

# MANE-VU Reasonable Progress Goals Project Summary

April 18, 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EPA issued draft guidance for implementing the reasonable progress requirement (dated 11/28/2005).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:

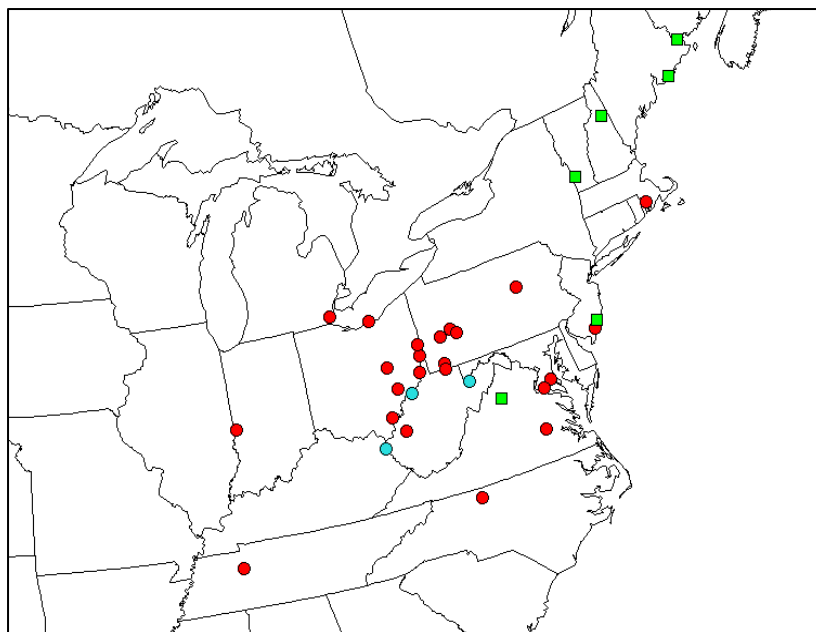
- Coal and oil-fired Electric Generating Units, (EGUs);
- Point and area source industrial, commercial and institutional boilers;
- Cement kilns;
- Lime kilns;
- The use of heating oil; and
- Residential wood combustion and open burning.

### WHERE DO THESE POLLUTANTS ORIGINATE?

#### Specific EGUs are Important


Roughly 70% of the 2.3 million tons of SO<sub>2</sub> emission in the 2002 MANE-VU emissions inventory (2002 MANE-VU Emission Inventory Version 3) were from EGUs, making them the largest SO<sub>2</sub> 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 

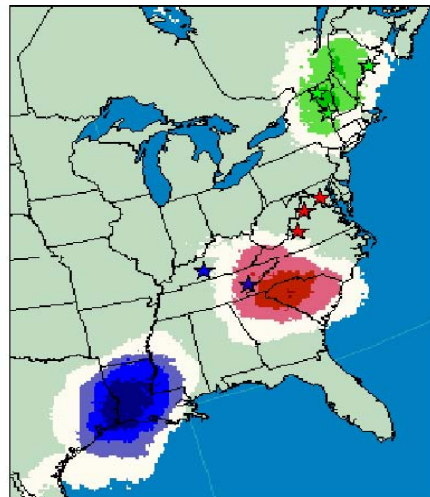
Top 15 EGUs affecting Shenandoah only (4 EGUs at 3 facilities) 

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**

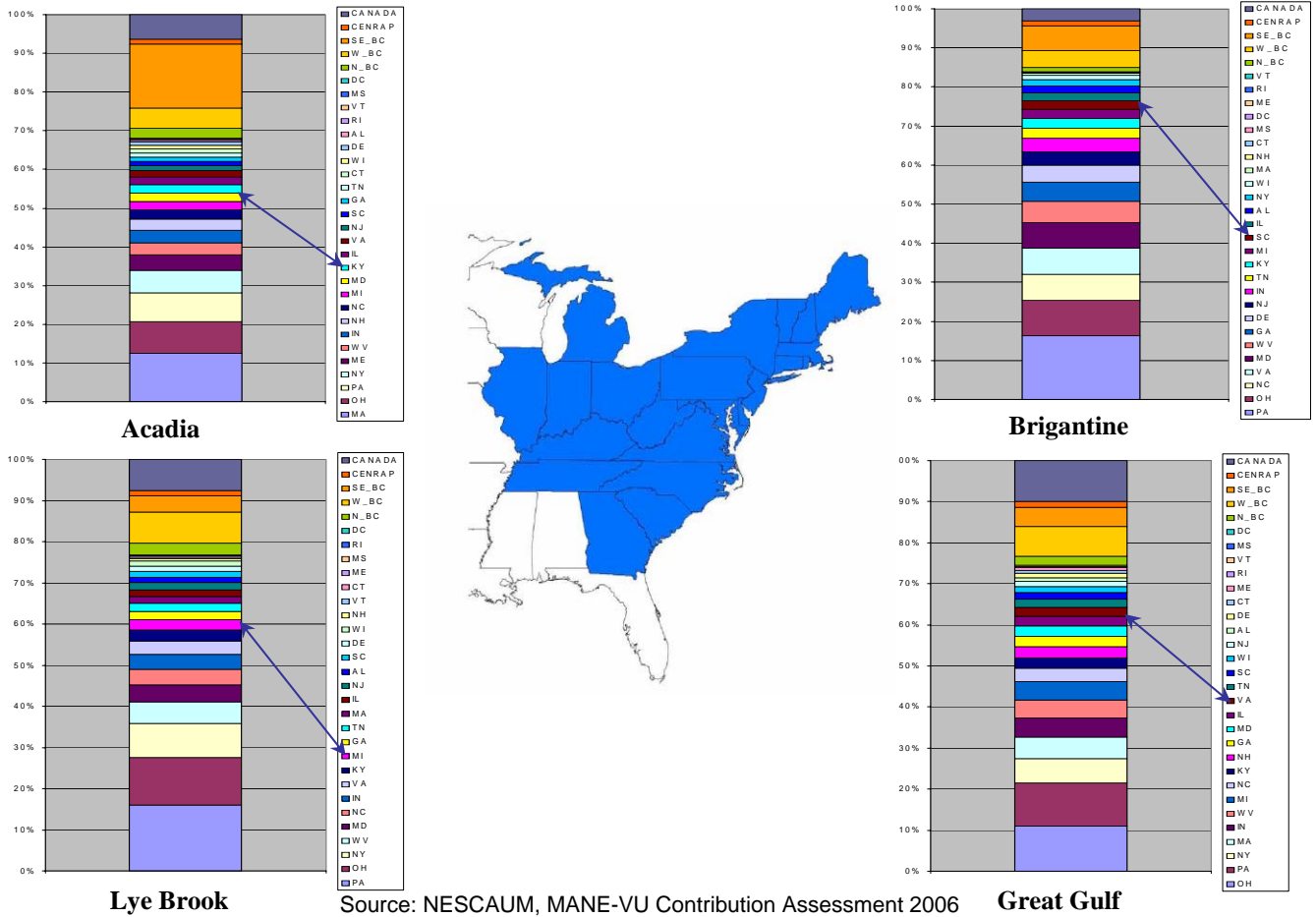
### Defining the Area of Influence

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<sub>4</sub> 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



**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**

<b>Source Category</b>	<b>Pollutant Analyzed</b>	<b>Total Cost (per ton of pollutant reduction)</b>	<b>Compliance Timeframe</b>	<b>Energy and Non-Air Quality Environmental Impacts</b>	<b>Remaining Useful Life</b>
Electric Generating Units	SO <sub>2</sub>	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 <sub>2</sub>	\$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 <sub>2</sub>	\$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 <sub>2</sub>	\$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 4<sup>th</sup> to Angela Crenshaw at MARAMA ([acrenshaw@marama.org](mailto: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>

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