Mid-Atlantic / Northeast Visibility Union
Second Interim Report

September 2011

Prepared by the Mid-Atlantic Regional Air Management Association
For the
Mid-Atlantic / Northeast Visibility Union

Ozone Transport Commission
444 N Capitol Street, NW, Suite 638
Washington, DC 20001
About MANE-VU, OTC, MARAMA, and NESCAUM

The Mid-Atlantic/Northeast Visibility Union (MANE-VU) was formed in 2001 by the Mid-Atlantic and Northeastern states, tribes, and federal agencies. MANE-VU encourages a coordinated approach to reducing visibility impairment in major national parks and wilderness areas in the Northeast and Mid-Atlantic region. MANE-VU provides technical assessments and assistance to its members, leverages progress on other regional air pollution issues, provides a forum for consultation, and encourages coordinated actions and coordination with other regions.

Three organizations work together closely to provide staff support to MANE-VU: the Ozone Transport Commission (OTC), the Northeast States for Coordinated Air Use Management (NESCAUM), and the Mid-Atlantic Regional Air Management Association (MARAMA).

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Carol McCoy, Chief

U.S. Fish and Wildlife Service Air Quality Branch
Sandra V. Silva, Chief

U.S. Forest Service
Ann Acheson, National Air Program Manager
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Executive Summary

The Mid-Atlantic/Northeast Visibility Union (MANE-VU) has produced strong regional agreements to improve visibility at major national parks and wilderness areas. This report is a guide to MANE-VU’s accomplishments in its first decade and a reference for assessing future progress. In this report you will find sidebars summarizing key federal requirements and brief descriptions of MANE-VU’s approach along with information about where to find more details. We begin this report with a description of the region’s Class I areas—the national treasures at the focus of these efforts.

Regional haze is caused by numerous sources over a broad area, and it obscures vistas integral to the value of our parks and wilderness areas. This report notes the predominant cause of haze pollution in this region is sulfate particles caused by emissions from burning coal and oil. Adding controls to large, old sources can help reduce haze, and Part 2 of the report focuses on MANE-VU’s approach to requiring Best Available Control Technology (BART) to reduce emissions from major old sources contributing to regional haze.

BART is a key part of MANE-VU’s agreement to pursue a broad long-term regional strategy to improve visibility. As summarized in Part 3, MANE-VU’s strategy includes:

- Timely implementation of BART,
- Reducing the sulfur content of fuel oil,
- Reducing sulfur dioxide emissions from electric power plants,
- Seeking to reduce emissions outside MANE-VU that impair visibility in our region, and
- Continuing to evaluate other measures such as energy efficiency, alternative clean fuels, and measures to reduce emissions from wood and coal combustion.

Visibility measurements are the focus of the next three parts of this report. Part 4 describes baseline and natural visibility conditions. Part 5 defines goals for improving visibility, measured as a five-year average. Part 6 presents the good news that visibility improved at all MANE-VU Class I areas comparing the baseline 2000-2004 period to the next five-year period, 2005-2009.

MANE-VU used a suite of technical methods to explore and define the causes of haze in our region. Part 7 describes the emissions sources in the region. Part 8 notes that coal and oil burning sources are major contributors to haze. MANE-VU identified key facilities in and outside MANE-VU whose emissions were particularly important. Sources within MANE-VU contributed 25 to 30 percent of the sulfate at our Class I areas, but emissions from sources outside MANE-VU also have significant impacts. As described in Part 9, states contributing two percent or more of the sulfate pollution in MANE-VU were consulted in developing MANE-VU’s long-term strategy.

The last parts of this report address benefits to public health and the environment and how MANE-VU identified reasonable controls and reached out to stakeholders. After completing extensive technical analyses, outreach, and consultation, MANE-VU states adopted State Implementation Plans (SIPs). Appendix A provides links to electronic copies of the SIPs as well as an annotated bibliography of reports produced by MANE-VU.
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MANE-VU’s Class I Areas

Acadia National Park
People have been drawn to the rugged coast of Maine throughout history. Awed by its beauty and diversity, early 20th-century visionaries donated the land that became Acadia National Park, the first national park east of the Mississippi River. The park is home to the tallest mountain on the U.S. Atlantic coast. Today visitors come to Acadia to hike granite peaks, bike historic carriage roads, or relax and enjoy the scenery.

Roosevelt Campobello International Park
A memorial to Franklin Delano Roosevelt and symbol of Canadian-American friendship, Roosevelt Campobello International Park is a combination indoor/outdoor site renowned internationally. Its historic beauty contributes to the tourism in both the Province of New Brunswick and the State of Maine. Wooded paths and fields offer vistas of nearby islands, bays, and shores.

Brigantine Wilderness
This trailless area, a tidal wetland and shallow bay habitat along New Jersey’s Atlantic coastline, is one of the most active flyways for migratory waterbirds in North America. Birdwatchers, binoculars in hand, have zoomed in on close to 300 species, including Atlantic brant and American black duck.

Great Gulf Wilderness
Cradled within the rugged crescent of New Hampshire’s Presidential Range lies the Great Gulf Wilderness. This steep-walled bowl begins at Mount Washington, and is flanked by Mounts Jefferson, Adams, and Madison. Great Gulf is the largest cirque in the White Mountains of New Hampshire with the small and beautiful Spaulding Lake lying at its floor. From the cirque’s low end, the West Branch of the Peabody River flows eastward.
Lye Brook Wilderness

The Lye Brook Wilderness is in the southern Green Mountains of Vermont. Lye Brook flows through the western half of this wilderness, which ranges from 900 feet to 2900 feet above sea level. Most of the wilderness is above 2500 feet, on a high plateau with several ponds and bogs. Waterfalls and rocky streams are found here as well as reflecting pools. The western section is extremely steep, facing west-northwest towards U.S. Route 7 and Manchester. Four and a half miles of the Appalachian/Long Trail cross the northwest tip of the wilderness.

Moosehorn Wilderness

This wilderness is located within northern Maine’s Moosehorn National Wildlife Refuge, a refuge and breeding ground for migratory birds, endangered species, and other wildlife. Scientists at Moosehorn have provided valuable information to stem the decline in the American woodcock, also called a Timberdoodle. Bald eagles frequent the refuge, and black bears and white-tailed deer are common. Ducks, geese, and loons congregate on more than 50 lakes.

Presidential Range/Dry River Wilderness

The large glacial cirque known as Oakes Gulf lies at the headwaters of the Dry River in New Hampshire. This river - and just to the east the Rocky Branch - carve sharply down through the heart of this Wilderness and offer contrast to the surrounding long, high ridgelines of the Southern Presidential Range and Montalban Ridge. The Dry River is something of a misnomer, as anyone who has tried to cross it after a period of even moderate rain can attest. The streams in this Wilderness are flashy and swift and run cold and clear from snow that melts well into the summer.

1. The Goal: Improving and Protecting Visibility

The public expects clear, clean air at U.S. national parks and wilderness areas. On the days with the best air quality, the air is quite clean, but regional haze frequently obscures these national treasures. We can do better. To spur efforts to protect the air quality values of national parks and wilderness areas, Congress enacted Clean Air Act requirements for visibility protection (Sidebar).

In response, states and tribes in the Northeast and Mid-Atlantic region, along with Federal Land Management Agencies and the U.S. Environmental Protection Agency, have worked together to develop strategies for reducing the haze that obscures natural vistas in areas designated in the Clean Air Act as Class I areas. This report explains those strategies and summarizes the technical information that gives us confidence that we can improve visibility at our national parks and wilderness areas.

Figure 1. Federal Class I Areas in and near the MANE-VU Region

The Problem: Haze and Its Causes

Our parks and wilderness areas are downwind from major urban and industrial areas both in the region and beyond its borders. Air pollution from these areas causes haze that obscures vistas that are integral to the value of these public areas. The good news is that we can reduce pollutant emissions and improve visibility at a reasonable cost, and that by doing so we will gain a cleaner, healthier environment throughout the region.

What makes up regional haze? Small particles and certain gaseous molecules in the atmosphere scatter or absorb light, thereby causing haze and...
reducing visibility. More pollution means more absorption and scattering of light, increasing haze. High humidity magnifies the haze problem, because some particles, such as sulfates, attract water and grow larger, scattering more light.

Figure 2 shows the relative importance of five types of particles that cause light extinction or haze: sulfates, nitrates, elemental carbon (EC), organic carbon (OC), sea salt, and soil particles. Parts 4 and 6 of this report provide more information on the characteristics of haze in the MANE-VU region.

The predominant cause of haze pollution in Northeast parks and wilderness areas is sulfate particles due to sulfur dioxide emissions from burning coal and oil to provide heat and power to homes, businesses, and industries. Additional pollutants contributing to regional haze are emitted by power plants, boilers, furnaces, motor vehicles, and other fuel-burning equipment as well as various types of fires. More information about these pollution sources is summarized in Part 7 of this report.

**Figure 2: Five Particle Types Comprising Regional Haze**

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**A Collaborative Solution Through MANE-VU**

Haze is a regional problem that requires collaborative interstate solutions. Congress charged each state with addressing its contribution to visibility problems in national parks and wilderness areas both within and outside its borders. EPA adopted rules to implement the law. (See Sidebar p. 3.)

The states that are home to Class I areas have established goals for improving visibility in those areas, as required by the Clean Air Act. Achieving these goals requires continued coordinated efforts among states on the long-term process of returning visibility to natural conditions.
The Mid-Atlantic and Northeastern states, tribes, and federal agencies formed the Mid-Atlantic/Northeast Visibility Union (MANE-VU) to coordinate regional haze activities for the region. MANE-VU encourages a coordinated approach to reducing visibility impairment. It provides technical assessments and assistance to its members, leverages progress on other regional air pollution issues, provides a forum for consultation, and encourages coordinated actions and coordination with other regions. Similar regional organizations were formed in other regions of the U.S., and MANE-VU has collaborated with them (Figure 3).

**Figure 3. Map of Regional Planning Organizations**

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**Key Requirements**

On July 1, 1999 EPA adopted rules to establish a comprehensive visibility improvement program for areas of great scenic importance — called Class I areas.

Key requirements of EPA’s regional haze rules are:

1. Large sources in 26 categories with units installed between 1962 and 1977 contributing to visibility impairment must install Best Available Retrofit Technology—BART.

2. States with Class I areas must set reasonable progress goals for visibility improvement in 156 major national parks and wilderness areas.

3. Any state or tribe whose emissions affect visibility in Class I areas must adopt a long-term strategy to reduce emissions and improve visibility.

4. States and tribes must report progress every 5 years.

5. Each state or tribe must revise its regional haze implementation plan by July 31, 2018 and every ten years thereafter.

(40 CFR 51.300 et seq.)
A Comprehensive Visibility Improvement Program
The MANE-VU states and tribes have worked together successfully to develop their air quality plans for the first planning period (through 2018). Part 2 of this report summarizes the MANE-VU states’ approaches to controlling major sources subject to the requirement for Best Available Retrofit Technology (BART). Part 3 of this report summarizes the long-term strategy MANE-VU developed to improve visibility at its Class I areas. States and participating tribes must revise and update these plans every ten years.

Next Steps
Most MANE-VU Regional Haze Plans have been submitted to EPA and are awaiting approval. Every five years, states must review their plans to determine whether adjustments are needed in order to achieve continued progress in improving visibility. MANE-VU states plan to work together to develop documentation of progress in reducing regional haze. States must report on:

1. The status of all Regional Haze SIP measures to achieve reasonable progress goals;
2. Emissions reductions achieved through implementation of all Regional Haze SIP measures;
3. Visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of five-year averages;
4. Five-year emissions changes by visibility-impairing pollutant and type of source or activity;
5. Any significant changes in anthropogenic emissions that have limited progress;
6. Whether current Regional Haze SIPs and strategies will enable meeting all established reasonable progress goals;
7. The state's visibility monitoring strategy and any modifications to the strategy as necessary (states with Class I areas);
8. The adequacy of the Regional Haze SIPs to ensure reasonable progress.

Many of the control measures included in the MANE-VU Long-Term Strategy are not scheduled to be implemented until after the first five-year period, but significant progress has been made in some states in reducing emissions of sulfur dioxide. This report is intended to serve as a point of reference for the first five-year review.

For more information:


2. Best Available Retrofit Technology

In 1977 Congress directed EPA and the states to identify existing sources that had been in operation for no more than 15 years and that caused or contributed to visibility impairment in major parks and wilderness areas. Those sources were to install and operate best available retrofit technology (BART) to reduce their impacts on Class I areas.

The BART requirement is an important element of EPA’s regional haze rule. Initially promulgated in 1999 and revised most recently in 2005, the BART portion of EPA’s rule required states or tribes to develop an inventory of sources within each state or tribal jurisdiction that could be subject to emission reduction strategies. The rule also:

- Outlined methods to determine if a source is “reasonably anticipated to cause or contribute to haze;”
- Defined the methodology for conducting a BART analysis;
- Provided presumptive BART limits for electricity generating units (EGUs) larger than 750 Megawatts; and
- Identified compliance with the Clean Air Interstate Rule (CAIR) as meeting BART requirements.

Based on EPA guidance, several MANE-VU states relied on CAIR as meeting BART requirements for some Electricity Generating Units (EGUs). CAIR was challenged in court and remanded to EPA for revision. EPA replaced CAIR with the Cross State Air Pollution Rule (CSAPR) in 2011. EPA has not yet determined whether CSAPR satisfies BART-related requirements.

The BART Process

The BART process has three steps:

- Determine if a source is BART-eligible - i.e., a large source in one of 26 source categories that was built between 1962 and 1977.
- Determine if a source is subject to BART – i.e., causes or contributes to visibility impairment in any Class I area; and
- Determine what if any additional controls or emission limits are necessary. (This is the BART determination.)

BART determinations are part of the State Implementation Plan (SIP) and, thus, require approval by EPA. The state or tribe must require sources to comply with any BART determinations as expeditiously as practicable, but no later than five years after EPA approval of the SIP.

Five-Factors Considered in BART Determinations

Once a source has been identified as BART-eligible and subject to BART, the state or tribe must make a BART determination by conducting an engineering review to determine if the installation of new control requirements is appropriate. This review considers five factors:

1. Cost of controls;
2. Energy and non-air quality environmental impacts;
3. Existing controls at the source;
4. The remaining useful life of the source; and
5. Visibility impairing pollutants to be addressed in BART reviews are sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter.

EPA completed rulemaking to implement the BART requirement in June 2005.

EPA’s regional haze rule mandates that each source subject to BART be required to install and operate BART as expeditiously as practicable, but in no event later than five years after approval of the implementation plan revision.

(40 CFR 51.308 (e)(1)(iv))
5. Visibility improvement reasonably expected from application of emission limitations.

Appendix Y to 40 CFR 51.308, “Guidelines for BART Determinations under the Regional Haze Rule,” gives the states discretion to determine the weight and significance to be assigned to each factor.

**MANE-VU Support and Coordination**

Both individual MANE-VU states and regional organizations helped implement the BART program in the MANE-VU region.

- MANE-VU states identified BART-eligible sources. The four primary source categories in the region were electricity generating units (EGUs), industrial boilers, cement plants, and pulp and paper facilities.

- MANE-VU conducted a control technology assessment for four primary source categories. The report, entitled *Assessment of Control Technology Options for BART-Eligible Sources: Steam Electric Boilers, Industrial Boilers, Cement Plants and Paper and Pulp Facilities*, focused on available control options and costs.

- The MANE-VU Board recommended that all BART-eligible sources in MANE-VU would be deemed subject to BART.

- Because it takes time to install BART controls in order to achieve air quality benefits by 2018, the MANE-VU BART work group recommended that the remaining useful life of a source be considered as follows:
  1. Either the facility will be controlled by 2013, or
  2. The facility will have a federally enforceable permit limitation or retirement date.

- MANE-VU identified potential BART control options for several BART-eligible sources across the region. NESCAUM synthesized this information into a regional five-factor analysis guide. The *Five-Factor Analysis of BART-Eligible Sources* 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 suggests that no additional controls would be required for any source that had a current annual average contribution to visibility impairment at any Class I area of less than 0.1 deciview during 2002. NESCAUM’s *BART Resource Guide* provided easy access to BART-related requirements and supporting information.

- In many instances, states required companies operating BART-eligible sources to provide more information so the states could determine if BART required additional controls.

- Because EPA’s CAIR program was overturned by the courts, some MANE-VU states made determinations for BART-eligible CAIR EGUs instead of relying on CAIR for BART.
• States provided opportunities for Federal Land Managers, EPA, and the public to review BART determinations.

• States included any new BART requirements in enforceable permit conditions or rules as part of SIPs in order to make the requirements federally enforceable. Appendix A provides a general description of states’ BART determinations.

• Appendix B summarizes MANE-VU states’ BART determinations for over 130 facilities potentially subject to BART.

For more information:

• *A Basis for Control of BART Eligible Sources*, NESCAUM, July 24, 2001
  Link: http://www.nescaum.org/documents/a-basis-for-control-of-bart-eligible-sources/

• *Assessment of Control Technology Options for BART Eligible Sources: Steam Electric Boilers, Industrial Boilers, Cement Plants, and Pulp and Paper Facilities*, NESCAUM, March 2005
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

• *BART Resource Guide*, NESCAUM, August 2006
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

• *Five Factor Analysis of BART-Eligible Sources: Survey of Options for Conducting BART Determinations*, NESCAUM, June 1, 2007
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents
3. MANE-VU’s Strategy for Achieving Clearer Views and Cleaner Air

In addition to establishing BART requirements, MANE-VU members agreed to pursue regional control measures comprising a long term strategy to reduce visibility impairment at Class I areas within the region by 2018. The strategy was supported by MANE-VU’s Contribution Assessment which showed that emissions from states both inside and outside MANE-VU contributed to hazy conditions at MANE-VU Class I areas. (See Part 8.) The strategy also reflected cost and benefit assessments. (See Parts 10 and 11 for more details.)

The MANE-VU long-term strategy is a multi-faceted approach designed to address key pollution sources that degrade visibility at MANE-VU Class I areas. The strategy targets sulfur emissions because sulfate was determined to be the pollutant with the greatest impact on visibility. The MANE-VU states with Class I areas requested that emissions from twenty-three states and the District of Columbia be reduced in order to make reasonable progress in improving visibility in MANE-VU Class I areas during the first 10-year planning period.

The MANE-VU long term strategy includes 1) commitments by the MANE-VU states to pursue certain controls within the MANE-VU region, 2) a request that neighboring states also reduce emissions, and 3) a call for EPA to strengthen national controls.

The MANE-VU Commitment
To ensure reasonable visibility improvement by 2018, MANE-VU states are pursuing a course of action that includes adopting and implementing the following emissions control strategies as appropriate and necessary:

1. Timely implementation of Best Available Retrofit Technology in the MANE-VU region
   As described in Part 2, above, certain large sources must apply Best Available Retrofit Technology (BART). This strategy will reduce SO₂ emissions at many major sources in the MANE-VU region. Each state made BART determinations as appropriate and included them in their State Implementation Plan.

2. Requiring low-sulfur fuel in the MANE-VU region
   MANE-VU members are pursuing reductions in SO₂ emissions by reducing the sulfur content of fuel oil. States are adopting regulatory revisions as needed to implement this part of the long term strategy, and the final requirements may vary slightly. The following milestones for 2012, 2014, 2016, and 2018 were included in the course of action that the MANE-VU states agreed to pursue.
By 2012, the strategy for the “inner zone” states (New Jersey, New York, Delaware, and Pennsylvania, or portions thereof) is to
- Reduce the sulfur content of distillate fuel to 0.05% (equivalent to fuel sulfur content of 500 ppm by volume),
- Reduce the sulfur content of #4 residual oil to 0.25%, and
- Reduce the sulfur content of #6 residual oil to 0.3-0.5%.

By 2014, the strategy for the other MANE-VU states (the outer zone states) is to reduce the sulfur content of distillate oil to 0.05%.

By 2016 the inner zone states plan to further reduce the sulfur content of distillate oil to 15 ppm.

By 2018 the outer zone states plan to
- Further reduce the sulfur content of distillate oil to 15 ppm (depending on supply and availability),
- Reduce the sulfur content of #4 residual oil to 0.25 to 0.50%, and
- Reduce the sulfur content of #6 residual oil to no greater than 0.5% sulfur by weight.

It is estimated that these reductions – when fully applied within the MANE-VU region – will result in a 35% reduction of MANE-VU’s projected 2018 non-EGU SO₂ emissions.

3. Reducing SO₂ from key electric generating units (EGUs)

Through air quality modeling, MANE-VU identified 167 EGU emission sources within and outside the MANE-VU region as contributing to substantial visibility degradation at Northeast Class I sites. (See Figure 4, p.10.) MANE-VU members agreed to pursue a 90% or greater reduction in SO₂ emissions from 2002 levels from each of these EGU stacks in the MANE-VU region, or to make equivalent reductions in emissions from other sources.

4. Continuing to seek additional reductions

MANE-VU states committed to continue evaluating other control measures, including energy efficiency, alternative clean fuels, new source performance standards for wood combustion, and additional measures to reduce SO₂ and NOₓ emissions from all coal-burning facilities by 2018.
Because of the importance of emissions from sources outside the MANE-VU region, MANE-VU also asked states in the Midwest and Southeast to pursue the following measures, which were considered comparable to those being implemented within the MANE-VU region:

- Timely implementation of BART.
- A 90% reduction relative to 2002 SO₂ emission levels from key EGU stacks (Figure 4) or equivalent reductions by region in lieu of reductions at these specific facilities.
- A 28% reduction in SO₂ emissions from non-EGU sources such as boilers and sources burning heating oil.¹
- Continued evaluation of other measures.

¹ Based on 2002 emissions, a 28% reduction of SO₂ emissions would amount to 131,600 tons/year in the Midwest and 308,000 tons/year in the Southeast. MANE-VU estimated that several emission reduction strategies would be needed to reach these levels, such as: reducing emissions from coal-fired ICI boilers by 60%, reducing emissions from oil-fired ICI boilers by 75%, and reducing emissions from other ICI Boilers by 50%. In addition to those strategies, achieving a 28% reduction in the VISTAS region would also require reducing emissions from other small oil combustion sources by 75%. This set of reductions is illustrative. Other options may also achieve the requested 28% overall reduction.
Request for National Rules
EPA’s 2005 Clean Air Interstate Rule (CAIR) was designed to reduce emissions from EGUs and was an integral part of MANE-VU’s projected future visibility improvements. In 2010, EPA proposed a Transport Rule to replace CAIR, which had been remanded to EPA for significant revision after a court decision. The final rule, renamed the Cross State Air Pollution Rule, was issued in July 2011 (Sidebar).

Analysis indicates that tighter emissions controls on EGUs would be effective in improving visibility in the region at a reasonable cost. Therefore, in 2007 MANE-VU called upon EPA to work with the eastern Regional Planning Organizations to develop a proposal for tightening the Clean Air Interstate Rule to achieve an additional 18% reduction in SO2 emissions by no later than 2018.

The MANE-VU member states continue to encourage EPA to ensure needed EGU emission reductions will take place. EPA has indicated it will propose further controls after adoption of revisions of the National Ambient Air Quality Standard for ozone.

Benefits of the Long-Term Strategy
Technical analyses demonstrate that MANE-VU’s expected plan for emission reductions, when combined with those of other states and tribes, is sufficient to achieve reasonable progress in improving visibility in Class I areas by 2018. NESCAUM estimated significant public health benefits also would result from implementing MANE-VU’s long term strategy. The program to reduce SO2 emissions at key EGUs would provide the greatest benefits, with $65 billion in health benefits. The low sulfur fuel strategy could achieve another $3.7 billion in health benefits. The analysis suggested other BART controls could lead to another $1.4 billion of health benefits.

The next four parts of this report describe baseline (2000-2004) and natural visibility conditions (Part 4), the improvements needed to achieve Clean Air Act targets and the region’s goals for progress in the next 10 years (Part 5), and progress in the first five years (2005-2009) (Part 6).

For more information:

Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress, adopted June 20, 2007

Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) concerning a Request for a Course of Action by the U.S. Environmental Protection Agency (EPA) toward Assuring Reasonable Progress, adopted June 20, 2007

Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) concerning a Request for a Course of Action by States outside

EPA’s Cross State Air Pollution Rule (CSAPR)

CSAPR establishes a process for determining each upwind state’s responsibility to protect downwind air quality. EPA expects to re-apply this process after adoption of revisions of the National Ambient Air Quality Standard for ozone and particulate matter. (www.epa.gov/airquality/transpor t/index.html)
MANE-VU toward Assuring Reasonable Progress, adopted June 20, 2007

Contributions to Regional Haze in the Northeast and Mid-Atlantic States, NESCAUM, August 2006

Resolution of the Commissioners of States with Mandatory Class I Federal Areas within MANE-VU Regarding Principles for Implementing the Regional Haze Rule, June 2007.


MANE-VU Modeling for Reasonable Progress Goals, NESCAUM, February 7, 2008
4. The Foundation: Defining Natural Visibility and Measuring Air Quality

To complete the transformation from existing, often polluted views to clearer and cleaner ones, states first considered what visibility levels should be and what current pollution levels are. These are called natural visibility conditions and baseline visibility conditions.

Natural Visibility in the MANE-VU Region
The visibility conditions that would exist in the absence of human-caused pollution are referred to as natural visibility conditions. These conditions represent the ultimate goal of the regional haze program.

Visibility varies naturally due to windblown dust, wildfires, volcanic activity, and emissions from vegetation (biogenic emissions). Estimates of natural visibility conditions are, therefore, best characterized with long-term (five-year) averages.

Natural haze levels are higher in the eastern United States than in most of the West primarily because average humidity levels are much higher in the East, and humidity affects visibility. There is some haziness in the air even under pristine conditions due to moisture, gases, and particles in the air. Natural visual range in the eastern United States is estimated to be between 60 and 80 miles.

Under natural conditions, sulfur compounds are responsible for only 10% of the visibility impairment in the eastern United States (Figure 5). Currently, sulfur compounds cause 60 to 90% of the visibility gradation on the worst days for regional haze.

Figure 5. Components of Natural Haze in the Eastern United States

Measuring Air Quality—The IMPROVE Monitoring Network
Since the mid-1980s, visibility has been measured at Class I areas throughout the U.S. under a cooperative effort known as the Interagency Monitoring of
Protected Visual Environments (IMPROVE). In and near Class I areas the IMPROVE monitoring network collects information on pollutants such as sulfates, nitrates, and organic carbon. The IMPROVE program scientifically documents the visual air quality of wilderness areas and national parks.

EPA’s regional haze rule requires each state containing a Class I area to measure and report visibility at the Class I area. These measurements are key to assessing current levels of visibility and measuring progress in improving visibility. State participation in the IMPROVE program meets this monitoring requirement and provides useful data on the concentrations of particles that impair visibility. The small particles that commonly cause hazy conditions in the East are primarily composed of ammoniated sulfate and nitrate compounds, organic matter, elemental carbon (soot), crustal material (such as soil dust), and sea salt. Based on particle concentration data collected by IMPROVE monitors, scientists calculate light extinction and determine visibility in deciviews (Sidebar).

Baseline Visibility in the MANE-VU Region

Visibility varies daily and from season to season and year to year. To account for variability, EPA’s regional haze rule specifies that the baseline visibility for each protected area must be determined using a five-year average based on monitoring data from 2000 through 2004. To get a general picture of visibility conditions at a Class I area during a year, scientists consider the average visibility on the 20% of days with the best visibility and the average visibility on the 20% of days with the worst visibility.

MANE-VU calculated the average of the 20% worst days and the average of the 20% best days for all MANE-VU Class I areas for the five years from 2000 to 2004 to determine the region’s baseline conditions. Table 1 presents both baseline visibility and estimated natural visibility for each of MANE-VU’s Class I areas as well as the difference between the baseline and natural conditions.

The baseline visibility shown in Table 1 is a five-year average for 2000-2004. Natural conditions are estimated, and the difference between the two gives an indication of how much visibility would have to improve in order to achieve the national goal of natural conditions. In terms of deciviews, more progress is needed on the worst visibility days: the 20% best days are closer to natural conditions, though progress is needed on those days as well.

Part 5 further describes the difference between baseline and natural conditions and the progress needed to reach natural conditions by 2064, the goal established in EPA’s regional haze rule.
### Table 1. Baseline Visibility and Natural Conditions on the 20% Worst and 20% Best Visibility Days for MANE-VU Class I Areas\(^2\)

<table>
<thead>
<tr>
<th>Class I Area</th>
<th>2000-2004 Baseline (dv)</th>
<th>Natural Conditions (dv)</th>
<th>Difference (dv)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Worst 20%</td>
<td>Best 20%</td>
<td>Worst 20%</td>
</tr>
<tr>
<td>Acadia National Park</td>
<td>22.89</td>
<td>8.77</td>
<td>12.43</td>
</tr>
<tr>
<td>Moosehorn Wilderness</td>
<td>21.72</td>
<td>9.15</td>
<td>12.01</td>
</tr>
<tr>
<td>Roosevelt/Campobello International Park</td>
<td>21.72</td>
<td>9.15</td>
<td>12.01</td>
</tr>
<tr>
<td>Great Gulf Wilderness</td>
<td>22.82</td>
<td>7.66</td>
<td>11.99</td>
</tr>
<tr>
<td>Presidential Range/Dry River Wilderness</td>
<td>22.82</td>
<td>7.66</td>
<td>11.99</td>
</tr>
<tr>
<td>Lye Brook Wilderness</td>
<td>24.45</td>
<td>6.36</td>
<td>11.73</td>
</tr>
<tr>
<td>Brigantine Wilderness</td>
<td>29.01</td>
<td>14.33</td>
<td>12.24</td>
</tr>
</tbody>
</table>

For more information:

*Baseline and Natural Background Visibility Conditions, NESCAUM, December 2006*

*Contributions to Regional Haze in the Northeast and Mid-Atlantic United States, NESCAUM, August 2006*

*2018 Visibility Projections, NESCAUM, May 2008*

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\(^2\) Source: VIEWS (http://vista.cira.colostate.edu/views/), prepared on 05/12/08. Both natural conditions and baseline visibility for the 5-year period from 2000 through 2004 were calculated in conformance with the alternative method approved by the IMPROVE Steering Committee.

#### Monitoring Requirement

Each state that is home to a Class I area must include in its SIP a strategy for measuring, characterizing, and reporting visibility impairment representative of the Class I area. This requirement may be met through the IMPROVE program.

(40 CFR51.308(d)(4))
5. Defining the Glide Path to Improved Visibility – Setting Reasonable Progress Goals

Uniform Rate of Progress – A Benchmark, Not a Requirement

The overall goal of the regional haze program is to improve visibility from what it is today to what it should be under natural conditions. EPA’s regional haze regulations establish a goal of achieving natural visibility conditions by the year 2064 with equal improvements in visibility each year, measured in deciviews, that would result in a “uniform rate of progress” in visibility improvement.

To develop a uniform rate of progress, we start with baseline visibility conditions on the 20% worst visibility days from 2000 to 2004 and then draw a line from this five-year average, starting in 2002, to estimated natural background visibility conditions in 2064. This determines the uniform rate of progress in visibility improvement that is needed on the 20% worst days. This is shown in Figures 6 and 7 for the Acadia and Brigantine Class I areas. The uniform progress line is also called the “glide path.”

The glide path shows uniform annual progress in visibility improvement from 2002 to 2064.

The glide path is a tool for measuring progress, not a requirement.

States with Class I areas must consider the uniform rate of improvement in visibility and determine whether air quality improvements can reasonably be achieved to attain that rate of improvement during the period covered by the implementation plan (generally 10 years).

The glide path is a benchmark to aid in developing reasonable progress goals.

Visibility varies from year to year due to changes in emissions and weather patterns. As a result, scientists recommend using a five-year average to assess visibility progress.

The uniform rate of progress glide path is a tool for measuring progress, not a requirement. States with Class I areas must consider the uniform rate of improvement in visibility and determine whether air quality improvements can reasonably be achieved to attain that rate of improvement during the period covered by the implementation plan (generally 10 years). The glide path is a benchmark to aid in developing reasonable progress goals.

MANE-VU compared the baseline visibility conditions to natural visibility conditions in each MANE-VU Class I area and determined the uniform rate of visibility improvement (in deciviews) that would be needed each year in order to attain natural visibility conditions by 2064. The uniform rate of improvement for various planning milestones is shown in Table 2.
Figure 7. Uniform Progress in Improving Visibility at Brigantine

Table 2. Uniform Rate of Progress: Deciview Improvement Benchmarks

<table>
<thead>
<tr>
<th>Class I Area</th>
<th>Total Deciview Improvement Needed by 2064</th>
<th>Uniform Rate of Improvement Annually</th>
<th>Benchmark Deciview Improvement by 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acadia National Park</td>
<td>10.5</td>
<td>0.174</td>
<td>2.4</td>
</tr>
<tr>
<td>Roosevelt/Campobello International Park</td>
<td>9.7</td>
<td>0.162</td>
<td>2.3</td>
</tr>
<tr>
<td>Moosehorn Wilderness</td>
<td>9.7</td>
<td>0.162</td>
<td>2.3</td>
</tr>
<tr>
<td>Presidential Range/Dry River Wilderness</td>
<td>10.8</td>
<td>0.180</td>
<td>2.5</td>
</tr>
<tr>
<td>Great Gulf Wilderness</td>
<td>10.8</td>
<td>0.180</td>
<td>2.5</td>
</tr>
<tr>
<td>Lye Brook Wilderness</td>
<td>12.8</td>
<td>0.212</td>
<td>3.0</td>
</tr>
<tr>
<td>Brigantine Wilderness</td>
<td>16.8</td>
<td>0.280</td>
<td>3.9</td>
</tr>
</tbody>
</table>
Defining Reasonable Progress Goals – Based on Reasonable Controls and Consultation

How much progress can we reasonably achieve in the next ten years? The amount of visibility improvement we can reasonably expect is determined by the emissions reductions that can reasonably be implemented.

Before MANE-VU Class I states set reasonable progress goals, MANE-VU states and tribes worked together to identify reasonable pollution control measures and assess the resulting visibility improvements. Next, MANE-VU states consulted with other states whose emissions also contributed to regional haze in the MANE-VU region. Based on modeling analysis to quantify the visibility improvement due to reasonable measures, states with Class I areas set goals for how much visibility improvement is reasonable to expect by 2018. These are called reasonable progress goals.

The reasonable progress goals must provide improvement in visibility for the most polluted days and ensure that visibility does not get worse on the clearest days.

States with Class I areas consulted with other states that contribute to poor visibility and considered the following four factors in assessing whether control measures and visibility improvements were reasonable:

- Costs of compliance with the control measures,
- Time necessary for compliance with the control measures,
- Energy and non-air quality environmental impacts of the measures, and
- The remaining useful life of any existing source subject to the control measures.

The goals approved by the MANE-VU Class I states are listed in Table 3. These goals were set after consultation with MANE-VU members and other states whose emissions affected visibility at the MANE-VU Class I areas. The goals were based on estimates of the effectiveness and cost of the MANE-VU Long-Term Strategy described in Part 3, above, including BART controls, other controls in the MANE-VU region, and emissions controls outside the MANE-VU region.

As can be seen by comparing Table 3 with Table 2, the goals for the worst visibility days that were chosen by MANE-VU states will achieve at least as much improvement in visibility as the uniform rate of progress.

As shown in Table 4, the goals established by MANE-VU states for the 20% best days call for no degradation in visibility and would achieve slight improvements in most areas. The largest improvement would be at the Brigantine Wilderness Area. The 2018 goals for the 20% best and worst days at Acadia National Park and Brigantine Wilderness are shown as asterisks on Figures 6 and 7, above.
Table 3. Proposed Reasonable Progress Goals—20% Worst Days

<table>
<thead>
<tr>
<th>Class I Area</th>
<th>2000-2004 Baseline Visibility 20% Worst Days (deciviews)</th>
<th>Improvement Predicted by 2018 (deciviews)</th>
<th>2018 Reasonable Progress Goals 20% Worst Days (deciviews)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acadia National Park</td>
<td>22.9</td>
<td>-3.5</td>
<td>19.4</td>
</tr>
<tr>
<td>Roosevelt/Campobello International Park</td>
<td>21.7</td>
<td>-2.7</td>
<td>19.0</td>
</tr>
<tr>
<td>Moosehorn Wilderness</td>
<td>21.7</td>
<td>-2.7</td>
<td>19.0</td>
</tr>
<tr>
<td>Presidential Range/Dry River Wilderness</td>
<td>22.8</td>
<td>-2.7</td>
<td>19.1</td>
</tr>
<tr>
<td>Great Gulf Wilderness</td>
<td>22.8</td>
<td>-2.7</td>
<td>19.1</td>
</tr>
<tr>
<td>Lye Brook Wilderness</td>
<td>24.5</td>
<td>-3.6</td>
<td>20.9</td>
</tr>
<tr>
<td>Brigantine Wilderness</td>
<td>29.0</td>
<td>-3.9</td>
<td>25.1</td>
</tr>
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</table>

Table 4. Proposed Reasonable Progress Goals—20% Best Days

<table>
<thead>
<tr>
<th>Class I Area</th>
<th>2000-2004 Baseline Visibility 20% Best Days (deciviews)</th>
<th>Improvement Predicted by 2018 (deciviews)</th>
<th>2018 Reasonable Progress Goals 20% Best Days (deciviews)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acadia National Park</td>
<td>8.8</td>
<td>-0.5</td>
<td>8.3</td>
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<tr>
<td>Roosevelt/Campobello International Park</td>
<td>9.2</td>
<td>-0.6</td>
<td>8.6</td>
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<tr>
<td>Moosehorn Wilderness</td>
<td>9.2</td>
<td>-0.6</td>
<td>8.6</td>
</tr>
<tr>
<td>Presidential Range/Dry River Wilderness</td>
<td>7.7</td>
<td>-0.5</td>
<td>7.2</td>
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<tr>
<td>Great Gulf Wilderness</td>
<td>7.7</td>
<td>-0.5</td>
<td>7.2</td>
</tr>
<tr>
<td>Lye Brook Wilderness</td>
<td>6.4</td>
<td>-0.9</td>
<td>5.5</td>
</tr>
<tr>
<td>Brigantine Wilderness</td>
<td>14.3</td>
<td>-2.1</td>
<td>12.2</td>
</tr>
</tbody>
</table>
For more information:

*Baseline and Natural Background Visibility Conditions*, NESCAUM, December 2006

*Contributions to Regional Haze in the Northeast and Mid-Atlantic United States*, NESCAUM, August 2006

*Assessment of Reasonable Progress for Regional haze in MANE-VU Class I Areas*, MACTEC for MARAMA, July 2007

*2018 Visibility Projections*, NESCAUM, May 2008
6. **Tracking Progress Through 2009**

The recently released IMPROVE Report V: *Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States*, includes estimates of five-year average reconstructed light extinction (the regional haze tracking metric) at IMPROVE sites for the baseline 2000-2004 period as well as for the most recently available 2005-2009 period. These five year averages include total light extinction as well as the extinction contributed by separate pollutant species for the haziest 20% of days and for the clearest 20% of days for each of these 5-year periods.

All MANE-VU Class I Area IMPROVE sites show improvements in visibility for the most recent 2005-2009 period compared to the 2000-2004 baseline period. These improvements occur for both the haziest 20% days (which are required to get gradually cleaner over time) as well as for the cleanest 20% days (which are required to get no worse over time). Improvements in total light extinction on both the haziest and the cleanest days result from reductions in light extinction from all four of the major visibility-impairing pollutant species: sulfates, nitrates, particulate organic matter, and elemental carbon.

Results are summarized below. For more details, see Chapter 9 and Appendix G of the IMPROVE Report V at: http://vista.cira.colostate.edu/IMPROVE/Publications/Reports/2011/2011.htm

**Figure 8. Visibility Improvements on Haziest 20% Days in MANU-VU Class I Areas: 2000-04 to 2005-09**
Figure 9. Visibility Improvements on Clearest 20% Days in MANE-VU Class I Areas: 2000-04 to 2005-09

Table 5. Visibility Improvements on Haziest 20% Days in MANU-VU Class I Areas: 2000-04 to 2005-09

<table>
<thead>
<tr>
<th>Hazeiest 20%</th>
<th>Brigantine</th>
<th>Lye Brook</th>
<th>Great Gulf</th>
<th>Acadia</th>
<th>Moosehorn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate Bext</td>
<td>127.1</td>
<td>107.4</td>
<td>87.3</td>
<td>79.0</td>
<td>76.6</td>
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<td>Nitrate Bext</td>
<td>15.7</td>
<td>12.2</td>
<td>9.1</td>
<td>5.6</td>
<td>3.0</td>
</tr>
<tr>
<td>POM Bext</td>
<td>24.2</td>
<td>14.9</td>
<td>15.3</td>
<td>10.8</td>
<td>14.4</td>
</tr>
<tr>
<td>EC Bext</td>
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<td>6.1</td>
<td>4.8</td>
<td>4.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Soil Bext</td>
<td>1.0</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Coarse Bext</td>
<td>5.4</td>
<td>7.3</td>
<td>1.8</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Sea Salt Bext</td>
<td>0.4</td>
<td>1.2</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Total PM Bext</td>
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<td>149.8</td>
<td>119.0</td>
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<td>Deciview (dv)</td>
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<td>27.3</td>
<td>24.4</td>
<td>23.0</td>
<td>22.8</td>
</tr>
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Table 6. Visibility Improvements on Clearest 20% Days in MANE-VU Class I Areas: 2000-04 to 2005-09

<table>
<thead>
<tr>
<th>Clearest 20%</th>
<th>Brigantine</th>
<th>Lye Brook</th>
<th>Great Gulf</th>
<th>Acadia</th>
<th>Moosehorn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate Bext</td>
<td>14.8</td>
<td>13.5</td>
<td>4.4</td>
<td>3.4</td>
<td>5.8</td>
</tr>
<tr>
<td>Nitrate Bext</td>
<td>3.9</td>
<td>3.6</td>
<td>1.2</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>POM Bext</td>
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<td>3.6</td>
<td>1.3</td>
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</tr>
<tr>
<td>EC Bext</td>
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<td>1.9</td>
<td>0.6</td>
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</tr>
<tr>
<td>Soil Bext</td>
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<td>0.1</td>
<td>0.1</td>
</tr>
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<td>0.5</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Sea Salt Bext</td>
<td>1.4</td>
<td>2.5</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Total PM Bext</td>
<td>30.4</td>
<td>28.6</td>
<td>8.1</td>
<td>6.1</td>
<td>10.8</td>
</tr>
<tr>
<td>Deciview (dv)</td>
<td>14.3</td>
<td>13.9</td>
<td>6.4</td>
<td>5.2</td>
<td>7.7</td>
</tr>
</tbody>
</table>
7. **MANE-VU Emissions of Pollutants Impairing Visibility**

Estimates of emissions from sources of air pollution help us understand the causes of regional haze. For regional haze planning, 2002 was chosen as the baseline emissions inventory year. To assess progress, future emissions were projected for the year 2018. The Mid-Atlantic Regional Air Management Association (MARAMA) assisted MANE-VU states and tribes in compiling and analyzing regional emissions data for 2002 and 2018.

**Pollutants Contributing to Regional Haze**

Activities contribute to haze pollution directly through emissions of fine particles or indirectly through emissions of pollutants that combine in the air to form particles. Emissions of SO₂, NOₓ, and ammonia contribute to the formation of sulfate and nitrate particles. Emissions of VOCs contribute to the formation of organic carbon particles. Emissions of fine and coarse particles contribute to elemental carbon concentrations as well as general dust or soil. Sea salt aerosol particles also affect visibility, as does water vapor. Some particles are formed in the atmosphere in chemical reactions among gaseous pollutants that occur downwind of emission sources.

**Regional Emissions**

Emissions come from both anthropogenic (human-made) and biogenic (natural) sources. The emissions inventory divides sources into five sectors: point sources, area sources, onroad sources, nonroad sources and biogenic sources. Table 5 summarizes regional emissions for 2002 and Table 6 summarizes projections for 2018.

**Focus on Sulfur Dioxide**

Sulfate particles commonly account for more than 50% of particle-related light extinction at northeastern Class I areas on the clearest days and for as much as or more than 80% on the haziest days. (See Figure 8, Section 6.)

Sulfate is formed in the atmosphere as a result of emissions of sulfur dioxide (SO₂). Sulfur dioxide gas interacts with ammonia and other pollutants in the atmosphere to form ammonium sulfate particles.

Because of the dominant role of sulfate in the formation of haze in the Mid-Atlantic/Northeast region, MANE-VU determined that the most effective initial strategy to improve visibility would be to reduce emissions of SO₂.

As shown in Table 7 and Figure 10, point sources dominate SO₂ emissions. Smaller stationary combustion sources called “area sources” (primarily commercial and residential heating, and smaller industrial facilities) also are an important source of SO₂ emissions in the MANE-VU states.

In contrast, on-road and non-road mobile sources make only a relatively small contribution to overall SO₂ emissions in the region. Area sources dominated emissions of PM and ammonia in 2002, on-road mobile sources emitted the most NOₓ, and biogenic sources were the source of most VOC emissions in the region (Table 7).

---

**Emissions Inventory Requirement**

EPA requires each state to compile a statewide inventory of emissions of pollutants reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area.

(40 CFR 51.308(d)(4)(v))

MANE-VU states and tribes worked together to develop a regional emissions inventory to promote consistency and use of the best available methods.

The pollutants that affect fine particle formation, and thus contribute to regional haze, are sulfur dioxide (SO₂), nitrogen oxides (NOₓ), volatile organic compounds (VOC), ammonia (NH₃), and direct emissions of fine particles (PM₂.₅) and coarse particles (PM₁₀). Regional modeling inventories also include emissions of carbon monoxide (CO).
Table 7. MANE-VU 2002 Emissions

<table>
<thead>
<tr>
<th>Source</th>
<th>SO₂ (tons/year)</th>
<th>NOₓ (tons/year)</th>
<th>VOC (tons/year)</th>
<th>PM₂.₅ (tons/year)</th>
<th>PM₁₀ (tons/year)</th>
<th>NH₃ (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point</td>
<td>1,908,000</td>
<td>674,000</td>
<td>97,000</td>
<td>55,000</td>
<td>89,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Area</td>
<td>316,000</td>
<td>262,000</td>
<td>1,528,000</td>
<td>333,000</td>
<td>1,455,000</td>
<td>250,000</td>
</tr>
<tr>
<td>On-Road Mobile</td>
<td>40,000</td>
<td>1,306,000</td>
<td>789,000</td>
<td>22,000</td>
<td>32,000</td>
<td>53,000</td>
</tr>
<tr>
<td>Non-Road Mobile</td>
<td>57,000</td>
<td>432,000</td>
<td>573,000</td>
<td>30,000</td>
<td>40,000</td>
<td>300</td>
</tr>
<tr>
<td>Biogenics</td>
<td>-</td>
<td>28,000</td>
<td>2,575,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2,321,000</td>
<td>2,704,000</td>
<td>5,562,000</td>
<td>440,000</td>
<td>1,616,000</td>
<td>309,000</td>
</tr>
</tbody>
</table>

Sources: MARAMA Version 3 inventory and Pechan (2005)

Importance of Emissions from EGUs
A variety of combustion sources make up the point source sector. The most important point sources involve combustion for generating electricity, industrial energy, and heat. Figure 8 shows that electric generating units emitted about 70% of SO₂ emissions in the MANE-VU region in 2002. Therefore, EGUs are a primary focus of the MANE-VU long-term strategy for reducing regional haze.

Figure 10. MANE-VU 2002 Emissions by Sector

Importance of Residual Oil Burning
Large combustion sources in the MANE-VU region are required to report hourly SO₂ or NOₓ emissions to EPA if they are subject to the Acid Rain Control Program or the NOₓ Budget Trading Program. This data provides further insight into the nature of sources causing regional haze.

MANE-VU identified the importance of EGUs and other sources burning residual oil on the days with the highest NOₓ emissions. Figure 9 shows
daily emissions of NOx in New England in order from lowest to highest emissions per day and identifies the fuel burned. Emissions from sources burning coal form a significant baseline of emissions on all days. Emissions from sources burning residual oil show a marked increase on days with the highest emissions. Because residual oil combustion also emits SO2, this information indicated the importance of residual oil combustion and supported the inclusion of residual oil burning as a focus of the MANE-VU long-term strategy for improving visibility.

**Figure 11. NOx Emissions from Power Plants and Other Large Sources in New England in 2007, by Type of Fuel Burned**

Source: *Analysis of 2007 Emissions from Power Plants and Other Large Combustion Sources in the Mid-Atlantic and Northeastern US*, February 2011, MARAMA

**Emissions Expected to Decrease**

In 2002 businesses, homes, cars, fires, and other sources emitted more than two million tons of SO2 and more than five million tons of VOCs. By 2018, improved technology, cleaner fuels, and emission controls are predicted to reduce SO2 emission from smoke stacks (point sources) by almost 70% and from mobile equipment other than cars and trucks by over 80%. Emissions of many pollutants from cars and trucks also will be reduced substantially due to tighter federal standards for fuels and the increased use of newer, cleaner vehicles. Table 8 summarizes predicted 2018 emissions from MANE-VU sources.
Table 8. Predicted MANE-VU 2018 Emissions

<table>
<thead>
<tr>
<th></th>
<th>$SO_2$ (tons/year)</th>
<th>$NO_x$ (tons/year)</th>
<th>VOC (tons/year)</th>
<th>$PM_{2.5}$ (tons/year)</th>
<th>$PM_{10}$ (tons/year)</th>
<th>NH$_3$ (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point</td>
<td>591,000</td>
<td>413,000</td>
<td>115,000</td>
<td>107,000</td>
<td>116,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Area</td>
<td>305,000</td>
<td>285,000</td>
<td>1,388,000</td>
<td>345,000</td>
<td>1,614,000</td>
<td>342,000</td>
</tr>
<tr>
<td>On-Road Mobile</td>
<td>9,000</td>
<td>304,000</td>
<td>270,000</td>
<td>9,000</td>
<td>10,000</td>
<td>66,000</td>
</tr>
<tr>
<td>Non-Road Mobile</td>
<td>9,000</td>
<td>271,000</td>
<td>380,000</td>
<td>24,000</td>
<td>27,000</td>
<td>400</td>
</tr>
<tr>
<td>Biogenics</td>
<td>-</td>
<td>28,000</td>
<td>2,575,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>914,000</td>
<td>1,301,000</td>
<td>4,728,000</td>
<td>485,000</td>
<td>1,767,000</td>
<td>420,000</td>
</tr>
</tbody>
</table>

Sources: MARAMA version 3 inventory and MACTEC (2007), Alpine (2008)

Figure 12 compares 2002 and 2018 emissions of $SO_2$ from each MANE-VU state. The states with the largest emissions in 2002—Pennsylvania, New York, Maryland, and Massachusetts—are projected to reduce emissions significantly by 2018. This will result in improved visibility at downwind Class I areas.

Figure 12. MANE-VU 2002 and Predicted 2018 $SO_2$ Emissions
For more information:

*Contributions to Regional Haze in the Northeast and Mid-Atlantic United States*, NESCAUM, August 2006.

MANE-VU 2002 Emissions Inventory, Version 3:
http://www.marama.org/visibility/Inventory%20Summary/2002EmissionsInventory.htm

MARAMA.MANE-VU 2018 Emissions Inventory, Version 3:


8. Assessing Contributions to Regional Haze

To understand the emission reductions that would be necessary to make progress in improving visibility, MANE-VU employed a number of analytical methods to identify emission sources contributing to visibility impairment in the baseline period (2000-2004).

The Northeast States for Coordinated Air Use Management (NESCAUM) conducted and coordinated contribution assessment work performed for MANE-VU. NESCAUM’s Contribution Assessment report documents which pollutants, states, and sources contribute to visibility impairment at MANE-VU Class I areas. The report also analyzes which Class I areas within and outside the MANE-VU region were affected by emissions from MANE-VU states and tribal areas.

Particles and Their Effect on Visibility
Regional haze is caused by airborne particles. On the haziest days, sulfate is the most important single constituent of haze-forming fine particle pollution and the principle cause of visibility impairment across the region.

Summertime visibility is driven almost exclusively by the presence or absence of regional sulfate, whereas wintertime visibility depends on a combination of regional and local influences coupled with local meteorological conditions (inversions) that can lead to the concentrated build-up of emissions from local sources. Organic carbon (OC) is typically the next most important contributor to overall fine particle mass throughout the region.

Techniques Used to Assess Contributions to Regional Haze
MANE-VU used a suite of technical analyses to identify which types of sources and which source regions were contributing to visibility impairment in the baseline period (2002). Using a number of analysis techniques allowed a weight-of-evidence approach, and increased confidence in the results. Because of the dominant role of sulfate, analysis concentrated on identifying sources of sulfate particles.

Techniques used included analysis of wind trajectories, the location and magnitude of emission sources, chemical analysis of particles at key locations, and air quality modeling using various meteorological data. The results of these different techniques were consistent, providing greater confidence in the conclusions.

Regional Contribution to Visibility Impairment in and Near MANE-VU
How much of the region’s haze problem is due to emissions from within the region itself? Notwithstanding small differences among assessment techniques, estimates obtained from averaging over five quantitative assessment techniques indicate that:

- MANE-VU states account for about 25-30% of the sulfate in the Acadia, Brigantine, and Lye Brook Class I areas.
- The Midwest RPO (MWRPO) and Visibility Improvement State and Tribal Association of the Southeast (VISTAS) states each account
for about 15% of the total sulfate contribution at Acadia and about 25% each at Brigantine and Lye Brook.

- The Central States Regional Air Partnership (CENRAP) states, Canada, and an “out of domain” contribution add the remainder.

Figure 13 shows a comparison of the percent contribution due to each RPO, Canada, and other areas outside the domain using the five different techniques. These five were the REMSAD model, two applications of the CALPUFF model (one using meteorology processed with the MM5 preprocessor and the other using weather observations from the National Weather Service), emissions divided by distance from the Class I area (E/D), and trajectory analysis used to assess the percent of time emissions are upwind of the Class I area (percent upwind).

Figure 13. Estimated Regional Contributions to Sulfate Concentrations at Class I Areas Using Different Assessment Techniques

Note: Shenandoah National Park is located in Virginia and visibility there is affected by sources in MANE-VU and the Midwest as well as sources in VISTAS.

State Level Contribution Assessment
MANE-VU scientists used three air quality modeling platforms to simulate the annual average impact of individual states’ SO2 emission sources on the sulfate fraction of PM2.5 over the northeastern U.S. The emissions divided by distance technique as well as the percent upwind analysis also enabled a state-level contribution analysis. Results of these analyses are graphed below for four Class I areas, including the Shenandoah National Park in Virginia, a nearby Class I area.
Figure 14. Comparison of Normalized Percent Contribution to Sulfate Levels at (a) Acadia, (b) Lye Brook, (c) Brigantine, and (d) Shenandoah
These results indicate that elevated point sources in Pennsylvania, Ohio, and New York contribute significantly, on an annual basis, to sulfate concentrations at all MANE-VU sites. Northern sites (e.g., Acadia) are more influenced by sources in upper Midwestern states (e.g., Wisconsin and Michigan) whereas southern sites like Brigantine are more influenced by sources in more southerly states such as West Virginia, Maryland, and Virginia.

Shenandoah National Park in Virginia, a VISTAS Class I site, appears to be most strongly influenced by sources in Ohio, Pennsylvania, and West Virginia, followed by other nearby Southeast and Midwest states.
Key Source Categories Affecting MANE-VU Class I Areas
While substantial visibility impairment is common across the region, it is most severe in the southern and western portions of the MANE-VU region that are closest to large power plant sources of sulfur dioxide (SO₂) emissions located in the Ohio and Tennessee River Valleys.

As reported in the Contribution Assessment, MANE-VU researchers summarized model results for receptors within and upwind of the MANE-VU region. Receptor-based models begin with ambient measurement data at one or more receptor locations and work “backward” to identify sources contributing to historical ambient pollutant concentrations at the receptor locations. Receptor models are not usually used to predict effects of future emissions changes, but can be applied to long historical records, providing a long-term indication of past source-receptor relationships and to evaluate the effects of historical emissions changes, thus providing a valuable complement to emission-based models for determining effective future emissions control strategies.

Receptor analysis studies have identified a number of common source categories which have discernable impacts on average PM₂.₅ mass concentrations and visibility impairment at most Northeast monitoring sites. These include:

- **Coal Burning**: (including primary aerosol and secondary aerosol formation): the largest mass-contributing and visibility-impairing source category at most sites, with contributions primarily from utility and industrial sources in western MANE-VU, northern VISTAS and the Midwest RPO planning regions.
- **Motor Vehicles and Secondary Organics**: a moderate to large contributor to average fine particle mass, with discernable influence from both gasoline and diesel vehicles in urban areas. At forested rural sites, biogenic organics are likely a more important contributor.
- **Ammonium Nitrate**: a small to moderate contributor to average fine particle mass, with regional influences at rural sites from upwind agricultural ammonia-emitting areas, and significant local source contributions in urban areas.
- **Wood Smoke**: a small to moderate contributor to average fine particle mass, 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.
- **Oil Burning**: a minor contributor to fine particle mass, but clearly identified at many MANE-VU sites, especially sites within and downwind of the Northeast urban corridor.
- **Sea Salt**: a minor contributor to fine mass, but clearly identified at coastal and near coastal sites. It can have significant visibility impacts at coastal sites like Acadia and Brigantine on the best visibility days.
- **Windblown Dust**: a minor contributor to average fine particle mass, but clearly identified at all sites, with highest short-term impacts often associated with Sahara dust transport.
Location of Coal Burning Sources Influencing Visibility in MANE-VU
Figure 15 was developed using 2000-2003 data from the MANE-VU Class I areas, and shows incremental probabilities for high sulfate. The incremental probability analysis asks, “Where did the air come from if sulfate was high at the receptor?” The colored contour lines are for the indicated individual sites’ probability levels, and the grey shaded areas depict linear averages aggregated for the five MANE-VU Class 1 areas. This analysis provides a qualitative indication of the relative importance of different contributing regions.

Figure 15. Geographic Regions Contributing to Incremental Probability of High Sulfate at Five Sites, 1999-2002

Sources of Wood Smoke
Fire from land management activities in MANE-VU Class I areas was not a major contributor to regional haze. The majority of emissions from fires in the region were from home wood burning such as fire places and debris disposal. Wildfires in Canada and the Southeastern U.S. do affect air quality in MANE-VU Class I areas.

Source attribution studies show that in MANE-VU wood-burning emissions may be a larger component of the total PM mass in rural areas than in urban areas. In rural areas, wood burning emissions may contribute 5 to 10% of the total PM mass measured at the monitoring site. Wood-burning emissions vary seasonally, with residential wood combustion occurring primarily in the winter months, while managed or prescribed burning activities occur largely in other seasons (e.g., agricultural field-burning activities or prescribed burning of forested areas).
**Oil Burning Sources**

Receptor modeling studies summarized in the Contribution Assessment indicate that oil burning sources affecting the MANE-VU Class I areas are located in a smaller upwind region than coal combustion sources. Figure 16 compares the incremental probability that air is transported from specific areas on days when data indicate oil sources are affecting air quality. The results of multiple independent studies show a clear convergence on the Northeast urban corridor, where the density of residual oil combustion is greatest.

**Figure 16. Incremental Probability of Contribution from Oil Burning Sources at Four Northeast monitoring Locations**

**Importance of Specific Electricity Generating Units**

MANE-VU’s modeling analysis also demonstrated that emissions from specific EGUs were important contributors to visibility impairment in MANE-VU Class I areas in 2002. Figure 17 shows the locations of the 167 EGU stacks that had the largest impacts on MANE-VU visibility in 2002. Since 2002, emissions from many of these sources, located within and outside the MANE-VU region, have declined due to both federal and state pollution control measures. MANE-VU’s analysis indicates that emissions reductions at these sources are particularly important to improving visibility at MANE-VU Class I areas.
Figure 17. EGU Stacks with Greatest Impact on MANE-VU in 2002

For more information:

*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.

*The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description*, NESCAUM, November 2006.

*Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (Contribution Assessment)* NESCAUM, August 2006.


9. Working Together with Other States

Because regional haze is an interstate problem, states must consult with each other as they develop Regional Haze SIPs, as they evaluate the SIP’s effectiveness via the five-year progress reports, and as they revise SIPs at the ten-year milestones.

MANE-VU asked states outside the region to address pollution generated in those states that affect MANE-VU Class I areas. States consulted include: Georgia, Illinois, Indiana, Kentucky, Michigan, North Carolina, Ohio, South Carolina, Tennessee, Virginia, and West Virginia (Figure 18). Vermont also identified at least one source in Wisconsin as a significant contributor to visibility impairment at the Lye Brook Wilderness.

MANE-VU asked states to pursue the adoption and implementation of control strategies similar to those adopted by MANE-VU, as described previously.

MANE-VU chose to consult with these states because emissions from each of these states were estimated to contribute more than 2% of the sulfate at a MANE-VU Class I area in 2002.

Figure 19 shows the modeled percent of sulfate ion impact from specific states for the Class I areas of Acadia, Brigantine, Lye Brook, and Great Gulf. The state with the largest individual sulfate impact at each 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 contributes more than 2% of modeled sulfate ion to that Class I area.

Consultation Requirement

The Regional Haze Rule requires that states with Class I areas consult with those states which may reasonably be anticipated to cause or contribute to visibility impairment in the Class I area when establishing the progress goal for the area. (40 CFR 51.308 (d)(1)(B)(iv))
Figure 19. Modeled Contribution to Sulfate at Four Class I Areas in 2002

Note: Each state listed at and below the arrows shown in Figure 19 contributed more than two percent of modeled 2002 sulfate to the named Class I areas. Figure 18 shows the composite area including all MANE-VU states and any state listed above as contributing more than two percent of modeled 2002 sulfate at any MANE-VU Class I area.
For more information:

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.

The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description, NESCAUM, November 2006.

Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (Contribution Assessment), NESCAUM, August 2006.


MANE-VU Inter-RPO Consultation Briefings, Volumes I and II, OTC, August 2007.

10. **Links to Other Air Pollution Concerns**

**Haze and Particle Pollution**

Haze and visibility impairment are directly linked to particle pollution. Particulate matter (PM) is among the so-called “criteria pollutants” for which EPA has established National Ambient Air Quality Standards (NAAQS) to protect human health. Individual NAAQS exist for particles up to 10 micrometers in diameter (PM10) and for particles up to 2.5 micrometers in diameter (PM2.5). Smaller particles pose particular health risks because they may be inhaled more deeply into the lungs.

Epidemiological evidence points to a number of health risks associated with both long- and short-term fine particle exposure. These risks include increased risk of respiratory and cardiovascular illness (including chronic bronchitis and asthma) and increased risk of premature death.

Reducing emissions of SO2, NOx, VOCs and ammonia helps reduce both particulate air pollution and regional haze.

**Haze and Ozone**

The connection of haze to another prominent criteria pollutant, ozone, is more complicated. Haze and ozone are fundamentally different phenomena: ozone, itself a colorless pollutant, does not directly impair visibility and is formed from a different set of chemical reactions. Thus, it is possible for particle levels, and hence visibility impairment, to be high on days that are relatively free of ground-level ozone pollution. On the other hand, ozone formation involves many of the same precursor pollutants (notably NOx and VOCs) and is enhanced by the same meteorological conditions conducive to the formation of fine particles, including the presence of sunlight and humidity. Consequently, researchers have found that high ozone levels are often associated with hazy air masses in the summertime, and weather forecasters are most likely to issue smog alerts on days described as “hazy, hot, and humid.”

In addition, there is an important, indirect link between ozone and haze. Ozone is an atmospheric oxidant and therefore promotes the formation of secondary particles that create haze – including sulfate, nitrate, and organic aerosols – from precursor emissions of SO2, NOx, and VOCs, respectively.

Reducing emissions of NOx and VOC helps reduce both ozone air pollution and regional haze.

**Haze and Ecosystem Impacts**

To the extent that haze is partially caused by precursor emissions of SO2, NOx, and ammonia, efforts to reduce haze and improve visibility will have an important link to concerns in many eastern states about the ongoing ecosystem impacts of acid deposition and nitrogen saturation/eutrophication. These ecosystem impacts affect critical natural resources in the Northeast and Mid-Atlantic states – impacts that are not confined to Class I areas. SO2 and NOx cause acid rain, which makes rivers, streams, and lakes unsuitable for fish and aquatic life, and erodes buildings, historical monuments, and
paint on cars. NOx and ammonia also contribute to the nutrient enrichment or
eutrophication of bays and estuaries.

Airborne particles of nitrate, which is a fertilizer for plant and algae growth,
are formed downwind of emissions of NOx. When nitrate deposits directly to
a body of water, it leads to excessive nutrient loading, accelerating
eutrophication. Among other effects, this process causes algae blooms, low
oxygen levels, red tides, fish kills, and general ecological degradation.
Degraded ecosystems may no longer be able to support certain fish species
leading to invasion by less desirable species.

Thus, haze precursors pose other important threats to critical natural
resources in the region in addition to their visibility impacts. Regional haze
programs are designed to improve visibility but significant health and
ecological benefits also will occur in the MANE-VU region with improved
air quality.

Benefits of Air Pollution Control Programs
NESCAUM used various models and U.S. census data and population
projections to investigate the public health and monetary benefits of several
pollution control programs under consideration by the OTC and MANE-VU
states. NESCAUM examined four potential control strategies aimed at
reducing regional haze in MANE-VU Class I areas. Two programs include
limitations on the sulfur content of fuel oil. The first phase of the sulfur
limitation leads to health benefits of almost $3.4 billion and the second phase
could lead to an additional $431 million in benefits, bringing the total
benefits to $3.7 billion. The third program is the Best Available Retrofit
Technology (BART) provisions of the Regional Haze Rule. The estimate of
benefits due to BART is based on controls at 14 units likely to be controlled
under BART alone and with no other program that would satisfy the BART
requirement. CMAQ and BenMAP modeling suggest that controls at these
units could lead to $1.4 billion in benefits in the MANE-VU region. The final
strategy investigated is a control program targeting the 167 stacks at EGUs
that have the most significant impacts on MANE-VU Class I areas. The 167
EGU stack control program leads to significant benefits, resulting in $6.5
billion of health benefits. If all these regional haze programs were
implemented, the report estimated a total of $11.7 billion in health benefits to
the MANE-VU region in 2018. While regional haze programs are designed
to improve visibility at Class I areas, significant health benefits also will
occur in the MANE-VU region with improved air quality.

For more information:

Public Health Benefits of Reducing Ground-level Ozone and Fine Particulate
11. Analysis of Potential Control Measures

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) contracted with an engineering 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).

MANE-VU sponsored the preparation of several reports, listed below, to analyze the feasibility, cost, and effectiveness of various specific control measures. As a result of these analyses and consultation with potentially affected states, MANE-VU refined the list of control measures considered in setting reasonable progress goals. Those described in Part 3, above, were selected to form MANE-VU’s long-term strategy for improving visibility.

For more information:

Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (Contribution Assessment), NESCAUM, August 2006.


VISTAS Reasonable Progress Analysis Plan, September 18, 2006.

12. **Engaging Stakeholders: Outreach Efforts**

MANE-VU informed and involved stakeholders in the process of developing strategies to reduce regional haze. MANE-VU has produced newsletters, fact sheets, and resource guides in addition to holding meetings to present findings, approaches, and other information, to regional haze stakeholders. This section documents MANE-VU’s outreach efforts, and the next section lists resource documents.

**Website: www.otcair.org/manevu**

MANE-VU established a website to provide basic information about the organization and serve as a portal for stakeholders to access and comment on draft work products. The website also contains MANE-VU publications, information about regional haze, and other helpful resources. Presentations from meetings and events also are available online.

**Annual Meetings:** The MANE-VU Board held annual public meetings on July 24, 2001; August 5, 2002; July 23, 2003; June 10, 2004; May 5, 2005; May 10, 2006; June 7, 2007, and September 15, 2011. Each meeting included opportunities for stakeholder comments.

**Committee Meetings:** MANE-VU’s Technical Support Committee (TSC) and Communications Committee also held public meetings that provided opportunities for stakeholder interaction.

**Stakeholder Briefings:** Stakeholder briefings were used to educate interested parties about MANE-VU activities. Events provided a useful forum for idea exchange and discussion. Stakeholder briefings were held on July 31, 2003, March 17, 2004, November 15, 2007, April 14, 2008, and December 17, 2008.

**Newsletter:** Launched in early 2005, MANE-VU’s bi-annual newsletter provided snapshots of MANE-VU projects, covered issues of interest to the regional haze community, and announced opportunities to comment on work products. MANE-VU published seven newsletters, available on the MANE-VU website and listed in Appendix A, below. Newsletters were distributed electronically and in limited print quantities.

**Stakeholder Comments:** Opportunities to comment on draft reports were announced to stakeholders on a regular basis. Notices contained a summary of the report, the due date for comments, where to send comments, and a link to the draft document posted online. Once comments were received, they were reviewed by MANE-VU, and many resulted in changes to the draft document.

**Brochure and Fact Sheets:** MANE-VU developed a brochure and several fact sheets to educate stakeholders about the organization and the regional haze planning process. Fact sheets covered regional haze issues, MANE-VU, and the health effects of regional haze.
**Guides:** MANE-VU’s Resource Guide for Journalists provided information about regional haze and why it matters, a directory of contact details for MANE-VU members, MANE-VU partners, other regional planning organizations, and additional resources helpful to journalists and others interested in regional haze. In addition to the media guide, a State Guide was prepared to further encourage communication between MANE-VU members and other interested parties.

**Press Outreach:** Targeted press releases along with fact sheets, brochures, and other visual elements were created for distribution to media outlets. MANE-VU has issued press releases about important regional haze documents, the creation of MANE-VU, and key decisions made by the MANE-VU Board.

**MANE-VU Timelines:** In 2004 and 2005, MANE-VU produced short summaries of work-to-date and plans for upcoming tasks called “State Implementation Plan Timelines.” These documents were distributed at MANE-VU annual meetings.

**Interim Reports:** The MANE-VU 2006 Interim Report and this 2011 Interim Report provided information about MANE-VU’s latest activities, summarized results and information prepared to date, and indicated the scope of future activities and plans. The reports helped build a common understanding, served as a reference, and supported the consultation process.

**Table Top Display:** MANE-VU’s table top display was used at meetings, workshops, and other events. This display explained the MANE-VU course of action to improve visibility, provided a summary of the Regional Haze Rule, and depicted the impact of haze via a hazy vs. clear day example from Brigantine.

**Contact Database:**
MANE-VU places an emphasis on web-based and electronic materials to minimize costs and achieve broad distribution. The foundation of this effort was the MANE-VU Stakeholder Database. This list of groups and individuals includes private sector representatives as well as state agencies, local governments, other regional planning organizations, non-profits, and federal agencies. List members received the MANE-VU newsletter, notices of comment opportunities, and meeting notifications. To ensure the list was effective, it was updated whenever a notice or announcement was distributed.
APPENDIX A: Resource Documents

This Appendix provides an annotated bibliography of MANE-VU actions and reports. Much of the content of this report is taken from these documents.

Links to MANE-VU State Implementation Plans
- Connecticut:
- Delaware:
- District of Columbia:
  Email request to: jessica.daniels@dc.gov
- Maine:
  http://www.maine.gov/dep/air/regulations/recentlyadopted.htm
- Maryland
  See http://www.mdc.state.md.us/programs/air/Pages/index.asp for future posting.
- Massachusetts:
  http://www.mass.gov/dep/air/priorities/sip.htm
- New Hampshire:
- New Jersey:
  http://www.state.nj.us/dep/baqp/2008%20Regional%20Haze/Regional%20Haze.html
- New York:
  http://www.dec.ny.gov/chemical/60257.html
- Pennsylvania:
  http://www.dep.state.pa.us/dep/deputate/airwaste/aq/plans/clean_air_plans.htm
- Rhode Island:
- Vermont:
  http://www.anr.state.vt.us/air/planning/htm/StateImplementationPlan.htm

MANE-VU Statements & Resolutions -- link: www.otcair.org/manevu
- Statement on Controls in MANE-VU, 2007
- Statement on Controls Outside of the MANE-VU Region, 2007
- Statement on National Controls, 2007
- Resolution Regarding Class I States Implementing Regional Haze Rules, 2007
- Statement on Natural Background Calculation, 2004
- Final Interim Principles for Regional Planning, 2001
- Resolution Supporting Creation of a Regional Planning Organization, 2001
Modeling and Analysis

- **The Nature of Fine Particles and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description** – NESCAUM, December 2006, revised August 2010
  Provides a conceptual description of fine particle pollution formation and transport into and within the MANE-VU region.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

  Reports on an analysis of 2004-2008 visibility data from IMPROVE monitors in MANE-VU.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

- **“Semi-continuous aerosol carbon data from the MANE-VU RAIN program: An assessment of data quality and data analysis approaches”** – NESCAUM, February 2010
  Reviews available data and provides recommendations to further develop measurements and analysis of organic carbon.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

  Quantifies the visibility impacts of those measures that were being actively considered by MANE-VU states as a result of the regional haze consultation process.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

- **MANE-VU Modeling for Reasonable Progress Goals** – NESCAUM, February 7, 2008
  Describes results of preliminary air quality modeling to assess impacts of potential measures to improve visibility at Class I areas in and near the MANE-VU region.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

- **Baseline and Natural Background Visibility Conditions** – NESCAUM, December 2006
  Reviews the default and alternative approaches to the calculation of baseline and natural background conditions and presents a discussion of the principle differences between the methods.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

- **Contributions to Regional Haze in the Northeast and Mid-Atlantic States** – NESCAUM, August 2006
  Assesses the regional sulfate contribution to ambient fine particle levels experienced at the MANE-VU Class I areas using various methods, including trajectory modeling, air quality modeling, receptor modeling and data analysis.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

  Presents the initial analysis of early RAIN data to provide an improved understanding of how RAIN fits into a long-term observing program to track and improve our understanding of visibility issues.
  Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

- **Source Apportionment of Air Quality Monitoring Data, Phase 2** – Desert Research Institute, Inc., for MARAMA and LADCO, March 2005
  Uses several techniques to identify source types influencing PM2.5 levels at four IMPROVE monitoring sites: Boundary Waters Canoe Area, Lye Brook Wilderness Area, Shenandoah National Park, and Washington DC.
  Link: http://www.marama.org/publications
• **Source Apportionment of Air Quality Monitoring Data, Phase 1** – Battelle Memorial Institute and Sonoma Technology, Inc., for MARAMA and LADCO, May 2002
Analyze air quality monitoring data from 16 sites in the northeastern quarter of the U.S. using two receptor models (PMF and UNMIX) and data from IMPROVE and CASTNET monitoring sites. At each site the largest portion of the reconstructed light extinction during the 20 percent worst days was due to secondary sulfate.
Link: http://www.marama.org/publications

**Best Available Retrofit Technology**

• **Five-Factor Analysis of BART-Eligible Sources** – NESCAUM, June 1, 2007
Summarizes one approach to satisfy the BART requirements of the Regional Haze Rule for consideration by member states. It also reviews BART-eligible sources in the MANE-VU region and provides an analysis of the general applicability of the five statutory factors that states must consider in determining BART controls for various source categories subject to BART.
Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

• **BART Resource Guide** – NESCAUM, August 2006
Compiles numerous resources helpful to states in making BART determinations.
Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

• **Assessment of Control Technology Options for BART-Eligible Sources** – NESCAUM, March 2005
Provides information on available technology options, control efficiency and typical installation costs for four important BART-eligible source categories in the MANE-VU region.
Link: http://www.nescaum.org/topics/regional-haze/regional-haze-documents

• **A Basis for Control of BART Eligible Sources** – NESCAUM, July 24, 2001
Evaluates the potential applicability of BART to emissions sources affecting Class I areas in the MANE-VU region.
Link: http://www.nescaum.org/documents/a-basis-for-control-of-bart-eligible-sources/

**Control Strategy/State Implementation Plan Development**

• **“Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas: Methodology for Source Selection, Evaluation of Control Options and Four Factor Analysis, ADDENDUM FOR RESIDUAL OIL,”** - OTC and MACTEC, April, 2011
Analyzes the economic and environmental impacts of reducing sulfur in residual oil, with respect to the cost of compliance, time necessary for compliance, energy and non-air impacts, and remaining useful life of the sources. Focuses primarily on reducing the sulfur content of No. 6 residual oil and resents information on reducing the sulfur content of No. 4 residual oil wherever data were available.
Link: http://www.otcair.org/manevu/  Click on Publications and look under 2011.

• **Analysis of 2007 Emissions from Power Plants and Other Large Combustion Sources in the Northeast/Mid-Atlantic Region** – MARAMA, MACTEC, and Alpine Geophysics, February 23, 2011
Documents the significant variability of emissions of SOx and NOx from power plants and other large sources reporting hourly emissions to EPA in 2007. Information is presented graphically and in text.
Link: http://www.marama.org/publications
  Summarizes presentations given at regional meeting and includes recommendations to improve emissions estimates.
  Link: [http://www.marama.org/reports](http://www.marama.org/reports)

- **Draft MANE-VU SIP Template** – MARAMA, April 2008
  Serves as a resource to states as they develop their own SIP submittals. Major sections address the assessment of baseline and natural conditions, monitoring, emissions inventory, best available retrofit technology (BART), reasonable progress goals, and long-term strategies for visibility improvement.

  Examines the public health and monetary benefits of several potential emission control programs under consideration by the Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU) states. In addition, the report examines the benefits of achieving several different levels of the National Ambient Air Quality Standard (NAAQS) for 8-hour average ozone concentrations (NAAQS rollback).

- **Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas** – MACTEC, July 9, 2007
  Analyzes the economic and environmental impacts of potential control scenarios that could be implemented by MANE-VU States to reduce emissions from key source categories and make reasonable progress toward meeting visibility improvement goals.
  Link: [http://www.marama.org/publications](http://www.marama.org/publications)

  Summarizes results of IPM modeling to predict the impact of the CAIR Plus proposal on emissions from the electricity generating sector and costs of controls.
  Link: [http://www.marama.org/publications](http://www.marama.org/publications)

  Estimates the number of RWC units, activity levels, and emission factors for various RWC appliance types, then calculates an emissions inventory by county, state, and entire MANE-VU region, and estimates cost effectiveness by state and MANE-VU region.
  Link: [http://www.marama.org/publications](http://www.marama.org/publications)

  Documents measures in the MANE-VU region to mitigate the impacts of construction activities.

Assesses the impacts of emissions from agricultural, managed, and prescribed fires and concludes it is unlikely they have large impacts on visibility in the MANE-VU region.
Link: http://www.marama.org/visibility/SIP_Planning/index.htm

Emissions Inventory Documentation

  Explains data sources and methods and summarizes results.

  Describes the process of estimating baseline and future emissions from electric generating units and documents data used in various modeling runs.
  Link: http://www.marama.org/publications

  Evaluates available data on condensable emissions from EGUs and recommend emissions factors to be used for future inventories
  Link: http://www.marama.org/publications

- Work Plan Emissions Inventory Development for Regional Air Quality Modeling in the Mid-Atlantic/Northeast States – MACTEC for MARAMA, updated January 2011 (original draft in 2007)
  Describes the work planned in order to develop a regional emission inventory for additional air quality modeling in the Northeast / Mid-Atlantic States.
  Link: http://www.marama.org/publications

  Describes the data sources, methods, and results for forecasting emissions from nonEGU point sources, area sources and non road mobile sources for existing and planned control measures.
  Link: http://www.marama.org/publications

  Explains data sources and methods and summarizes results used in MANE-VU 2002 baseline modeling.

  Explains data sources and methods and summarizes results.
Summarizes the development of a 2002 emissions inventory for the Mid-Atlantic-Northeast Visibility Union (MANE-VU) for residential wood combustion (RWC), based on a survey. (Note that this inventory was later replaced with an updated version.)
Link: http://www.marama.org/publications

Reports improved 2002 emissions estimates for the MANE-VU region based on a survey of both regulatory control and activity for residential municipal solid waste burning, and yard waste burning, including both brush waste and leaf waste.
Link: http://www.marama.org/publications

Describes the work planned in order to develop a regional emission inventory for air quality modeling in the Northeast / Mid-Atlantic States in a five-year work plan.
Link: http://www.marama.org/publications

Describes the development of a work plan to develop an emission inventory for the residential wood combustion and open burning source categories. in the MANE-VU region.
Link: http://www.marama.org/publications

• Assessment of Emissions Inventory Needs for Regional Haze Plans, PES, Inc. for MARAMA, March 2001
Identifies high priority activities needed to improve emissions inventories for regional haze planning.
Link: http://www.marama.org/publications
**MANE-VU Communications and Outreach --link: www.manevu.org**

- **MANE-VU InterRPO Consultation Briefings, Volumes I and II, OTC, August 2007**  
  Posted under Meetings and Events on MANE-VU website at www.otcair.org/mane-vu/meetings.asp

- **MANE-VU Interim Report, 2006**  
  Provides information about MANE-VU accomplishments through 2006 and summarizes information prepared by MANE-VU members as well as staff from the OTC, NESCAUM, and MARAMA.  
  Link: http://www.otcair.org/manevu

- Semi-Annual Newsletter, 2005 – 2008
- Health Effects Fact Sheet, 2005
- About MANE-VU Fact Sheet, 2005
- Regional Haze Fact Sheet, 2005
- About MANE-VU Brochure, 2005
APPENDIX B: Facilities in the MANE-VU Region

Potentially Subject to BART

Appendix A of NESCAUM’s Five Factor Analysis of BART-Eligible Sources provided a list of sources potentially subject to BART. MARAMA and state staff reviewed information in state regional haze SIPs to update the list and prepare this table. For the most up-to-date information, and more details, please refer to the individual states’ SIPs.
 Facilities in the MANE-VU Region Potentially Subject to BART

<table>
<thead>
<tr>
<th>State</th>
<th>Plant</th>
<th>Type</th>
<th>Number of Units</th>
<th>BART Action (Unit in Bold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>Middletown Power LLC (NRG)</td>
<td>EGU</td>
<td>2</td>
<td>Existing CTDEP Regulatory Programs for SO2, NOx and PM reductions achieve a greater visibility improvement than BART.</td>
</tr>
<tr>
<td>CT</td>
<td>Montville Power LLC (NRG)</td>
<td>EGU</td>
<td>1</td>
<td>Existing CTDEP Regulatory Programs for SO2, NOx and PM reductions achieve a greater visibility improvement than BART.</td>
</tr>
<tr>
<td>CT</td>
<td>Norwalk Power LLC (NRG)</td>
<td>EGU</td>
<td>1</td>
<td>Existing CTDEP Regulatory Programs for SO2, NOx and PM reductions achieve a greater visibility improvement than BART.</td>
</tr>
<tr>
<td>CT</td>
<td>PSEG Power CT Bridgeport Harbor Station</td>
<td>EGU</td>
<td>1</td>
<td>Existing CTDEP Regulatory Programs for SO2, NOx and PM reductions achieve a greater visibility improvement than BART.</td>
</tr>
<tr>
<td>CT</td>
<td>PSEG Power CT New Haven Harbor Station</td>
<td>EGU</td>
<td>1</td>
<td>Existing CTDEP Regulatory Programs for SO2, NOx and PM reductions achieve a greater visibility improvement than BART.</td>
</tr>
<tr>
<td>CT</td>
<td>Cascades Boxboard</td>
<td>Fossil Fuel Boiler (&gt;250 MMBtu</td>
<td>1</td>
<td>Existing CTDEP Regulatory Programs for SO2, NOx and PM reductions achieve a greater visibility improvement than BART.</td>
</tr>
<tr>
<td>DC</td>
<td>Benning (PEPCO -15) - PEPCO-Benning Unit 15</td>
<td>EGU</td>
<td>1</td>
<td>Expected to shut down in 2012 - DC's permit conditions on PEPCO-Benning expected to achieve an equivalent or greater improvement than BART.</td>
</tr>
<tr>
<td>DC</td>
<td>Benning (PEPCO -16) - PEPCO-Benning Unit 16</td>
<td>EGU</td>
<td>1</td>
<td>Expected to shut down in 2012 - DC's permit conditions on PEPCO-Benning expected to achieve an equivalent or greater improvement than BART.</td>
</tr>
<tr>
<td>DE</td>
<td>City of Dover -Mckee Run</td>
<td>EGU</td>
<td>1</td>
<td>Unit 3: SO2 and NOx (DE Regulation 1146), PM (Sulfur Content &lt; 0.5%)</td>
</tr>
<tr>
<td>DE</td>
<td>Connectiv Edgmore</td>
<td>EGU</td>
<td>2</td>
<td>Unit 4: SO2 and NOx (DE Regulation 1146), PM (Operation of ESP and Install DSI). Unit 5: SO2 and NOx (DE Regulation 1146) PM (Sulfur Content &lt; 0.5%).</td>
</tr>
<tr>
<td>DE</td>
<td>NRG-Indian River</td>
<td>EGU</td>
<td>1</td>
<td>Unit 3: SO2 and Nox (DE Regulation 1146), PM (Operation of ESP).</td>
</tr>
<tr>
<td>MA</td>
<td>Exxon Mobil Everett</td>
<td>Petroleum Storage</td>
<td>1</td>
<td>No action - VOC source</td>
</tr>
<tr>
<td>MA</td>
<td>Global Petroleum Revere</td>
<td>Petroleum Storage</td>
<td>1</td>
<td>No action - VOC source</td>
</tr>
<tr>
<td>MA</td>
<td>Gulf Oil Chelsea</td>
<td>Petroleum Storage</td>
<td>1</td>
<td>No action - VOC source</td>
</tr>
<tr>
<td>MA</td>
<td>Solutia</td>
<td>Chemical Process Plant</td>
<td>3</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>MA</td>
<td>Braintree Electric</td>
<td>EGU</td>
<td>1</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
<td>----------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>MA</td>
<td>Brayton Point</td>
<td>EGU</td>
<td>4</td>
<td>Alternative BART</td>
</tr>
<tr>
<td>MA</td>
<td>Eastman Gelatin (boilers only)</td>
<td>Chemical Process Plant/Industrial Boilers</td>
<td>4</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>MA</td>
<td>General Electric Lynn</td>
<td>EGU</td>
<td>1</td>
<td>Cap out</td>
</tr>
<tr>
<td>MA</td>
<td>Harvard U (Blackstone)</td>
<td>EGU</td>
<td>2</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>MA</td>
<td>Mirant Kendall LLC</td>
<td>EGU</td>
<td>3</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>MA</td>
<td>Mirant-Canal Electric</td>
<td>EGU</td>
<td>2</td>
<td>Alternative BART</td>
</tr>
<tr>
<td>MA</td>
<td>Mystic</td>
<td>EGU</td>
<td>1</td>
<td>Alternative BART</td>
</tr>
<tr>
<td>MA</td>
<td>New Boston</td>
<td>EGU</td>
<td>1</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>MA</td>
<td>Salem Harbor</td>
<td>EGU</td>
<td>1</td>
<td>Alternative BART</td>
</tr>
<tr>
<td>MA</td>
<td>TMLP - Cleary Flood</td>
<td>EGU</td>
<td>3</td>
<td>Alternative BART</td>
</tr>
<tr>
<td>MA</td>
<td>Trigen - Kneeland St</td>
<td>EGU</td>
<td>1</td>
<td>No action - de minimis source</td>
</tr>
<tr>
<td>MA</td>
<td>Wheelabrator - Saugus</td>
<td>Municipal Incinerator</td>
<td>2</td>
<td>Units 1 and 2: NOx - 185 ppm; SO2 - 29 ppm; PM - 25 mg/dscm</td>
</tr>
<tr>
<td>MD</td>
<td>CONSTELLATION POWER SOURCE GENERATION CP CRANE</td>
<td>EGU</td>
<td>1</td>
<td>Existing Controls: (Unit 2) OFA, SNCR, low-sulfur coal, and fabric filters</td>
</tr>
<tr>
<td>MD</td>
<td>CONSTELLATION POWER SOURCE GENERATION HERBERT WAGNER</td>
<td>EGU</td>
<td>1</td>
<td>Existing Controls: (Unit 3) OFA, LNB, ESP, low-sulfur coal, SCR</td>
</tr>
<tr>
<td>MD</td>
<td>EASTALCO ALUMINUM</td>
<td>Primary Aluminum Ore Reduction Plant</td>
<td>2</td>
<td>CLOSED - SHUT DOWN</td>
</tr>
<tr>
<td>MD</td>
<td>INDEPENDENT CEMENT ST LAWERENCE</td>
<td>Portland Cement</td>
<td>1</td>
<td>Existing Controls: ESP and Multiclones, Mid-kiln firing, low NOX type burner, mixing air injection, dry scrubbing, upgraded kiln computer control system</td>
</tr>
<tr>
<td>MD</td>
<td>LEHIGH PORTLAND CEMENT</td>
<td>Portland Cement</td>
<td>3</td>
<td>On initial list when researching potentially eligible sources; later determined to not be BART-eligible because the plant began operations in 1978 after satisfying PSD requirements</td>
</tr>
<tr>
<td>MD</td>
<td>METTIKI Coal Corporation</td>
<td>Coal Cleaning</td>
<td>1</td>
<td>On initial list when researching potentially eligible sources; later determined to not be BART-eligible because the plant began operations in 1978 after satisfying PSD requirements</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MD</td>
<td>MILLENIUM INORGANIC CHEMICALS</td>
<td>Chemical Process Plants</td>
<td>5</td>
<td>On initial list when researching potentially eligible sources; later determined to not be BART-eligible.</td>
</tr>
<tr>
<td>MD</td>
<td>MIRANT MID ATLANTIC LLC MORGANTOWN</td>
<td>EGU</td>
<td>2</td>
<td>Existing Controls: [Units 1 &amp; 2] FGD, LNB &amp;OFA, SCR, cold-side ESP</td>
</tr>
<tr>
<td>MD</td>
<td>MIRANT MID ATLANTIC DICKERSON</td>
<td>EGU</td>
<td>1</td>
<td>MD Healthy Air Act</td>
</tr>
<tr>
<td>MD</td>
<td>PEPCO CHALK POINT</td>
<td>EGU</td>
<td>3</td>
<td>Existing Controls: [Units 1 &amp; 2] FGD, LNB, cold-side ESP SCR, [Unit 3] LNB, Fuel-S content, NG during 03 sason</td>
</tr>
<tr>
<td>MD</td>
<td>TRIGEN LEADENHALL STREET</td>
<td>Fossil Fuel Boiler (&gt;250 MMBtu)</td>
<td>4</td>
<td>On initial list when researching potentially eligible sources; later determined to not be BART-eligible.</td>
</tr>
<tr>
<td>MD</td>
<td>VIENNA GENERATING STATION</td>
<td>EGU</td>
<td>1</td>
<td>On initial list when researching potentially eligible sources; later determined to not be BART-eligible.</td>
</tr>
<tr>
<td>MD</td>
<td>WESTVACO FINE PAPERS</td>
<td>Kraft Pulp Mill/Fossil Fuel Boiler (&gt;250 MMBtu)</td>
<td>1</td>
<td>Existing controls plus planned installation of either a Spray Dryer Absorber or a Circulating Dry Scrubber</td>
</tr>
<tr>
<td>ME</td>
<td>Domtar Ind</td>
<td>Industrial Boiler/Kraft Pulp Mill</td>
<td>2</td>
<td><strong>Power Boiler #9:</strong> Opperate wet scrubber to meet emission limits - SO2 (0.30 lb/MMBtu), PM (0.15 lb/MMBtu, 84.4 lb/hr), Nox (0.4 lb/MMBtu). <strong>Lime Kiln:</strong> PM emission limit (0.064 gr/dscf corrected to 10% O2). SO2 operate two wet scrubbers to achieve 90% control efficiency and meet limit of 8.3 lb/hr., NOx 120 ppmvd</td>
</tr>
<tr>
<td>ME</td>
<td>Dragon Products</td>
<td>Portland Cement</td>
<td>1</td>
<td>On October 1, 2010, and on November 8, 2010, Dragon Products, LLC submitted documentation asserting that the facility (klin) qualifies as a reconstructed source. The Department is therefore deferring the BART applicability determination for this source to U.S. EPA. The discussion regarding the Dragon Products BART determination in this Chapter and elsewhere in the Maine Regional Haze SIP represents the Department's draft BART determination prior to the submission of this documentation. In the event that U.S. EPA finds that Dragon Products, LLC is, in fact, BART eligible, the Department is committing to issue a final BART order within 60 days of said finding. The Department's proposed BART limits were: SO2 - 70.0 lb/hr and 200 tons per year, PM-9.3 lb/hr and 0.3 lb/ton, NOx-350.0 lb/hr and 45% control efficiency (SNCR)</td>
</tr>
<tr>
<td>ME</td>
<td>Red Shield Environmental LLC</td>
<td>Industrial Boiler/Kraft Pulp Mill</td>
<td>2</td>
<td><strong>Recovery Boiler:</strong> SO2- use of 0.5 % sulfur fuel oil, NOx- 150 ppm, PM- ESP and 0.028 gr/dscf. <strong>Lime Kiln:</strong> SO2 emission limit of 8.1 lb/hr, NOX emission limit of 170 ppm, PM emission limit of 0.13 gr/dscf.</td>
</tr>
<tr>
<td>ME</td>
<td>Verso Bucksport LLC</td>
<td>Fossil Fuel Boiler (&gt;250 MMBtu)</td>
<td>1</td>
<td><strong>Boiler #5:</strong> 250 Tons/Year Emission Limit</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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<tr>
<td>ME</td>
<td>Verso Androscoggin LLC</td>
<td>Industrial Boiler/ Kraft Pulp Mill</td>
<td>9</td>
<td>Boilers 1, 2: Sulfur in Fuel Content of 0.7% by weight in 2013 and 0.5% by weight in 2018, NOx- 0.477 lbs/MMBtu, PM- Compliance with 40 CFR Part 63Subpart DDDD. Waste fuel Incinerator: SO2- 0.8 lbs/MMBtu, NOx- 0.4 lbs/MMBtu, PM - Compliance with 40 CFR Part 63Subpart DDDD, Recovery Boiler 1: SO2 emission limit of 120 ppmv, NOx- rounded to 8% oxygen on a 30 day rolling avg, NOx- 150 ppmv, PM- Compliance with 40 CFR Part 63Subpart DDDD, Recovery Boiler 2: SO2 emission limit of 120 ppmv, PM- Compliance with 40 CFR Part 63Subpart DDDD, Smelt Tanks 1 and 2: SO2 limit on Tank #1 of 2.7 lbs/hr and Tank #2 of 3.9 lbs/hr, NOx- NA, PM- Compliance with 40 CFR Part 63Subpart DDDD, Lime Kilns A and B: SO2 emission limits of 6.7 lbs/hr and 74.6 tpy, NOx emission limits of 120 ppm, PM- Compliance with 40 CFR Part 63Subpart DDDD. Flash Dryer: SO2 - use of 0.5% low sulfur fuel oil, NOx- 11.8 lbs/hr, PM- 5 lbs/hr. s</td>
</tr>
<tr>
<td>ME</td>
<td>Katahdin Paper Millinocket</td>
<td>Fossil Fuel Boiler (&gt;250 MMBtu)</td>
<td>1</td>
<td>Power Boiler #4: 250 Tons/Year Emission Limit</td>
</tr>
<tr>
<td>ME</td>
<td>Lincoln Paper and Tissue</td>
<td>Industrial Boiler/Kraft Pulp Mill</td>
<td>1</td>
<td>Recovery Boiler #2: SO2-low sulfur oil 141 ppmv, NOx- combustion engineering 223 ppmv, PM- ESP 0.44 gr/dscf.</td>
</tr>
<tr>
<td>ME</td>
<td>Rumford Paper</td>
<td>Industrial Boiler</td>
<td>1</td>
<td>Power Boiler 5: 250 Tons/Year Emission Limit</td>
</tr>
<tr>
<td>ME</td>
<td>S.D Warren</td>
<td>Industrial Boiler/Kraft Pulp Mill</td>
<td>4</td>
<td>Lime Kiln: SO2 1.92 lb/mmBtu and Limit of 100 Tons/Year, NOx 120 ppmv, PM- 0.10 gr/dscf and 58 lb/hr. Recovery Boiler SO2 Limit of 100 PPM on 30 Day Rolling Avg/1975 lbs/hr, NOx 120 ppm and 750 lb/hr, PM- 0.030 gr/dscf and 207 lb/hr. Smelt Tanks 1 and 2: SO2 limit of 26 lb/hr, NOx- NA, PM-26 lb/hr and 0.2 lbs/ton BLS.</td>
</tr>
<tr>
<td>ME</td>
<td>Wyman Station</td>
<td>EGU</td>
<td>2</td>
<td>Boiler #3: Emission limit PM (0.18/MMBtu), Nox (0.175 lb/MMBtu, 90 day rolling avg), SO2 - fuel oil with 0.7% or less Sulfur by weight. Boiler 4: Emission Limits - PM (0.1 lb/MMBtu), Nox (0.170 lb/MMBtu, 90 day rolling avg), SO2 (0.8 lb/MMBtu and 0.7% sulfur.</td>
</tr>
<tr>
<td>NH</td>
<td>PSNH Merrimack Station</td>
<td>EGU</td>
<td>1</td>
<td>Unit MK2: Use of FGD, SCR, ESP’s and emission limits for SO2 (10% of uncontrolled emissions, monthly avg.), NOx (0.30 lb/MMBtu, 30 Day Rolling Ag), PM (0.08 lb/MMBtu, TSP)</td>
</tr>
<tr>
<td>NH</td>
<td>PSNH Newington Station</td>
<td>EGU</td>
<td>1</td>
<td>Unit NT1: Emissions Limitations for SO2 (0.50 lb/MMBtu, 30-day rolling average), NOx Emission (0.35 lb/MMBtu (oil) and 0.25 lb/MMBtu (oil/gas), daily avg.) and use of existing low Nox Burners, and PM (0.22 lb/MMBtu, TSP) and use of existing electrostatic precipitator</td>
</tr>
<tr>
<td>State</td>
<td>Plant Name</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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<tr>
<td>NJ</td>
<td>Hess Corporation-Port Reading</td>
<td>Petroleum Refinery</td>
<td>1</td>
<td>Below Emission Threshold of 250 Tons/Year</td>
</tr>
<tr>
<td>NJ</td>
<td>ConocoPhillips-Bayway Refinery</td>
<td>Petroleum Refinery</td>
<td>11</td>
<td>Use of controls, emission limits (NOx, 0.040 lbs/MMBtu; H2S &lt; 162 ppmv) and averaging times from the USEPA CD with Bayway for process heaters. ULNBs in place on all BART-qualified process heaters at Bayway. H2S and SO2 PTE compliance by June 30, 2011.</td>
</tr>
<tr>
<td>NJ</td>
<td>Chevron Products Company</td>
<td>Petroleum Refinery</td>
<td>2</td>
<td>Reduction of Annual Combustion Limit for furnaces, Units E1501 and E1502, to bring Potential to Emit under 250 tpy of NOx. March 15, 2011.</td>
</tr>
<tr>
<td>NJ</td>
<td>Sunoco-Eagle Point (formerly Coastal)</td>
<td>Petroleum Refinery</td>
<td>13</td>
<td>Below Emission Threshold of 250 Tons/Year</td>
</tr>
<tr>
<td>NJ</td>
<td>PSEG Hudson Generating Station</td>
<td>EGU</td>
<td>4</td>
<td>Use of SCR, FGD, and Baghouse at coal-fired boiler, Unit E2 (NOx=0.100 lb/MMBtu, 30-day avg. and 0.150 lb/MMBtu, 24-hr avg; SO2=0.150 lb/MMBtu, 30-day avg and 0.250 24-hr avg; and PM10=0.0150 lb/MMBtu) from the USEPA CD with PSEG by December 31, 2010. Use of SCR or equivalent and more stringent NOx Emission Limits (NJ A.C.7:27-19.4) when burning Natural Gas (1.0 lb/MW-hr) and #6 fuel oil (2.0 lb/MW-hr) at boiler, Unit E1, by May 1, 2015. Also restrict use of #6 fuel oil in E1 to gas curtailments by December 31, 2011. Use of existing PM controls (enclosures and dust suppression system) for coal handling systems, Units E22 and E23.</td>
</tr>
<tr>
<td>NY</td>
<td>3M TONAWANDA</td>
<td>Chemical Process Plants/Industrial Boilers</td>
<td>4</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because NOx, SO2, PM10 emissions &lt;250 tpy.</td>
</tr>
<tr>
<td>NY</td>
<td>ALCAN ALUMINUM CORPORATION</td>
<td>Primary and Secondary Aluminum Production</td>
<td>9</td>
<td>Now “Novelis Corp.” On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because many units/processes began operation post-1977 and emissions of earlier units are below threshold.</td>
</tr>
<tr>
<td>NY</td>
<td>ALCOA MASSENA OPERATIONS (WEST PLANT)</td>
<td>Primary and Secondary Aluminum Production</td>
<td>6</td>
<td>Potline, baking furnace, four package boilers. Proposed BART is current operations + fuel sulfur limits</td>
</tr>
<tr>
<td>NY</td>
<td>ARTHUR KILL GENERATING STATION</td>
<td>EGU</td>
<td>1</td>
<td>Boiler #30. Proposed BART: NOx = 0.15 lb/mmBtu limit; SO2 = 0.3% fuel S limit (actual much lower); PM = current operation with 0.1 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>ASTORIA GENERATING STATION</td>
<td>EGU</td>
<td>2</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because units commenced operation prior to BART window.</td>
</tr>
<tr>
<td>NY</td>
<td>BOWLINE POINT GENERATING STATION</td>
<td>EGU</td>
<td>2</td>
<td>Boilers #1 + 2. Proposed BART: NOx = current controls, NOx RACT limit; SO2 = current 0.37% fuel S limit; PM = current 0.1 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>BUFFALO COLOR CORP -LEE ST PLANT</td>
<td>Chemical Process Plants/Industrial Boilers</td>
<td>5</td>
<td>Facility closed</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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<tr>
<td>NY</td>
<td>CON ED-59TH ST STA</td>
<td>Fossil Fuel Boiler (&gt;250 mmBtu)</td>
<td>2</td>
<td><strong>Steam boilers #14 + 115.</strong> Proposed BART: NOx = current controls, NOx RACT limit; SO2 = current 0.3% fuel S limit; PM = current operation, 0.1 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>DANSKAMMER GENERATING STATION</td>
<td>EGU</td>
<td>1</td>
<td><strong>Boiler #4.</strong> Proposed BART: NOx = .12 lb/mmBtu limit; SO2 = 0.50 lb/mmBtu limit; PM = existing ESP, 0.1 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>EF BARRETT POWER STATION</td>
<td>EGU</td>
<td>1</td>
<td><strong>Boiler #2.</strong> Proposed BART: NOx = SOFA with 0.20 lb/mmBtu limit on oil &amp; 0.10 lb/mmBtu limit on gas; SO2 = existing 0.37% fuel S limit; PM = current 0.10 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>ERWIN MANUFACTURING COMPLEX</td>
<td>Glass Fiber Processing Plants</td>
<td>3</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because facility doesn’t fall within a BART source category plus NOx, SO2, PM10 emissions &lt;250 tpy.</td>
</tr>
<tr>
<td>NY</td>
<td>GENERAL ELECTRIC SELKIRK PLASTICS PLT</td>
<td>Chemical Process Plants/Industrial Boilers</td>
<td>16</td>
<td>Now &quot;Sabic Innovative Plastics US LLC.&quot; On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because NOx, SO2, PM10 emissions &lt;250 tpy.</td>
</tr>
<tr>
<td>NY</td>
<td>GLENS FALLS LEHIGH CEMENT COMPANY</td>
<td>Portland Cement</td>
<td>1</td>
<td><strong>Process kiln.</strong> Proposed BART: NOx = installation of SNCR, limit TBD; SO2 = existing lime spray dryer; PM = installation of baghouse to comply with NESHAP</td>
</tr>
<tr>
<td>NY</td>
<td>INTERFACE SOLUTIONS INC</td>
<td>Kraft Pulp Mill/Industrial Boilers</td>
<td>9</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because the boilers are below the BART size threshold and remaining emissions are &lt;250 tpy.</td>
</tr>
<tr>
<td>NY</td>
<td>INTERNATIONAL PAPER TICONDEROGA MILL</td>
<td>Kraft Pulp Mill/Industrial Boilers</td>
<td>2</td>
<td><strong>Power boiler, Recovery boiler.</strong> Proposed BART: NOx = current 0.25 lb/mmBtu (PB) and 100ppm (RB) limits; SO2 = existing wet scrubber (PB) and 1.5% fuel S limit (RB); PM = current 0.1 lb/mmBtu limit &amp; compliance with upcoming MACT (PB) and current 0.03 grains/dscf limit (RB)</td>
</tr>
<tr>
<td>NY</td>
<td>KODAK PARK DIVISION</td>
<td>Chemical Process Plants/Industrial Boilers</td>
<td>3</td>
<td><strong>Boilers #41, 42, 43.</strong> Proposed BART: NOx = meet 0.20 lb/mmBtu RACT limit; SO2 = comply with upcoming NESHAP; also reduce NOx/SO2/PM by firing only 2 of 3 boilers concurrently</td>
</tr>
<tr>
<td>NY</td>
<td>LACKAWANNA PLANT-REPUBLIC ENG PROD INC</td>
<td>Primary Metal Production/Industrial Boilers</td>
<td>3</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because the boilers are below the BART size threshold.</td>
</tr>
<tr>
<td>NY</td>
<td>LAFARGE BUILDING MATERIALS INC</td>
<td>Portland Cement</td>
<td>2</td>
<td><strong>Two process kilns.</strong> These kilns being shut down &amp; replaced as per consent order. Full BART analysis therefore not completed.</td>
</tr>
<tr>
<td>NY</td>
<td>LOVETT GENERATING STATION</td>
<td>EGU</td>
<td>4</td>
<td>Facility closed</td>
</tr>
<tr>
<td>NY</td>
<td>NORTHPORT POWER STATION</td>
<td>EGU</td>
<td>4</td>
<td><strong>Boilers #1, 2, 3, 4.</strong> Proposed BART: NOx = SOFA with 0.20 lb/mmBtu limit on oil &amp; 0.10 lb/mmBtu limit on gas; SO2 = 0.7% fuel S limit; PM = existing ESP with 0.1 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>OSWEGO HARBOR POWER</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers #5, 6.</strong> Proposed BART: NOx = existing controls, 600 tpy limit on each or 1200 tpy combined; SO2 = &lt;1.0% fuel S limit; PM = existing ESP, 0.10 lb/mmBtu limit</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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<tr>
<td>NY</td>
<td>OWENS-CORNING DELMAR PLANT</td>
<td>Glass Fiber Processing Plants</td>
<td>19</td>
<td>Eligible units contained in DM1 + DM2 manufacturing lines. Accepting 250 tpy cap for NOx, SO2, PM10 on BART-eligible sources to avoid BART.</td>
</tr>
<tr>
<td>NY</td>
<td>RAVENSWOOD GENERATING STATION</td>
<td>EGU</td>
<td>3</td>
<td>Boilers #10, 20, 30. Proposed BART: NOx = no additional control, limit to be determined; SO2 = current 0.3% fuel S limit; PM = current 0.10 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>REVERE SMELTING &amp; REFINING CORP</td>
<td>Primary Metal Production/Industrial Boilers</td>
<td>8</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because units commenced operation prior to BART window.</td>
</tr>
<tr>
<td>NY</td>
<td>RIVERBAY CORP-CO-OP CITY</td>
<td>Industrial Boilers</td>
<td>4</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because boilers were replaced/reconstructed.</td>
</tr>
<tr>
<td>NY</td>
<td>RIVERHEAD TERMINAL-CONOCOPHILLIPS</td>
<td>Petroleum Storage/Industrial Boilers</td>
<td>7</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because NOx, SO2, PM10 PTE &lt;250 tpy.</td>
</tr>
<tr>
<td>NY</td>
<td>ROSETON GENERATING STATION</td>
<td>EGU</td>
<td>2</td>
<td>Boilers #1 + 2. Proposed BART: NOx = 0.20 lb/mmBtu limit; SO2 = 1% fuel S limit; PM = current 0.10 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>SAMUEL A CARLSON GENERATING STATION</td>
<td>EGU</td>
<td>1</td>
<td>Boiler #12. Either shutting down or accepting 250 tpy cap for NOx, SO2, PM10 on BART-eligible source to avoid BART. Decision expected by Oct. 2011.</td>
</tr>
<tr>
<td>NY</td>
<td>SCHENECTADY INTERNATIONAL ROTT JCT FAC</td>
<td>Chemical Plant/Industrial Boilers</td>
<td>18</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because boilers are below the BART size threshold and remaining emissions are &lt;250 tpy.</td>
</tr>
<tr>
<td>NY</td>
<td>ST LAWRENCE CEMENT CORP-CATSKILL QUARRY</td>
<td>Portland Cement</td>
<td>1</td>
<td>Now “Holcim (US) Inc - Catskill Plant.” Process kiln. Proposed BART: NOx = installation of SNCR, limit TBD; SO2 = current operations; PM = existing ESP with limits of 0.30 lb/ton of feed or 0.05 grains/dscf</td>
</tr>
<tr>
<td>NY</td>
<td>WASHINGTON MILLS ELECTRO MINERALS</td>
<td>Glass Fiber Processing Plants</td>
<td>3</td>
<td>On initial list when researching potentially eligible sources; later determined to NOT be BART-eligible because it doesn’t fall within a BART source category.</td>
</tr>
<tr>
<td>NY</td>
<td>Ravenswood Steam Plant</td>
<td>Fossil fuel boiler (&gt;250 mmBtu)</td>
<td>1</td>
<td>Boiler #2. Proposed BART: NOx = meet RACT limit. SO2 = current 0.3% fuel S limit; PM = current 0.10 lb/mmBtu limit</td>
</tr>
<tr>
<td>NY</td>
<td>Syracuse Energy Corp.</td>
<td>EGU</td>
<td>1</td>
<td>Boiler #1. Plan to shut down unit by 1/1/2014.</td>
</tr>
<tr>
<td>PA</td>
<td>ALLEGHENY_LUDLUM_CORP BRACKENRIDGE</td>
<td>EGU</td>
<td>8</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>EASTMAN_CHEMICAL_RESINS_INC</td>
<td>Chemical Process Plants/Industrial Boilers</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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<tr>
<td>PA</td>
<td>ESSROC/BESSEMER</td>
<td>Portland Cement</td>
<td>8</td>
<td>Kiln 5: NOx: 476 lbs/hr. SO2: 500 ppmvd. PM: 0.02 grains/dscf. Other units not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>NEVILLE CHEMICAL COMPANY</td>
<td>Chemical Process Plants</td>
<td>5</td>
<td>On initial list when researching potentially eligible sources; later determined to not be BART-eligible because it is not date eligible nor emissions threshold-eligible for BART.</td>
</tr>
<tr>
<td>PA</td>
<td>ORION POWER MIDWEST_CHERSWICK STATION</td>
<td>EGU</td>
<td>1</td>
<td>Boiler 1: Permitted PTE: SO2: 67,452 typ; NOx: 10,840 tpy PM10: 3.61 tpy</td>
</tr>
<tr>
<td>PA</td>
<td>USS_CLAIRTON WORKS</td>
<td>Metal Production/Industrial Boilers</td>
<td>4</td>
<td>Desulfurization Plant: SO2: 590 tpy; NOx: 27 tpy Boiler 2: SO2: 1508 tpy; NOx: 1285 tpy R 1 Boiler: SO2: 796 tpy; NOx: 525 tpy T 1 Boiler: SO2: 572 tpy; NOx: 358 tpy</td>
</tr>
<tr>
<td>PA</td>
<td>AK STEEL CORP BUTLER WORKS</td>
<td>Iron and Steel Mill Plants</td>
<td>16</td>
<td>Electric Arc Furnaces 2,3,4: NOx: 75 lbs/hr. SO2: 500 ppmvd. PM: 0.0036 grains/dscf. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>ALLEGHENY ENERGY SUPPLY CO HATFIELDS FER</td>
<td>EGU</td>
<td>5</td>
<td>Main Boilers 1, 2, 3: PM: 0.075 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>ALLEGHENY ENERGY SUPPLY CO MITCHELL POWE</td>
<td>EGU</td>
<td>3</td>
<td>Boiler 3: PM: 0.1 lb/MMBtu. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>AMER REF GROUP BRADFORD</td>
<td>Petroleum Refinery</td>
<td>4</td>
<td>Permit Limit &lt;250 TPy</td>
</tr>
<tr>
<td>PA</td>
<td>APPLETON PAPERS SPRING MILL</td>
<td>Kraft Pulp Mill/Industrial Boilers</td>
<td>9</td>
<td>Number 3 Power Boiler: NOx: 0.63 lb/MMBtu. SO2: 4.0 lb/MMBtu (over any 1-hr period). PM: 3.6 x Heat Input (lbs/MMBtu) raised to a negative 0.56 power. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>CARMEUSE LIME INC MILLARD LIME PLT</td>
<td>Lime Plant</td>
<td>8</td>
<td>Kiln Number 5: NOx: 6.0 lb/ton lime. SO2: 500 ppmvd. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>CEMEX INC WAMPUM CEMENT PLT</td>
<td>Portland Cement</td>
<td>15</td>
<td>Kiln 3: NOx: 6.2 lbs/ton clinker (May-Sep 6.0 lbs/ton). SO2: 500 ppmvd. PM: 0.02 grains/dscf. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
</tr>
<tr>
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</tr>
<tr>
<td>PA</td>
<td>COCOPHILLIPS CO TRAINER REF</td>
<td>Petroleum Refinery</td>
<td>21</td>
<td><strong>Unit #C01</strong> SO2: 25 ppmvd (365-day rolling average). PM: 0.5 lb/1000 lb coke burn (3-hr average). NOx: 121.1 ppmvd (365-day) 155.3 ppmvd (7-day). <strong>Unit 738</strong> NOx: 0.12 lb/MMBtu. SO2: 0.011 lb/MMBtu (both limits are on an annual basis). Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>DUFERCO FARRELL CORP FARRELL PLT</td>
<td>Iron and Steel Mill Plants</td>
<td>1</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>DYNO NOBEL INC DONORA</td>
<td>Chemical Process Plants</td>
<td>9</td>
<td>NOx: 396 tons/12-month period. NO2: 5.5 lb/ton acid product (expressed as 100% HNO3).</td>
</tr>
<tr>
<td>PA</td>
<td>ESSROC NAZARETH LOWER CEMENT PLT 1</td>
<td>Portland Cement</td>
<td>1</td>
<td>This facility was determined to not meet the date-eligible criteria for a BART source because the BART unit was reconstructed after 1977 and the reconstruction met the general provisions for NSPS at 40 CFR 60.15(f)(1)-(3) for identifying reconstructed affected facilities which must also be used under the regional haze regulations to identify reconstructed stationary sources for purposes of the BART requirement.</td>
</tr>
<tr>
<td>PA</td>
<td>EXELON GENERATION CO EDDYSTONE</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers 3 and 4</strong>: PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>EXIDE TECH READING SMELTER</td>
<td>Secondary Metal Production</td>
<td>9</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>HOMER CITY OL HOMER CITY GEN STA</td>
<td>EGU</td>
<td>3</td>
<td><strong>Main Boilers 1, 2, 3</strong>: PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>HORSEHEAD CORP MONACA SMELTER</td>
<td>Primary Zinc Smelter</td>
<td>25</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>INDSPEC CHEM CORP PETROLIA</td>
<td>Chemical Process Plants</td>
<td>17</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>INMETCO ELLWOOD CITY</td>
<td>Iron and Steel Mill Plants</td>
<td>6</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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</tr>
<tr>
<td>PA</td>
<td>ISG PLATE LLC COATESVILLE</td>
<td>Iron and Steel Mill Plants</td>
<td>15</td>
<td>Electric Arc Furnace D: SO2: 500 ppmvd. PM: 0.02 grains/dscf (primary baghouse). PM: 0.0052 grains/dscf (secondary baghouses). Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>KEYSTONE PORTLAND CEMENT EAST ALLEN</td>
<td>Portland Cement</td>
<td>2</td>
<td>Kn 1: NOx: 529 lbs/hr SO2: 500 ppmvd PM: 0.02 grains/dscf Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>LAFARGE CORP WHITEHALL PLT</td>
<td>Portland Cement</td>
<td>23</td>
<td>Kn 2: NOx: 297.7 lbs/hr. NOx: 260.5 lbs/hr (TDF). SO2: 362 lbs/hr PM: 14.8 lbs/hr. Kn 3: NOx: 202.3 lbs/hr. NOx: 166.0 lbs/hr (TDF). SO2: 195.0 lbs/hr. PM: 7.3 lbs/hr. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>LEHIGH CEMENT CO EVANSVILLE CEMENT PLT</td>
<td>Portland Cement</td>
<td>34</td>
<td>Kn 1: NOx: 367.7 lbs/hr. SO2: 59.4 lbs/hr. PM: 34.8 tons/12 month period. PM10: 87.4 tons/12 month period. Kn 2: NOx: 367.7 lbs/hr. SO2: 59.4 lbs/hr. PM: 34.8 tons/12 month period. PM10: 87.4 tons/12 month period. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>LEHIGH CEMENT CO YORK OPERATIONS</td>
<td>Portland Cement</td>
<td>18</td>
<td>White Cement Kn: NOx: 8.2 lbs/ton. SO2: 500 ppmvd. PM: 0.02 grains/dscf. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>LWB REFRactories CO W MANCHESTER</td>
<td>Mineral Products</td>
<td>13</td>
<td>Permit Limit &lt; 250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>MERCER LIME &amp; STONE BRANCHTON</td>
<td>Lime Plant</td>
<td>6</td>
<td>Permit Limit &lt; 250 TPY</td>
</tr>
<tr>
<td>PA</td>
<td>NEW CASTLE POWER PLT</td>
<td>EGU</td>
<td>1</td>
<td>Boiler 5: PM: 0.1 lb/MBtu.</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
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</tr>
<tr>
<td>PA</td>
<td>PA POWER CO BRUCE MANSFIELD PLT</td>
<td>EGU</td>
<td>3</td>
<td><strong>Main Boilers 1, 2, 3:</strong> PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>PH GLATFELTER CO SPRING GROVE Paper and Pulp/Industrial Boilers</td>
<td>9</td>
<td><strong>Number 1 Power Boiler:</strong> NOx: 0.66 lb/MMBtu (30-day rolling average). SO2: 3.7 lb/MMBtu (30-day rolling average). PM: 3.6 x Heat Input (lbs/MMBtu) raised to a negative 0.56 power.</td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>PPL BRUNNER ISLAND L BRUNNER ISLAND</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers 2 and 3:</strong> PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>PPL MARTINS CREEK LLC MARTINS CREEK</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers 3, 4:</strong> PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>PPL MONTOUR LLC MONTOUR SES</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers 1, 2:</strong> PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>RELIANT ENERGY NORTHEAST CONEMAUGH PLT</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers 1, 2:</strong> PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>RELIANT ENERGY NORTHEAST MGMT KEYSTONE POWER PLT</td>
<td>EGU</td>
<td>2</td>
<td><strong>Boilers 1, 2:</strong> PM: 0.1 lb/MMBtu for each boiler.</td>
</tr>
<tr>
<td>PA</td>
<td>RELIANT ENERGY PORTLAND GENERATING STATION</td>
<td>EGU</td>
<td>1</td>
<td><strong>Boiler 2:</strong> PM: 0.1 lb/MMBtu.</td>
</tr>
<tr>
<td>PA</td>
<td>SUNOCO CHEMICALS (FORMER ALLIED SIGNAL) Chemical Process</td>
<td>9</td>
<td><strong>Units 101 and COB1</strong> NOx: 0.3 lbs/MMBtu. PM: 0.1 lb/MMBtu. SO2: 0.52 lbs/MMBtu. Other units determined not subject to BART.</td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>SUNOCO INC (R&amp;M) MARCUS HOOK REFINERY</td>
<td>Refinery</td>
<td>10</td>
<td><strong>Units 101 and COB1</strong> SO2: 25 ppmvd (365-day rolling average). NOx: 20 ppmvd (365-day rolling average). PM: 1.0 lb/1000 lb coke burn. <strong>17-2A, H-01 Heater</strong> NOx: 0.25 lb/MMBtu (24-hr basis). SO2: 500 ppmvd. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>State</td>
<td>Plant</td>
<td>Type</td>
<td>Number of Units</td>
<td>BART Action (Unit in Bold)</td>
</tr>
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<td>-------</td>
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</tr>
<tr>
<td>PA</td>
<td>SUNOCO INC (R&amp;M)</td>
<td>Refinery</td>
<td>26</td>
<td>Unit 1232: SO2: 25 ppmvd (365-day rolling average). NOx: 20 ppmvd (365-day rolling average). PM: 0.5 lb/1000 lb coke burn. Process Heaters: NOx: 0.020 lb/MMBtu (24-hr basis). SO2: 500 ppmvd Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>TRIGEN-EDISON</td>
<td>EGU</td>
<td>2</td>
<td>Boilers 3, 4: NOx: 0.5 lb/MMBtu for each boiler. PM: 0.1 lb/MMBtu for each boiler. SO2: 0.5% sulfur (#6 fuel oil), 0.2% sulfur (#2 oil).</td>
</tr>
<tr>
<td>PA</td>
<td>TRIGEN-SCHUYLKILL</td>
<td>EGU</td>
<td>1</td>
<td>Boiler 26: NOx: 0.36 lb/MMBtu (30-day rolling avg). PM: 0.1 lb/MMBtu. SO2: 0.5% sulfur (#6 fuel oil).</td>
</tr>
<tr>
<td>PA</td>
<td>UNITED REFINING CO WARREN PLT</td>
<td>Refinery</td>
<td>9</td>
<td>Boiler 4: NOx: 0.173 lb/MMBtu. SO2: 24.3 lbs/hr. Crude Heater North: NOx: 0.226 lb/MMBtu. SO2: 207.7 lbs/hr. Other units determined not subject to BART.</td>
</tr>
<tr>
<td>PA</td>
<td>VICTAULIC CO AMER FORKS FACILITY</td>
<td>Production</td>
<td>12</td>
<td>Permit Limit &lt;250 TPY</td>
</tr>
</tbody>
</table>

Notes:
The list of BART eligible sources came from Appendix A of NESCAUM’s Five-Factor Analysis of BART-Eligible Sources. MARAMA and state staff reviewed the State Implementation Plans (SIPs) and updated the table to include the BART action for each of the facilities. More information on each of the BART eligible sources can be found in the state SIPs.