MANE-VU FLM/RPO BRIEFING BOOK

MANE-VU FLM / RPO BRIEFING BOOK - Table of Contents

RPO Summary of Work
Section 1

Baseline, Natural Conditions, and Uniform Rate

1) 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, 21 pages 12/2006
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

2) The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description, 92 pages 11/2006
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

Emission Inventories

I. 2002 Emissions Inventory

MANE-VU

Contractor: Pechan – Randy Strait
Documentation and Database files can be found at **ftp.marama.org**
Subdirectory 2002 Version 3
Username: mane-vu
Password: exchange

- Version 3 of the 2002 MANE-VU Inventory
- Summaries for biogenic, Area, Point, Non-Road, and Onroad sectors of Version 3 of 2002 MANE-VU Inventory.
- Technical Support Document (TSD)

Midwest RPO

Contractor: Alpine – Greg Stella

- BaseK Emission Inventory conversion to SMOKE-ready format.

II. Non-EGU Future Year Emissions Inventory

MANE-VU

Contractor: MACTEC – Ed Sabo
Documentation and Database files can be found at
www.marama.org/visibility/Inventory%20Summary/FutureEmissionsInventory.htm

- OTB/OTW 2009/12/18 MANE-VU Inventory

  "On the books/On the Way" (OTB/OTW) Emissions inventories in both NIF and IDA format for Non-EGU, Point, Area, and Non-Road.

- BOTW 2009/12/18 MANE-VU Inventory

  "Beyond On the Way" (BOTW) Emissions inventories in both NIF and IDA format for non EGU Point, Area, and Non-Road were developed based on the OTC control measures matrix. For regional haze purposes, except for SO2 controls, the BOTW controls are assumed in place by 2018.

- Technical Support Document (TSD)

Midwest RPO

Contractor: Alpine – Greg Stella

- BaseK 2009/12/18 OTB/OTW Growth and Control Factors Conversion to produce SMOKE-ready input files for all source categories.

III. EGU Future Year Emissions Inventory

IPM Modeling of EGU emissions for future years
Contractor: ICF – Boddu Venkatesh & Alpine – Greg Stella
Database files can be found at **ftp.marama.org**
Subdirectory 2.1.9 EGUs
Username: mane-vu
Password: exchange

Documentation for this IPM run is not available

- VISTAS 2.1.9 IPM 2009/12/18 CAIR Inventory. (ICF – Boddu Venkatesh)

  "ICF completed an IPM 2.1.9 modeling run based on the VISTAS PC_1f inventory. This run was headed by VISTAS, but has input from all RPOs. ***This is the IPM run MANE-VU is using for all of our base case CMAQ modeling.***

- 2009/12/18 VISTAS 2.1.9 IPM output was converted into NIF and IDA format for CMAQ modeling by Alpine (Greg Stella)

- 2009 Non-Fossil EGU IDA Conversion of non-Fossil EGU data into an IDA format for CMAQ modeling. All MANE-VU states were asked to submit a list of their non-fossil EGU units in the 2009 inventory. (Alpine – Greg Stella)

IV. MANE VU Inventories for Sensitivity Analysis

- **MANE-VU Fuel Oil sulfur content sensitivity Inventories. (Ongoing)**
  Contractor: Alpine – Greg Stella
  No documents yet available for posting online.

  Two 2018 sensitivity modeling inventories (S-1 and S-1) are being developed for use in REMSAD modeling. They will be based on the MANE-VU 2018 BOTW Emissions Inventory. The sulfur content of the #2/4/6 fuel oils will be restricted for all SCCs that use these fuels, except EGUs. EGUs are excluded because the sulfur in fuels burning in EGUs is subject to emissions trading. Therefore

restrictions on the sulfur content of these fuels would free up allowances in the market that would be used elsewhere, resulting in no net emissions decrease. The sulfur content for fuel oil is restricted as follows:

Sensitivity Inventory - 2018 S-1

Home heating and #2 Distillate Oil -	500 ppm S (0.05%)
#4 Distillate/Residual Oil	2500 ppm S (0.25%)
#6 Residual Oil (Except parts of CT & NY)	5000 ppm S (0.5%)
#6 Residual Oil (For parts of CT & NY)	3000 ppm S (0.3%)

Sensitivity Inventory - 2018 S-2

Home heating and #2 Distillate Oil -	15 ppm S (0.0015%)
#4 Distillate/Residual Oil	2500 ppm S (0.25%)
#6 Residual Oil (Except parts of CT & NY)	5000 ppm S (0.5%)
#6 Residual Oil (For parts of CT & NY)	3000 ppm S (0.3%)

Alpine is tasked with developing the Growth and Control packets that can be applied to the MANE-VU 20018 BOTW Inventory to develop the S-1 and S-2 inventories.

- **MANE-VU Additional Limits on EGU NOx and SOx Sensitivity IPM Modeling Run Comparing CAIR with CAIR+**
  Contractor: ICF – Boddu Venkatesh
  Database files are not yet available.

  Draft documentation and fact sheets can be found at:
  www.marama.org/visibility/Inventory%20Summary/FutureEmissionsInventory.htm

  - 2.1.9 IPM 2009/12/18 MANE-VU Base Case EGU Inventory S.T.E.T.

    This IPM run is known as the MANE-VU Base Case or MARAMA_5c. It was developed by MANE-VU based on the VISTAS 2.1.9 framework with updated natural gas prices and a few other adjustments to the input specifications. This Base Case was run to allow a comparison to the MANE-VU CAIR+ run described below. It has not been used for regional air quality modeling.
    State level results are available for this run.
    2009/12/18 NIF and IDA files are available. (Susan, is this true?)

    Discrepancies in the modeling output are currently being resolved. The state level and parsed results will have to be rerun.

- 2.1.9 IPM 2009/12/18 MANE-VU CAIR+ Inventory S.T.E.T.

  This IPM run is known as the MANE-VU CAIR+ or MARAMA_4c. It was developed by MANE-VU based on the VISTAS 2.1.9 framework with updated natural gas prices and a few other adjustments to the input specifications. The results of this CAIR+ can be compared to the to the MANE-VU Base Case run described above. It has not been used for regional air quality modeling.
  State level results are available for this run.

  Discrepancies in the modeling output are currently being resolved. The draft Technical Support Document will be available April 30th.

IV. Inter-RPO EI Warehouse System

Contractor: ERG – Grace Kitzmiller/William Gerber
Warehouse can be found at:
http://app2.erg.com:8080/rpoapp/

MARAMA has uploaded the Version 3 2002 MANE-VU Emissions Inventory. VISTAS has also uploaded data. Problems with the uploaded data and the warehouse system are currently being worked out.

V. Additional Data

Contractor: EH Pechan
OMNI

Documentation and Database files can be found at
http://www.marama.org/visibility/ResWoodCombustion/

MARAMA has provided two updates of the National Emissions Inventory for residential wood combustion. Some states have chosen to use some of these results in preparing their 2002 inventories. In general, these updates are part of an ongoing process to refine information about this source category as it is a large source of emissions with very uncertain emission estimates.

BART

1) Five-Factor Analysis of BART-Eligible Sources: 2/2007
Survey of Options for Conducting BART Determinations
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

2) BART Resource Guide, 34 pages 8/2006
http://www.nescaum.org/documents/bart-resource-guide

3) Assessment of Control Technology 3/2005
Options for BART-Eligible Sources, 102 pages
http://www.nescaum.org/documents/bart-resource-guide

4) Development of a List of BART-Eligible Sources in the 5/2003
MANE-VU Region: Interim Report, 74 pages
http://www.nescaum.org/documents/bart-resource-guide

5) A Basis for Control of BART-Eligible Sources, 168 pages 7/2001
http://www.nescaum.org/documents/bart-resource-guide

Areas of Influence

1) Contributions to Regional Haze in the Northeast and Mid-Atlantic United States, 122 pages + Appendices A-D 8/2006
http://www.nescaum.org/documents/contributions-to-regional-haze-in-the-northeast-and-mid-atlantic--united-states

2) Regional Aerosol Intensive Network (RAIN), Preliminary Data Analysis, 63 pages 5/2006
www.manevu.org/document.asp?FView+reports#

3) UMD Data Analysis Subcontract: Manuscripts on Data from the 2002 MANE-VU UMD Flights 2/2006
www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

4) Upper Air Balloon Study – Millersville, PA, Winter 2004 2/2006
www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

5) Source Apportionment Analysis of Air Quality Monitoring Data: Phase II, 102 pages 3/2005
http://www.marama.org/visibility/SA_phase2/index.html

6) Wintertime Tethered Balloon Measurements of Meteorological Variables and Aerosol Characterization in Support of MANE-VU, 17 pages 1/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

7) Review of Speciation Trends Network and IMPROVE Chemically Speciated Data, Technical Memo #7, 71 pages 3/2003
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

8) REMSAD Platform Intercomparison Experiments, Technical Memo #5, 25 pages 2/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

9) Trajectory Analysis of Potential Source Regions Affecting Class I Areas in the MANE-VU Region, Technical Memo #3, 32 pages 2/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

10) REMSAD Modeling Exercises, Technical Memo #2, 44 pages 2/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

11) GIS Mapping of Regional Haze-Related Data in the MANE-VU Region, Technical Memo #4, 41 pages 2/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

12) Updated Visibility Statistics for the MANE-VU Region, Technical Memo #1, 50 pages 2/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

13) Source Apportionment Analysis of Air Quality Monitoring Data: Phase 1, 110 pages 2/2002
http://www.marama.org/visibility/SA_report/

14) Meteorological Data Archive Feasibility Assessment, 3 pages 1/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

15) Determination of Fine Particle and Coarse Particle Concentrations in the Northeast United States, 1995, 85 pages 12/1999
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

Reasonable Progress and Long Term Strategy

1) Reasonable Progress Goal Project Summary, 5 pages 4/2007
http://www.marama.org/visibility/RPG/index.html#products

2) Assessing Reasonable Progress for Regional Haze in the Mid-Atlantic North Eastern Class I Areas Draft Final Report, 140 pages 4/2007
http://www.marama.org/visibility/RPG/index.html#products

3) Assessing Reasonable Progress for Regional Haze in the Mid-Atlantic North Eastern Class I Areas (Revised Draft Final Technical Memorandum #3), 129 pages 3/2007
http://www.marama.org/visibility/RPG/index.html#products

4) Methods for Evaluations Technical Memorandum #2 Final, 5 pages 2/2007
http://www.marama.org/visibility/RPG/index.html#products

5) Control Scenarios Technical Memorandum #1 Final, 4 pages 2/2007
http://www.marama.org/visibility/RPG/index.html#products

6) Final Work Plan, 11 pages 1/2007
http://www.marama.org/visibility/RPG/index.html#products

Communications and Outreach

1) MANE-VU Newsletter — Fall 2006
http://www.manevu.org/document.asp?fview=Fact%20Sheets#

2) MANE-VU's Comments on EPA / Bill Harnett Memorandum entitled "Process for Interstate Consultation on Regional Haze SIP Development," 3 pages — 8/2006
http://www.manevu.org/document.asp?fview=Correspondence#

3) MANE-VU's Comments on Proposed IMPROVE Network Reduction Plan, 7 pages — 8/2006
http://www.manevu.org/document.asp?fview=Correspondence#

4) Final Consultation Framework as approved by the MANE-VU Board on May 10, 2006, 6 pages — 5/2006
http://www.manevu.org/document.asp?fview=Correspondence#

5) MANE-VU Newsletter — Spring 2006
http://www.manevu.org/document.asp?fview=Fact%20Sheets#

6) MANE-VU's Comments on EPA's "Draft Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program," 9 pages — 1/2006
http://www.manevu.org/document.asp?fview=Correspondence#

7) MANE-VU's Comments on Proposed BART Trading Rule, 5 pages — 9/2005
http://www.manevu.org/document.asp?fview=Correspondence#

8) MANE-VU Newsletter — Fall 2005
http://www.manevu.org/document.asp?fview=Fact%20Sheets#

9) MANE-VU Newsletter — Spring 2005
http://www.manevu.org/document.asp?fview=Fact%20Sheets#

10) Regional Haze – A Resource Guide for Journalists, 33 pages — 5/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

11) Regional Haze Reduces Visibility (Tri-fold brochure) — 3/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

12) Haze Communication Using CAMNET and IMPROVE Archives: Case Study at Acadia National Park, 13 pages 1/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

13) About Regional Haze: Fact Sheet, 2 pages 1/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

14) The Health Effects of Regional Haze: Fact Sheet, 2 pages 1/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

15) About MANE-VU: Fact Sheet, 2 pages 1/2005
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=0

16) MANE-VU's Comments on Proposed BART Rule, 27 pages 7/2004
http://www.manevu.org/document.asp?fview=Correspondence#

17) Scoping Study on Regional Haze, Initial Communications and Outreach Framework, 52 pages 12/2002
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

Miscellaneous

1) TSD on Measures to Mitigate the Visibility Impacts of Construction Activities in the MANE-VU Region, 13 pages — 10/2006
http://www.marama.org/visibility/SIP%5FPlanning/

2) TSD on Agricultural and Forestry Smoke Management in the MANE-VU Region, 18 pages — 9/2006
http://www.marama.org/visibility/SIP%5FPlanning/

3) EPA Checklist for Regional Haze SIPs Submitted Under 40 CFR 51.308, 14 pages — 8/2006
http://www.marama.org/visibility/SIP%5FPlanning/

4) 2006 Interim Report, 21 pages — 5/2006
http://www.manevu.org/document.asp?Fview=Reports#

5) Draft Regional Haze SIP/TIP Template, 42 pages — 1/2005
http://www.manevu.org/document.asp?Fview=Reports

6) MANE-VU Technical Work Plan, 20 pages — 3/2003
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

7) Regional Haze and Visibility in the Northeast and Mid-Atlantic States, 265 pages — 1/2001
http://www.nescaum.org/topics/regional-haze/regional-haze-documents/atct_topic_view?b_start:int=50

Outcomes of MANE-VU Work

- MANE-VU is unique in that its visibility issues are due to emissions outside of as well as within the MANE-VU region
- The primary contributor to visibility impairment is sulfate
- MANE-VU Class I areas will need action on the part of a number of states, both within and outside of the MANE-VU region, to achieve their 2018 goals.

Draft Statement of Principles for MANE-VU Class I States:

- Set reasonable progress goals based on the 4-Factor Analysis, identification of existing sources affecting visibility and existing CAA measures to achieve uniform **or better** progress
- Rely Upon **All** Identified Contributing States for Reductions to meet the first Reasonable Progress Goal – *Even if all States do not agree on the reasonable measure*
- Reasonable measures **should** include beyond currently planned CAA short-term measures and CAIR in all contributing States
- Seek Contributing States assistance in determining which measures are “reasonable” for all States

Draft Statement of Principles for MANE-VU Class I States:

- Allow State flexibility to obtain its share of the emission reductions needed to meet the progress goal for the area.
- Class I States **will determine** what measures to propose as "reasonable" thru consultation
- Expect the FLM's **to comment upon** SIP's inconsistent with Class I States goals during 60-day SIP review
- Expect EPA **to act** on disagreements between States of what measures are "reasonable" and on incomplete SIP's in the SIP review process
- Will seek **USEPA implementation** of some measures (States will move ahead in the interim)

Draft Statement of Principles for MANE-VU Class I States:

- Will Seek **near-term (now) and long-term commitments (10 year**) to reduce PM and SO_2 emissions
- Will use the 5-year SIP revision to review the status of measures, address unresolved new control programs, determine new reasonable measures and adjust the SIP accordingly

“On the Table” Control Strategies

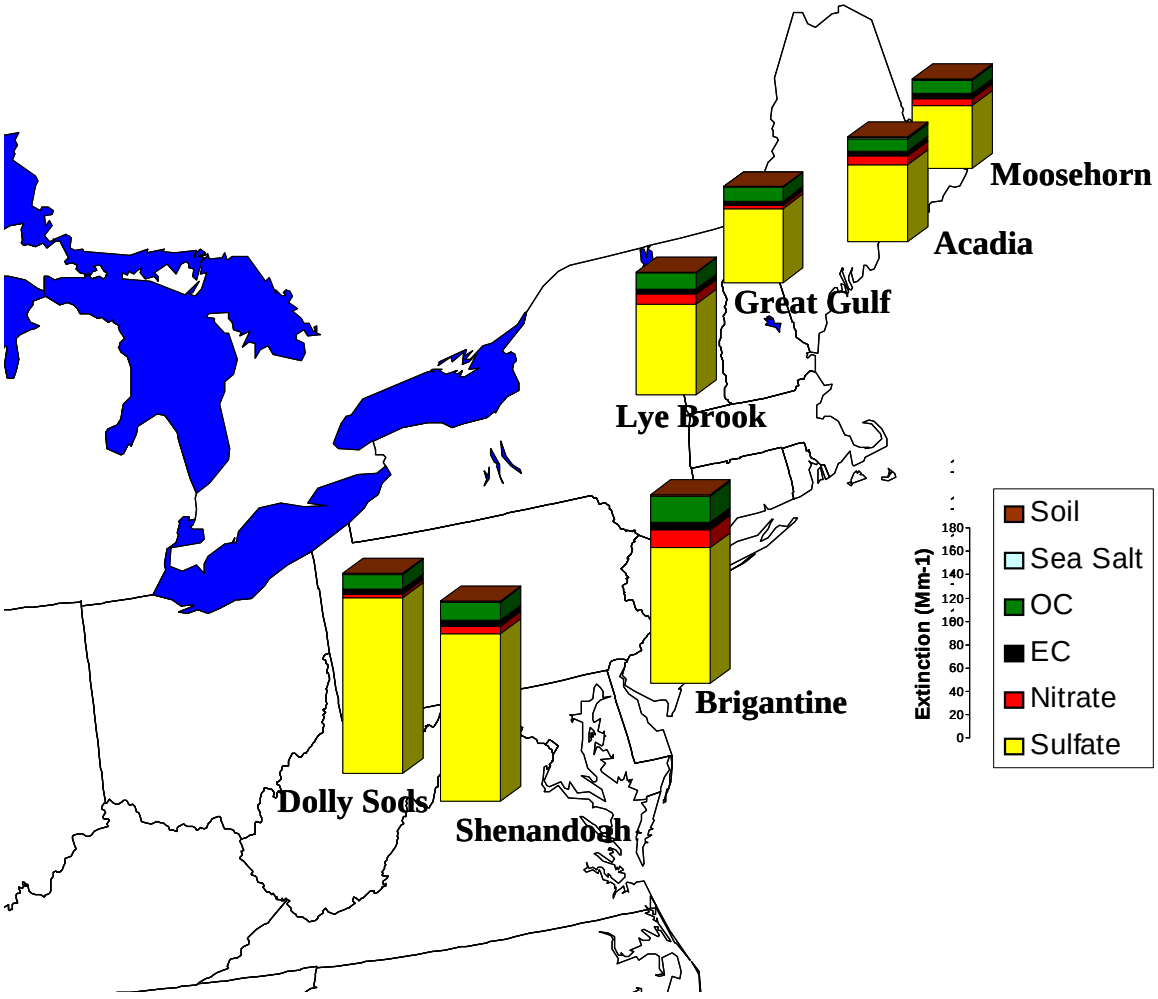
Section 2

What's on the MANE-VU "Table"
-Control Option Assessment-

Focus on SO_2

- MANE-VU has conducted a contribution assessment and developed a conceptual model that indicates that the dominant contributor to visibility impairment at all sites during all seasons is particulate sulfate formed from emissions of SO_2. While other pollutants, including organic carbon, need to be addressed in order to achieve the national visibility goals, our technical assessments suggest that an early emphasis on SO_2 will yield the greatest near-term benefit. See **Figure 1**.
- Source region for SO_2 emissions is generally south and west (upwind) of MANE-VU Class I areas on worst visibility days.

Figure 1: Contribution of Sulfur to Visibility Impairment in the Eastern U.S.

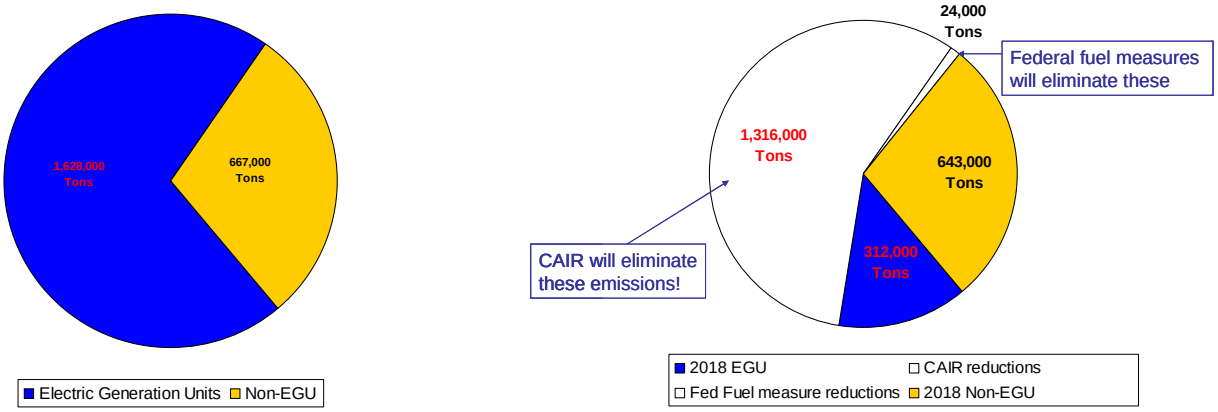


- Wood combustion near Class I areas contributes to organic carbon. This component of fine particle pollution also contributes to visibility impairment and is observed at MANE-VU sites.

Inventory Analysis

- By 2018, implementation of CAIR is projected to reduce 1.3 million tons of MANE-VU SO_2 emissions annually. Relative to our current 2002 total of 1.6 million tons per year in the power sector, this represents a very significant reduction of over 80% of power sector emissions in the MANE-VU region.
- By contrast, non-EGU SO_2 emissions are project to be reduced by federal programs (primarily through on-road and non-road fuel standards) in the MANE-VU region by only 24,000 tons. This would bring our current SO_2 emissions of 667,000 tons per year down to approximately 643,000 tons per year.
- Significant opportunities remain to further reduce the projected remaining 312,000 tons of annual EGU SO_2 emissions as well as the 643,000 tons of annual non-EGU SO_2 emissions. See **Figure 2**.

Figure 2: Potential Reduction Opportunities in the MANE-VU Region



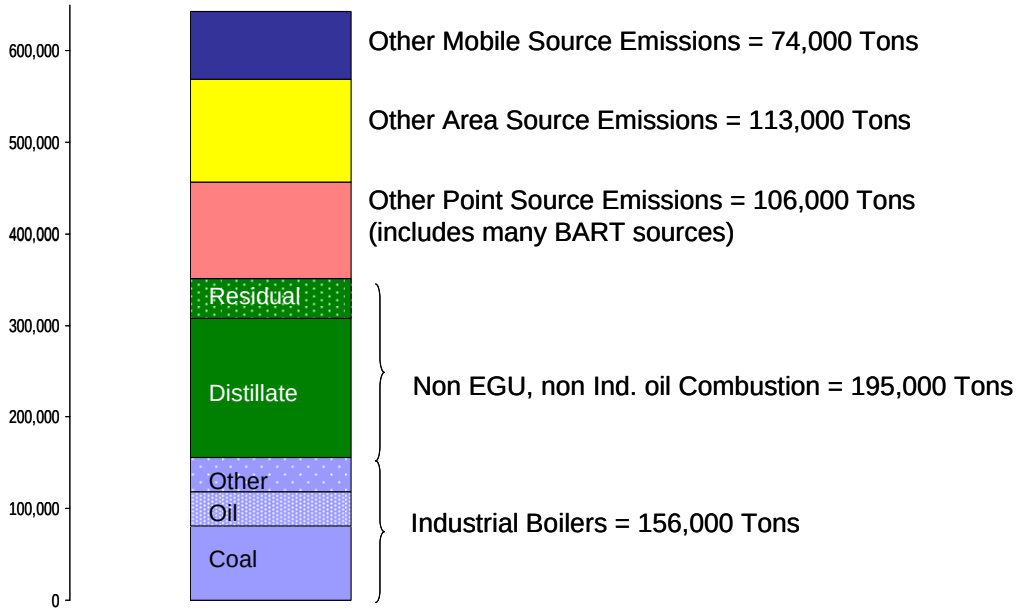
EGUs

- MANE-VU remains interested in EGU strategies beyond CAIR for SO_2 as a means of achieving $PM_{2.5}$ NAAQS compliance and furthering regional haze progress in a reasonable (cost-effective) way.
- The MANE-VU four-factor analysis has identified several large EGUs (both within and outside MANE-VU) with significant impact on MANE-VU Class I visibility during 2002. Control options for these sources are being considered.

Non-EGU SO_2

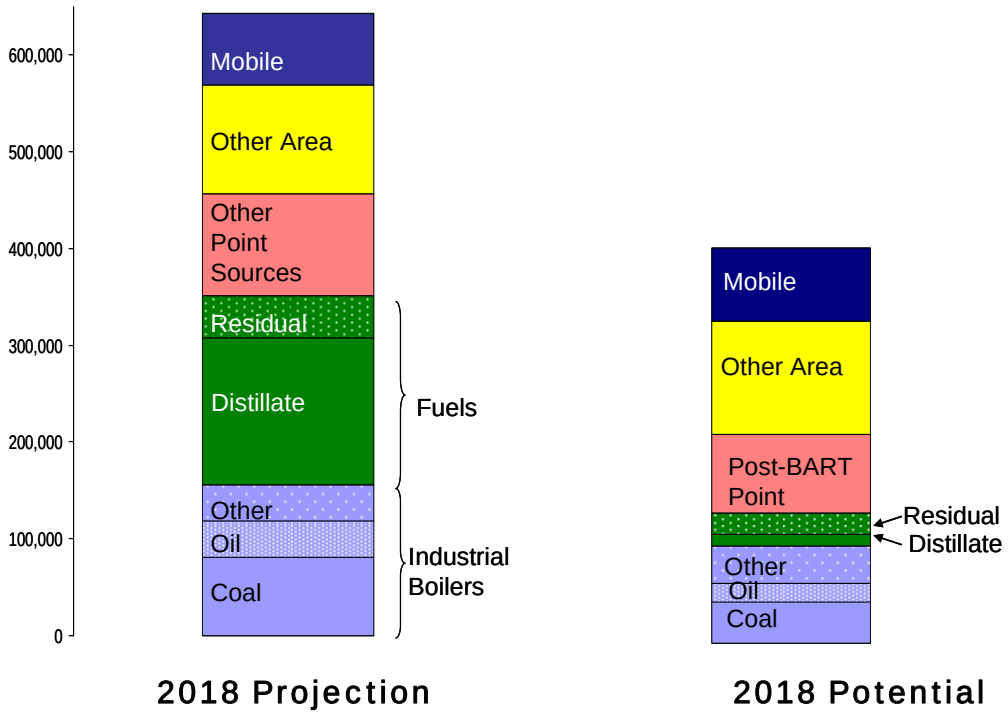
- The 643,000 tons in non-EGU SO_2 emissions can be broken down into the following categories: Industrial Boilers (156,000 tons), Other oil combustion sources (195,000 tons), Other non-oil point sources (includes many BART emissions reduction candidates; 106,000 tons), Other area sources (113,000 tons), and other mobile sources (74,000 tons). See **Figure 3**.

Figure 3: 2018 Projected Non-EGU SO_2 Emissions in the MANE-VU Region



- Coal burning industrial boilers have non-FGD control options including Hydrate Boiler Injection, and Lime Slurry Duct Injection. These methods have been shown to achieve between 20 and 60 percent and 35 to 90+ percent control at reasonable costs in the range of $500 to $1000 per ton of SO_2 removed. A conservative assumption of 50% control could achieve a 40,500 ton reduction.
- Limits on the fuel-sulfur content of oil-burning industrial boilers could also yield reductions on the order of 50% from this category by requiring the use of 0.5 percent S residual oil. Such a strategy might yield a 19,000 ton reduction.
- Low-sulfur fuel requirements would offer significant additional reduction from non-EGU, non-industrial boiler sources. Requiring 500 and/or 15 ppm distillate (relative to current 2000+ ppm baseline) could result in between 110,000 and 140,000 tons of SO_2 reduction annually.
- The use of 0.5 percent (5000 ppm) residual oil (relative to current residual oil that has sulfur content of 1 percent or higher) could result in ~22,000 tons reduction.
- Preliminary findings from our BART analysis suggest additional emissions reduction potential in the 35,000 ton range from several MANE-VU BART-eligible sources.
- The combined emission reduction of all these measures would result in nearly a 40 percent reduction in SO_2 emissions from the non-EGU sources in MANE-VU relative to projected 2018 levels. See **Figure 4**.
- The MANE-VU four-factor analysis has identified several large non-EGUs (both within and outside MANE-VU) with significant impact on MANE-VU Class I visibility during 2002. Control options for these sources are being considered.

Figure 4: 2018 Potential Non-EGU SO_2 Emission Reductions in the MANE-VU Region



Long-term Emissions Management Options for MANE-VU

MANE-VU is considering (1) a beyond CAIR EGU program for SO_2, (2) measures to reduce non-EGU emissions in MANE-VU by either 40 percent or 250,000 tons of SO_2, and (3) programs to reduce wood combustion-related emissions in MANE-VU.

Regional Haze Control Measures Under Consideration by MANE-VU States

1) Low Sulfur Fuel Oil Strategies

Low-Sulfur Fuel Oil Strategy #1 - SO2 Reduction Potential in 2018

Assumptions:

Type of Fuel Oil	Assumed Baseline Sulfur Content (% S by wt.)	"Controlled" Sulfur Content (% S by wt.)	Percent Reduction
Home Heating	0.2	0.05	75
#2 Distillate	0.2	0.05	75
#4	0.5	0.25	50
#6 Residual	1.0	0.5	50

Low-Sulfur Fuel Oil Strategy #2 – SO2 Reduction Potential in 2018

Assumptions:

Type of Fuel Oil	Assumed Baseline Sulfur Content (% S by wt.)	"Controlled" Sulfur Content (% S by wt.)	Percent Reduction
Home Heating	0.2	0.015	99.25
#2 Distillate	0.2	0.015	99.25
#4	0.5	0.25	50
#6 Residual	1.0	0.5	50

2) ICI Boilers

- >250 MM Btu/hr – 0.25#/MM Btu or 85% reduction
- 100-250 MM Btu/hr – 1.2#/MM Btu or 85% reduction
- 25-100 MM Btu/hr – 2.0#/MM Btu or 30% reduction
- <25 MM Btu/hr – annual tune-up

3) EGUs / CAIR-Plus

- 5% SO2 reduction beyond CAIR in 2009
- 11% SO2 reduction beyond CAIR in 2018

4) Lime and Cement Kilns

- 25-85% SO2 reduction (facility-specific)

5) Open Burning, Residential Wood Combustion, and Outdoor Wood Boilers

- Various state regulations – penetration and enforcement issues with open burning; funding impediments to wood stove changeout programs; various issues with regulation of OWBs

What is “Reasonable”
Section 3

MANE-VU Approach to the Development of "Consulting Groups"

On November 1, representatives from each RPO and the FLMs began a dialogue aimed at identifying groups of Class I areas that might serve to focus consultations for purposes of the regional haze rule. While it appears that consultations will be conducted state-to-state, the RPO representatives agreed that there may be a role for the RPO staff in identifying Class I areas with common visibility issues where a joint consultation process might be more efficient. At this point, the focus of the RPO efforts is to help identify common Class I "consulting groups" and leave it to the states involved in any future joint consultation process to discuss details regarding the nature and extent of state contributions to a common Class I group. Another role that the RPOs may play in the process is to assist with the scheduling of consultations so as to ensure that RPO-developed technical products would be ready and available to facilitate state discussions.

The Class I states within the MANE-VU RPO have considered the question of how best to group common Class I areas from the perspective of forming consulting groups. After reviewing monitoring and modeling data related to the sources of visibility impairment for each Class I site, they have proposed an approach that would create a single consulting group that encompasses all MANE-VU Class I sites. The "MANE-VU consulting group" would consist of the Acadia National Park, Maine; Brigantine Wilderness (within the Edwin B. Forsythe National Wildlife Refuge), New Jersey; Great Gulf Wilderness, New Hampshire; Lye Brook Wilderness, Vermont; Moosehorn Wilderness (within the Moosehorn National Wildlife Refuge), Maine; Presidential Range – Dry River Wilderness, New Hampshire; and Roosevelt Campobello International Park, New Brunswick.

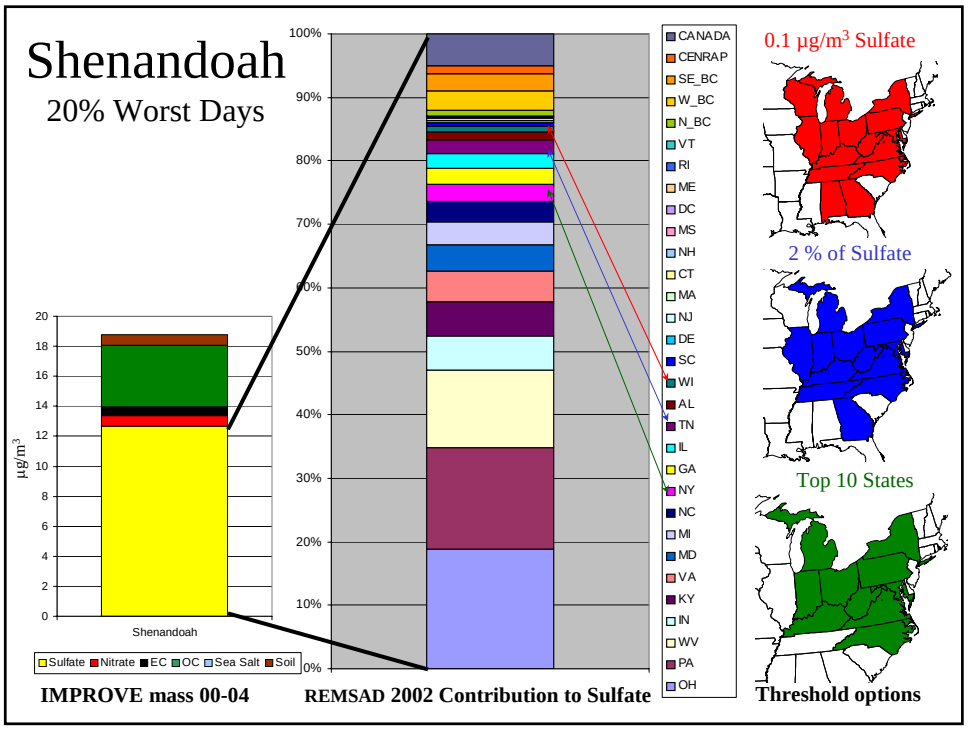
The Class I states of MANE-VU recognize some differences between the Brigantine Wilderness and the northern tier of Class I sites in Vermont, New Hampshire and Maine. However, when viewed from the perspective of contributions to sulfate pollution – which is still the dominant form of visibility impairment experienced on the twenty percent worst visibility days at all MANE-VU sites – the group found more similarities than differences and felt that a single consulting group representing all MANE-VU sites offered the best opportunity to engage contributing states in a meaningful consultation process.

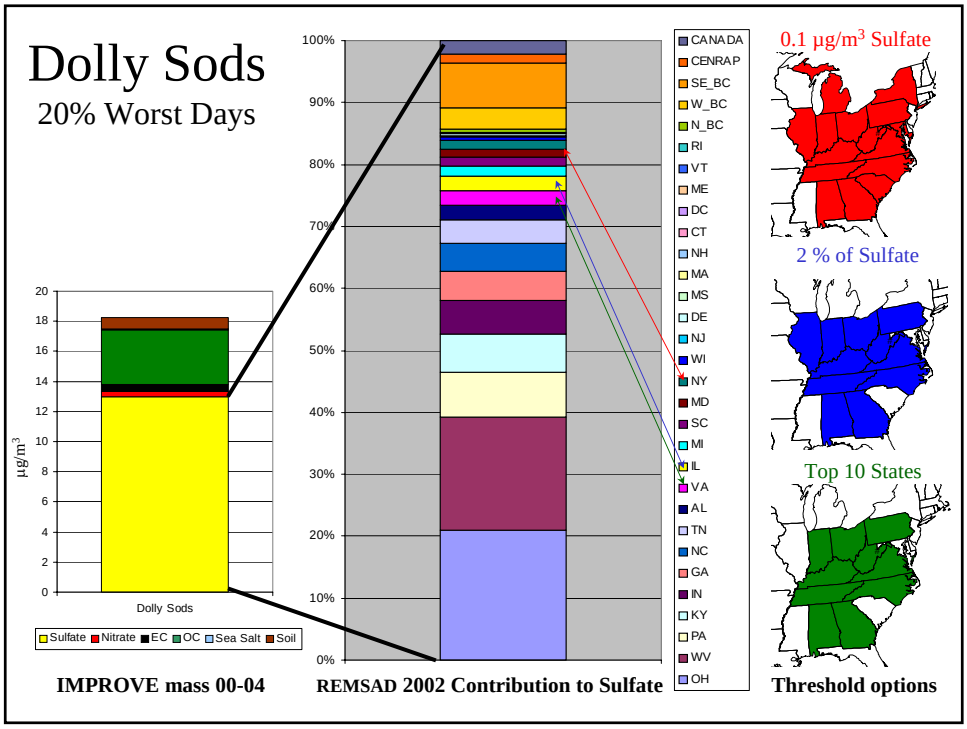
MANE-VU, therefore, proposes the addition of the MANE-VU consulting group to those already suggested by the Mid-West RPO in their October 19 memorandum. The revised "Table 1" on the next page reflects the proposed composition of the MANE-VU consulting group in a manner similar to that of the October 19 memo for three other proposed consulting groups. The MANE-VU Class I states are planning to contact those states listed in the proposed consulting group shortly to initiate the consultation process.

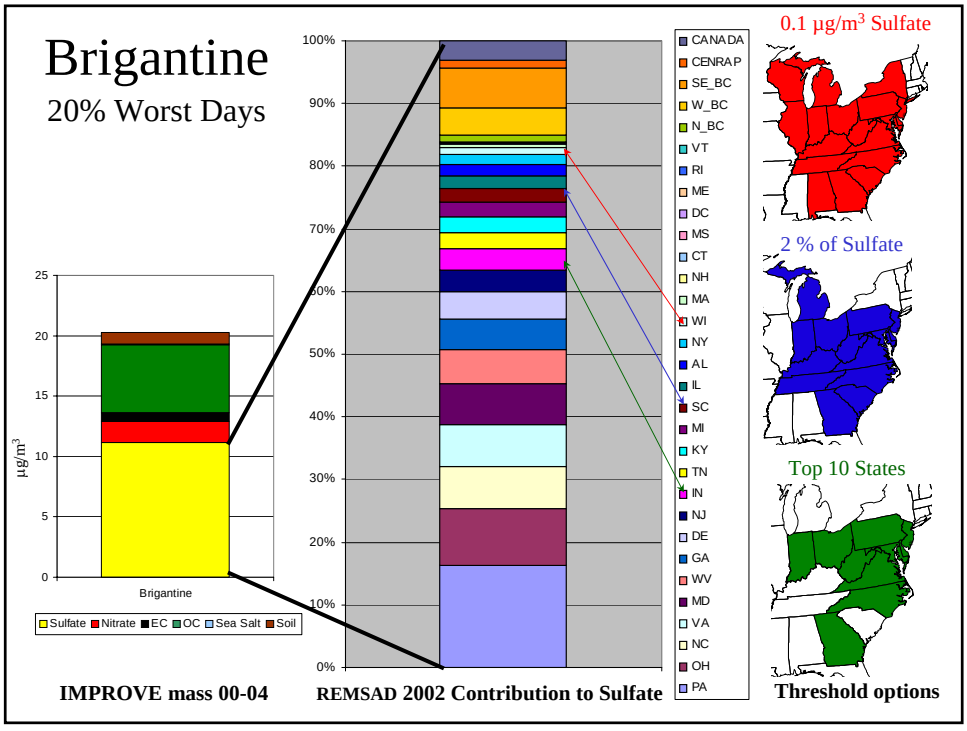
RPO	State	MI/MN (BOWA, VOYA, ISRO, SEN)	AR/MO/KY (UPBU, MINGO, HG, MACA)	VA/WV (DOSO, SHEN, JRIV)	MANE-VU (ACAD, MOOS, GRGU, LYBR, BRIG)
MANE-VU	Connecticut				x
	Delaware				x
	Maine				x
	Maryland			x	x
	Massachusetts				x
	New Hampshire				x
	New Jersey				x
	New York				x
	Pennsylvania			x	x
	Rhode Island				x
	Vermont				x
VISTAS	Alabama				
	Florida				
	Georgia				x
	Kentucky		x		x
	Mississippi				
	North Carolina				x
	South Carolina				x
	Tennessee		x		x
	Virginia			x	x
	West Virginia			x	x
MRPO	Illinois	x	x		x
	Indiana	?	x		x
	Michigan	x			x
	Ohio			x	x
	Wisconsin	x			
CENRAP	Arkansas		x		
	Iowa	x			
	Kansas				
	Louisiana				
	Minnesota	x			
	Missouri	?	x		
	Nebraska				
	Oklahoma				
	Texas				
WRAP	N. Dakota	x			
	S. Dakota				
	Other Western States				
Canada	Manitoba				
	New Brunswick				x
	Ontario	x			x
	Quebec				x
	Other Provinces				

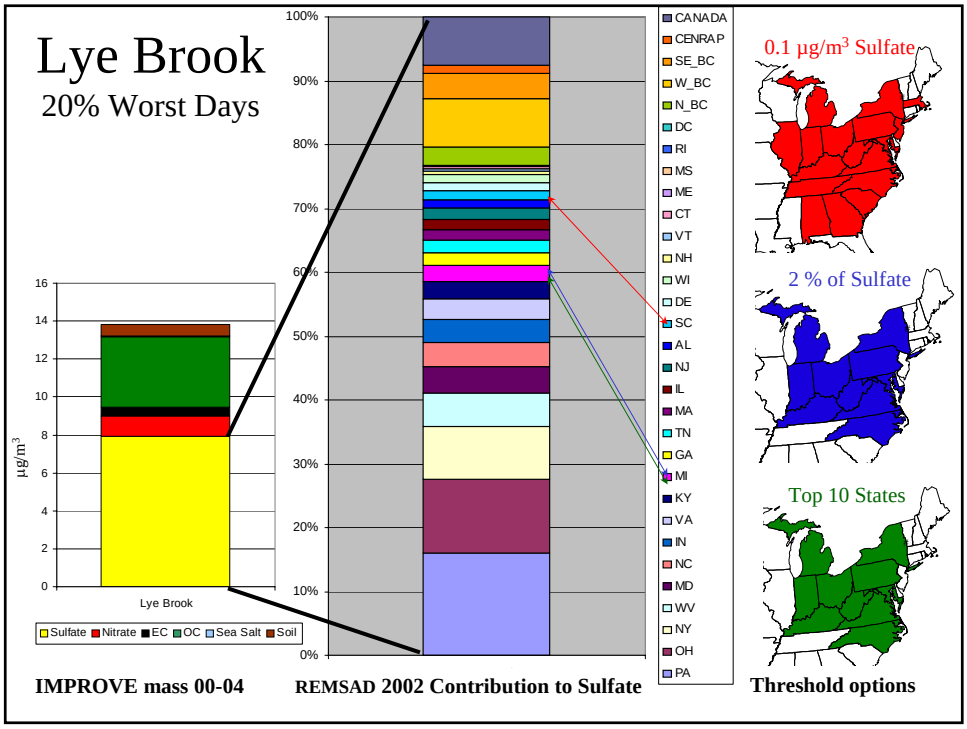
Contribution Thresholds Determined Three Ways

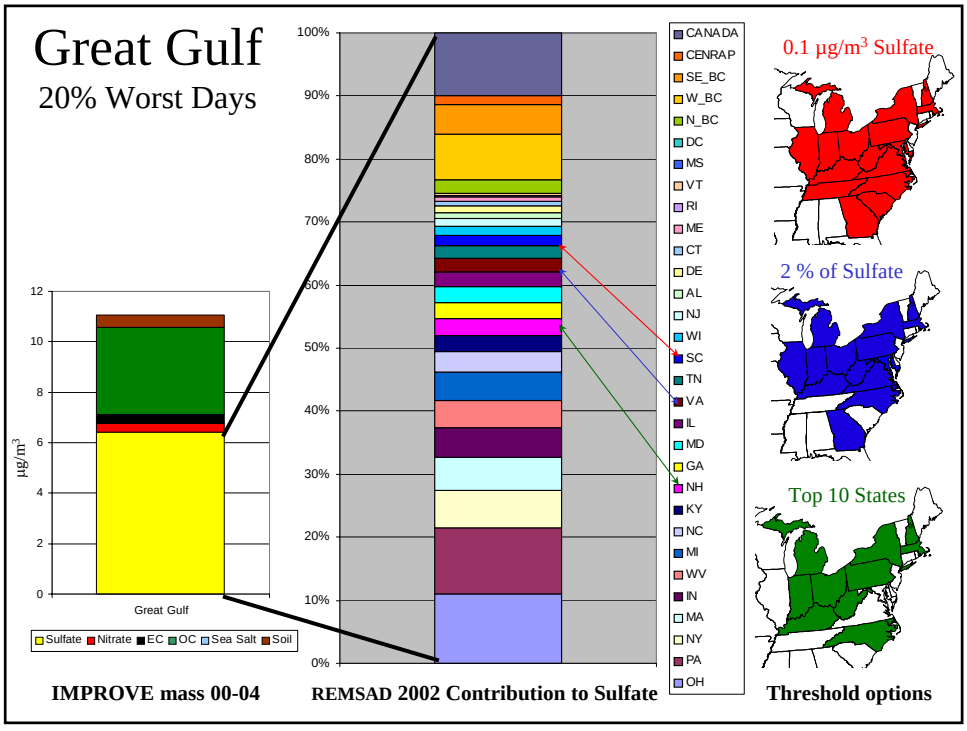
- Method 1: States/regions that contribute 0.1 ug/m3 sulfate or greater on 20% worst visibility days
- Method 2: States/regions that contribute at least 2% of total sulfate observed on 20% worst visibility days
- Method 3: Top ten contributing states on 20% worst visibility days

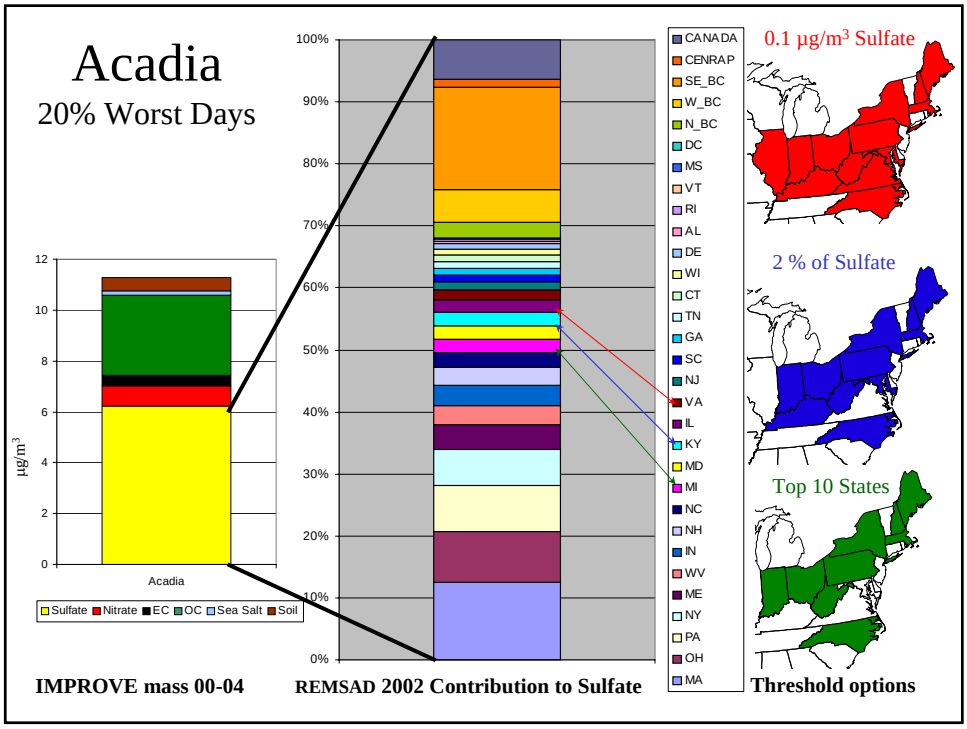


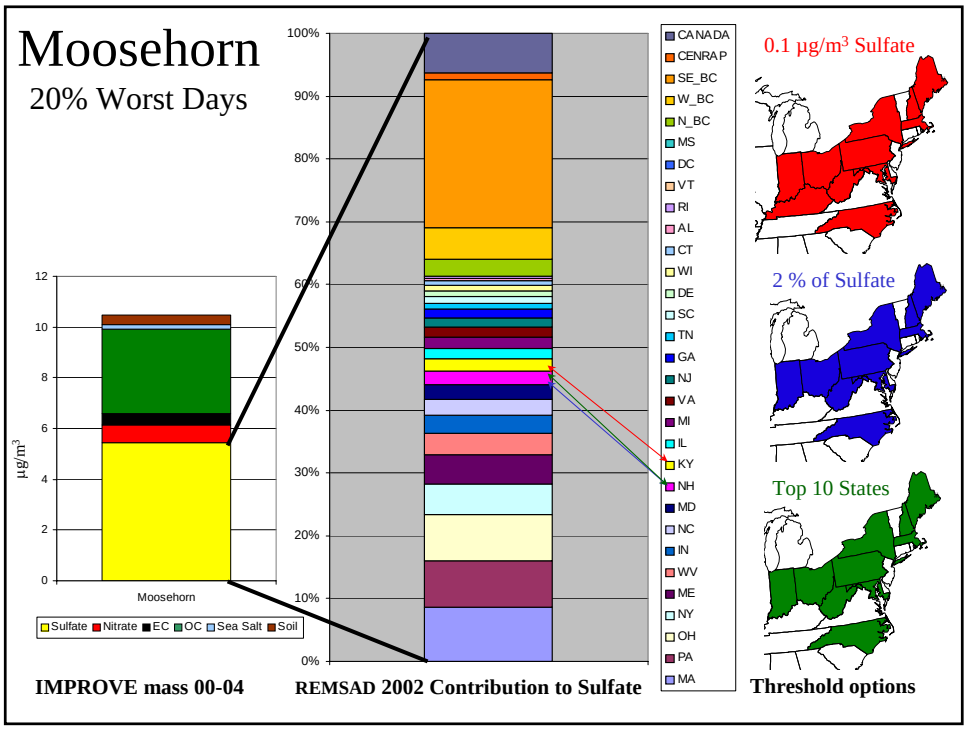

Dolly Sods
20% Worst Days
µg/m3
Dolly Sods
Sulfate Nitrate EC OC Sea Salt Soil
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CANADA
CENRAP
SE_BC
W_BC
N_BC
RI
VT
ME
DC
CT
NH
MA
MS
DE
NJ
WI
NY
MD
SC
MI
IL
VA
AL
TN
NC
GA
IN
KY
PA
WV
OH
0.1 µg/m3 Sulfate
2 % of Sulfate
Top 10 States
IMPROVE mass 00-04
REMSAD 2002 Contribution to Sulfate
Threshold options


Brigantine
20% Worst Days
µg/m3
Brigantine
Sulfate Nitrate EC OC Sea Salt Soil
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CANADA
CENRAP
SE_BC
W_BC
N_BC
VT
RI
ME
DC
MS
CT
NH
MA
WI
NY
AL
IL
SC
MI
KY
TN
IN
NJ
DE
GA
WV
MD
VA
NC
OH
PA
0.1 µg/m3 Sulfate
2 % of Sulfate
Top 10 States
IMPROVE mass 00-04
REMSAD 2002 Contribution to Sulfate
Threshold options


Lye Brook
20% Worst Days
µg/m3
Lye Brook
Sulfate Nitrate EC OC Sea Salt Soil
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CANADA
CENRAP
SE_BC
W_BC
N_BC
DC
RI
MS
ME
CT
VT
NH
WI
DE
SC
AL
NJ
IL
MA
TN
GA
MI
KY
VA
IN
NC
MD
WV
NY
OH
PA
0.1 µg/m3 Sulfate
2 % of Sulfate
Top 10 States
IMPROVE mass 00-04
REMSAD 2002 Contribution to Sulfate
Threshold options


Great Gulf
20% Worst Days
µg/m3
Great Gulf
Sulfate Nitrate EC OC Sea Salt Soil
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CANADA
CENRAP
SE_BC
W_BC
N_BC
DC
MS
VT
RI
ME
CT
DE
AL
NJ
WI
SC
TN
VA
IL
MD
GA
NH
KY
NC
MI
WV
IN
MA
NY
PA
OH
0.1 µg/m3 Sulfate
2 % of Sulfate
Top 10 States
IMPROVE mass 00-04
REMSAD 2002 Contribution to Sulfate
Threshold options


Acadia
20% Worst Days
µg/m3
Acadia
Sulfate Nitrate EC OC Sea Salt Soil
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CANADA
CENRAP
SE_BC
W_BC
N_BC
DC
MS
VT
RI
AL
DE
WI
CT
TN
GA
SC
NJ
VA
IL
KY
MD
MI
NC
NH
IN
WV
ME
NY
PA
OH
MA
0.1 µg/m3 Sulfate
2 % of Sulfate
Top 10 States
IMPROVE mass 00-04
REMSAD 2002 Contribution to Sulfate
Threshold options


Moosehorn
20% Worst Days
µg/m3
Moosehorn
Sulfate Nitrate EC OC Sea Salt Soil
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CANADA
CENRAP
SE_BC
W_BC
N_BC
MS
DC
VT
RI
AL
CT
WI
DE
SC
TN
GA
NJ
VA
MI
IL
KY
NH
MD
NC
IN
WV
ME
NY
OH
PA
MA
0.1 µg/m3 Sulfate
2 % of Sulfate
Top 10 States
IMPROVE mass 00-04
REMSAD 2002 Contribution to Sulfate
Threshold options

MANE-VU Reasonable Progress Goals Project Summary

April 25, 2007

PURPOSE

The Clean Air Act requires states to consider the following four factors to determine which 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 (i.e., the reasonable progress goal).

EPA issued draft guidance for implementing the reasonable progress requirement (dated 11/28/2005). The guidance recommends the following process for developing reasonable progress goals: 1) identify pollutants and associated source categories affecting visibility in Class I areas, 2) list possible control measures for these pollutants and source categories, 3) apply the four statutory factors to each control measure for each source category, and 4) assess the visibility improvement resulting from various combinations of strategies and select the Reasonable Progress Goals.

MANE-VU has developed information about the pollutants and sources affecting visibility and has developed a list of possible control measures for consideration. In order to assist MANE-VU in applying the four statutory factors, in January 2007, MARAMA signed a contract with MACTEC Federal Programs Inc., to prepare a technical support document. The report MACTEC is preparing under this project 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. NESCAUM will assist MANE-VU by conducting air quality and visibility modeling to address the fourth step of the process described in EPA's guidance.

POLLUTANTS AND SOURCE CATEGORIES AFFECTING VISIBILITY

What Pollutants Affect Visibility?

The MANE-VU Contribution Assessment (NESCAUM 2006) and the MANE-VU Conceptual Model for Fine Particles and Regional Haze Air Quality Problems (NESCAUM 2006) identifies sulfate as the largest contributor to visibility impairment in Mid-Atlantic and Northeastern Class I areas. Organic carbon is typically the second-largest contributor to regional haze in the MANE-VU region.

What are the Major Source Categories of these Pollutants?

The largest categories of sources of sulfur dioxide in the region are electric generating units (EGUs), industrial, commercial, and institutional (ICI) boilers, cement kilns, lime kilns, and distillate-oil fired heating units.

According to Appendix B of the MANE-VU Contribution Assessment (NESCAUM 2006), 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. 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.

Based on available information, the MANE-VU Reasonable Progress Workgroup selected the following source categories for analysis:

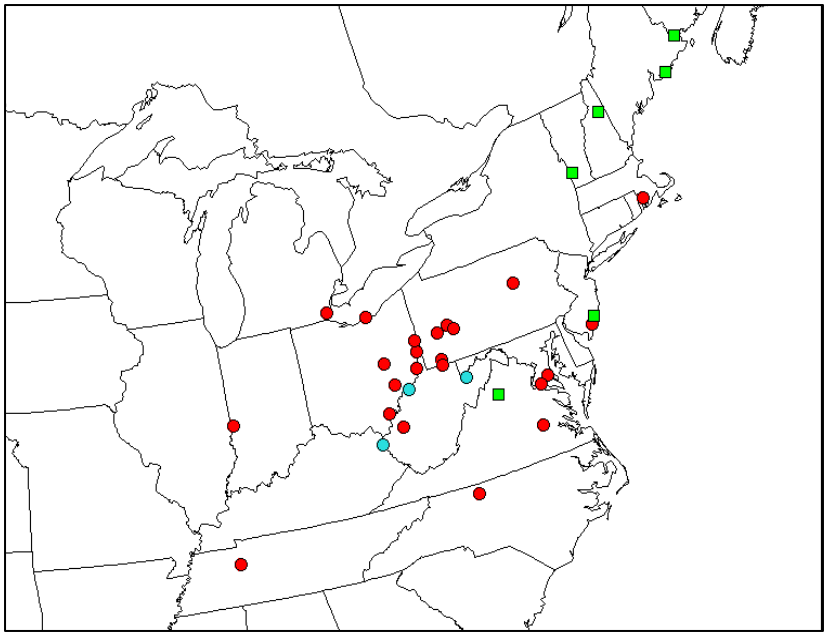
- Coal and oil-fired Electric Generating Units, (EGUs);
- Point and area source industrial, commercial and institutional boilers;
- Cement kilns;
- Lime kilns;
- The use of heating oil; and
- Residential wood combustion and open burning.

WHERE DO THESE POLLUTANTS ORIGINATE?

Specific EGUs are Important

Roughly 70% of the 2.3 million tons of SO_2 emission in the 2002 MANE-VU emissions inventory (2002 MANE-VU Emission Inventory Version 3) were from EGUs, making them the largest SO_2 source category in terms of visibility impairing emissions. Figure 1 shows the locations of 34 EGUs that impact at least one Class I area in MANE-VU or Shenandoah (a nearby Class I area). Many of these EGUs are in MANE-VU but some are outside of the region.

Figure 1 EGUs that impact at least one Class I area (Moosehorn, Acadia, Great Gulf, Lye Brook, and Shenandoah)



Note: There are 34 EGUs represented by the circles, but these are located at 26 distinct Facilities

Class I Areas

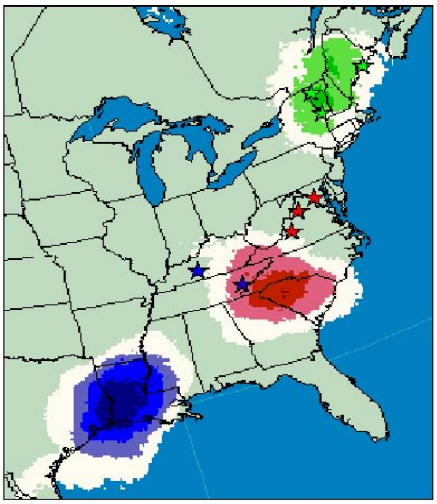
Top 15 EGUs affecting Shenandoah only (4 EGUs at 3 facilities)

Top 15 EGUs affecting any MANE-VU Class I area (30 EGUs at 23 Facilities)

Woodsmoke is More Local in Origin

Figure 2 is from Appendix B of the MANE-VU Contribution Assessment (NESCAUM 2006) 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 2 Woodsmoke Source Regional Aggregations



NE: ACAD, PMRC, LYBR

MA: WASH, SHEN, JARI

SE: GRSM, MACA

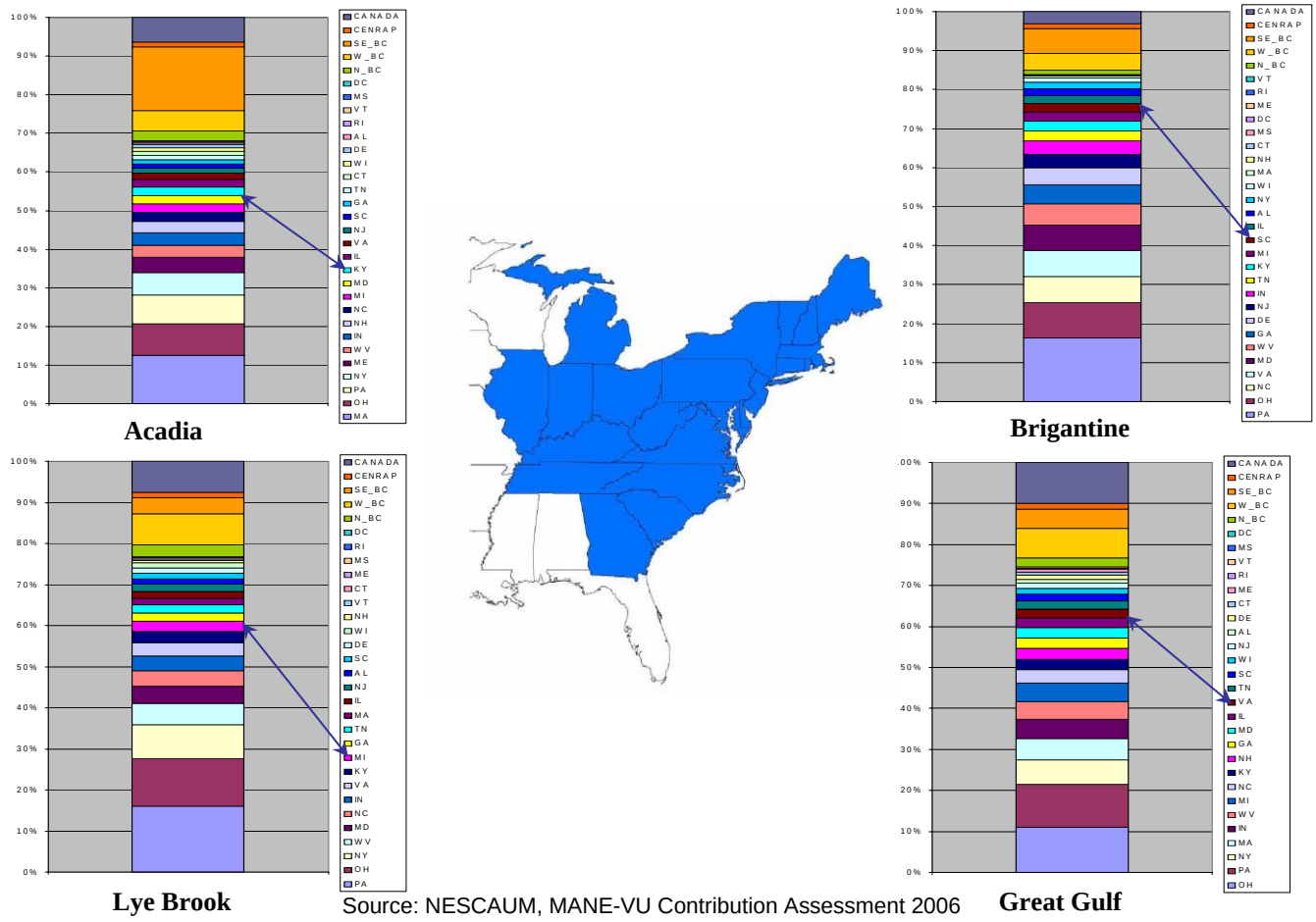
Defining the Area of Influence

In order to identify states where emissions are most likely to influence visibility in MANE-VU Class I areas, analyses such as represented in Figure 1 and 2 above as well as other analyses documented in the MANE-VU Contribution Assessment were considered.

The MANE-VU States concluded that it was appropriate to include in the area of influence all of the states participating in MANE-VU plus other states that modeling showed contributed at least 2% of the sulfate ion at MANE-VU Class I areas in 2002.

Figure 3 shows for Acadia, Brigantine, Lye Brook, and Great Gulf the modeled percent of sulfate ion impact from specific states. The state with the largest individual sulfate impact at that Class I area is shown at the bottom of the bar and the list to the right. The size of the bar slice is proportional to the modeled impact (using the REMSAD model). The percentages at the left of the bar refer to the percent of SO_4 impact within the modeling domain. Each of the states at and below the arrow contribute more than 2% of modeled sulfate ion to that Class I area.

Figure 3 States Contributing to Sulfate in MANE-VU in 2002



Source: NESCAUM, MANE-VU Contribution Assessment 2006

POTENTIAL CONTROL MEASURES AND FOUR FACTOR ANALYSIS

In consultation with the MANE-VU Reasonable Progress Workgroup, MACTEC has drafted a report that identifies potential control measures and assesses costs, time needed for compliance, energy and non-air quality impacts, and the remaining useful life of affected sources. The table below presents a summary of the four factor analysis for the source categories analyzed; more detailed information is available in the draft final report document, which may be found on MARAMA's website at http://www.marama.org/visibility/RPG/index.html

Table 1 Summary of Results from the Four Factor Analysis

Source Category	Pollutant Analyzed	Total Cost (per ton of pollutant reduction)	Compliance Timeframe	Energy and Non-Air Quality Environmental Impacts	Remaining Useful Life
Electric Generating Units	SO_2	IPM predicts $700-$1,400 (1999 dollars) $150-$5000 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	$150-$10,000 based on available literature	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, control device energy requirements, wastewater issues	10-30 years
Cement and Lime Kilns	SO_2	$2,000-$73,000 based on available literature	2-3 years following SIP submittal	Control device energy requirements, wastewater issues	10-30 years
Heating Oil	SO_2	$500-$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	$700-$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
Open Burning	PM	Cost data not available on a "per ton" basis	Minimal	Improvement in water quality, reduction in stress placed on the environment	N/A

MANE-VU invites all interested parties to submit comments on the draft report by May 4th to Angela Crenshaw at MARAMA (acrenshaw@marama.org).

THE MANE-VU REASONABLE PROGRESS WORKGROUP:
Guiding this effort is MANE-VU's Reasonable Progress Workgroup, which reviews draft documents and reports to MANE-VU's Technical Support Committee. The Workgroup has been meeting via conference call several times per month, with eleven calls in total. Regular participants include the MANE-VU states and tribes, VISTAS, LADCO, NESCAUM, OTC, the Environmental Protection Agency, the National Park Service, and the Forest Service. Workgroup minutes, and all related project documents are available on the MARAMA website:
http://www.marama.org/visibility/RPG/index.html

CONTACT INFORMATION:
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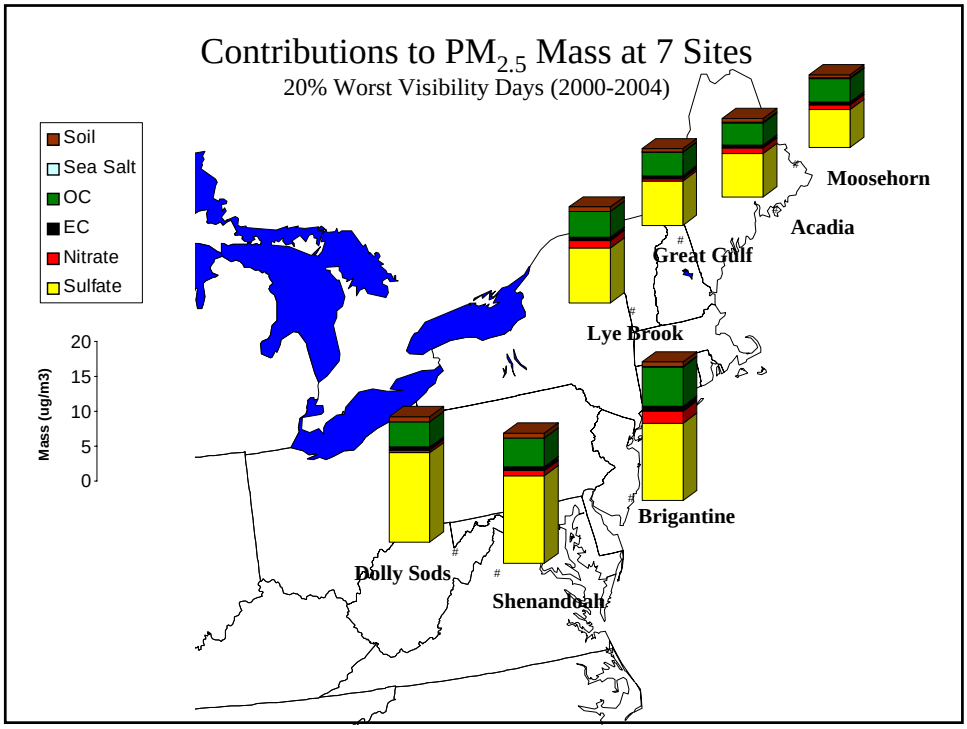
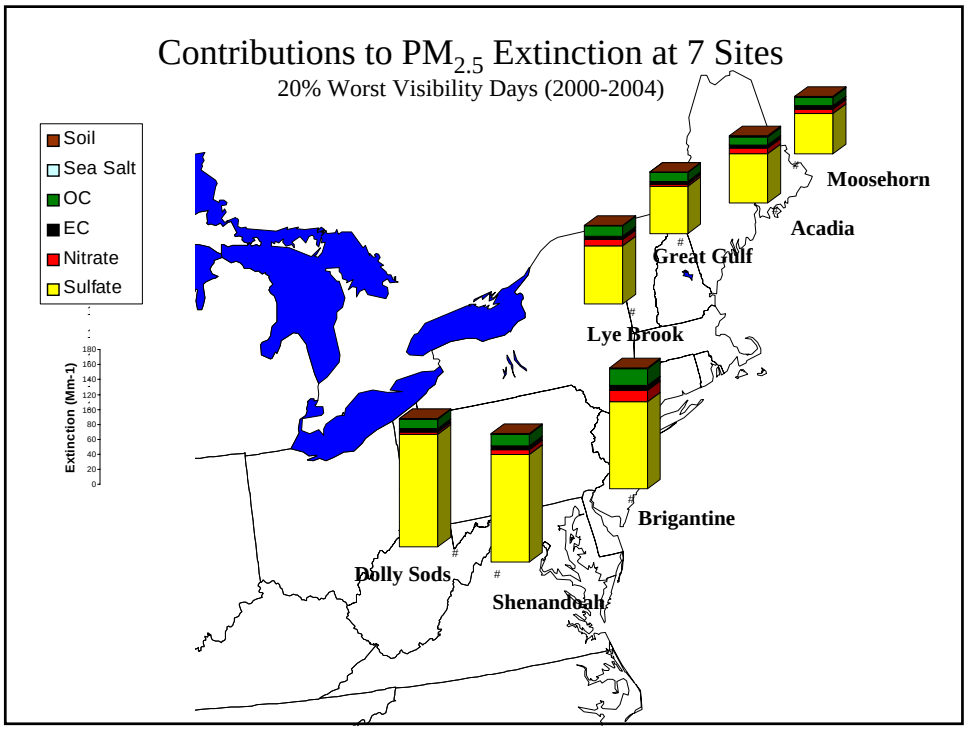
Susan Wierman, MARAMA, swierman@marama.org, 410-467-0170
Art Werner, MACTEC, EJSabo@mactec.com, 919-941-0333

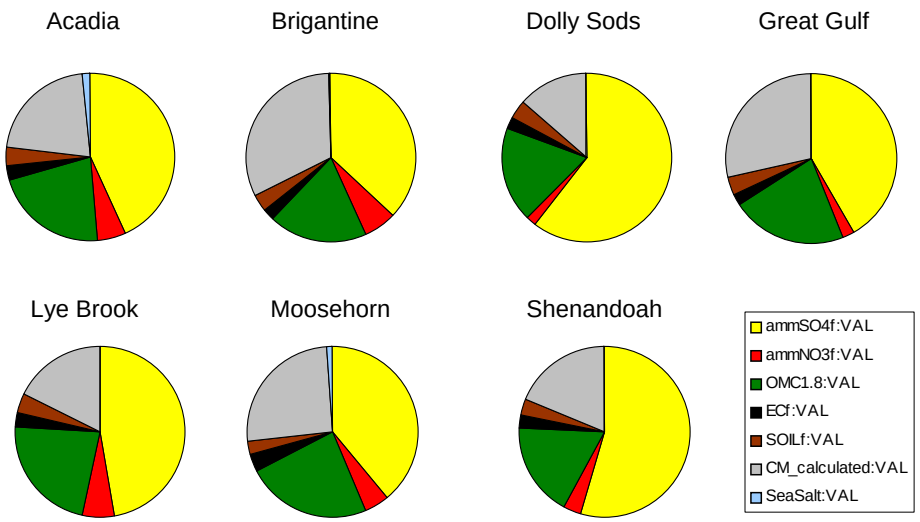
MARAMA, 711 W. 40th Street, Suite 312, Baltimore, MD 21211

Glideslopes/Uniform Rates
Section 4

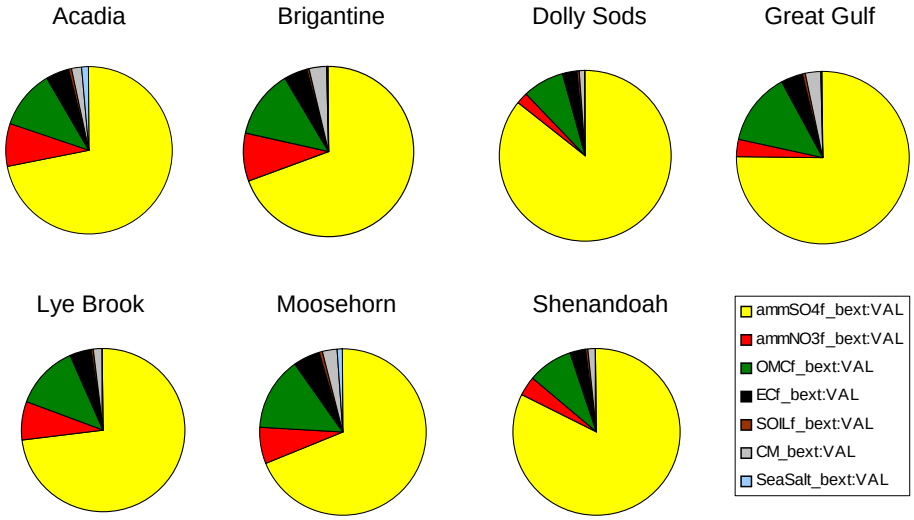

Contributions to PM2.5 Mass at 7 Sites
20% Worst Visibility Days (2000-2004)
Soil
Sea Salt
OC
EC
Nitrate
Sulfate
Mass (ug/m3)
20
15
10
5
0
Moosehorn
Acadia
Great Gulf
Lye Brook
Brigantine
Dolly Sods
Shenandoah


Contributions to PM2.5 Extinction at 7 Sites
20% Worst Visibility Days (2000-2004)
Soil
Sea Salt
OC
EC
Nitrate
Sulfate
Extinction (Mm-1)
180
160
140
120
100
80
60
40
20
0
Moosehorn
Acadia
Great Gulf
Lye Brook
Brigantine
Dolly Sods
Shenandoah

2000-2004 Worst 20% Days Mass Contribution
(New Algorithm)

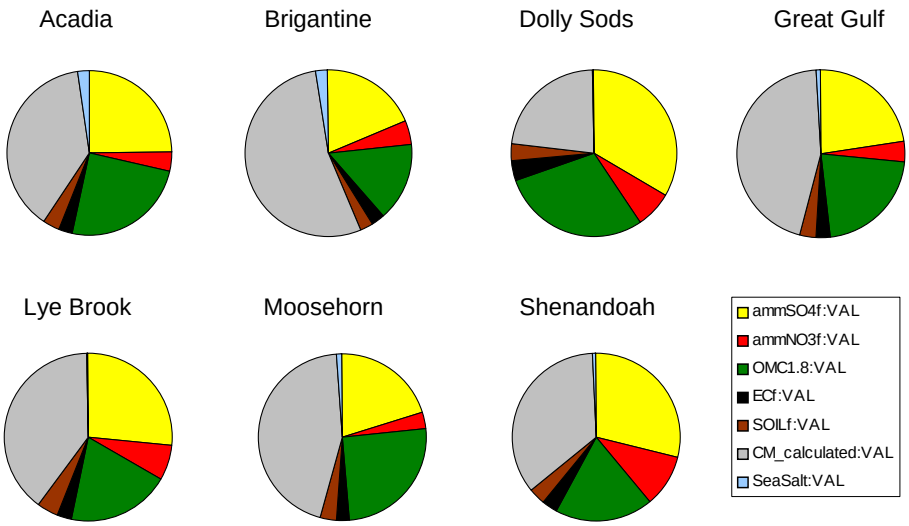


2000-2004 Worst 20% Days Extinction Contribution
(New Algorithm)



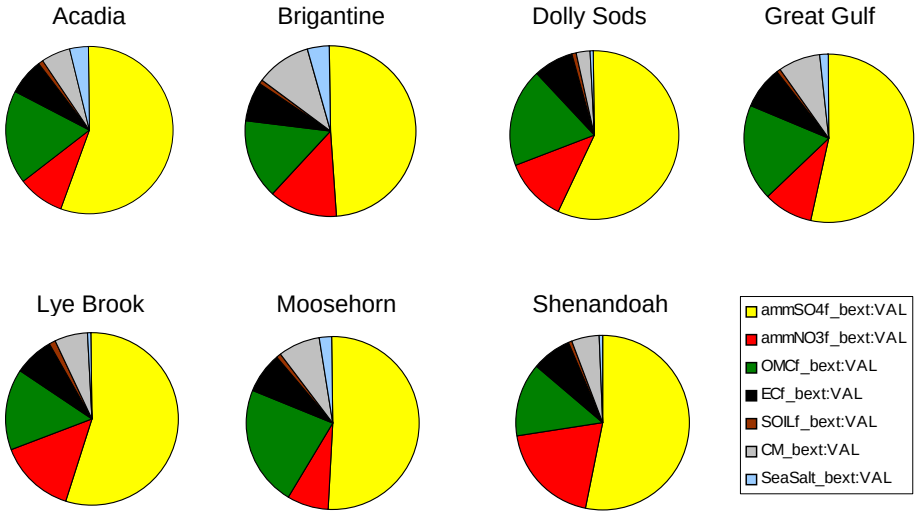
2000-2004 Best 20% Days Mass Contribution

(New Algorithm)

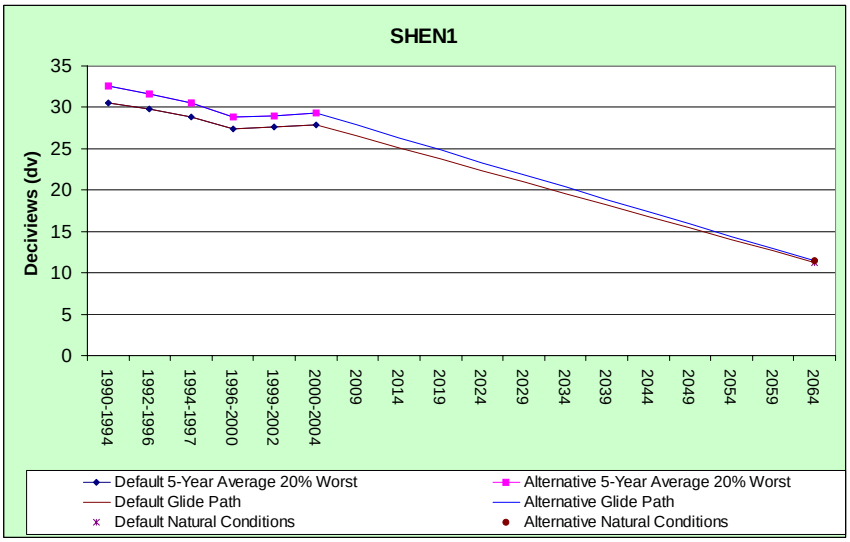


2000-2004 Best 20% Days Extinction Contribution

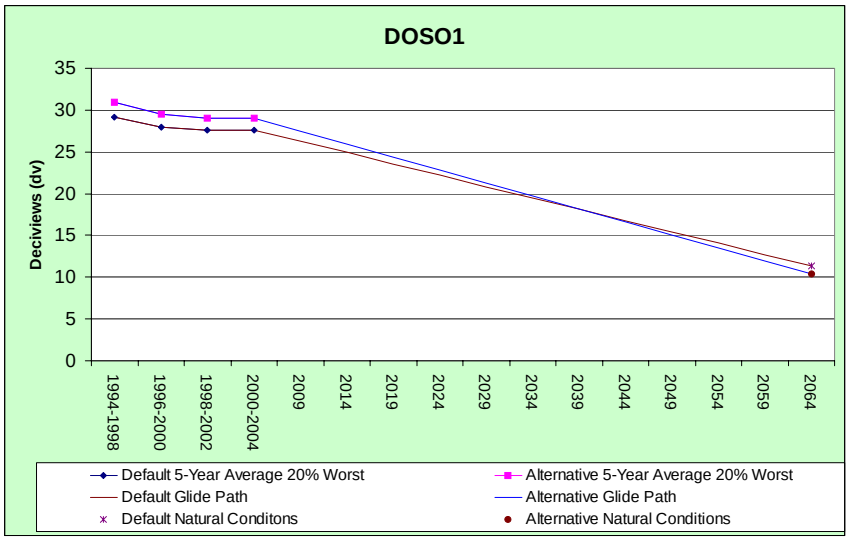
(New Algorithm)



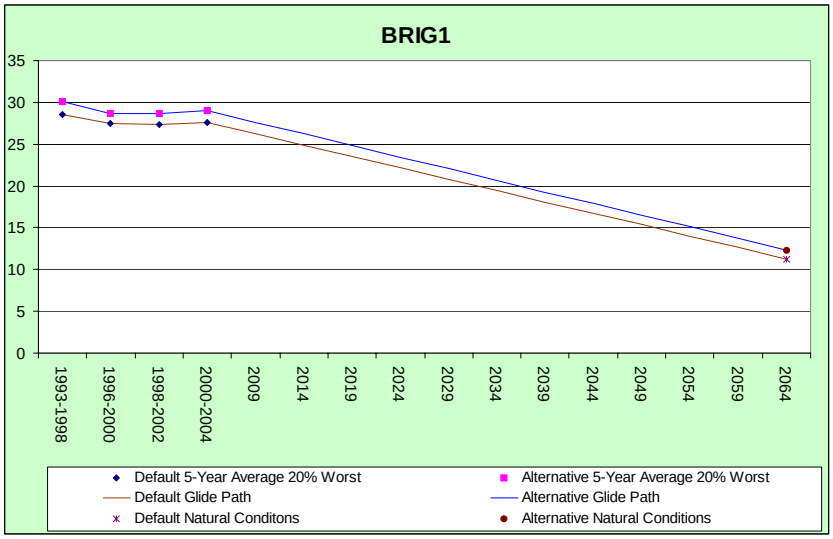
Shenandoah Glide Path to Natural Conditions 2004-2064



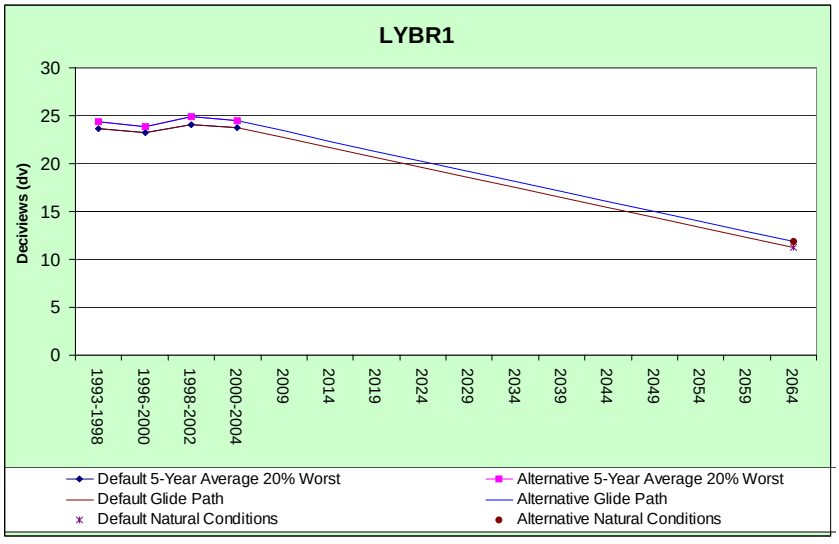
Dolly Sods Glide Path to Natural Conditions 2004-2064



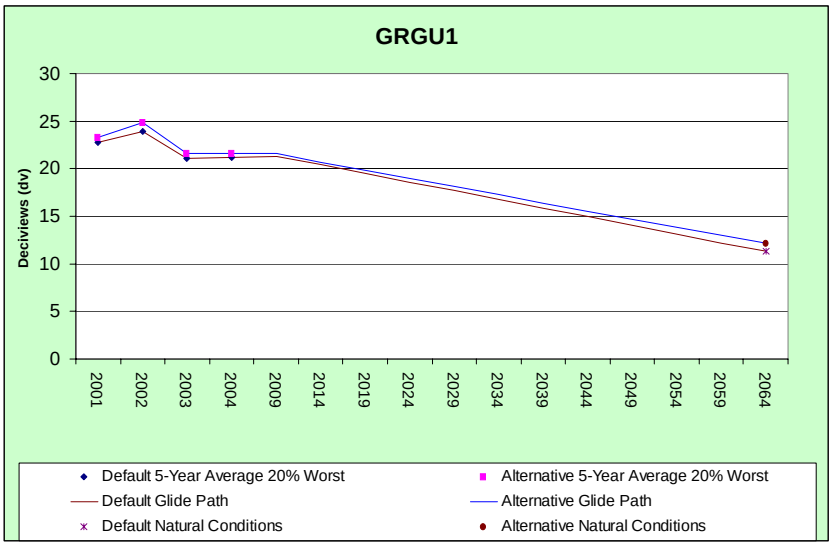
Brigantine Glide Path to Natural Conditions 2004-2064



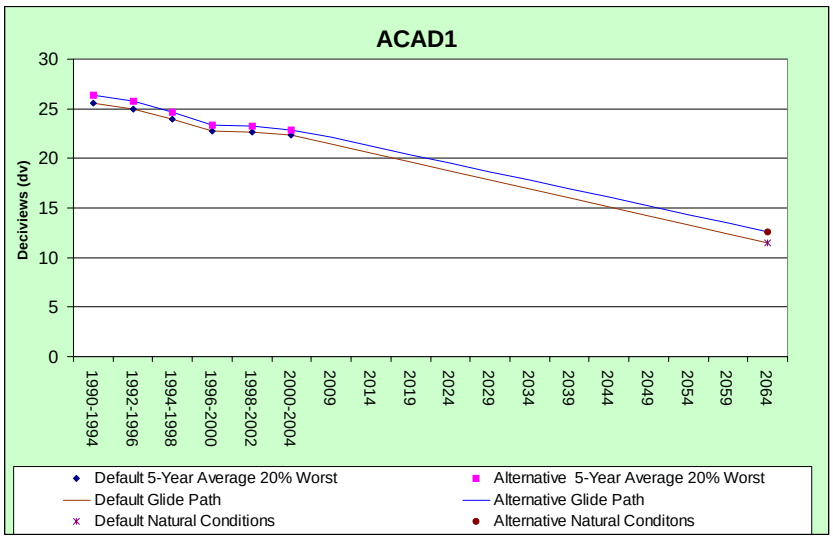
Lye Brook Glide Path to Natural Conditions 2004-2064



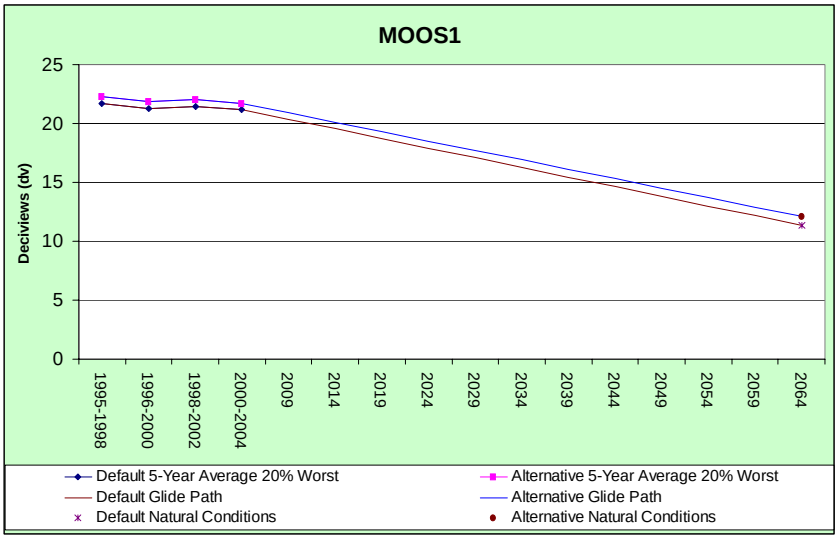
Great Gulf Glide Path to Natural Conditions 2004-2064



Acadia Glide Path to Natural Conditions 2004-2064

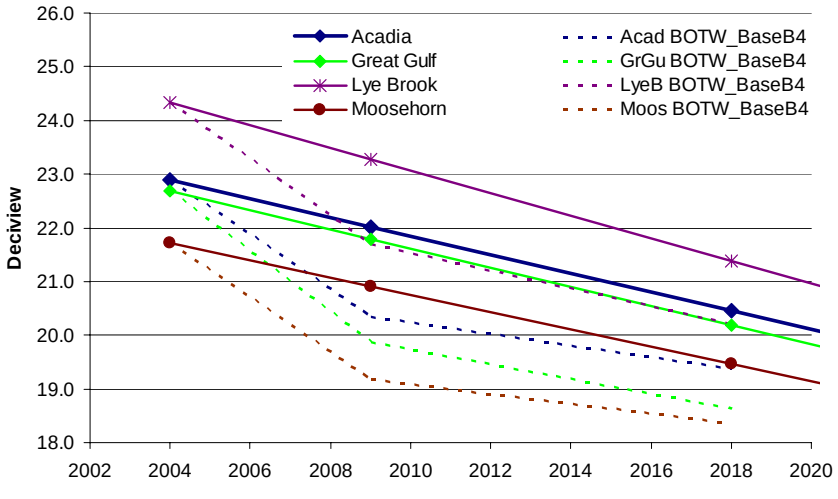


Moosehorn Glide Path to Natural Conditions 2004-2064



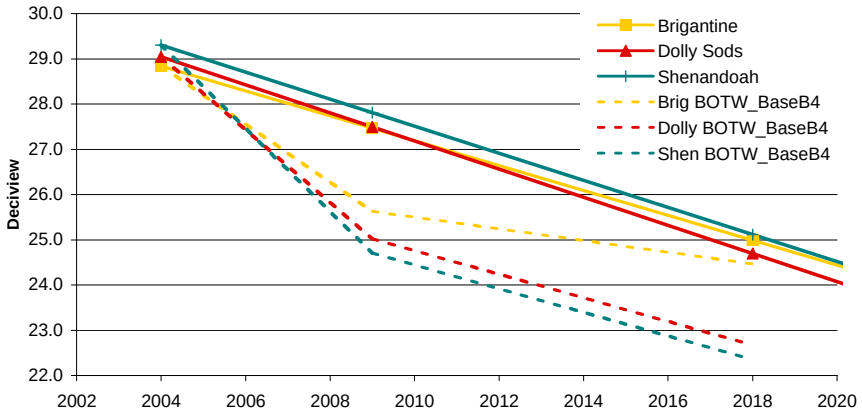
Modeling: First Run Progress

- Show anticipated 2018 progress relative to uniform rate.



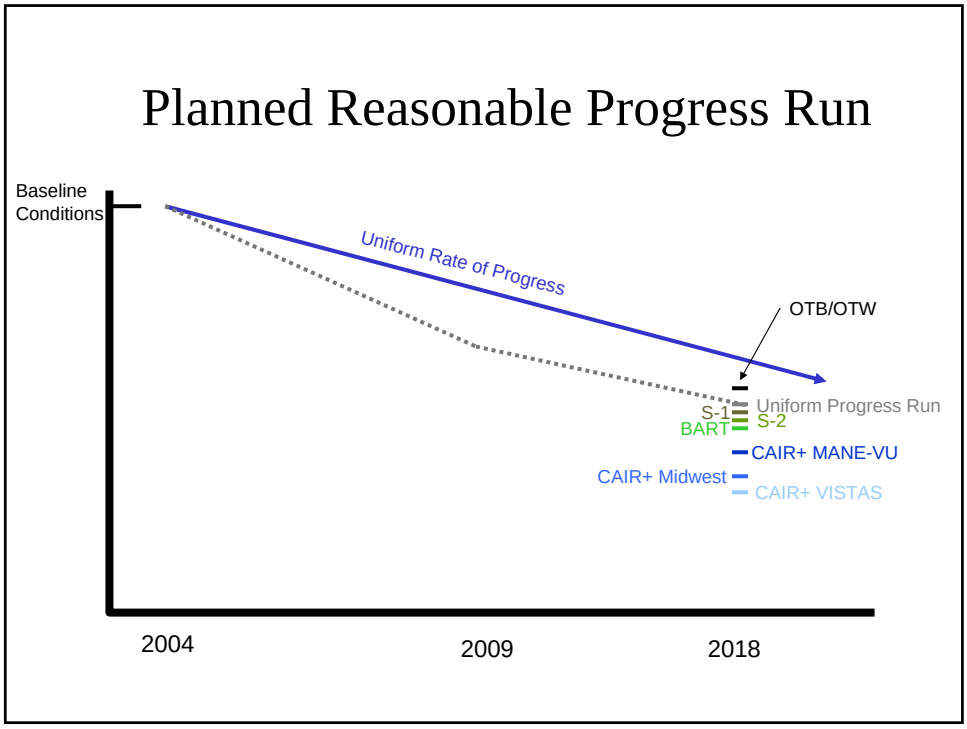
Modeling: First Run Progress

- Show anticipated 2018 progress relative to uniform rate.



Planned Reasonable Progress Tags

- SO2 : All other SO2 in the system
- SO2_1: VISTAS CAIR+ SO2 emissions reduction
- SO2_2: MWRPO CAIR+ SO2 emissions reduction
- SO2_3: M-V CAIR+ SO2 emissions reductions
- SO2_4: BART SO2 emissions reductions
- SO2_5: S-2 low sulfur oil strategies
  - 15ppm residential heating oil
  - 0.0015%S #2 distillate (presumably for commercial/institutional boilers)
  - 0.25% #4 distillate/residual oil
  - 0.5% #6 residual oil (industrial boilers AND marine sources??)
- SO2_6: S-1 low sulfur oil strategies
  - 500 ppm residential heating oil in DE/VT
  - 0.05% S #2 distillate (presumably for commercial/institutional boilers)
  - 0.25% S #4 distillate/residual
  - 0.5% S #6 residual (industrial boilers AND marine sources??)
- SO2_7: 500 ppm residential and commercial distillate everywhere in M-V (except DE/VT) relative to current in-state baseline S content in fuel.


Planned Reasonable Progress Run
Baseline Conditions
Uniform Rate of Progress
OTB/OTW
S-1
S-2
BART
Uniform Progress Run
CAIR+ MANE-VU
CAIR+ Midwest
CAIR+ VISTAS
2004
2009
2018

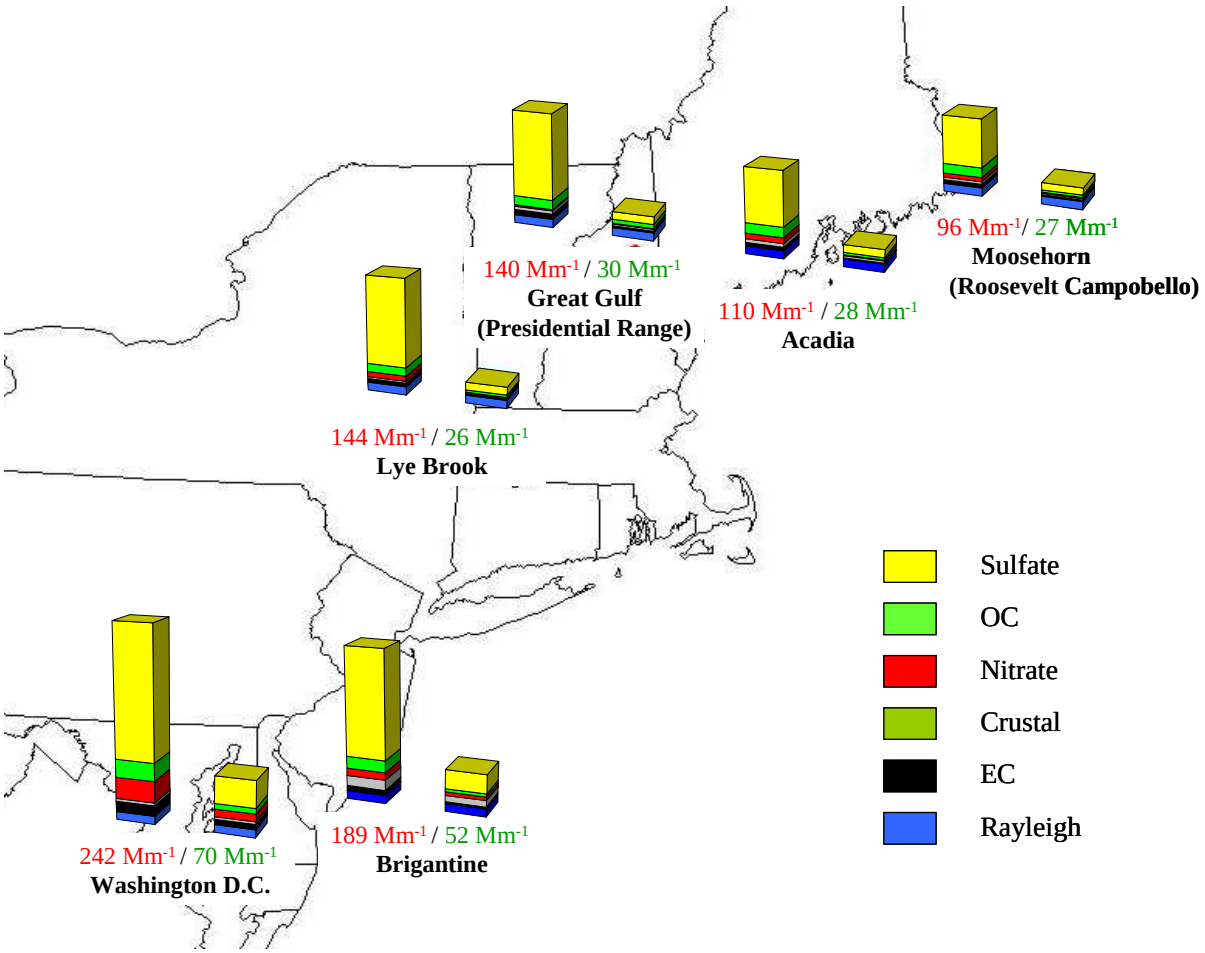
Miscellaneous
Section 5

MANE-VU Approach to Best Visibility Days

Best/Worst Chemical Differences

- Chemical differences exist between the visibility impairment present in MANE-VU Class I areas on best and worst visibility days; however, secondary sulfate still accounts for the majority of observed extinction.

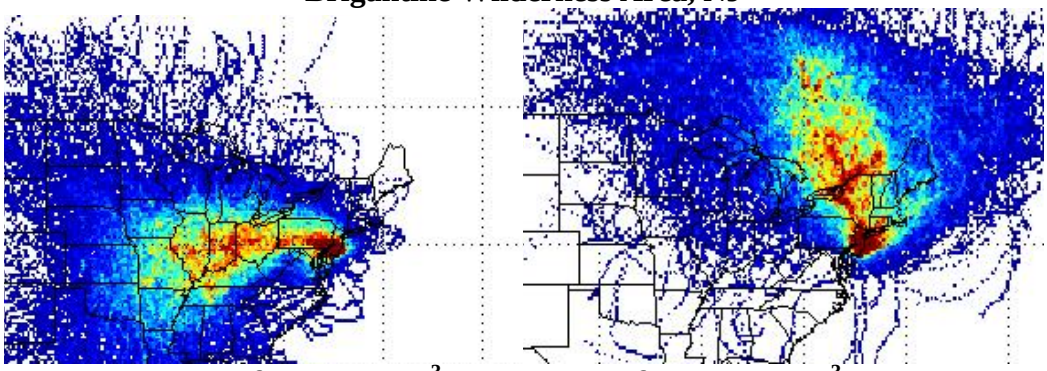
Figure 1: Visibility Impairment in the MANE-VU Region on the Best and Worst Visibility Days



Best/Worst Meteorological Differences

- Meteorological differences between the best and worst days are stark indicating that MANE-VU Class I sites are affected by very different source regions under Best Day conditions and Worst Day Conditions.
- The source region under Worst Day Conditions tends to include the southern and western portion of MANE-VU and the adjacent areas.
- The source region under Best Day Conditions tends to include the far northern portions of MANE-VU and the Eastern Canadian Provinces.

Figure 2: Meteorological transport associated with the highest and lowest extinction at Brigantine Wilderness Area, NJ



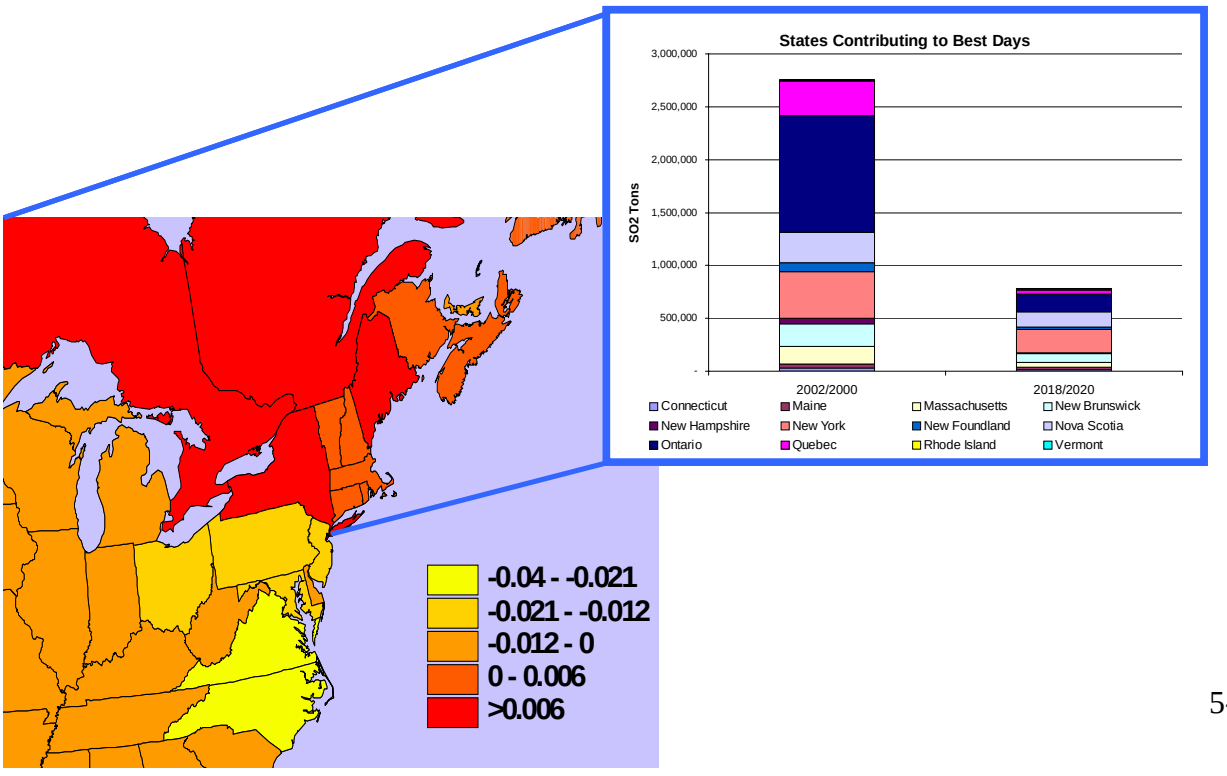
Sulfate=6.8µg/m^3
Extinction=111 Mm^{-1}

Sulfate = 2.2µg/m^3
Extinction=49 Mm^{-1}

Emissions Inventory Analysis

- Current and projected emissions for the source region that contributes to the best visibility conditions in MANE-VU Class I areas suggest substantial emissions reductions in SO_2.
- The projected SO_2 emissions reduction between now and 2018/2020 are likely to provide a "buffer" that is expected to preserve – if not improve – visibility conditions on the best days.
- This emission reduction buffer assumes implementation of projected emissions reductions. There is some uncertainty as to whether these reductions will be fully realized (e.g. Ontario).

Figure 3: Meteorological source regions for Brigantine Wilderness Area on the 20 percent best visibility days (as determined by trajectory-based incremental probabilities) and projected SO_2 emissions reductions



BART
Section 6

MANE-VU Approach to BART

BART-Eligible Source Identification

- MANE-VU developed preliminary list of BART-eligible EGUs based on review of Clean Air Markets Division databases (*A Basis for Control of BART-Eligible Sources*; http://www.nescaum.org/documents/a-basis-for-control-of-bart-eligible-sources/).
- MANE-VU developed preliminary list of BART-eligible non-EGUs based on review of state permit files (*Development of a list of BART-eligible sources in the MANE-VU region*; http://www.nescaum.org/documents/memo6-bart.pdf/).
- States reviewed preliminary lists and have developed their own final list of BART eligible sources

'Subject' to BART

- MANE-VU developed a preliminary demonstration that broad regions of the Eastern U.S. were likely to contribute to Baseline Regional Haze (*A Basis for Control of BART-Eligible Sources*; http://www.nescaum.org/documents/a-basis-for-control-of-bart-eligible-sources/).
- MANE-VU refined and finalized an assessment of contributing sources to sulfate in the Eastern U.S. in their contribution assessment report (*Contributions to Regional Haze in the Northeast and Mid-Atlantic United States*; http://www.nescaum.org/documents/contributions-to-regional-haze-in-the-northeast-and-mid-atlantic--united-states/)
- In 2004, the MANE-VU Board adopted the approach proposed by EPA that allowed states to find all MANE-VU BART-eligible sources "subject" to BART supported by findings in the preceding two reports that emissions from all MANE-VU states contribute some degree of visibility impairment in Class I areas. (No exemption modeling was conducted)

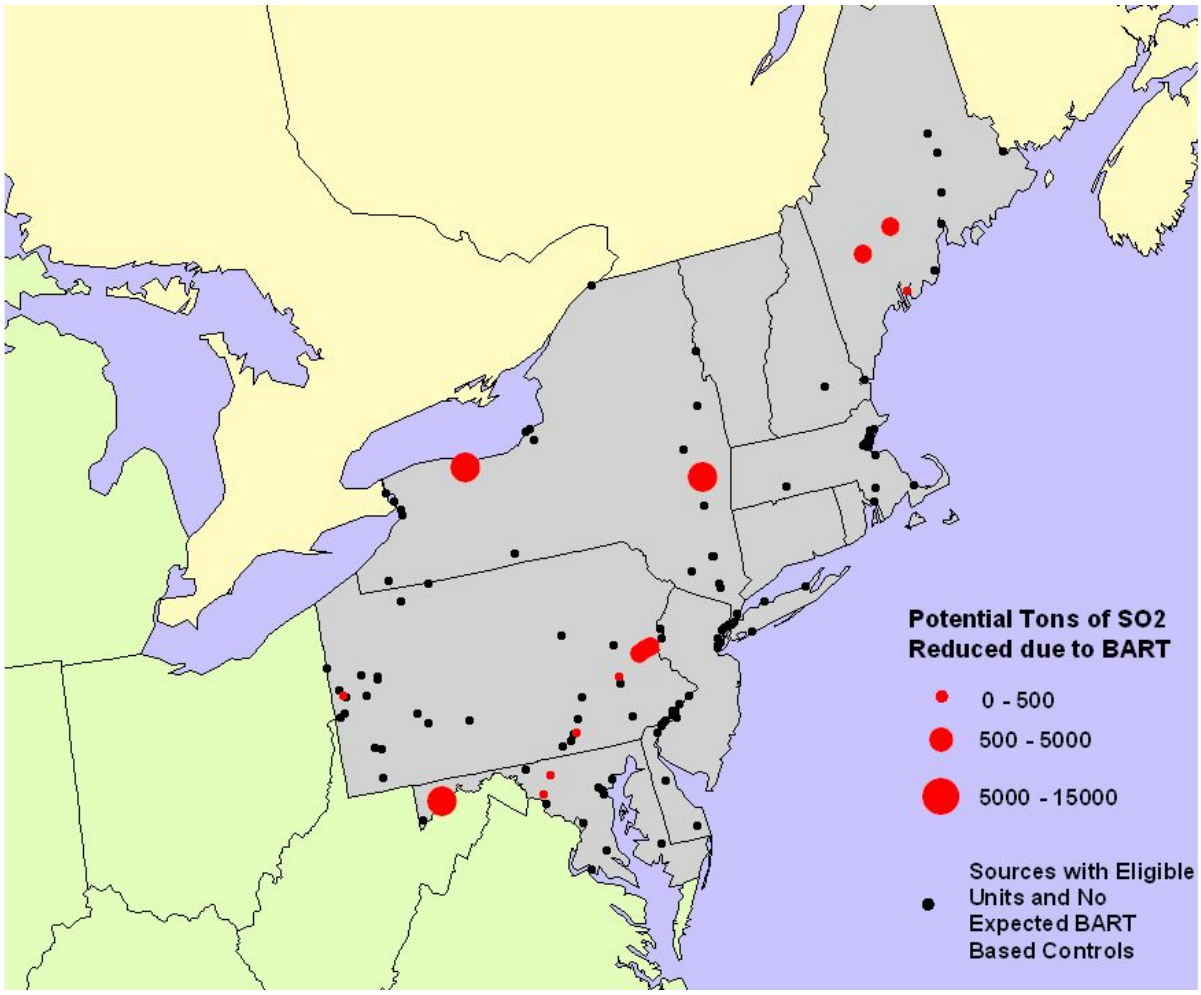
BART Determinations

- MANE-VU conducted a control technology assessment for four primary source categories that were most common in our region. This report focused on available control options and costs for EGUs, Industrial Boilers, Paper and Pulp facilities and Cement Plants. (*Assessment of Control Technology Options for BART-Eligible Sources*; http://www.nescaum.org/documents/bart-control-assessment.pdf/).
- MANE-VU coordinated and surveyed a working group of state staff focused on BART issues. Out of this survey process, MANE-VU identified potential BART control options for several BART eligible sources across the region. This information was synthesized to develop a regional "first-order" five-factor analysis to guide states as they develop their own five-factor analysis for BART-eligible sources in their state. (*Five Factor Analysis of BART-Eligible Sources*; http://www.nescaum.org/documents/bart-memo-02-09-07.pdf/). This report provides a suggested approach for considering each of the five statutory BART factors including the degree of visibility improvement that may result from installation of controls. For this factor it was suggested that a weight be given

such that no additional controls would be warranted for any source that has a current annual average contribution to visibility impairment at any Class I area of less than 0.1 delta deciview during 2002.

- Primary findings from this analysis are shown in the figure below and three attached tables. The analysis suggests that the majority of BART-eligible sources either do not warrant additional controls based on cost or visibility considerations or are being controlled already under other programs (e.g. CAIR) and that these controls will serve as BART.

Figure 1: Potential Reductions from BART-Eligible Sources in the MANE-VU Region



Note: "No Expected BART-Based Controls" implies that the eligible units at that source either do not warrant additional controls based on cost or visibility considerations or are being controlled already under other programs (e.g. CAIR) and that these controls will serve as BART.

Table 1. Possible range of SO_2 controls and costs based on survey of state staff

Type of Unit	*Counts By Type*	*Control Strategies*	*Number of Units where this option might apply*	*Total 2002 SO_2 Emissions*	*Total Estimated Decrease in SO_2 (tons/yr)*	*Estimated Cost ($/Ton SO2)*	*Notes*
Chemical Manufacturer	4	Currently Controlled	3	24000	NA	0	
		Wet Scrubber	1	NA	NA	400-8000	Mid Range Cost (1)
Glass Fiber	6	Currently Controlled	6	17	0	0	
Coal Cleaning	1	No Known Further Controls	1	68	0	0	
EGU/Coal	5	Dry Scrubber	4	64000	NA	200-500	Mid Range
		1.5% Fuel Sulfur Limit	1	5200	1300	NA	
EGU/Oil (Resid and Dist)	17	0.3% fuel sulfur limit	3	1400		NA	
		0.56 lb/MMBtu	1	85	NA		
		0.33 lb/MMBtu	2	8000	4400	0	
		3.0 lb/MWh	5	31000	NA	0	
		1.1-1.2 lb/MMBtu	2	480	NA		
		BART WG Reco?	2	1800			
Incinerator	2	Currently Controlled	2	84	0		
Metal Production	7	Currently Controlled	5	2200	0	0	
		Increased efficiency of the facility's wet scrubber	2	3000	300	Limited Cost	Low Range
Paper and Pulp	30	FGD (SO_2 Scrubber)	3	13000	11000	400-8000	Mid Range (1)
		No Known further controls	9	10000	0	0	
		Currently Controlled	8	4400	0	0	
		BART WG Rec?	10	8500	7600		
Portland Cement	25	Fuel switching: CE of SOx 10%	3	2300	230	NA	
		Currently Controlled	4	3400	0	0	
		No Known Further Controls	7	300	0	0	
		SO_2 Scrubber	10	26000	19000	400-80000	Mid Range (1)
		BART WG Reco?	1	300	NA		
Refinery	37	Refinery RACT	9	5400	NA	0	
		No Known Controls	25	NA	NA	0	
		Wet Scrubber	3	NA	NA	400-8000	Mid Range (1)

(1) Cost estimate from NESCAUM, 2005 for Industrial Boilers

(2) Cost estimate from NY DEC analysis of cost of installation at a Cement Plant

Table2. Possible range of NO_X controls and costs based on survey of state staff

Type of Unit	*Counts By Type*	*Control Strategies*	*Number of Units where this option might apply*	*Total 2002 NO_x Emissions*	*Total Estimated Decrease in NO_x (tons/yr)*	*Estimated Cost ($/Ton NO_x)*	*Notes*
Chemical Manufacturer	1	Currently Controlled	3	5000	0	0	
		No known controls.	1	NA	NA	NA	
Glass Fiber	6	Currently Controlled	6	180	0	0	
Coal Cleaning	1	Low NOx burners, CE of 15%	1	160	25	1-2 Million (capital cost)	Low Range
EGU/Coal	5	Currently Controlled	2	3800	820	0	
		SCR and 1.5 lb/MWh	2	9800	NA	1000-1500	Mid Range (1)
		NOx Budget & 1.5 #/MWh	1	2300	NA	NA	
EGU/Oil	17	Currently Controlled	4	3400	360	0	
		No Known Controls	3	390	0	0	
		NOx Budget	1	400	NA	NA	
		NOx Budget and 1.5 lb/MWh	4	5300	NA	NA	
		SNCR, 1.5 lb/MWh	1	2400	NA	500-700	Mid Range (1)
		NOx Budget	2	280	NA	NA	
		BART WG Reco?	2	440	NA	NA	
Incinerator	1	Currently Controlled	2	720	NA	NA	
Metal Production	7	Currently Controlled	7	110	0	0	
Paper and Pulp	30	SCR or SNCR	2	710	430	1300-10000	Mid to High Range (2)
		No Known Controls	13	4500	0	0	
		BART WG Reco?	7	1800	NA	NA	
		Currently Controlled	8	2800	0	0	
Portland Cement	25	Low NOx burners	3	2800	430	200-3000	Mid Range (4)
		LNB and Mid Kiln Firing, 40% Reduction	2	8500	3400	1200-10000	Mid Range (2).
		SCR, 65% Red.	1	740	480	1300-10000	-2
		No Known Controls	9	2000	0	0	
		Currently Controlled	1	1700	0	0	
		SNCR	9	7100	2900	900-1200	Mid Range (4)
Refinery	37	Refinery RACT	9	2300	NA	NA	
		No Known Controls	25	0	0	0	
		SCR	2	NA		1300-10000	-2
		SNCR	1	NA		1300-10000	-2

(1) Cost estimate from NESCAUM, 2005, EGU controls
(2) Cost estimate from NESCAUM 2005, Industrial Boiler controls
(3) Cost estimate based on NYDEC analysis of facility
(4) Cost estimate form NESCAUM 2005, Portland Cement Kilns

Table 3. Possible range of PM_{10} controls and costs based on survey of state staff

Type of Unit	*Counts By Type*	*Control Strategies*	*Number of Units where this option might apply*	*Total 2002 PM_{10} Emissions*	*Total Estimated Decrease in PM_{10} (tons/yr)*	*Estimated Cost*	*Notes*
Chemical Manufacturer	4	Currently Controlled	3	200	0	0	
		No Known Controls	1	NA	NA	NA	
Coal Cleaning	1	No Known Controls	1	46	0	0	
EGU/Coal	10	Currently Controlled ESP	7	3500	1400	0	
		PM co-benefit reductions expected due to FGD-25-50% reduction	2	1500	370	0	
		Baghouse	1	1500		$50 M	Capital Cost, NJ estimate
EGU/Natural Gas	2	Controls information included with oil/coal boilers	2	13	NA	NA	
EGU/Oil	18	Dry wire-plate ESP	2	34	14	$25-68 M	Capital Cost
		Currently Controlled Mech Collector	1	9	0	0	
		Currently Controlled	10	170	42	0	
		No Known Controls	5	52	0	0	
Incinerator	2	Currently Controlled Fabric Filter	2	0	0	0	
Glass Fiber	6	Currently Controlled	6	190	0	0	
Metal Production	7	Currently Controlled	7	41	0	0	
Paper and Pulp	30	Upgrade from ESP to baghouse, CE of 4% estimate	2	180	7	$15 M	Capital Cost
		No Known Controls	7	280	0	0	
		Currently Controlled (ESP, Venturi Scrubbers, Demister, or MultiCyclones)	9	690	0	0	
		BART WG Reco?	7	670	NA	NA	
Portland Cement	25	Upgrade on current ESP, CE of 5%	3	210	11	Limited Cost	
		No Known Controls	15	300	0	0	
		Currently Controlled	6	370	0	0	
		Baghouse or electric precipitator	1	4	NA	NA	
Refinery	37	No Known Controls	28	NA	0	0	
		Refinery RACT	9	270	NA	NA	