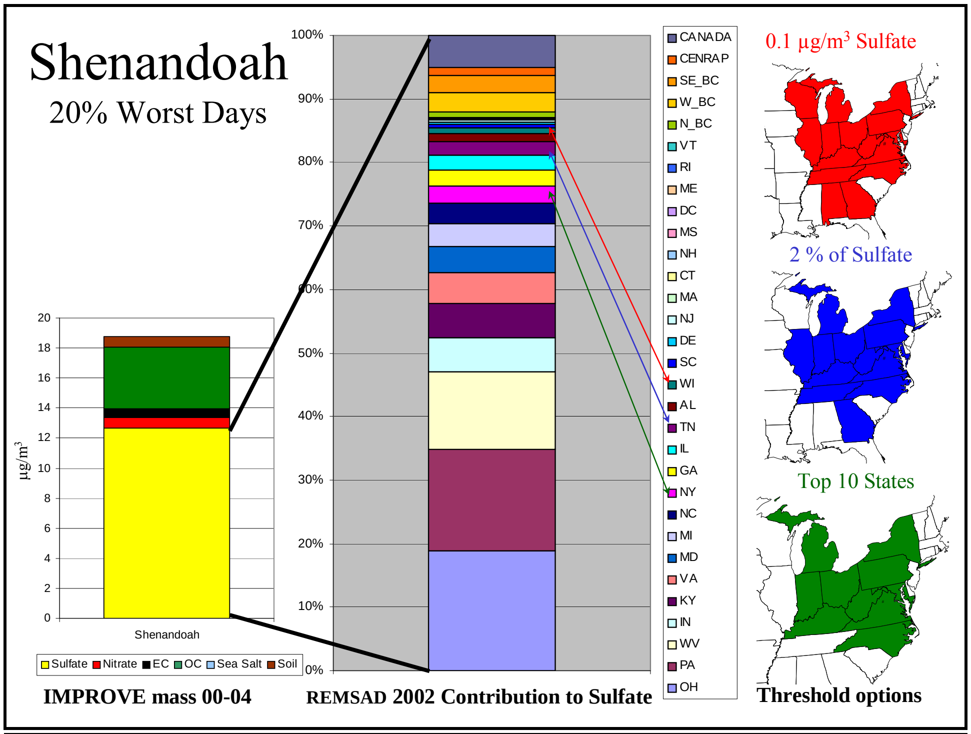
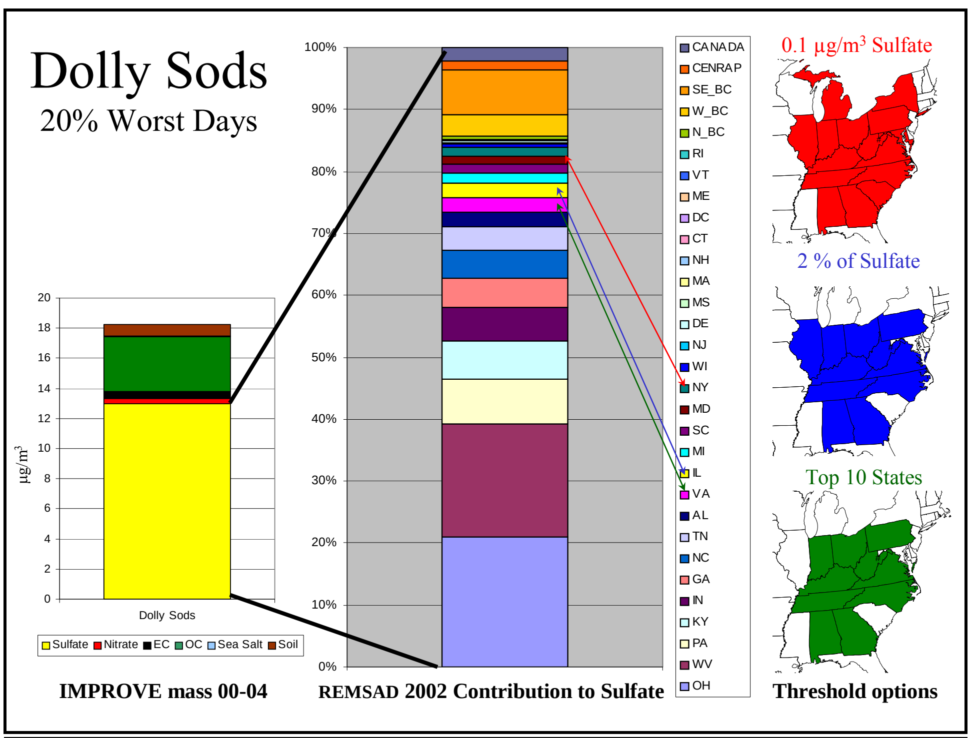


FIGURE 12.10 MODELED 2002 CONTRIBUTIONS TO SULFATE BY STATE AT DOLLY SODS



For purposes of deciding how broadly to consult, the MANE-VU States decided to use method 2, including states that contributed at least 2 percent of total sulfate observed on the 20 percent worst visibility days in 2002.

CT, DC, RI, and VT were not identified as among states contributing at least 2 percent of sulfate to any of the above Class I areas. However, as participants in MANE-VU, those states have agreed to pursue adoption of regional control measures in order to contribute to visibility improvement on the worst days and to the prevention of visibility degradation on clear days.

Based on the MANE-VU Contribution Assessment, emissions from the State of Maryland contributes to visibility degradation in the following Class I areas:

- Acadia National Park,
- Brigantine Wilderness,
- Dolly Sods Wilderness and Otter Creek Wilderness,
- Lye Brook Wilderness,
- Shenandoah National Park.

12.2.3 Baseline Emissions

40 CFR Section 51.308(d)(3)(iii) requires State of Maryland to identify the baseline emissions information on which the long-term strategy is based.

For the MANE-VU region, the State of Maryland used the 2002 MANE-VU Emissions Inventory Version 3.0 as its baseline-modeling inventory. The inventory is documented in Section 7 of this SIP.

For other regions, MANE-VU used emissions inventories developed by the RPOs for those regions, including VISTAS Base G2, MRPO's Base K, and CenRAP's emissions inventory.

More specific information about the baseline emissions inventory data used may be found in the inventory section of this SIP.

12.2.4 Modeling Techniques Used

The following documents describe preliminary and final modeling runs conducted by MANE-VU and used in developing this long term strategy:

- Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (NESCAUM, August 2006)(called the Contribution Assessment) (Appendix A)
- MANE-VU Modeling for Reasonable Progress Goals: Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits (NESCAUM, February 2008)(Appendix L)
- 2018 Visibility Projections (NESCAUM, March 2008)(Appendix M)

As documented in the MANE-VU Contribution Assessment, two regional-scale air quality models were used to perform air quality simulations for MANE-VU. These are the Community Multi-Scale Air Quality modeling system (CMAQ; Byun and Ching, 1999) and the Regional Modeling System for Aerosols and Deposition (REMSAD; SAI, 2002). CMAQ was developed by EPA, while REMSAD was developed by ICF Consulting/Systems Applications International (ICF/SAI) with EPA support. CMAQ provides one-atmosphere results for multiple pollutants while the REMSAD model was used primarily for attribution of sulfate species in the Eastern US via the species-tagging scheme included in Version 7.10 and newer versions of the model.

Three rounds of modeling were conducted:

- CMAQ was run for a complete set of baseline simulations including 2002, 2009 and 2018. Preliminary runs are described in greater detail in Appendix C of the MANE-VU *Contribution Assessment*.
- Runs assessing impacts of potential control measures are described in the *Modeling for Reasonable Progress Goals* report (NESCAUM, 2008).
- Final modeling to help develop reasonable progress goals is described in the *2018 Visibility Projections* report (NESCAUM, 2008).

The modeling tools utilized for these analyses include MM5, SMOKE, CMAQ and REMSAD, and incorporate tagging features that allow for the tracking of individual source regions or measures.

A significant feature of the REMSAD work used to evaluate regional contributions is that NESCAUM reprocessed the SO_2 emission data from each state to take advantage of REMSAD's tagging capabilities. Thus, all SO_2 emissions included in the model for the eastern half of the country were tagged according to state of origin, and emissions from Canada and the boundary conditions were also tagged. This allowed for a rough estimation of the total contribution from elevated point sources in each state to simulated sulfate concentrations at eastern receptor sites. Using identical emission and meteorological inputs to those prepared for the Integrated SIP (CMAQ) platform, REMSAD was used to simulate the annual average impact of each state's SO_2 emission sources on the sulfate fraction of $PM_{2.5}$ over the northeastern United States. For more information see Appendix C of the MANE-VU Contribution Assessment.

In addition to the REMSAD run with tagging, NESCAUM and its modeling partners at the University of Maryland and Rutgers University performed a sensitivity run with the CMAQ Particle and Precursor Tagging Methodology (CMAQ-PPTM) system. This run was used to assess the impacts of potential control measures under consideration. This work is described in the *Modeling for Reasonable Progress* report.

The modeling platform is further described in the reports *Modeling for Reasonable Progress* and *2018 Visibility Protections*. MANE-VU used the Inter-RPO modeling domain. The 36-km gridded domain covers the continental US, southern Canada, and northern Mexico. The 12-km gridded inner domain covers the northeastern, central, and southeastern U.S. as well as southeastern Canada.

Meteorological inputs for CMAQ, provided by Dalin Zhang's group at the University of Maryland, were derived from the Fifth-Generation Pennsylvania State University/National Center for Atmospheric Research (NCAR) Mesoscale Model (MM5). A detailed description of the meteorological inputs can be found in the *Modeling for Reasonable Progress* report.

The evaluation of model performance is also described in the report on *Modeling for Reasonable Progress*. The modeling tools were evaluated and found to perform adequately relative to USEPA modeling guidance.

12.2.5 Monitoring and Emissions Data Analysis

Chapters 4 and 5 of the MANE-VU Contribution Assessment document the techniques for analyzing air monitoring data and emissions data used by MANE-VU to assess the contribution of various states, regions, and source categories to visibility impairment at MANE-VU Class I areas. Some examples of these analyses have been included here. (Figures 12.2 and 12.3 in Section 12.2.2, above, show the results of emissions inventory analysis (Q/d) to estimate the percent sulfate contribution from each state on MANE-VU's Class I areas. Figure 12.12, in Section 12.2.6, below, shows results of source apportionment analysis of monitoring data to assess the areas contributing to wood smoke emissions affecting MANE-VU Class I areas.)

12.2.6 Anthropogenic Sources of Visibility Impairment

40 CFR Section 51.308(d)(3)(iv) requires Maryland to identify all anthropogenic sources of visibility impairment considered by the State/Tribe in developing its long-term strategy.

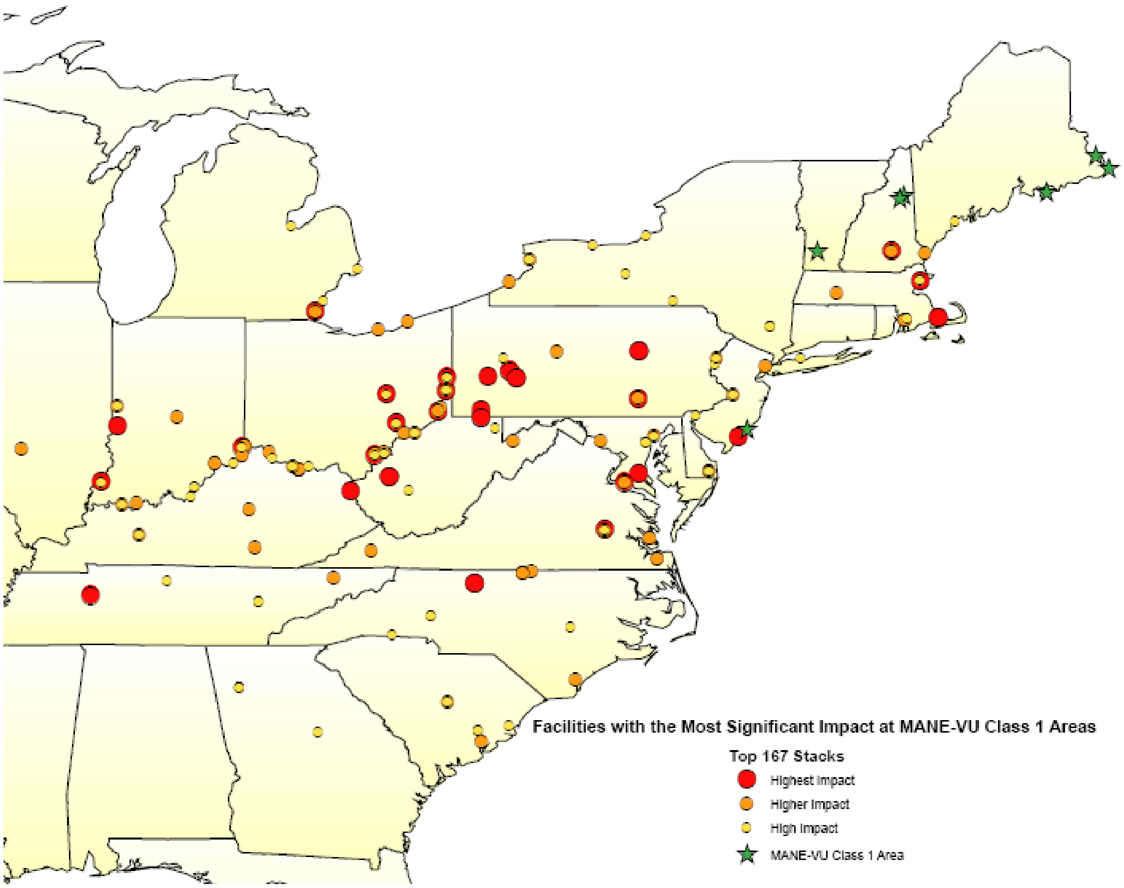
Chapter 4 of the MANE-VU Contribution Assessment Document summarizes an analysis of haze-associated pollutant emissions. Chapter 5 of the same document describes the results of numerous source apportionment analyses, which are further explained in Appendix B of the Contribution Assessment. Together, these studies identify the major source categories affecting Class I areas in and near MANE-VU. These are identified below.

12.2.6.1 12.2.6.1 Sources of SO_2 Emissions

For the reasons described above in Section 12.2.1, the emphasis in developing this SIP revision was placed on sources of SO_2. Emissions inventory analysis shows that point sources dominated the 2002 inventory of SO_2 emissions. The largest source category of sulfur dioxide in the region is electric generating units (EGUs). Additional SO_2 source categories analyzed include oil-fired installations at residential, commercial, institutional, or industrial facilities; industrial, commercial, and institutional (ICI) boilers; and cement and lime kilns.

Roughly 70 percent of the 2.3 million tons of SO_2 emission in the 2002 MANE-VU emissions inventory Version 3.0 were from EGUs, making them the largest SO_2 source category in terms of visibility impairing emissions. MANE-VU found through modeling analysis documented in the Contribution Assessment that emissions from specific EGUs were important contributors to visibility impairment in MANE-VU Class I areas in 2002. The figure below shows the locations of 167 EGU stacks that impair visibility at one or more MANE-VU Class I area. Some of the stacks identified as important were outside the states identified as contributing at least 2 percent of the sulfate at MANE-VU Class I areas, these were dropped from the list. The list of these sources is found in the Emissions Inventory Chapter of this document (Chapter 7).

FIGURE 12.11: 167 EGU STACKS AFFECTING MANE-VU CLASS I AREA(S)

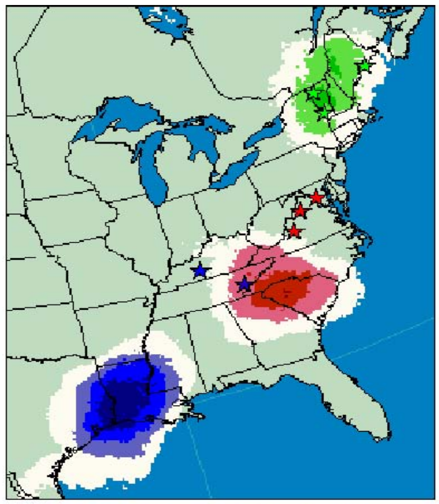


12.2.6.2
12.2.6.3 12.2.6.2 Sources of Other Pollutants

Source apportionment documented in Appendix B of the MANE-VU Contribution Assessment also identified biomass combustion as a local source contributing to visibility impairment. According to Appendix B of the MANE-VU Contribution Assessment, woodsmoke also contributes to visibility impairment, with contributions typically higher in rural areas than urban areas, winter peaks in northern areas from residential wood burning, and occasional large summer impacts at all sites from wildfires.

Wood smoke impacting MANE-VU Class I areas is more local in origin than sources of SO_2, except for major transport events. The figure below is from Appendix B of the MANE-VU Contribution Assessment and represents the results of source apportionment and trajectory analyses. It illustrates that the impacts of woodsmoke on MANE-VU Class I areas are more likely due to emissions from within MANE-VU and Canada. The green highlighted section of the map shows the woodsmoke source region for several MANE-VU Class I areas represented by the green stars. (Brigantine was not analyzed for this map.)

FIGURE 12-12: WOODSMOKE SOURCE REGIONAL AGGREGATIONS



The MANE-VU *Technical Support Document on Agricultural and Forestry Smoke Management in the MANE-VU Region* concluded that fire from land management activities was not a major contributor to regional haze in MANE-VU Class I areas, and that the majority of emissions from fires were from residential wood combustion.

12.2.6.4 12.2.6.3 Identification of Key Source Categories

Based on available information about emissions and potential impacts, the MANE-VU Reasonable Progress Workgroup selected the following source categories for detailed analysis of the four factors the Clean Air Act establishes as the basis for determining how much progress in visibility improvement is reasonable:

- Coal and oil-fired Electric Generating Units, (EGUs);
- Point and area source industrial, commercial and institutional boilers;
- Cement kilns;
- Lime kilns;
- The use of heating oil; and
- Residential wood combustion and open burning.

The State of Maryland worked with other members of the Ozone Transport Commission and MANE-VU as described in Section 10.1.3 above to consider a wide variety of potential emission reduction strategies covering a wide range of sources of SO_2 and other pollutants contributing to regional haze.

12.3 Emission Reductions Due to Ongoing Air Pollution Programs

40 CFR Section 51.308(d)(3)(v)(A) requires State/Tribes to consider emission reductions from ongoing pollution control programs. In developing its Long Term Strategy, Maryland considered emission control programs being implemented between the baseline period and 2018, as discussed below.

Significant emissions control programs are being implemented between the baseline period and 2018. These programs are described in more detail below.

MANE-VU's 2018 "beyond on the way" (BOTW) emissions inventory accounts for emission controls already in place as well as emission controls that are not yet finalized but are likely to achieve additional reductions by 2009. The BOTW inventory was developed based on the MANE-VU 2002 Version 3.0 inventory and the MANE-VU 2018 on the books/on the way (OTB/OTW) inventory. Inventories used for other RPOs also reflect anticipated emissions controls that will be in place by 2018. The inventory is termed "beyond on the way" because it includes control measures that were developed for ozone SIPs which were not yet on the books in some states. For some states it also included controls that were under consideration for regional haze SIPs that have not yet been adopted. More information may be found in the following documents:

- *Development of Emissions Projections for 2009, 2012, and 2018 for Non-EGU Point, Area, and Non-road Sources in the MANE-VU Region* (MACTEC, February 2007)(Appendix E)
- *Documentation of 2018 Emissions from Electric Generating Units in the Eastern U.S. for MANE-VU's Regional Haze Modeling* (Alpine Geophysics, March 2008)(Appendix R)
- *MANE-VU Modeling for Reasonable Progress Goals: Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits*, (NESCAUM, February 2008)(Appendix L)
- *2018 Visibility Projections*, NESCAUM (March 2008) (Appendix M)

12.3.1 EGU Emissions Controls Expected by 2018 Due to Ongoing Control Programs

Clean Air Interstate Rule (CAIR). CAIR will permanently cap emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_X) in the eastern United States by 2015. When fully implemented, CAIR will reduce SO_2 emissions in the CAIR region by more than 70 percent and NO_X emissions by more than 60 percent from 2003 levels.

The IPM® model was used to predict future emissions from EGUs after implementation of CAIR.[19] Modifications to the output of IPM® made to better represent anticipated controls are described in the report *Documentation of 2018 Emissions from Electric Generationg Units (Alpine, 2008)*. Controls considered in making these modifications include the following:

Delaware EGU Regulations: Delaware adopted the following regulations governing EGU emissions:

1. *Reg. 1144, Control of Stationary Generator Emissions*, SO_2, PM, VOC and NO_X emission control, State-wide, Effective January 2006.
2. *Reg. 1146, EGUs, Electric Generating Unit (EGU) Multi-Pollutant Regulation,* SO_2 and NO_X emission control, State-wide, Effective December 2007. SO_2 reductions will be more than regulation specifies
3. *Regulation No. 1148, Control of Stationary Combustion Turbine Electric Generating Unit Emissions*, SO_2, NO_X and $PM_{2.5}$ emission control, State-wide, Effective January 2007.

Delaware estimates that these regulations will result in the following emission reductions for affected units:

SO_2 2002 levels of 32,630 to 8,137 in 2018 (75 percent)
NO_X 2002 levels of 8,735 to 3,740 in 2018 (57 percent)

Delaware Consent Decree: Valero Refinery Delaware City, DE (formerly Motiva, Valero Enterprises). 2002 SO_2 levels of 29,747 will drop to 608 in 2018 (98 percent). NO_X 2002 levels of 1,022 will fall to 102 in 2018 (90 percent).

Massachusetts EGU Regulations: Based on the Massachusetts Department of Environmental Protection's 310 CMR 7.29, *Emissions Standards for Power Plants,* adopted in 2001, six of the largest fossil fuel-fired power plants in Massachusetts must comply with emissions limitations for NO_X, SO_2, mercury, and CO_2. These regulations will achieve an approximately 50 percent reduction in NO_X emissions and 50 percent - 75 percent reduction in SO_2 emissions compared to

[19] Although the IPM® model runs also anticipated the implementation of EPA's Clean Air Mercury Rule (CAMR), that rule has since been vacated by the courts. However, it is anticipated the adjustments to the predicted SO_2 emissions from electric generating units (EGUs) used in the air quality modeling, which were based on state-specific comments on the amount of SO_2 controls that will actually be installed due to state specific regulations and the EPA's CAIR rule, will have more of an impact on the air quality modeling analysis conducted for this SIP than the vacature of the CAMR rule. MANE-VU believes the adjustments based on state-specific comments improved the reliability of the inventory and made the modeling results more dependable.

previous emissions. Depending upon the compliance path selected by the affected facilities, the facilities will comply with the output-based NO_X and SO_2 standards between 2004 and 2008.

Maryland EGU Regulations:

In April of 2006, the Maryland General Assembly enacted the Maryland Healthy Air Act (HAA). The Maryland General Assembly record related to the HAA and the final version of the Act itself can be found at: http://mlis.state.md.us/2006rs/billfile/SB0154.html

The MDE Regulations (Code of Maryland Regulations) can be found at: http://www.mde.state.md.us/assets/document/CPR_12-26-06_Emergency_and_Permanent_HAA_Regs_for_AELR.pdf

The HAA is one of the toughest power plant emission laws on the east coast. The HAA requires reductions in Nitrogen Oxide (NO_X), Sulfur Dioxide (SO_2) and Mercury emissions from large coal burning power plants. The Healthy Air Act also requires that Maryland become involved in the Regional Greenhouse Gas Initiative (RGGI) which is aimed at reducing greenhouse gas emissions.

The Maryland Department of the Environment (MDE) has been charged with implementing the HAA through regulations. As enacted, these regulations constitute the most sweeping air pollution emission reduction measure proposed in Maryland history.

Affected Sources

These Healthy Air Act NO_X, SO_2, and mercury reduction requirements affect the following fossil fuel fired electric generating units:

Constellation Energy Group System	
Brandon Shores 1 & 2	Anne Arundel County
H. A. Wagner 2 & 3	Anne Arundel County
C. P. Crane 1 & 2	Baltimore County
Mirant System	
Chalk Point 1 & 2	Prince George's County
Dickerson 1, 2, & 3	Montgomery County
Morgantown 1 & 2	Charles County
Allegheny Energy	
R. Paul Smith 3 & 4	Washington County

Overview of Expected Emission Reductions

Over ninety-five percent of the air pollution emitted from Maryland's power plants comes from the largest and oldest coal burning plants. Electric generating units are the largest single contributor of SO_2 emissions in the baseline modeling inventory in Maryland, accounting for over 75 percent of total SO_2 emissions in the state. The emission reductions from the Healthy Air Act come in two phases. The first phase requires reductions in the 2009/2010 timeframe. The second phase of emission control occurs in the 2012/2013 timeframe. At full implementation the HAA will reduce the overall SO_2 emissions of the state by approximately 63 percent from 2002 levels.

Summary - Maryland's Healthy Air Act

The point source NO_X, SO_2, and Hg direct controls are a phased approach to controlling emissions from power plants and other large fuel combustion sources. The expected emission reductions for 2018 were calculated using the emissions estimates consistent with annual allocations under the Healthy Air Act implementing regulation. The program does not allow trading of emission allowances.

North Carolina Clean Smokestacks Act: Under the act, enacted in 2002, coal-fired power plants (EGUs) in North Carolina must achieve a 77-percent cut in nitrogen oxide (NO_x) emissions by 2009 and a 73-percent cut in sulfur dioxide (SO_2) emissions by 2013. This legislation establishes annual caps on both SO_2 and NO_X emissions for the two primary utility companies in North Carolina, Duke Energy and Progress Energy. These reductions must be made in North Carolina, and allowances are not saleable.

Consent Agreements in the VISTAS region: The impact of the following consent agreements in the VISTAS states was reflected in the emissions inventory used for those states:

- Santee Cooper: A 2004 consent agreement calls for Santee Cooper in South Carolina to install and commence operation of continuous emission control equipment for $PM/SO_2/NO_X$ emissions; comply with system-wide annual $PM/SO_2/NO_X$ emissions limits; agree not to buy, sell or trade SO_2/NO_X allowances allocated to Santee Cooper System as a result of said agreement; and to comply with emission unit limits of said agreement.
- TECO: Under a settlement agreement, by 2008, Tampa Electric in the state of Florida will install permanent emissions-control equipment to meet stringent pollution limits; implement a series of interim pollution-reduction measures to reduce emissions while the permanent controls are designed and installed; and retire pollution emission allowances that Tampa Electric or others could use, or sell to others, to emit additional NO_X, SO_2 and PM.
- VEPCO: Virginia Electric and Power Co. agreed to spend \$1.2 billion between by 2013 to eliminate 237,000 tons of SO_2 and NO_X emissions each year from eight coal-fired electricity generating plants in Virginia and West Virginia.
- Gulf Power 7: A 2002 agreement calls for Gulf Power to upgrade its operation to cut NO_X emission rates by 61 percent at its Crist 7 generating plant by 2007 with major reductions beginning in early 2005. The Crist plant is a significant source of nitrogen oxide emissions in the Pensacola Florida area.

- EKPC: A July 2, 2007 consent agreement between the EPA and East Kentucky Power Cooperative requires the utility to reduce its emissions of SO_2 by 54,000 tons per year and its emissions of NO_X by 8,000 tons per year, by installing and operating selective catalytic reduction (SCR) technology; low-NO_X burners, and PM and mercury Continuous Emissions Monitors at the utility's Spurlock, Dale and Cooper Plants. According to the EPA, total emissions from the plants will decrease between 50 and 75 percent from 2005 levels. As with all federal consent decrees, EKPC is precluded from using reductions required under other programs, such as CAIR, to meet the reduction requirements of the consent decree. EKPC is expected to spend $654 million to install pollution controls.
- AEP: American Electric Power agreed to spend $4.6 billion dollars to eliminate 72,000 tons of NO_X emissions each year by 2016 and 174,000 tons of SO_2 emissions each year by 2018 from sixteen plants located in Indiana, Kentucky, Ohio, Virginia and West Virginia.

12.3.2 Other Point Source Controls Expected by 2018 Due to Ongoing Air Pollution Control Programs

Control factors were applied to the 2018 MANE-VU inventory to represent the following national, regional, or state control measures:

- NO_X SIP Call Phase I (NO_X Budget Trading Program)
- NO_X SIP Call Phase II
- NO_X RACT in 1-hour Ozone SIPs
- NO_X OTC 2001 Model Rule for ICI Boilers
- 2-, 4-, 7-, and 10-year MACT Standards
- Combustion Turbine and RICE MACT
- Industrial Boiler/Process Heater MACT[20]
- EPA's Refinery Enforcement Initiative

In addition, states provided specific control measure information about specific sources or regulatory programs in their state. MANE-VU used the state-specific data to the extent it was available.

For specific states, the measures included in this analysis reduce emissions for the following pollutants and non-EGU point source categories due to strategies developed for purposes of reducing ozone in the Ozone Transport Region (OTR):

- NO_X measures:
  - asphalt production plants in CT, DC, NJ, and NY;
  - cement kilns in ME, MD, NY, PA;

[20] The inventory was prepared before the MACT for Industrial Boilers and Process Heaters was vacated. Control efficiency was assumed to be at 4 percent for SO_2 and 40 percent for PM.

  - o glass and fiberglass furnaces in ME, MD, NY, PA;

- VOC measure: adhesives and sealants application (all MANE-VU states except NJ and VT).

These measures were included in the "Beyond on the Way" inventory for the states identified.

For other regions, MANE-VU used inventories developed by the RPOs for those regions, including VISTAS Base G2, MRPO's Base K, and CenRAP's emissions inventory. (Emissions for CenRAP states in the MANE-VU modeling domain were taken from the VISTAS Base G2 inventory.)

Non-EGU source controls incorporated into the modeling include the following consent agreements reflected in the VISTAS inventory:

- Dupont: A 2007 agreement calls for E. I. Dupont Nemours & Company's James River plant to install dual absorption pollution control equipment by September 1, 2009, resulting in emission reductions of approximately 1,000 tons SO_2 annually. The James River plant is a non-EGU located in the state of Virginia.
- Stone Container: A 2004 agreement calls for the West Point Paper Mill in Virginia owned by Smurfit/Stone Container to control with a wet scrubber the SO_2 emissions of the #8 Power Boiler. This control device should result in reductions of over 3,500 tons of SO_2 in 2018.

12.3.3 Area Sources Controls Expected by 2018 Due to Ongoing Control Programs

For area sources within MANE-VU, the State of Maryland relied on MANE-VU's Version 3.0 Emissions Inventory for 2002. In general, the 2018 inventory for area sources was developed by MANE-VU applying growth and control factors to the 2002 Version 3.0 inventory. Area source control factors were developed for the following national or regional control measures:

- OTC VOC Model Rules
- Federal On-board Vapor Recovery
- New Jersey Post-2002 Area Source Controls
- Residential Woodstove NSPS

The following additional control measures were included in the 2018 analysis to reduce VOC emissions for the following area source categories for some states (as identified below):

- VOC measures: adhesives and sealants (controls added in all MANE-VU states except VT),
- emulsified and cutback asphalt paving (controls added in all MANE-VU states except DE, ME, and VT),
- consumer products (controls added in all MANE-VU states except VT), and
- portable fuel containers (controls added in all MANE-VU states except VT);

After release of Version 3.0 of the MANE-VU 2002 inventory, Massachusetts revised their inventory of area source heating oil emissions due to two changes: (1) The sulfur percent used to derive the emissions factors was adjusted from 1.0 to 0.3; and (2) use of the latest DOE-EIA 2002 fuel use data instead of the previous version used 2001. These two changes significantly altered the 2002 SO_2 emissions for area source heating oil combustion. Massachusetts provided revised 2002 PE and EM tables, which MACTEC used in preparing the 2009/2012/2018 projection inventories.

The District of Columbia discovered a gross error in the 2002 residential, non-residential and roadway construction. They requested that the following values be used for the 2002 base year as the basis for the 2009/2012/2018 projections:

Table 12-2 Corrected Construction Emissions from the District of Columbia

Source Classification Code	Pollutant Code	2002 Annual Emissions (tpy)
2311010000 Residential Construction	PM_{10}-PRI	8.2933
	PM_{25}-PRI	1.6587
2311020000 Indust/Comm/Inst Const	PM_{10}-PRI	486.1951
	PM_{25}-PRI	97.239
2311030000 Road Construction	PM_{10}-PRI	289.8579
	PM_{25}-PRI	57.9716

As noted above, the inventory information used for other regions was obtained from those regions' RPOs.

12.3.4 Controls on Non-road Sources Expected by 2018 due to Ongoing Air Pollution Control Programs

The State/Tribe used Version 3.0 of the MANE-VU 2002 Emissions Inventory. Non-road source controls incorporated into the modeling include the following:

Nonroad Diesel Rule. This rule sets standards that will reduce emissions by more than 90 percent from nonroad diesel equipment, and reduce sulfur levels by 99 percent from current levels in nonroad diesel fuel starting in 2007. This step will apply to most nonroad diesel fuel in 2010 and to fuel used in locomotives and marine vessels in 2012. (http://www/epa/gov/nonroaddiesel/)

As noted above, the inventory information used for other regions was obtained from those regions' RPOs.

12.3.5 Mobile Source Controls Expected by 2018 due to Ongoing Air Pollution Control Programs

Mobile source controls incorporated into the modeling include the following:

Heavy Duty Diesel (2007) Engine Standard. EPA set a PM emissions standard for new heavy-duty engines of 0.01 grams per brake-horsepower-hour (g/bhp-hr), to take full effect for diesel engines in the 2007 model year. This rule also includes standards for NO_X and non-methane hydrocarbons (NMHC) of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These NO_X and NMHC standards will be phased in together between 2007 and 2010 for diesel engines. Sulfur in diesel fuel must be lowered to enable modern pollution-control technology to be effective on these trucks and buses. EPA will require a 97 percent reduction in the sulfur content of highway diesel fuel from its current level of 500 parts per million (low sulfur diesel, or LSD) to 15 parts per million (ultra-low sulfur diesel, or ULSD).

Tier 2 Motor Vehicle Standards. Tier 2 is a fleet averaging program, modeled after the California LEV II standards. Manufacturers can produce vehicles with emissions ranging from relatively dirty to zero, but the mix of vehicles a manufacturer sells each year must have average NO_X emissions below a specified value. Tier 2 standards became effective in the 2005 model year and are included in the assumptions used for calculating mobile source emissions inventories used for 2018.

Large Spark Ignition and Recreational Vehicle Rule. EPA has adopted new standards for emissions of NO_X, hydrocarbons (HC), and carbon monoxide (CO) from several groups of previously unregulated nonroad engines. Included in these are large industrial spark-ignition engines and recreational vehicles. Nonroad spark-ignition engines are those powered by gasoline, liquid propane, or compressed natural gas rated over 19 kilowatts (kW) (25 horsepower). These engines are used in commercial and industrial applications, including forklifts, electric generators, airport baggage transport vehicles, and a variety of farm and construction applications. Nonroad recreational vehicles include snowmobiles, off-highway motorcycles, and all terrain vehicles. These rules were initially effective in 2004 and were assumed to be fully phased-in by 2012.

12.3.6 Source Retirement and Replacement Schedules

40 CFR Section 51.308(d)(3)(v)(D) requires Maryland to consider source retirement and replacement schedules in developing reasonable progress goals.

Source retirement and replacement were considered in developing the 2018 emissions inventory described in *Development of Emissions Projections for 2009, 2012, and 2018 for Non-EGU Point, Area, and Non-road Sources in the MANE-VU Region* (MACTEC, February 2007)(Appendix E-2).

Retirement and replacement must comply with existing SIP/TIP requirements including those pertaining to PSD and New Source Review. There are no sources that qualify for retirement or replacement in the state of Maryland.

12.4 Additional Reasonable Strategies

40 CFR Section 51.308(d)(3)(v) requires states to consider the following four factors to determine which additional emission control measures are needed to make reasonable progress in improving visibility: 1) costs of compliance, 2) time necessary for compliance, 3) energy and non-air quality environmental impacts of compliance, and 4) remaining useful life of any existing source subject to such requirements. The plan must include reasonable measures and identify the visibility improvement that will result from those measures.

12.4.1 MANE-VU Statement of June 20, 2007

The reasonable progress goals adopted by the MANE-VU Class I States represent implementation of the regional course of action set forth by MANE-VU on June 20, 2007 and entitled, "Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress." As such, these reasonable progress goals are intended to reflect the pursuit by MANE-VU States of a course of action including pursuing the adoption and implementation of the following "emission management" strategies, as appropriate and necessary:

a. Timely implementation of BART requirements; and

b. A low sulfur fuel oil strategy in the inner zone states (New Jersey, New York, Delaware, and Pennsylvania, or portions thereof) to reduce the sulfur content of:
   - Distillate oil to 0.05 percent sulfur by weight (500 ppm) by no later than 2012,
   - #4 residual oil to 0.25 percent sulfur by weight by no later than 2012,
   - #6 residual oil to 0.3 – 0.5 percent sulfur by weight by no later than 2012, and
   - Further reduce the sulfur content of distillate oil to 15 ppm by 2016; and

c. A low sulfur fuel oil strategy in the outer zone states (the remainder of the MANE-VU region) to reduce the sulfur content of:
   - Distillate oil to 0.05 percent sulfur by weight (500 ppm) by no later than 2014,
   - #4 residual oil to 0.25 percent-0.50 percent sulfur by weight by no later than 2018,
   - #6 residual oil to no greater than 0.5 percent sulfur by weight by no later than 2018, and
   - Further reduce the sulfur content of distillate oil to 15 ppm by 2018 depending on supply and availability; and

d. A 90 percent or greater reduction in sulfur dioxide (SO_2) emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU (Appendix N) comprising a total of 167 stacks, dated June 20, 2007) as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and

e. Continued evaluation of other control measures including energy efficiency, alternative clean fuels, and other measures to reduce SO_2 and nitrogen oxide (NO_X) emissions from all coal-burning facilities by 2018 and new source performance standards for wood combustion.

As stated above, this long-term strategy to reduce and prevent regional haze will allow each state up to 10 years to pursue adoption and implementation of reasonable and cost-effective NO_X and SO_2 control measures as appropriate and necessary.

12.4.2 Analysis of the Four Statutory Factors

MANE-VU agreed on the above additional reasonable strategies after consideration of an analysis of the four factors that the Clean Air Act requires to be considered in determining whether controls are reasonable.

The State of Maryland relied on analysis developed for MANE-VU in applying the four factors to a series of emission control measures. This analysis is described in detail in the *Reasonable Progress Report*. (Appendix K) The *Reasonable Progress Report* summarizes MANE-VU's assessment of pollutants and associated source categories affecting visibility in Class I areas in and near MANE-VU, lists possible control measures for those pollutants and source categories, and develops the requisite four factor analysis. Table 12.3 presents a summary of the four factor analysis for the source categories analyzed in the Reasonable Progress Report[21].

[21] Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas by MACTEC

Table 12-3: Summary of Results from the Four Factor Analysis

Source Category	Primary Regional Haze Pollutant	Control Measure(s)	Average Cost in 2006 dollars (per ton of pollutant reduction)	Compliance Timeframe	Energy and Non-Air Quality Environmental Impacts	Remaining Useful Life
Electric Generating Units	SO_2	Switch to a low sulfur coal (generally <1% sulfur), switch to natural gas (virtually 0% sulfur), coal cleaning, Flue Gas Desulfurization (FGD)-Wet, -Spray Dry, or -Dry.	IPM®* v.2.1.9 predicts $775-$1,690. $170-$5,700 based on available literature	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, reduction in electricity production capacity, wastewater issues	50 years or more
Industrial, Commercial, Institutional Boilers	SO_2	Switch to a low sulfur coal (generally <1% sulfur), switch to natural gas (virtually 0% sulfur), switch to a lower sulfur oil, coal cleaning, combustion control, Flue Gas Desulfurization (FGD)-Wet, -Spray Dry, or -Dry.	$130-$11,000 based on available literature. Depends on size.	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, control device energy requirements, wastewater issues	10-30 years

*Integrated Planning Model®

Source Category	Primary Regional Haze Pollutant	Control Measure(s)	Average Cost in 2006 dollars (per ton of pollutant reduction)	Compliance Timeframe	Energy and Non-Air Quality Environmental Impacts	Remaining Useful Life
Cement and Lime Kilns	SO_2	Fuel switching, Dry Flue Gas Desulfurization-Spray Dryer Absorption (FGD), Wet Flue Gas Desulfurization (FGD), Advanced Flue Gas Desulfurization (FGD).	\$1,900-\$73,000 based on available literature. Depends on size.	2-3 years following SIP submittal	Control device energy requirements, wastewater issues	10-30 years
Heating Oil	SO_2	Lower the sulfur content in the fuel. Depends on the state.	\$550-\$750 based on available literature. There is a high uncertainty associated with this cost estimate.	Currently feasible. Capacity issues may influence timeframe for implementation of new fuel standards	Increases in furnace/boiler efficiency, Decreased furnace/boiler maintenance requirements	18-25 years
Residential Wood Combustion	PM	State implementation of NSPS, Ban on resale of uncertified devices, installer training certification or inspection program, pellet stoves, EPA Phase II certified RWC devices, retrofit requirement, accelerated changeover requirement, accelerated changeover inducement.	\$0-\$10,000 based on available literature	Several years - dependent on mechanism for emission reduction	Reduce greenhouse gas emissions, increase efficiency of combustion device	10-15 years

Guided by this analysis, MANE-VU arrived at a suite of suggested control measures that the MANE-VU states agreed to pursue as a region. The corollary was that the MANE-VU Class I states (Maine, New Hampshire, Vermont, and New Jersey) also asked states outside of MANE-VU that also contribute to visibility impairment to pursue similar strategies for reducing sulfate emissions from source sectors, or equivalent sulfate reductions if not from the source sectors that MANE-VU has identified for its own sulfate reductions.

12.4.3 Best Available Retrofit Technology

BART controls are among the reasonable strategies included in this SIP. BART controls in the State of Maryland are identified in Section 9 of this SIP.

To assess the impacts of MANE-VU states' implementation of the BART provisions of the Regional Haze Rule for other facilities, NESCAUM included estimated reductions anticipated for BART-eligible facilities in the MANE-VU region in the final 2018 CMAQ modeling analysis. A survey of state staff indicated that eight non-CAIR facilities in MANE-VU would likely be controlled under BART alone. These states provided potential control technologies and levels of control, which were in turn incorporated into the 2018 emission inventory projections. Table 12.4 lists affected facilities and emissions assumptions used in the modeling.

Maryland has updated the BART analysis for the facilities listed in Table 12.4

The LeHigh Portland Cement – Union Bridge facility is not a BART facility. The NO_X and SO_2 emissions come from a portion of the facility that was constructed three years ago.

The LeHigh Portland Cement – Woodsboro facility does not fall within the 26 industrial categories EPA developed in the BART guidelines. The facility produces lightweight aggregate (Lelite) from the shale quarried on the site. The facility does not produce Portland cement nor does it process taconite ore. The facility is not a BART-eligible facility.

Westvaco Fine Paper agreed to reduce facility emissions by 90% of Unit 2's base year emission inventory. This is an additional 5% reduction (or 446 tpy) and is more than the reductions NESCAUM predicted for Maryland's LeHigh facilities. The BART controls included in Section 9 of this SIP are therefore consistent with the modeling assumptions used for the facilities located in Maryland.

Since starting work on this SIP Eastalco Aluminum ceased all operations and subsequently shut down.

Additional visibility benefits are likely to result from installation of controls at other non-CAIR BART-eligible facilities located in adjacent RPOs. These benefits were not accounted for in the MANE-VU modeling, since information about final BART determinations was not available.

BART controls included in Section 9 of this SIP are consistent with the modeling assumptions used for the State of Maryland.

Table 12-4 Estimated Emissions from Non-EGU BART-Eligible Facilities Located in MANE-VU Used in Final Modeling

	Facility Name	Unit Name	SCC Code	Plant ID (from the MANE-VU Inventory)	Point ID (from the MANE-VU Inventory)	Facility Type	Fuel	2002 Emissions (tons)	2018 Emissions (tons)
MD	EASTALCO ALUMINUM	28	30300101	021-0005	28	Metal Production		1506	1356
MD	EASTALCO ALUMINUM	29	30300101	021-0005	29	Metal Production		1506	1356
MD	LEHIGH PORTLAND CEMENT	39	30500606	013-0012	39	Portland Cement		9	8
MD	LEHIGH PORTLAND CEMENT	16	30500915	021-0003	16	Portland Cement		1321	1,189
MD	LEHIGH PORTLAND CEMENT	17	30500915	021-0003	17	Portland Cement		976	878
MD	WESTVACO FINE PAPERS	2	10200212	001-0011	2	Paper and Pulp		8923	1338
ME	Wyman Station	Boiler 3	10100401	2300500135	004	EGU	Oil	616	308
ME	SAPPI Somerset	Power Boiler #1	10200799	2302500027	001	Paper and Pulp	Oil/Wood Bark/Process Gas	2884	1442
ME	IP Jay	Power Boiler #2	10200401	2300700021	002	Paper and Pulp	Oil	3086	1543
ME	IP Jay	Power Boiler #1	10200401	2300700021	001	Paper and Pulp	Oil	2964	1482
NY	KODAK PARK DIVISION	U00015	10200203	8261400205	U00015	Chemical Manufacturer		23798	14216
NY	LAFARGE BUILDING MATERIALS INC	41000	30500706	4012400001	041000	Portland Cement		14800	4440

12.4.4 Low-Sulfur Oil Strategy

The assumption underlying the MANE-VU low-sulfur fuel oil strategy is that refiners can, by 2018, produce home heating and fuel oils that contain 50 percent less sulfur for the heavier grades (#4 and #6 residual), and a minimum of 75 percent and maximum of 99.25 percent less sulfur in #2 fuel oil (also known as home heating oil, distillate, or diesel fuel) at an acceptably small increase in price to the end user. As much as 75 percent of the total sulfur reductions achieved by this strategy come from using the low-sulfur #2 distillate for space heating in the residential and commercial sectors. While costs for these emissions reductions are somewhat uncertain, they appear reasonable in comparison to costs of controlling other sectors as documented in the MANE-VU Reasonable Progress Report, estimated at $550 to $750 per ton.

The MANE-VU states agreed that a low-sulfur oil strategy is reasonable to pursue by 2018 as appropriate and necessary. As mentioned in section 11, Maryland will reduce SO_2 emissions by 269,444 tons per year and yield a surplus of 57,552 tons per year beyond that of the 2018 RPG target.

12.4.5 EGU Strategy

MANE-VU identified emissions from 167 stacks at EGU facilities as having visibility impacts in MANE-VU Class I areas that make controlling emissions from those stacks crucial to improving visibility at MANE-VU Class I areas.

MANE-VU's agreed regional approach for this source sector is to pursue a 90 percent control level on SO_2 emissions from these 167 stacks by 2018 as appropriate and necessary. MANE-VU has concluded that pursuing this level of sulfur reduction is both reasonable and cost-effective. Even though current wet scrubber technology can achieve sulfur reductions greater than 95 percent, historically a 90 percent sulfur reduction level includes lower average reductions from dry scrubbing technology. The cost for SO_2 emissions reductions will vary by unit, and the MANE-VU Reasonable Progress report summarizes the various control methods and costs available, ranging from $170 to $5,700 per ton, with site-specific factors such as size and type of unit, fuels, etc. influencing the cost.

Maryland has instituted the Healthy Air Act discussed in Section 11.3.1. The reductions from the Maryland Healthy Air Act (an EGU emissions control program) more than satisfy Reasonable Progress Goals as illustrated in comparing Tables 11-2 and 11-3. Thus, Maryland already fulfills its share of emission reductions under the RPG "ask" for EGUs.

12.4.6 Changes to Emissions by 2018

The emission inventory for Maryland projects changes to point, area and mobile source inventories by the end of the first implementation period resulting from population growth; industrial, energy and natural resources development; land management; and air pollution control. A summary of these changes is given in Tables 12.4 and 12.5 for emissions of sulfur dioxide. More detail is provided in:

- *Development of Emissions Projections for 2009, 2012, and 2018 for Non-EGU Point, Area, and Non-road Sources in the MANE-VU Region* (MACTEC, February 2007)(Appendix E-2), and
- *Documentation of 2018 Emissions from Electric Generationg Units in the Eastern U.S. for MANE-VU's Regional Haze Modeling (Alpine Geophysics, March 2008)*(Appendix R)

Table 12-5 Emission from Point, Area and Mobile Sources in MANE-VU (OTB/OTW SO2 tpy) [22]

	Baseline 2002	2018 (with additional measures for RPG)
Area	286,921	129,656
Non-EGU Point	264,377	91,438
EGU Point	1,643,257	368,717
On-Road Mobile	40,090	8,757
Non-Road Mobile	57,257	8,643

Table 12-6 Emission from Point, Area and Mobile Sources in Maryland (OTS/OTW SO2 tpy) [23]

	Baseline 2002	2018 (with additional measures for RPG)
Area	27,318	4,904
Non-EGU Point	34,193	27,006
EGU Point	256,749	43,764
On-Road Mobile	4,058	656
Non-Road Mobile	7,942	577

12.5 Additional Measures Considered

12.5.1 Measures to Mitigate the Impacts of Construction Activities

40 CFR Section 51.308(d)(3)(v)(B) requires Maryland to consider measures to mitigate the impacts of construction activities.

A description of MANE-VU's consideration of measures to mitigate the impacts of construction can be found in the MANE-VU Construction TSD entitled, *Technical Support Document on*

22 Emissions from final MANE-VU Modeling
23 Emissions from final MANE-VU Modeling

Measures to Mitigate the Visibility Impacts of Construction Activities in the MANE-VU Region in Appendix O.

Maryland has instituted the following measure to mitigate the visibility impacts of construction activities:

- COMAR 26.11.06.03D [24]

This regulation states that during construction activities there must be "reasonable precautions to prevent particulate matter from becoming airborne" and lists possible control measures. The listing of the regulation in this document does not imply the inclusion of the regulation in the SIP. All Maryland regulations are enforceable under Maryland laws but only those incorporated in the federally enforceable SIP are enforceable under federal laws. Ambient air quality data shows that soil dust makes up only a minor fraction of the $PM_{2.5}$ measured in MANE-VU Class I Areas. The impacts of diesel emissions in these rural areas are also a small part of total $PM_{2.5}$. Maryland has rules in place to mitigate potential impacts of construction on visibility in Class I Areas.

12.5.2 Agricultural and Forestry Smoke Management

40 CFR Section 51.308(d)(3)(v)(E) requires Maryland to consider smoke management techniques for the purposes of agricultural and forestry management in developing reasonable progress goals. Smoke Management Programs are only required when smoke impacts from fires managed for resource benefits contribute significantly to regional haze. The MANE-VU study concluded that it is "unlikely that fires for agricultural or forestry management cause large impacts on visibility in any of the Class I areas in the MANE-VU Region." Though Maryland does not need an official Smoke Management Plan, Maryland does have the legal authority to allow or prohibit burning through a formal permitting system.

A description of MANE-VU's analysis of smoke management in the context of regional haze SIPs can be found in the MANE-VU Smoke Management TSD entitled, "*Technical Support Document on Agricultural and Forestry Smoke Management in the MANE-VU Region*" in Appendix P.

12.6 Estimated Impacts of Long Term Strategy on Visibility

40 CFR Section 51.308(d)(3)(v)(G) requires Maryland to address the net effect on visibility resulting from changes projected in point, area and mobile source emissions by 2018.

NESCAUM has conducted modeling for MANE-VU to document the impacts of the long term strategy on visibility at affected Class I areas. (See *2018 Visibility Projections, NESCAUM, March 2008) (Appendix M)*

The Class I states affected by emissions from within the State of Maryland have established reasonable progress goals for each of their Class I areas for 2018. The control measures included

24 "Particulate Matter from Materials Handling and Construction" ; http://www.dsd.state.md.us/comar/26/26.11.06.03.htm

in this SIP represent the reasonable contribution of Maryland toward achieving those reasonable progress goals by 2018.

The starting point for indicating progress achieved by measures included in this SIP and other MANE-VU-member SIPs is the 2000-2004 baseline visibility at affected Class I areas. To calculate the baseline visibility for affected Class I areas, using 2000-2004 IMPROVE monitoring data, the deciview value for the 20 percent best days in each year were averaged together, producing a single average deciview value for the best days. Similarly, the deciview values for the 20 percent worst days in each year were averaged together, producing a single average deciview value for the worst days.

Initial modeling to assess the impact of potential control measures is documented in *MANE-VU Modeling for Reasonable Progress Goals: Model Performance Evaluation, Pollution Apportionment, and Control Measure Benefits*, (NESCAUM, February 2008) (Appendix L). Results of the reasonable progress modeling showed that sulfate aerosol – the dominant contributor to visibility impairment in the Northeast's Class I areas on the 20 percent worst visibility days – has significant contributions from states throughout the eastern U.S. that are projected to continue in future years from all three of the eastern regional planning organizations (RPOs). An assessment of potential control measures identified a number of promising strategies that would yield significant visibility benefits beyond the uniform rate of progress and, in fact, significantly beyond the projected visibility conditions that would result from "on the books/on the way" air quality protection programs. These additional measures include the adoption of low sulfur heating oil, implementation of Best Available Retrofit Technology (BART) requirements, and additional electric generating unit (EGU) controls on select sources.

Final modeling was conducted after consultation with states in and outside of MANE-VU. Final modeling is documented in *2018 Visibility Projections,* (NESCAUM, March 2008) (Appendix M). Emissions inventory adjustments were made for this modeling in order to better represent the likely outcome of efforts to pursue the BART, low sulfur fuel, and EGU control measures included in the MANE-VU June 20, 2007 statements and described in Section 12.4.1, above.

Figures 12.13a through 12.13e illustrate the predicted visibility improvement by 2018 resulting from the implementation of the MANE-VU regional long term strategy. This improvement is compared to the Uniform Rate of Progress for affected Class I areas. All MANE-VU sites are projected to meet or exceed the uniform rate of progress goal for 2018. In addition, no site anticipates increases in best day visibility relative to the baseline.

FIGURE 12.13A PROJECTED VISIBILITY IMPROVEMENT AT ACADIA NATIONAL PARK BASED ON 2009 AND 2018 BEST AND FINAL PROJECTIONS

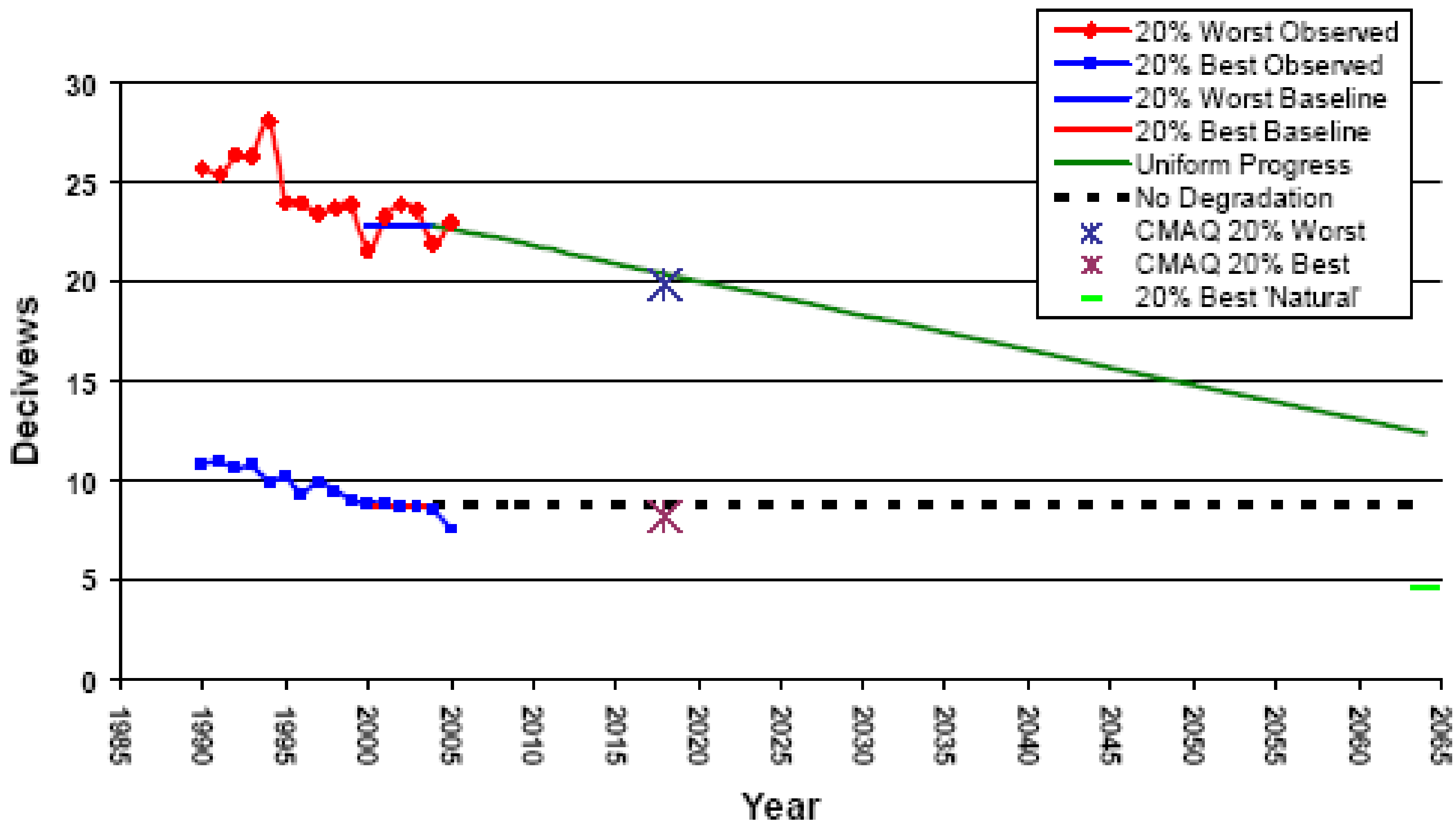


FIGURE 12.13B PROJECTED VISIBILITY IMPROVEMENT AT BRIGANTINE NATIONAL WILDLIFE REFUGE BASED ON BEST AND FINAL MODELING

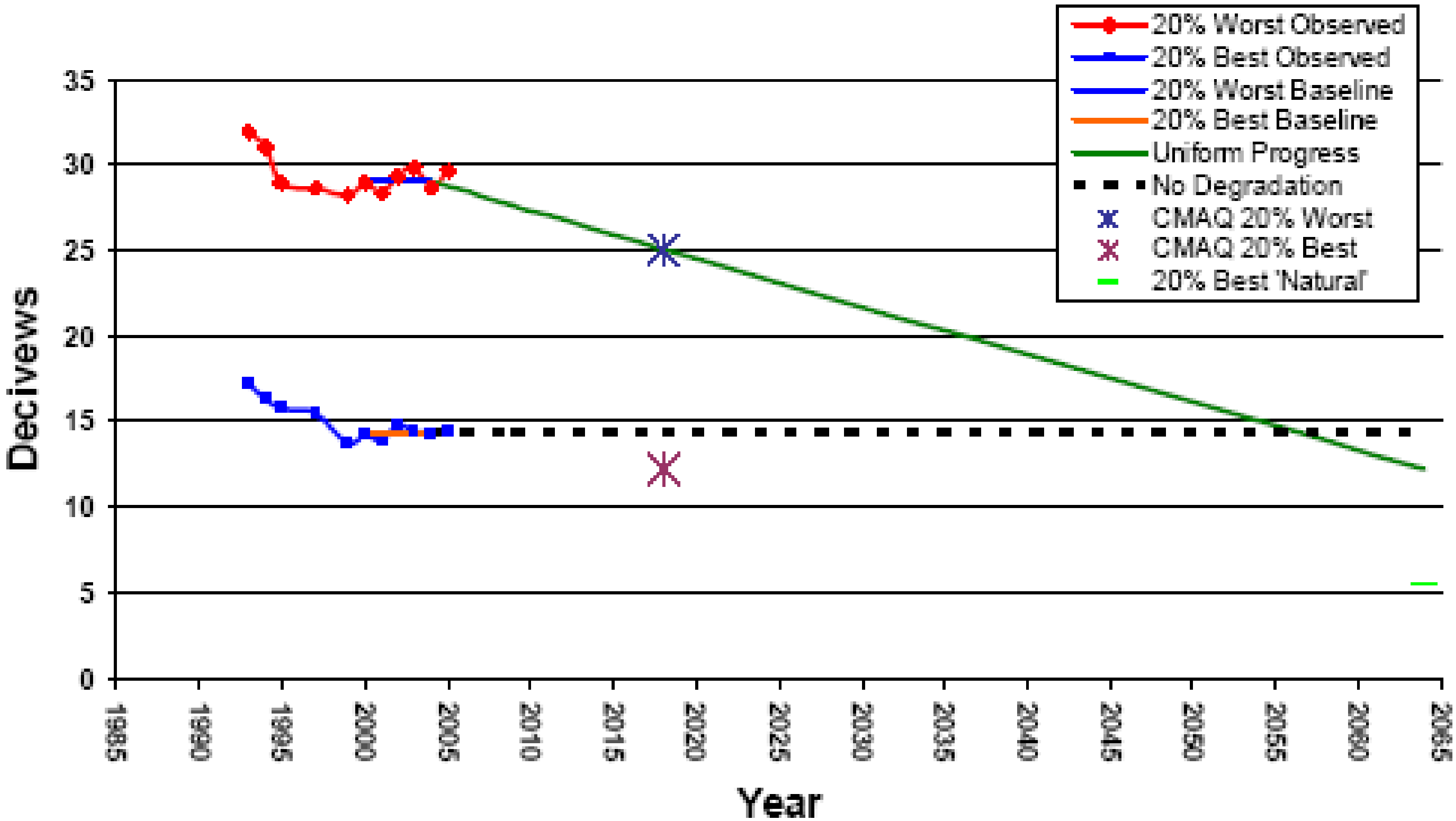
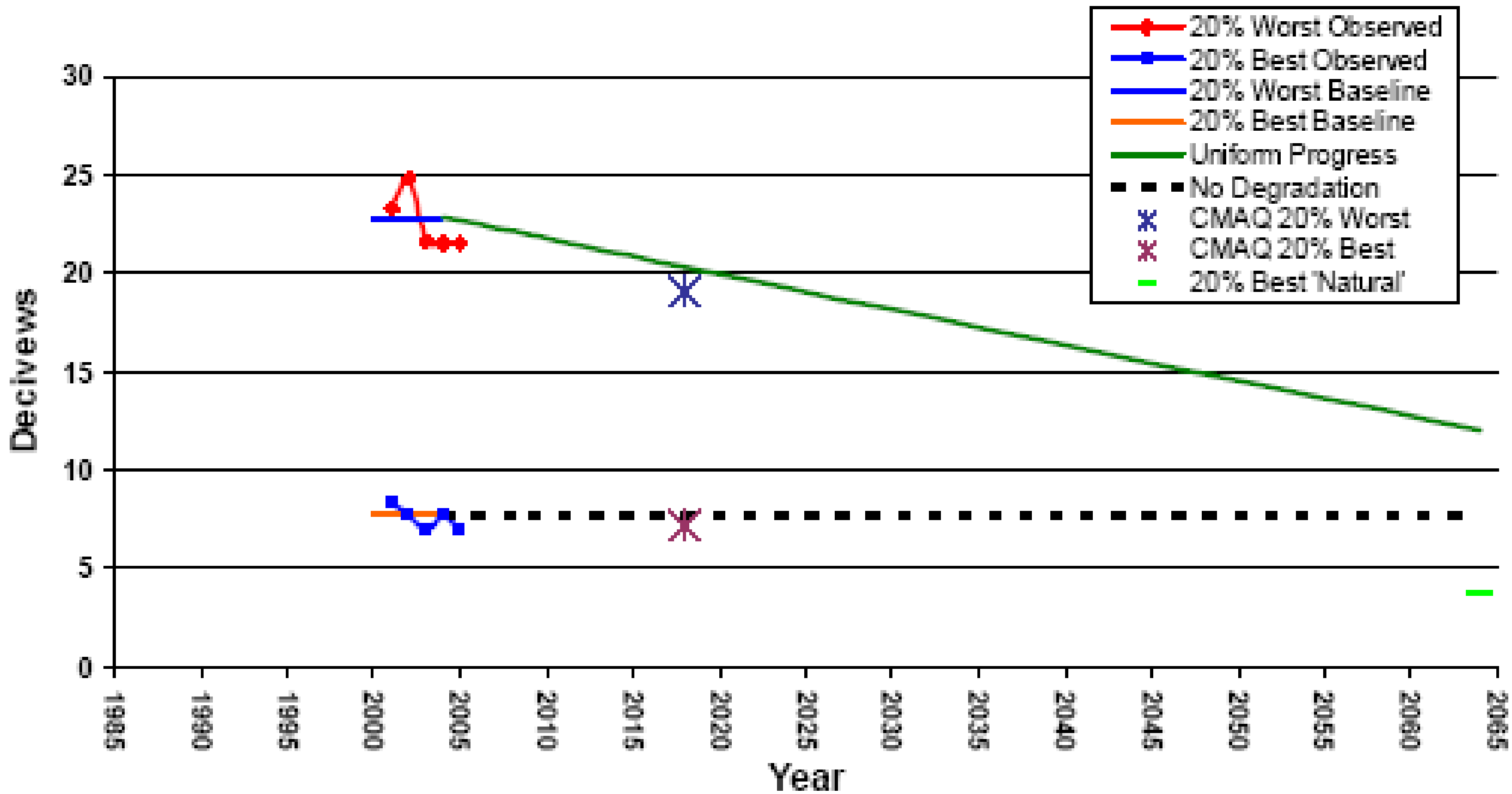


FIGURE 12.13C PROJECTED VISIBILITY IMPROVEMENT AT GREAT GULF WILDERNESS AREA BASED ON BEST AND FINAL MODELING[25]



25 The estimate for Great Gulf Wilderness Area also serves to provide an estimate for the Presidential Range/Dry River Wilderness Area

FIGURE 12.13D PROJECTED VISIBILITY IMPROVEMENT AT LYE BROOK WILDERNESS AREA BASED ON BEST AND FINAL MODELING

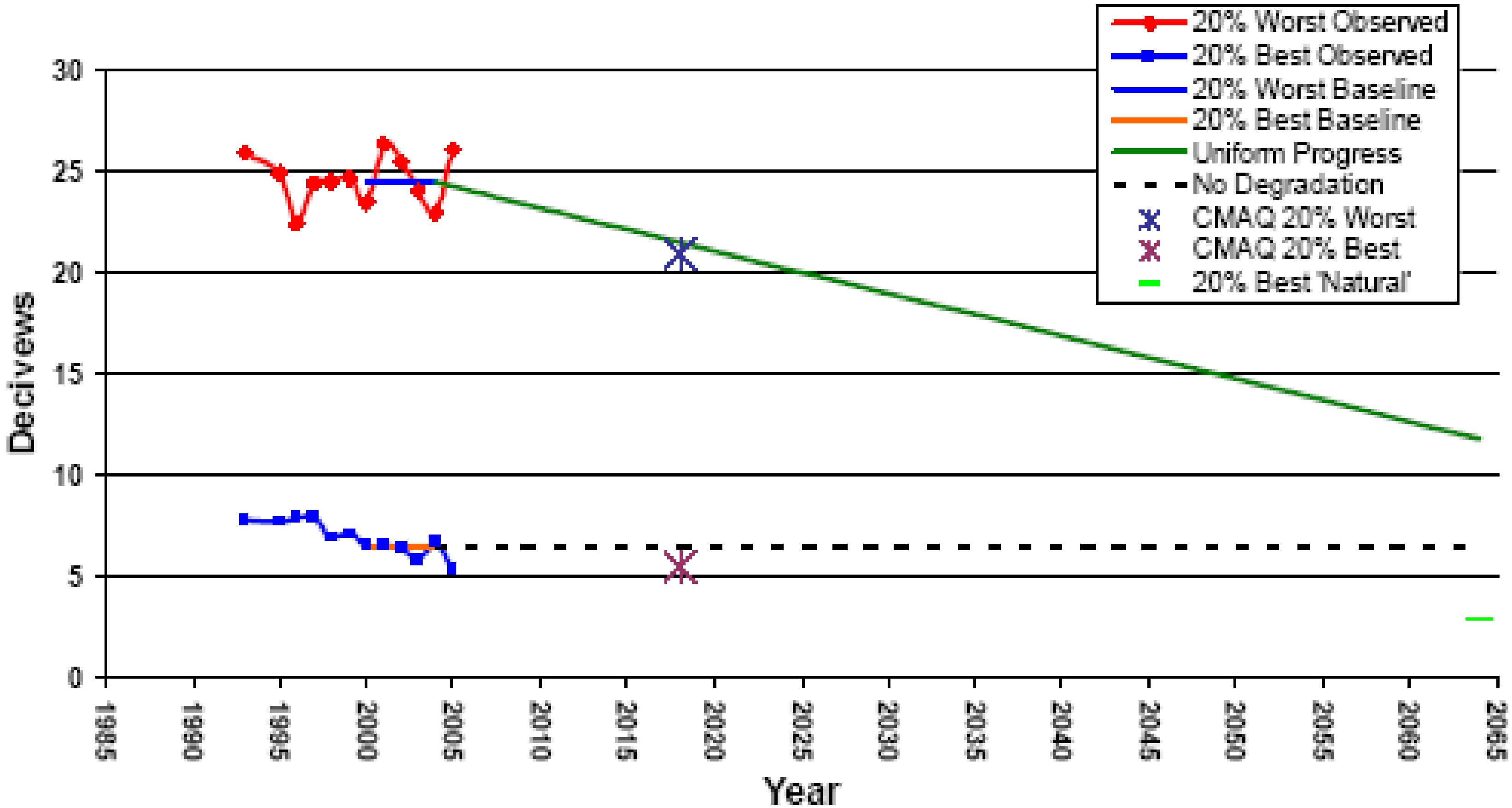
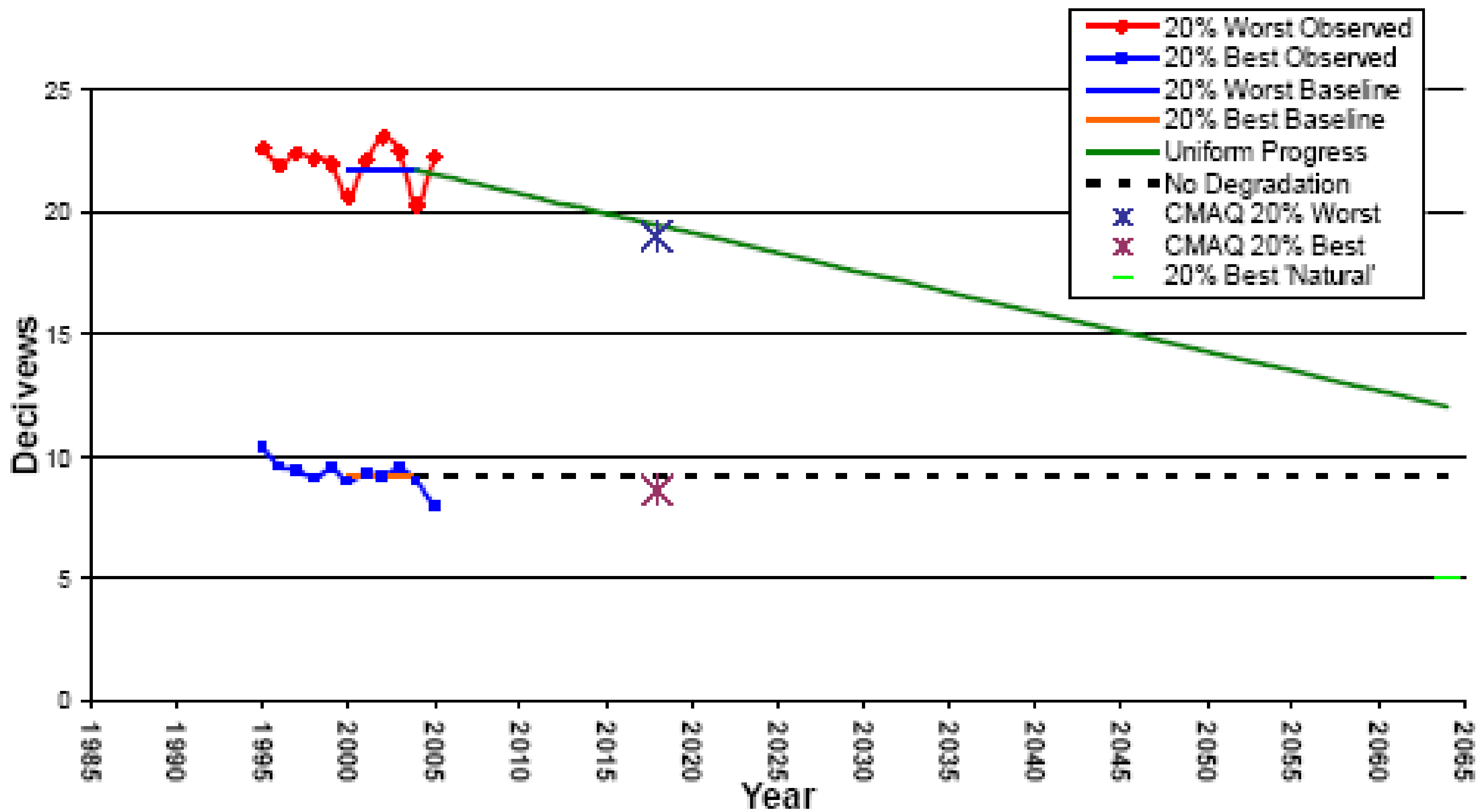


Figure 12.13E Projected Visibility Improvement at Moosehorn Wilderness Area Based on Best and Final Modeling [26]



26 The estimate for Moosehorn Wilderness Area also serves to provide an estimate for Roosevelt/Campobello International Park.

12.7 Share of Emissions Reductions

40 CFR Section 51.308(d)(3)(ii) requires Maryland to demonstrate that its implementation plan includes all measures necessary to obtain its fair share of emission reductions needed to meet reasonable progress goals.

The modeling analysis referenced in section 12.6, above, demonstrated that Maryland's long-term strategy when coordinated with other State's strategy is sufficient to meet reasonable progress goals.

The statement agreed to by MANE-VU on June 20, 2007 provided that each state will have up to 10 years to pursue adoption and implementation of reasonable NO_X and SO_2 control measures as appropriate and necessary. This SIP is consistent with that statement. The Maryland EGU "surplus" of 57,552 TPY (Table 11.3) from the Healthy Air Act is greater than the entire benefit of 7,473.4 TPY from the low-sulfur fuel strategy. Therefore, Maryland meets the Reasonable Progress Goal "ask" for low-sulfur fuels by implementing expanded regulations on EGUs, and thus achieved its fair share of SO_2 emission reductions.

12.8 Enforceability of Emission Limitations and Control Measures

40 CFR Section 51.308(d)(3)(v)(F) requires Maryland to ensure that emission limitations and control measures used to meet reasonable progress goals are enforceable. Maryland EGU control measures alone were demonstrated to achieve the reasonable progress goal; in terms of total SO_2 emissions reductions (see Section 8.7, 10.2 and 10.4). These EGU measures are already on the books and are enforceable at both the state and federal levels (COMAR 26.11.27).

Although Maryland has obtained its fair share of reductions, the State of Maryland is continuing to evaluate the measures included in the long term strategy to determine whether they are reasonable to adopt and implement by 2018 and expects to make that determination in the SIP revision due in five years.

12.9 New Source Review and Prevention of Significant Deterioration

Maryland commits to ensuring NSR and PSD permitting activity and will ensure that such activity supports Maryland's regional haze SIP commitments.

References

Byun D.W., and J.K.S. Ching. *Science Algorithms of the EPA Models-3 Community Multiscale Air Quality (CMAQ) Modeling System*. EPA/600/R-99/030. March 1999.

SAI. *User's Guide to the Regional Modeling System for Aerosols and Deposition (REMSAD), Version 7.* ICF Consulting/SAI, San Francisco, CA. 2002

Table 12-7: Non-EGU Source Shutdowns in the MANE-VU Region

STATE	FIPS	SITE ID	FACILTY NAME	EU ID	UNIT DESCRIPTION
DE	10003	1000300021	SUNCO INC R M	1	BOILER #1
DE	10003	1000300021	SUNCO INC R M	2	BOILER #2
DE	10003	1000300021	SUNCO INC R M	3	BOILER #3
DE	10003	1000300016	MOTIVA ENTERPRISES LLC	72	METHANOL PLT HTR 41-H-1
DE	10003	1000300004	WILMINGTON PIECE DYE CO	ALL	ALL
DE	10003	1000300032	GENERAL CHEMICAL CORPORATION	ALL	ALL
DE	10003	1000300074	METACHEM PRODUCTS LLC	ALL	ALL
DE	10003	1000300127	VPI FILM LLC	ALL	ALL
DE	10003	1000300129	LAFARGE NORTH AMERICA INC	ALL	ALL
DE	10003	1000300350	KANEKA DELAWARE CORPORATION	ALL	ALL
MA	25001	1200202	PARTYLITE WORLDWIDE	ALL	ALL
MA	25001	1200614	BOURNE LANDFILL	ALL	ALL
MA	25003	1170002	ADVANCED INFORMATION	ALL	ALL
MA	25003	1170005	CATAMOUNT PELLET FUE	ALL	ALL
MA	25003	1170048	SPRAGUE NORTH ADAMS	ALL	ALL
MA	25003	1170056	BERKSHIRE GAS STOCKB	ALL	ALL
MA	25003	1170078	MACDERMID GRAPHIC AR	ALL	ALL
MA	25003	1170091	LANE CONSTRUCTION CO	ALL	ALL
MA	25005	1200009	TEXAS INSTRUMENTS	ALL	ALL
MA	25005	1200031	CONDEA VISTA CO	ALL	ALL
MA	25005	1200036	ELKAY REVERE CORP	ALL	ALL
MA	25005	1200037	AEROVOX INCORPORATED	ALL	ALL
MA	25005	1200065	ROSEMAR SILVER COMPA	ALL	ALL
MA	25005	1200080	ATTLEBORO REFINING C	ALL	ALL
MA	25005	1200116	STEDRO TEXTILES	ALL	ALL
MA	25005	1200138	CLIFTEX CORPORATION	ALL	ALL
MA	25005	1200169	PAUL DEVER STATE SCH	ALL	ALL
MA	25005	1200209	PHARMACY SERVICE COR	ALL	ALL
MA	25005	1200216	BRISTOL COUNTY JAIL	ALL	ALL
MA	25005	1200235	SEA WATCH INTERNATIO	ALL	ALL
MA	25005	1200393	OLSONS GREENHOUSES	ALL	ALL
MA	25005	1200468	AA WILL MATERIALS-FR	ALL	ALL
MA	25005	1200498	CRAPO HILL LANDFILL	ALL	ALL
MA	25005	1200510	KREW INCORPORATED	ALL	ALL
MA	25005	1200513	AEROVOX INCORPORATED	ALL	ALL
MA	25005	1200542	LALLY COLUMN CORP	ALL	ALL
MA	25005	1200673	HOMELAND BUILDERS	ALL	ALL
MA	25005	1200824	JUSTIN CLOTHING CO	ALL	ALL
MA	25005	1200880	VELVET DRIVE TRANSMI	ALL	ALL
MA	25005	1192308	INTERSTATE MAT & RUB	ALL	ALL
MA	25009	1210057	COASTAL METAL FINISH	ALL	ALL
MA	25009	1210058	AMESBURY CHAIR	ALL	ALL
MA	25009	1210075	HAMPSHIRE FABRICS	ALL	ALL

MA	25009	1210099	WASTE MANAGEMENT HUN	ALL	ALL
MA	25009	1210110	CUSTOM INDUSTRIES IN	ALL	ALL
MA	25009	1210114	SAGAMORE INDUSTRIAL	ALL	ALL
MA	25009	1210143	LABELS INC	ALL	ALL
MA	25009	1210154	NEWARK ATLANTIC PAPE	ALL	ALL
MA	25009	1210208	TEK COATING COMPANY	ALL	ALL
MA	25009	1210209	NATIONAL NORTHEAST	ALL	ALL
MA	25009	1210223	STARENSIER INC	ALL	ALL
MA	25009	1210400	SANMINA CORPORATION	ALL	ALL
MA	25009	1210401	COVANTA HAVERHILL IN	ALL	ALL
MA	25009	1210404	TEKE FURNITURE RESTO	ALL	ALL
MA	25009	1190756	PERMAIR LEATHERS INC	ALL	ALL
MA	25009	1190842	SLB SNACKS INC	ALL	ALL
MA	25009	1190983	SALEM OIL & GREASE C	ALL	ALL
MA	25009	1191036	JCR ELECTRONICS	ALL	ALL
MA	25009	1195900	LEPAGES INC	ALL	ALL
MA	25013	420008	DELUXE FINANCIAL	ALL	ALL
MA	25013	420010	FRYE COPYSYSTEMS INC	ALL	ALL
MA	25013	420013	JAHN FOUNDRY CORPORA	ALL	ALL
MA	25013	420052	APW/WRIGHT LINE	ALL	ALL
MA	25013	420130	KODAK POLYCHROME GRA	ALL	ALL
MA	25013	420175	FIBERMARK DSI	ALL	ALL
MA	25013	420218	SPRINGFIELD PRINTING	ALL	ALL
MA	25013	420252	KODAK POLYCHROME GRA	ALL	ALL
MA	25013	420528	NATIONAL METAL INDUS	ALL	ALL
MA	25015	420060	BERKSHIRE GAS HATFIE	ALL	ALL
MA	25015	420105	INDUSTRIAL POWER SER	ALL	ALL
MA	25015	420170	TECHALLOY COMPANY IN	ALL	ALL
MA	25015	420424	MAGNAT MACHINETECH I	ALL	ALL
MA	25015	420463	INDUSTRIAL PROP OF E	ALL	ALL
MA	25015	420540	GENERAL CABLE CORP	ALL	ALL
MA	25015	420614	REXAM IMAGE PRODUCTS	ALL	ALL
MA	25017	1210013	MERRIMACK MAGNETICS	ALL	ALL
MA	25017	1210050	MAJILITE MFG INC	ALL	ALL
MA	25017	1210064	FINISH UNLIMITED INC	ALL	ALL
MA	25017	1190080	MASS BROKEN STONE CO	ALL	ALL
MA	25017	1210127	USM CORPORATION	ALL	ALL
MA	25017	1210147	UMASS LOWELL-RESIDEN	ALL	ALL
MA	25017	1210182	JOAN FABRICS CORP	ALL	ALL
MA	25017	1190203	SC WAKEFIELD 200	ALL	ALL
MA	25017	1190212	OLYMPUS SPECIALTY HO	ALL	ALL
MA	25017	1190258	ROYAL INSTITUTIONAL	ALL	ALL
MA	25017	1210334	T&T INDUSTRIAL	ALL	ALL
MA	25017	1190465	PRINTED CIRCUIT CORP	ALL	ALL
MA	25017	1190611	GEORGE MEADE FOUNDRY	ALL	ALL
MA	25017	1190734	NEW ENGLAND CONFECTI	ALL	ALL

MA	25017	1180794	SCHOTT CML FIBEROPTI	ALL	ALL
MA	25017	1190984	SUNGARD AVAILABILITY	ALL	ALL
MA	25017	1191008	RAYTHEON SYSTEMS CO	ALL	ALL
MA	25017	1191217	BOSTON SCIENTIFIC CO	ALL	ALL
MA	25017	1191267	AGFA DIVISION OF BAY	ALL	ALL
MA	25017	1191351	MIT EDUCATIONAL FACI	ALL	ALL
MA	25017	1191389	LONGVIEW FIBRE COMPA	ALL	ALL
MA	25017	1191534	SWISSTRONICS INCORPO	ALL	ALL
MA	25017	1191653	FOCAL INCORPORATED	ALL	ALL
MA	25017	1191668	LEE PRODUCTS COMPANY	ALL	ALL
MA	25017	1191735	TYCO ELECTRONICS COR	ALL	ALL
MA	25017	1191897	GENZYME CORPORATION	ALL	ALL
MA	25017	1194001	WF WOOD INC	ALL	ALL
MA	25017	1194010	RR DONNELLEY & SONS	ALL	ALL
MA	25017	1214012	PERFORMANCE CORRUGAT	ALL	ALL
MA	25021	1190246	SOUTHWOOD COMMUNITY	ALL	ALL
MA	25021	1190313	INNOVATIVE MEMBRANE	ALL	ALL
MA	25021	1180359	BEVILACQUA PAVING CO	ALL	ALL
MA	25021	1200515	FOXBOROUGH REALTY AS	ALL	ALL
MA	25021	1200616	PLAINVILLE GENERATIN	ALL	ALL
MA	25021	1190670	RAYTHEON ELECTRONIC	ALL	ALL
MA	25021	1190714	TEVA PHARMACEUTICAL	ALL	ALL
MA	25021	1190962	NIDEC AMERICA CORPOR	ALL	ALL
MA	25021	1191562	BARCLAY HOUSE THE	ALL	ALL
MA	25021	1191726	MWRA QUINCY PS	ALL	ALL
MA	25021	1192130	CURRY WOODWORKING IN	ALL	ALL
MA	25021	1199000	MEDFIELD STATE HOSPI	ALL	ALL
MA	25023	1200637	FRANKLIN FIXTURES IN	ALL	ALL
MA	25023	1200698	CRANBERRY GRAPHICS I	ALL	ALL
MA	25023	1192101	GTR FINISHING CORPOR	ALL	ALL
MA	25023	1192109	ALGER CORPORATION TH	ALL	ALL
MA	25023	1192210	IMPERIA CORPORATION	ALL	ALL
MA	25023	1199994	TEST-RADIUS-FITZGERA	ALL	ALL
MA	25025	1190035	BOSTON WATER & SEWER	ALL	ALL
MA	25025	1190057	NEPONSET RIVER VALLE	ALL	ALL
MA	25025	1190101	UNIFIRST CORP	ALL	ALL
MA	25025	1190357	DAMRELL EWER PARTNER	ALL	ALL
MA	25025	1190478	WINTHROP COMMUNITY H	ALL	ALL
MA	25025	1190649	ZAPCO READVILLE COGE	ALL	ALL
MA	25025	1190808	PUBLIC HEALTH COMMUN	ALL	ALL
MA	25025	1191551	BEACON CAPITAL PARTN	ALL	ALL
MA	25025	1191566	NEW ENGLAND TRAWLER	ALL	ALL
MA	25025	1191621	FEDERAL MOGUL FRICTI	ALL	ALL
MA	25025	1191662	EQUITY OFFICE	ALL	ALL
MA	25025	1191956	CHANNEL CENTER:PARCE	ALL	ALL
MA	25025	1195596	SYNTHON IND INCORPOR	ALL	ALL

MA	25027	1180010	CANTERBURY TOWERS	ALL	ALL
MA	25027	1180014	ER BUCK CHAIR COMPAN	ALL	ALL
MA	25027	1180029	GENERAL ELECTRIC FIT	ALL	ALL
MA	25027	1180091	ANGLO FABRICS COMPAN	ALL	ALL
MA	25027	1180100	ZAPCO ENERGY TACTICS	ALL	ALL
MA	25027	1180111	CINCINATTI MILACRON	ALL	ALL
MA	25027	1180114	NEW ENGLAND PLATING	ALL	ALL
MA	25027	1180129	GF WRIGHT STEEL & WI	ALL	ALL
MA	25027	1180132	STANDARDFOUNDRY	ALL	ALL
MA	25027	1180174	WORCESTER TOOL & STA	ALL	ALL
MA	25027	1180203	WORCESTER COUNTY HOS	ALL	ALL
MA	25027	1180244	HI TECH METALS & FIN	ALL	ALL
MA	25027	1180340	GHM INDUSTRIES INC	ALL	ALL
MA	25027	1180353	ADVANCED MICROSENSOR	ALL	ALL
MA	25027	1180355	NEWARK AMERICA	ALL	ALL
MA	25027	1180373	ZYGO TERAOPTIX	ALL	ALL
MA	25027	1180389	ETHAN ALLEN-DUDLEY	ALL	ALL
MA	25027	1180439	INLAND PAPERBOARD &	ALL	ALL
MA	25027	1180484	NELMOR COMPANY	ALL	ALL
MA	25027	1180518	JAMESBURY INCORPORAT	ALL	ALL
MA	25027	1180556	M&H TIRE CO INC	ALL	ALL
MA	25027	1180568	CROFT CORPORATION	ALL	ALL
MA	25027	1180796	LINCOLN PLAZA CENTER	ALL	ALL
MA	25027	1180994	COZ PLASTICS INC	ALL	ALL
MA	25027	1181045	WORCESTER TAPER PIN	ALL	ALL
NH	33011	3301100093	BATESVILLE MANUFACTURING	ALL	ALL
NH	33015	3301500058	VENTURE SEABROOK	ALL	ALL
Listing of all of the non-EGU facility closings in the MANE-VU region before 2009					
Source - Table B-5 from "Draft Emission Projections TSD 16June2006.doc" created by MACTEC.					
Prepared June 16, 2006					

13.0 Comprehensive Periodic Implementation Plan Revisions

Section 51.308(f) requires a Maryland to revise its regional haze implementation plan and submit a plan revision to EPA by July 31, 2018 and every ten years thereafter. In accordance with the requirements listed in Section 51.308(f) of the federal rule for regional haze, Maryland commits to revising and submitting this regional haze implementation plan by July 31, 2018 and every ten years thereafter.

In addition, Section 51.308(g) requires periodic reports evaluating progress towards the reasonable progress goals established for each mandatory Class I area. In accordance with the requirements listed in Section 51.308(g) of the federal rule for regional haze, Maryland commits to submitting a report on reasonable progress to EPA every five years following the initial submittal of the SIP/TIP. The report will be in the form of a SIP/TIP revision submitted five (5) years following the initial submittal and will evaluate the progress made towards the reasonable progress goals. All requirements listed in 51.308(g) shall be addressed in the SIP/TIP revision for reasonable progress.

Section (d)(4)(v) requires periodic updates of the emission inventory. Maryland commits to update the inventory 5 years after the initial submittal of our Regional Haze SIP.

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Commitment to Determine the Adequacy of the Existing Plan determines that the existing implementation plan requires no further substantive revision in order to achieve established goals for visibility improvement and emissions reductions, the State will provide to the Administrator a negative declaration that further revision of the existing implementation plan is not needed.

(2) If the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another State(s) which participated in a regional planning process, the State will provide notification to the Administrator and to the other State(s) which participated in the regional planning process with the States. The State will also collaborate with the other State(s) through the regional planning process for the purpose of developing additional strategies to address the plan's deficiencies.

(3) If the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another country, the State will provide notification, along with available information, to the Administrator.

(4) If the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources within the State, the State will revise its implementation plan to address the plan's deficiencies within one year.

The findings of the five-year progress report will determine which action is appropriate and necessary.

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