The State of New Hampshire
Department of Environmental Services

Thomas S. Burack, Commissioner

December 16, 2014

Mr. Curtis Spalding
Regional Administrator
U.S. Environmental Protection Agency, Region I
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: Revision to New Hampshire's State Implementation Plan to Meet the Requirements of the Clean Air Act, Section 169A, Protection of Visibility – Regional Haze Progress Report and Amendment to Env-A 2302.02, Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers

Dear Mr. Spalding:

Pursuant to Section 110 of the federal Clean Air Act as amended, the New Hampshire Department of Environmental Services (NHDES) submits one hard copy and one electronic copy of this State Implementation Plan (SIP) revision to fulfill the requirements of section 169A, pertaining to protection of visibility. The enclosed SIP revision includes New Hampshire's Regional Haze 5-Year Progress Report and a related amendment to administrative rule Env-A 2302.02, Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers. NHDES has prepared this SIP revision in accordance with the general SIP submittal requirements of 40 CFR Part 51 Appendix V and in accordance with USEPA regulations and guidance on regional haze plans and progress reports. As Governor Maggie Hassan's designee, I am requesting EPA's approval of this SIP revision.

The USEPA and the Federal Land Managers have provided comments on the regional haze progress report. NHDES has addressed these comments in the SIP revision and has included documentation certifying the public process.

If you have any questions regarding this submittal, please contact Jeff Underhill at (603) 271-1102.

Sincerely,

Craig A. Wright

Craig A. Wright
Director
Air Resources Division

caw/chm

enclosures: paper copy and electronic copy
via email and postal service

ec: Anne Arnold, EPA Region I
Anne McWilliams, EPA Region I
Holly Salazer, NPS
Tim Allen, FWS
Ralph Perron, FS
Bret Anderson, FS

Publication No. R-ARD-14-2

Revision to the

New Hampshire
State Implementation Plan

Regional Haze 5-Year Progress Report

December 16, 2014

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Air Resources Division

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

ACKNOWLEDGEMENTS

The New Hampshire Department of Environmental Services would like to express appreciation to the many staff members of the NESCAUM, MARAMA, and OTC regional organizations and to staff members of the MANE-VU states for their invaluable assistance and timely contributions to analyses and supporting documents that made possible the preparation of New Hampshire's Regional Haze SIP 5-Year Progress Report.

ON THE COVER: Split-image view of Presidential Range and nearby valley from Conway, New Hampshire, on clear and hazy days.
http://hazecam.net/mtwash_gallery.aspx

EXECUTIVE SUMMARY

Section 169A of the Clean Air Act (CAA) provides for the protection of visibility at mandatory Class I federal areas. These designated areas include 156 national parks and wilderness areas located throughout the United States. Regional haze obscures vistas that are integral to the value of such areas. In 1999, the U.S. Environmental Protection Agency (EPA) adopted the Regional Haze Rule (published at 64 FR 35714 and codified at 40 CFR 51.300-309), which calls for state, tribal, and federal agencies to work together to improve visibility in all Class I areas. Two of these areas – Great Gulf Wilderness Area and Presidential Range-Dry River Wilderness Area – are located in New Hampshire's White Mountain National Forest.

States are required to revise their State Implementation Plans, or SIPs, in order to reduce the pollution that causes visibility impairment and regional haze.[1] These plans establish reasonable progress goals for visibility improvement and include strategies to reduce air pollutant emissions from sources contributing to visibility impairment at Class I areas.

Regional haze is caused by numerous and diverse air emission sources over a broad geographic area. The predominant cause of haze pollution in the Mid-Atlantic/Northeast region is sulfate particles (aerosols) present in, or formed from, emissions when coal or oil is burned. The largest sources of this pollution are electrical generating units (EGUs) located in the eastern half of the United States.

As a member of the Mid-Atlantic/Northeast Visibility Union (MANE-VU),[2] New Hampshire has committed to implementing a long-term strategy to improve visibility at MANE-VU's Class I areas. The defined long-term strategy covers the 10-year period ending in 2018 and includes:

- Timely implementation of Best Available Retrofit Technology (BART) at specified EGUs;
- Enforceable reductions in sulfur dioxide emissions from targeted EGUs;
- A request for emissions reductions from non-MANE-VU states whose emissions contribute to visibility impairment within our region, and
- Evaluation of other measures such as reducing the sulfur content of fuel oil, expanding the use of alternative clean fuels, increasing energy efficiency, and further reducing emissions from coal and wood combustion.

This document addresses 40 CFR 51.308(g), which requires periodic reports evaluating progress in carrying out New Hampshire's regional haze plan. The results to date indicate real progress: Control strategies in the SIP are being implemented, power plant emissions of sulfur dioxide (SO_2) have declined, and visibility measurements at mandatory Class I federal areas affected by New Hampshire's emissions are trending in the right direction. More specifically,

- Required sulfur dioxide control measures at New Hampshire's two BART units and a third, targeted unit are installed and operational; and both BART units are operating under new limits for nitrogen oxides (NOx) and particulate matter (PM);

[1] New Hampshire's regional haze SIP revision is available at http://des.nh.gov/organization/divisions/air/do/asab/rhp/index.htm.

[2] MANE-VU includes the following member states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the District of Columbia.

- From 2002 to 2013, total sulfur dioxide emissions declined by 95 percent for these three units and by 93 percent for all New Hampshire EGUs reporting to EPA's Clean Air Markets Division (CAMD);
- Similar reductions in SO_2 emissions are occurring throughout the MANE-VU region, the result of a major shift within the power production sector away from coal toward greater use of natural gas;
- Regional emissions of other haze-causing pollutants, particularly NOx and volatile organic compounds (VOC), are expected to continue on a downward trend;
- For the period 2009-2013 (the most recent 5 years of certified monitoring data at the time of this report), all Class I areas affected by New Hampshire's regional-haze-producing emissions showed visibility improvements relative to 2000-2004 on both best and worst visibility days. In fact, for all such areas, observed haze levels were already better than the 2018 reasonable progress goals (see table below).

Observed Visibility vs. Reasonable Progress Goals (all values in deciviews)

Class I Area IMPROVE* Site	2000-2004 5-Year Average	2009-2013 5-Year Average	2013 Annual Average	2018 Reasonable Progress Goal
20% Worst Days				
Acadia National Park	22.9	17.9	16.5	19.4
Moosehorn Wilderness Area**	21.7	16.8	15.9	19.0
Great Gulf Wilderness Area***	22.8	16.7	15.0	19.1
Lye Brook Wilderness Area	24.4	18.8	17.5	20.9
Brigantine Wilderness Area	29.0	23.8	21.5	25.1
20% Best Days				
Acadia National Park	8.8	7.0	6.3	8.3
Moosehorn Wilderness Area	9.2	6.7	6.4	8.6
Great Gulf Wilderness Area	7.7	5.9	5.4	7.2
Lye Brook Wilderness Area	6.4	4.9	5.4	5.5
Brigantine Wilderness Area	14.3	12.3	11.8	14.3

* IMPROVE = Interagency Monitoring of Protected Visual Environments program.
** The IMPROVE monitor for Moosehorn Wilderness also represents Roosevelt Campobello International Park.
*** The IMPROVE monitor for Great Gulf Wilderness also represents Presidential Range - Dry River Wilderness Area.

On the basis of the documented progress, NHDES declares that New Hampshire's Regional Haze SIP is sufficient in its current form to achieve the necessary emission reductions to meet the 2018 reasonable progress goals for visibility. Therefore, further revision of the existing implementation plan is not needed at this time. Achieving these goals represents the first major milestone toward restoring natural visibility conditions at all Class I areas by the regulatory target year of 2064.

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

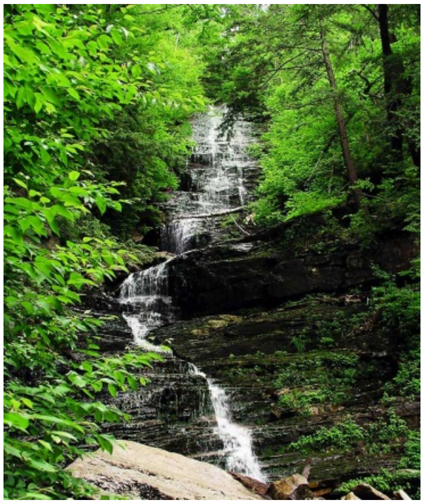
A memorial to Franklin Delano Roosevelt and symbol of Canadian-American friendship, Roosevelt Campobello International Park is a combination indoor/outdoor site renowned internationally. Its historic beauty contributes to the tourism in both the Province of New Brunswick and the State of Maine. Wooded 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 water birds 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; the small and beautiful Spaulding Lake rests 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 2,900 feet above sea level. Most of the wilderness is above 2,500 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 toward 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 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.

Photo credits: National Park Service, US Fish and Wildlife Service, and wilderness.net

SIP SUBMITTAL

Pursuant to the requirements of 40 CFR 51.308(g), (h), and (i), New Hampshire submits this regional haze progress report as a SIP revision. New Hampshire has adopted this SIP revision in accordance with federal regulations at 40 CFR 51.102 and 51.103 and state administrative rule Env-A 204.

The following sections address requirements concerning the status of committed control measures, assessment of current emissions and emission reductions, visibility progress, adequacy of current monitoring strategy, and any impediments to visibility improvement. Lastly, NHDES asserts that the original regional haze SIP revision is adequate to achieve continued progress toward the goal of achieving natural visibility conditions by 2064 for mandatory Class I federal areas affected by sources in New Hampshire.

New Hampshire's Regional Haze SIP contains the emission reductions needed to achieve New Hampshire's share of emission reductions agreed upon through the regional planning process. Furthermore, the SIP ensures that regional-haze-causing emissions from New Hampshire will not interfere with the reasonable progress goals for neighboring states' Class I areas. EPA approved New Hampshire's Regional Haze SIP on August 22, 2013 (77 FR 50602). New Hampshire submitted this SIP to meet the requirements of 40 CFR 51.308 and the visibility-related requirements of CAA section 110(a)(2) including, but not limited to, 110(a)(2)(D)(i)(II) and 110(a)(2)(J).

Pursuant to 40 CFR 51.308(g) and 40 CFR 51.102, on August 22, 2014, New Hampshire published notice of a public hearing and a 30-day public comment period on the regional haze progress report/ SIP revision. New Hampshire held a public hearing regarding the SIP revision on September 23, 2014. Comments submitted by EPA and the Federal Land Managers (FLMs) were addressed and are incorporated into the final SIP. Those comments are summarized and included in Attachment K. No comments were received from the general public.

In accordance with 40 CFR 51.308(i), New Hampshire provided the Federal Land Managers an opportunity for consultation, in person, at least 60 days before holding any public hearing on this SIP revision. New Hampshire will continue to coordinate with the FLMs on future revisions to New Hampshire's Regional Haze SIP. Section 12 of this document provides details of consultation with the FLMs.

In summary, this 5-year progress report fulfills all requirements for SIP submittals and periodic progress reports as set forth in 40 CFR 51.102; 51.103; and 51.308 (g), (h), and (i).

5-Year Progress Report Submittal Checklist

Yes or **No**	**Regulation Citation**	**Regulation Summary** (***not verbatim***)	**Location in Report**	**Comments**
Y	51.308(g)(1)	Status of Control Strategies in the Regional Haze SIP: Does the report include a list of measures the state relied upon? *(all states)*	Sections 3, 4, 5	
Y	51.308(g)(2)	Emissions Reductions from Regional Haze SIP Strategies: Does the report include estimated reduction estimates for these measures? *(all states)*	Sections 6, 7	
Y	51.308(g)(3)	Visibility Progress: Does the report include the summaries of monitored visibility data as required by the Regional Haze Rule? *(states with Class I areas only)*	Section 2	
Y	51.308(g)(4)	Emissions Progress: Does the report provide emissions trends across the entire inventory for a 5-year period as required by the Regional Haze Rule? *(all states)*	Sections 6, 7	
Y	51.308(g)(5)	Assessment of Changes Impeding Progress: Does the report include an explicit statement of whether there are anthropogenic emissions changes impeding progress? *(all states)*	Section 8	
Y	51.308(g)(6)	Assessment of Current Strategy: Does the report include an assessment of whether the state's haze plan is on track to meet reasonable progress goals? *(all states)*	Section 9	
Y	51.308(g)(7)	Review of Monitoring Strategy: Does the report review the monitoring plan including any non-IMPROVE monitors the state is using? *(states with Class I areas only)*	Section 10	
Y	51.308(h)	Determination of Adequacy: Does the report (or the transmittal materials) provide the explicit determination required by the Regional Haze Rule? *(all states)*	Section 11	

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

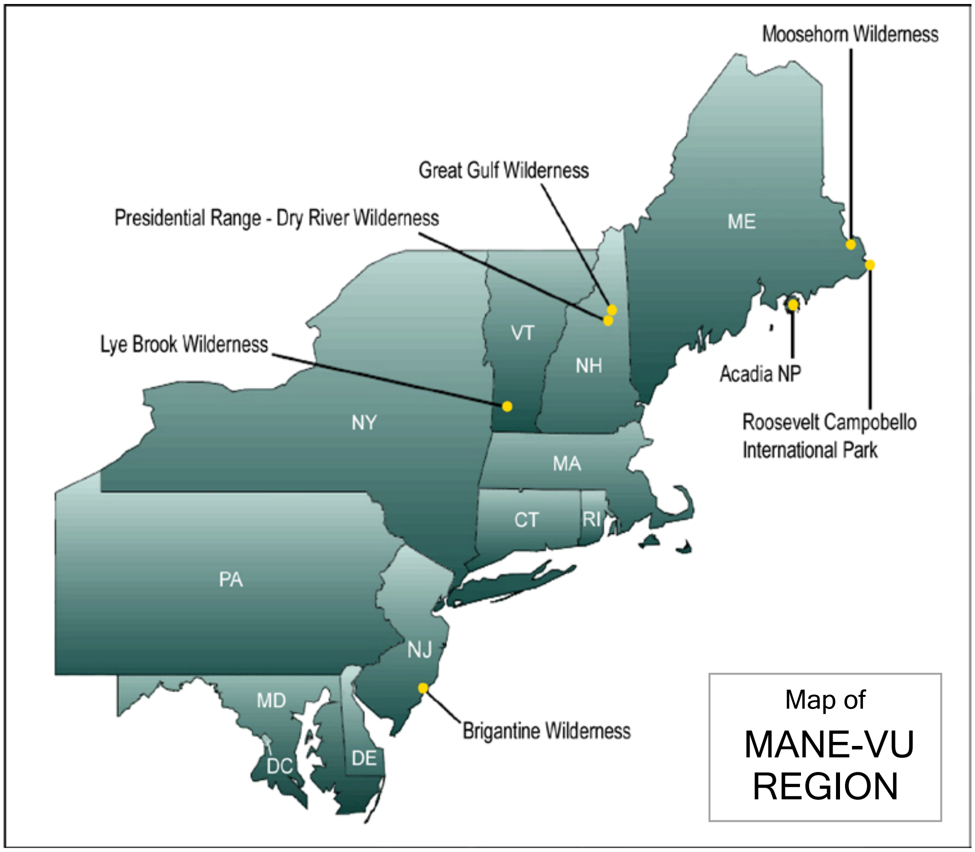
SECTION 1 – FEDERAL REGIONAL HAZE PROGRAM REQUIREMENTS

1.1 Background

The federal Clean Air Act (CAA) sets requirements to protect the air-quality-related values of national parks and wilderness areas. Specifically, Section 169A of the CAA requires the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution."

Areas protected by this portion of the law include national parks exceeding 6,000 acres, wilderness areas and national memorial parks exceeding 5,000 acres, and all international parks in existence on August 7, 1977. There are 156 mandatory Class I federal areas in the United States, of which seven are in the Mid-Atlantic and Northeast Region (Figure 1-1).

Figure 1-1. Nearby Class I Areas

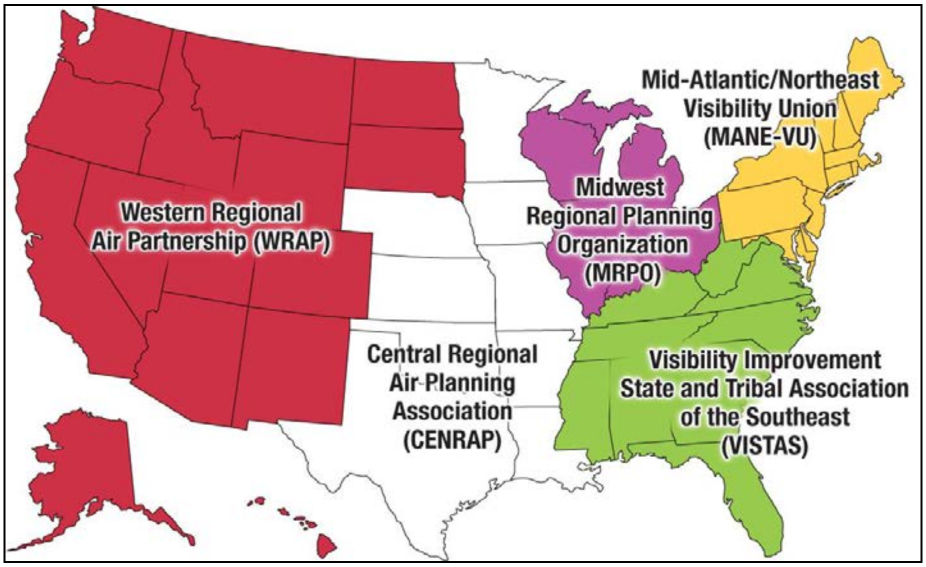


Section 169A of the CAA directed the U.S. Environmental Protection Agency (EPA) to promulgate regulations to assure reasonable progress toward meeting the national goal of improved visibility in Class I areas. On July 1, 1999, the EPA finalized the Regional Haze Rule (published at 64 FR 35714 and codified at 40 CFR 51.300-309). The rule calls for state, tribal, and federal agencies to work together to improve visibility.

Working with the states,[3] EPA designated five Regional Planning Organizations (RPOs) (Figure 1-2) to assist with the coordination and cooperation states needed to address the visibility issue. New Hampshire is a member of the Mid-Atlantic/Northeast Visibility Union (MANE-VU).

[3] From this point forward, as used in this report, "state" means either a state or a tribe.

Figure 1-2. U.S. Regional Planning Organizations



States in the Mid-Atlantic and Northeast region, along with Federal Land Managers (FLMs) and EPA, worked together through MANE-VU to develop strategies for reducing the haze that obscures natural vistas at mandatory Class I areas. A NESCAUM report[4] prepared for MANE-VU determined that the predominant cause of haze pollution in Northeast parks and wilderness areas is sulfate particles (aerosols) present in, or formed from, emissions when coal or oil is burned to provide heat and power to homes, businesses, and industries. Additional pollutants – especially oxides of nitrogen and organic carbon – contribute to regional haze. Sources of these other pollutants include emissions from power plants, boilers, furnaces, motor vehicles, and other fuel-burning equipment (including wood combustion devices), and natural sources such as forest fires.

EPA's Regional Haze Rule requires states to revise their State Implementation Plans, or SIPs, to reduce the pollution that causes visibility impairment. These plans establish reasonable progress goals and emission reduction strategies for various air pollution sources – including point sources, area sources, and mobile sources (both on-road and non-road) – whose emissions are harmful to visibility at Class I areas.

1.2 Summary of the Requirements for Periodic Progress Reports

40 CFR 51.308(g) requires New Hampshire to submit a report to EPA every 5 years that evaluates progress toward the reasonable progress goal for each mandatory Class I federal area located within the state and each mandatory Class I federal area located outside the state that may be affected by emissions from within the state. The 5-year progress report is intended to fulfill the requirements of 40 CFR 51.308(g), (h), and (i) and must be in the form of a SIP revision that complies with the procedural requirements of 40 CFR 51.102 and 51.103. The following paragraphs summarize those requirements.

[4] NESCAUM, "Contributions to Regional Haze in the Northeast and Mid-Atlantic United States," August 2006; available at http://www.nescaum.org/documents/contributions-to-regional-haze-in-the-northeast-and-mid-atlantic--united-states. NESCAUM is the Northeast States for Coordinated Air Use Management, a regional association which includes the 6 New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) plus New York and New Jersey.

1.2.1 General and Procedural Requirements

The submission of New Hampshire's first 5-year periodic progress report occurs more than half-way through the initial 10-year planning period from 2008 to 2018. Because EPA has accepted January 29, 2010, as the official submittal date of New Hampshire's first regional haze SIP, the actual regulatory deadline for this progress report is January 29, 2015.

This report was prepared and submitted in accordance with the following federal requirements:

- 40 CFR 51.102 – provide notice of SIP public comment periods and hearings;
- 40 CFR 51.103 – submit the SIP revision in accordance with specified requirements;
- 40 CFR 51.308(g) – evaluate progress toward the reasonable progress goals established in the initial SIP for each mandatory Class I federal area located within the state and each mandatory Class I federal area located outside the state which may be affected by emissions from within the state;
- 40 CFR 51.308(h) – determine the adequacy of the existing implementation plan; and
- 40 CFR 51.308(i) – provide continued coordination with other states with Class I areas impacted by New Hampshire and consult with FLMs at least 60 days prior to any public hearing in order to maintain and improve visibility in Class I areas.

1.2.2 Required Elements of the Progress Report

Pursuant to 40 CFR 51.308(g), periodic progress reports must contain at a minimum the following elements:

(1) A description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for mandatory Class I federal areas both within and outside the state.

(2) A summary of the emissions reductions achieved throughout the state through implementation of the measures described in paragraph (1).

(3) For each mandatory Class I federal area within the state, an assessment of the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of 5-year averages of these annual values:

   - the current visibility conditions for the most impaired and least impaired days;
   - the difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions; and
   - the change in visibility impairment for the most impaired and least impaired days over the past 5 years.

(4) An analysis tracking the changes over the past 5 years in pollutant emissions contributing to visibility impairment from all sources and activities within the state. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.

(5) An assessment of any significant changes in anthropogenic emissions within or outside the state that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

(6) An assessment of whether the current implementation plan elements and strategies are sufficient to enable the state, or other states with mandatory Class I federal areas affected by emissions from the state, to meet all established reasonable progress goals.

(7) For any state with a Class I area, a review of the state's visibility monitoring strategy and any modifications to the strategy as necessary.

Each of these required elements is addressed in subsequent sections of this report.

1.2.3 Required State Actions

Based on the required calculations and assessments in the progress report, the state must take one of four actions as specified in 40 CFR 51.308(h):

(1) If the state determines that the existing implementation plan requires no further substantive revision at this time in order to achieve established goals for visibility improvement and emissions reductions, the state must provide to the EPA Administrator a negative declaration that further revision of the existing implementation plan is not needed at this time.

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

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

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

1.3 MANE-VU Regional Course of Action

The reasonable progress goals adopted by the MANE-VU Class I states represent implementation of the regional course of action set forth by MANE-VU on June 20, 2007 in two resolutions: "Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress," and "Statement of The Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Request for a Course of Action by States Outside of MANE-VU toward Assuring Reasonable Progress." These two resolutions are components of what is commonly known as the MANE-VU Ask.[5]

[5] Both statements may be found in Attachment E to New Hampshire's Regional Haze SIP at http://des.nh.gov/organization/divisions/air/do/asab/rhp/sip.htm.

MANE-VU modeling demonstrated that the control strategies for meeting the Reasonable Progress Goals would enable all MANE-VU Class I areas to meet their targets for visibility improvement in 2018. These control strategies included On-the-Books / On-the-Way (OTB/OTW) and Beyond-on-the-Way (BOTW) measures (see Section 7.2.1) as well as the additional control measures described in Sections 1.3.1 and 1.3.2, below.

1.3.1 Requested Action within MANE-VU

On June 20, 2007, the Mid-Atlantic and Northeast States agreed to pursue a coordinated course of action that would assure reasonable progress in reducing regional haze at mandatory Class I federal areas within the MANE-VU region. The coordinated effort would also leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment. This course of action went beyond OTB/OTW and BOTW measures to include the adoption and implementation of the following emission control strategies by the MANE-VU states, as appropriate and necessary:

- Timely implementation of BART requirements.
- A 90% or greater reduction in sulfur dioxide (SO_2) emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I federal area in the MANE-VU region – comprising 167 stacks in total.[6] If it were determined to be infeasible for a state to achieve that level of reduction from a targeted unit, equivalent alternative measures would be pursued in such state.
- A low-sulfur fuel oil strategy in the inner zone states (New Jersey, New York, Delaware, and Pennsylvania, or portions thereof) to reduce the sulfur content of: distillate oil to 0.05% sulfur by weight (500 ppm) by no later than 2012, of #4 residual oil to 0.25% sulfur by weight by no later than 2012, of #6 residual oil to 0.3 – 0.5% sulfur by weight by no later than 2012, and to further reduce the sulfur content of distillate oil to 15 ppm by 2016.
- A low-sulfur fuel oil strategy in the outer zone states (the remainder of the MANE-VU region) to reduce the sulfur content of distillate oil to 0.05% sulfur by weight (500 ppm) by no later than 2014, of #4 residual oil to 0.25 – 0.5% sulfur by weight by no later than 2018, and of #6 residual oil to no greater than 0.5% sulfur by weight by no later than 2018, and to further reduce the sulfur content of distillate oil to 15 ppm by 2018, depending on supply availability.
- Continued evaluation of other control measures, including energy efficiency, alternative (clean) fuels, additional measures to reduce SO_2 and nitrogen oxide (NO_x) emissions from all coal-burning facilities by 2018, and new source performance standards for wood combustion. These and other measures would be evaluated during the consultation process to determine whether they were reasonable.

This long-term strategy to reduce and prevent regional haze would allow each state up to ten years to pursue adoption and implementation of reasonable NO_x and SO_2 control measures.

Note that NHDES did not include MANE-VU's low-sulfur fuel oil strategy in New Hampshire's initial regional haze SIP as an enforceable control measure but did include a commitment to evaluate this strategy further for possible implementation by 2018.

[6] The list of 167 stacks is available from the web address in the previous footnote.

1.3.2 Requested Action outside MANE-VU

Also on June 20, 2007, the MANE-VU states adopted a statement requesting that states outside the MANE-VU region identified as contributing to visibility impairment in the MANE-VU mandatory Class I federal areas pursue a course of action similar to that of the MANE-VU states. This course of action would assure reasonable progress toward preventing any future, and remedying any existing, impairment of visibility in those Class I areas. The requested course of action for the non-MANE-VU states called for the adoption and implementation of the following emission control strategies, as appropriate and necessary:

- Timely implementation of BART requirements.
- A 90% or greater reduction in sulfur dioxide (SO_2) emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I federal area in the MANE-VU region – comprising 167 stacks in total.[7] If it were determined to be infeasible for a state to achieve that level of reduction from a targeted unit, equivalent alternative measures would be pursued in such state.
- The application of reasonable controls on non-EGU sources resulting in a 28% reduction in non-EGU SO_2 emissions by 2018, relative to on-the-books/on-the-way 2018 projections used in regional haze planning – a reduction equivalent to that which would be achieved through MANE-VU's low-sulfur fuel oil strategy.[8]
- Continued evaluation of other control measures, including measures to reduce SO_2 and nitrogen oxide (NO_x) emissions from all coal-burning facilities by 2018, and promulgation of new source performance standards for wood combustion. These and other measures would be evaluated during the consultation process to determine whether they were reasonable.

This long-term strategy to reduce and prevent regional haze would allow each state up to ten years to pursue adoption and implementation of reasonable NO_x and SO_2 control measures.

[7] See footnote 6.

[8] MANE-VU requested the 28 percent reduction in emissions from non-EGU sources outside the MANE-VU region as being equivalent to the 2018 projected emission reductions that would result from implementation of the low-sulfur fuel oil strategy within the MANE-VU region. This request intentionally omitted reference to specific control measures, as the MANE-VU states thought that each contributing non-MANE-VU state should be allowed to determine the most reasonable way to achieve the requested reduction.

SECTION 2 – CHANGES IN VISIBILITY AT CLASS I AREAS IN THE STATE

2.1 Requirements to Track Visibility Progress

The ultimate goal of the Regional Haze Rule is to restore natural visibility conditions to each of the 156 Class I areas identified in the 1977 Clean Air Act Amendments by 2064. The regional haze SIPs must contain measures that make "reasonable progress" toward this goal by reducing anthropogenic emissions that cause haze. For each Class I area, there are three metrics of visibility that enter into the determination of reasonable progress: 1) baseline conditions, 2) natural conditions (in 2064), and 3) current conditions.

40 CFR 51.308(g)(3) of the Regional Haze Rule requires states with Class I areas to assess the current visibility conditions for the five years of most recent visibility data, compare those conditions to baseline visibility conditions for the 2000-2004 period, and assess the change in visibility impairment over the past five years for each area. To lessen the influence of year-to-year variability, the Regional Haze Rule mandates the use of 5-year average visibility values for the 20% best (least impaired) and 20% worst (most impaired) days in determining visibility progress.

Progress in improving visibility at Class I areas is measured via the IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring network. A coalition composed of the National Park Service (NPS), the Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM), the Forest Service (FS) and the USEPA established the IMPROVE program in response to the 1977 CAA amendments. This monitoring network has collected speciated fine aerosol and related visibility data in or near Class I federal areas since 1988.

2.2 Visibility Progress – General Assessment

MANE-VU states with mandatory Class I federal areas adopted in their regional haze SIPs a set of goals for visibility improvement by 2018. These intermediate goals were approved by EPA as representing reasonable progress toward the restoration of natural visibility conditions at Class I areas by 2064. Table 2-1 presents observed visibility values, expressed in deciviews, for MANE-VU's Class I areas versus the corresponding short-term (2018) and long-term (2064) visibility goals. The 5-year average deciview values for the periods 2000-2004 and 2009-2013 are presented along with visibility improvements. The data indicate that all MANE-VU Class I areas have seen reduced haze levels since 2000-2004 and are, in fact, already surpassing their 2018 reasonable progress goals.

For the assessment of visibility progress, the Regional Haze Rule, at 40 CFR 51.308(g)(3), requires a determination of the change in visibility impairment for the most impaired and least impaired days over the past five years. This would involve a comparison of the 2009-2013 mean values against the 2004-2008 mean values for each Class I area. The comparison in Table 2-1 uses the 2000-2004 mean values, instead, to provide a better representation of visibility progress since the beginning of the current planning period. All sites have seen improvements of approximately 5-6 deciviews on the 20 percent worst days and approximately 1-2 deciviews on the 20 percent best days through 2013. The observed rates of improvement exceed prior projections and are mainly due to regional emission reductions of haze-causing pollutants in the past decade. While continued improvement is expected, past rates may not be indicative of future visibility progress.

Table 2-1. Observed Visibility vs. Established Visibility Goals (deciviews)

Class I Area IMPROVE* Site	2000-2004 5-Year Average	2009-2013 5-Year Average	Difference = Visibility Improvement	2013 Annual Average	2018 Reasonable Progress Goal	2064 Goal (Natural Visibility)
20% Worst Days						
Acadia National Park	22.9	17.9	5.0	16.5	19.4	12.4
Moosehorn Wilderness Area**	21.7	16.8	4.9	15.9	19.0	12.0
Great Gulf Wilderness Area***	22.8	16.7	6.1	15.0	19.1	12.0
Lye Brook Wilderness Area	24.4	18.8	5.6	17.5	20.9	11.7
Brigantine Wilderness Area	29.0	23.8	5.2	21.5	25.1	12.2
20% Best Days						
Acadia National Park	8.8	7.0	1.8	6.3	8.3	4.7
Moosehorn Wilderness Area	9.2	6.7	2.5	6.4	8.6	5.0
Great Gulf Wilderness Area	7.7	5.9	1.8	5.4	7.2	3.7
Lye Brook Wilderness Area	6.4	4.9	1.5	5.4	5.5	2.8
Brigantine Wilderness Area	14.3	12.3	2.0	11.8	14.3	5.5

* IMPROVE = Interagency Monitoring of Protected Visual Environments program.
** The IMPROVE monitor for Moosehorn Wilderness also represents Roosevelt Campobello International Park.
*** The IMPROVE monitor for Great Gulf Wilderness also represents Presidential Range - Dry River Wilderness Area.

2.3 Visibility Progress – Detailed Assessment

NESCAUM produced a comprehensive study for MANE-VU: "Tracking Visibility Progress, 2004-2011" (Attachment B). The analysis was performed to determine the extent of progress in meeting short-term and long-term visibility goals under the Regional Haze Rule. This technical document examined visibility data collected from IMPROVE's Class I area monitors, starting with the historic baseline period of 2000-2004 and ending with 2009-2011, the last 5-year period for which data were available at the time of the report.

The results of the NESCAUM analysis are summarized as following:

- There are definite downward trends in overall haze levels at the Class I areas in and adjacent to the MANE-VU region.[9]
- Based on 5-year rolling averages demonstrating progress since the 2000-2004 baseline period, the MANE-VU Class I areas appear to be on track to meet their 2018 reasonable progress goals (RPGs) for both best and worst visibility days.
- The trends in visibility improvement are mainly driven by large reductions in sulfate light extinction and, to a lesser extent, nitrate light extinction.
- Levels of organic carbon mass (OCM) and light absorbing carbon (LAC) appear to be approaching natural background levels on days of best visibility at most of the MANE-VU Class I areas.
- In some cases, the levels set by the 2018 reasonable progress goals have already been met, and progress beyond those goals appears achievable.

[9] New Hampshire's regional haze SIP has previously shown that sources in New Hampshire do not contribute significantly to visibility impairment in Class I areas outside the MANE-VU region. The same is true for visibility impairment at Brigantine Wilderness Area, for which New Hampshire's contribution to total sulfate aerosol is less than 1 percent. References to Brigantine and non-MANE-VU Class I areas are included for context only and do not signify any obligation on New Hampshire's part with respect to visibility at those locations.

- Although the Brigantine Wilderness Area in New Jersey is on track to meet its 2018 reasonable progress goals, challenges remain. Sulfate light extinction levels are higher at this site than at others across the region. Additional sulfate reductions would be effective in reducing overall haze levels at Brigantine.[10]

2.3.1 Graphical Analysis of Visibility Trends

Figures 2-1 through 2-5, taken from the NESCAUM study and updated with visibility values for 2012 and 2013, display the annual average deciview (haze index) levels on the 20 percent worst and 20 percent best visibility days for each MANE-VU Class I area. The observational data cover the period 2000-2013 and are shown in relation to established visibility goals to facilitate interpretation. The MANE-VU Class I areas are graphed individually and arranged in approximately north-to-south order. Corresponding numerical data (through 2011) are found in Table A-1 of the NESCAUM report (Attachment B).

The visibility graphs have been drawn using the following conventions:

- Blue and purple diamonds represent annual average deciview values for best and worst visibility days, respectively.
- Solid red (worst) and blue (best) lines represent 5-year-back rolling averages.
- Red (worst) and black (best) plus signs represent the 2018 reasonable progress goals established in New Hampshire's regional haze SIP.
- Red (worst) and black (best) dotted lines represent hypothetical glidepaths to meet the 2018 reasonable progress goals.
- Red (worst) and black (best) dashed lines represent hypothetical glidepaths to meet long-term natural visibility goals. The worst-day glidepath is also called the "uniform rate of progress" line, and the best-day glidepath is also called the "no degradation" line.[11]
- The grey region denotes the range of 20 percent best to 20 percent worst haze levels expected to occur under natural conditions. By design, the uniform rate of progress line intersects with the upper limit of the grey area in 2064.

These figures indicate that, from 2000 to 2013, haze levels declined on the best and worst days across the entire region. Visibility trends documented in the last NESCAUM report[12] for the period ending in 2008 largely continued through 2010. Most Class I areas experienced a relatively steep drop in deciview values for the 20 percent worst days between 2007 and 2010, followed by a brief uptick in haze levels before resumption of the downtrend. This somewhat irregular pattern may be explained by meteorological variability and changes in regional emissions in the period after 2007. The 5-year averaging of annual deciview values (represented by solid lines) smooths any short-term effects and validates the general trend toward improved visibility on both best and worst days over the period analyzed.

---

[10] See footnote 9.

[11] For the Brigantine Wilderness Area, whose haze levels on the 20 percent best days during the 2000-2004 baseline period were higher than estimated natural conditions on the 20 percent worst days, the no degradation line (representing the long-term best-day goal) is higher than the uniform rate of progress line (representing the long-term worst-day goal) at dates approaching 2064. This nonsensical situation is an artifact of technical guidance and only represents stated visibility goals, not anticipated results.

[12] NESCAUM, "Tracking Visibility Progress, 2004-2008," MANE-VU Technical Memorandum, May 12, 2010; available at http://www.nescaum.org/documents/tracking-progress-final-05-12-10.pdf.

Figure 2-1. Visibility Progress at Acadia National Park

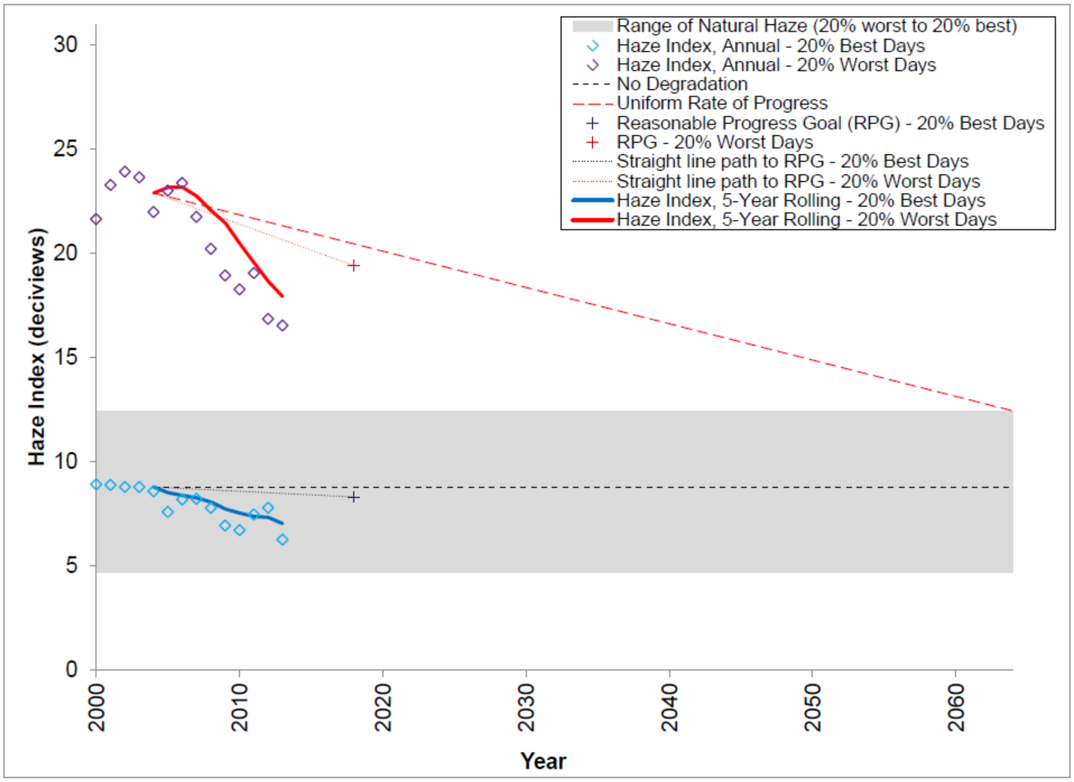


Figure 2-2. Visibility Progress at Moosehorn Wilderness Area

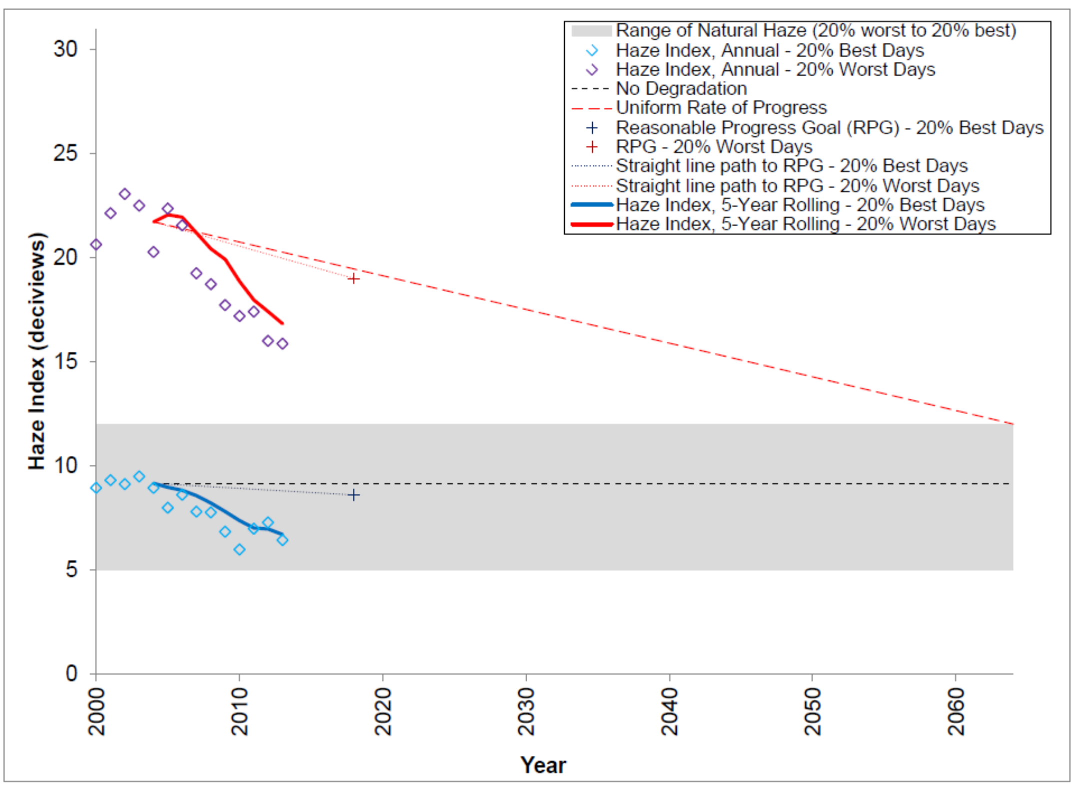


Figure 2-3. Visibility Progress at Great Gulf Wilderness Area

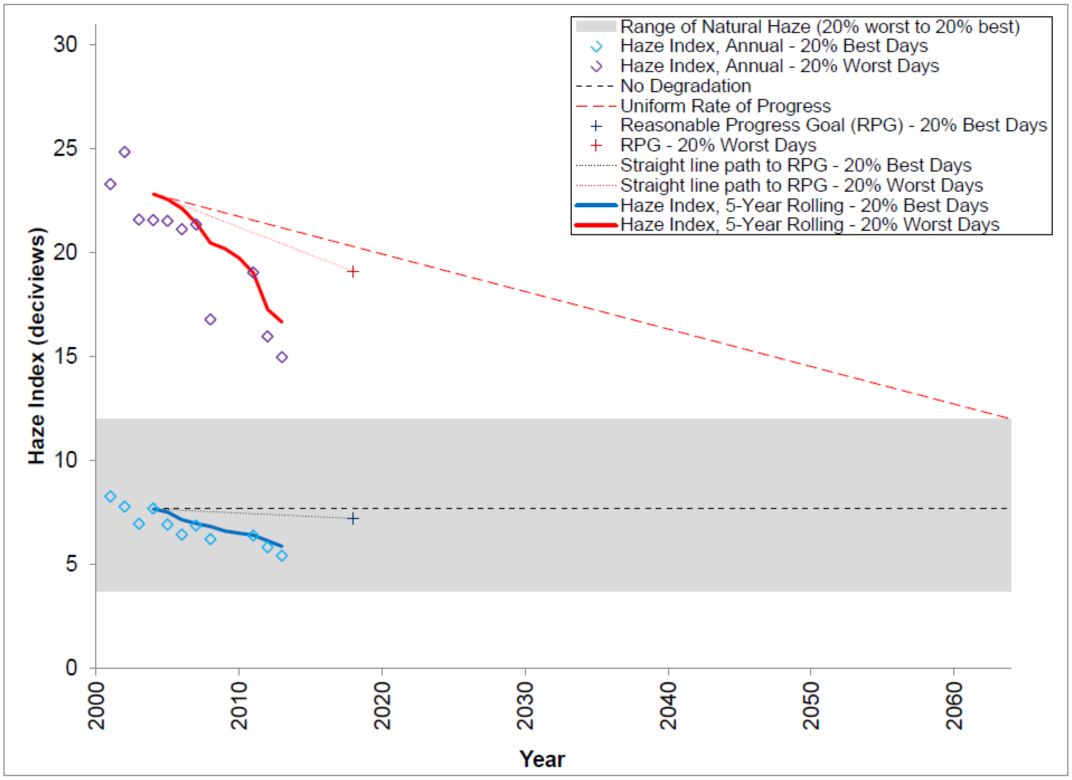


Figure 2-4. Visibility Progress at Lye Brook Wilderness Area

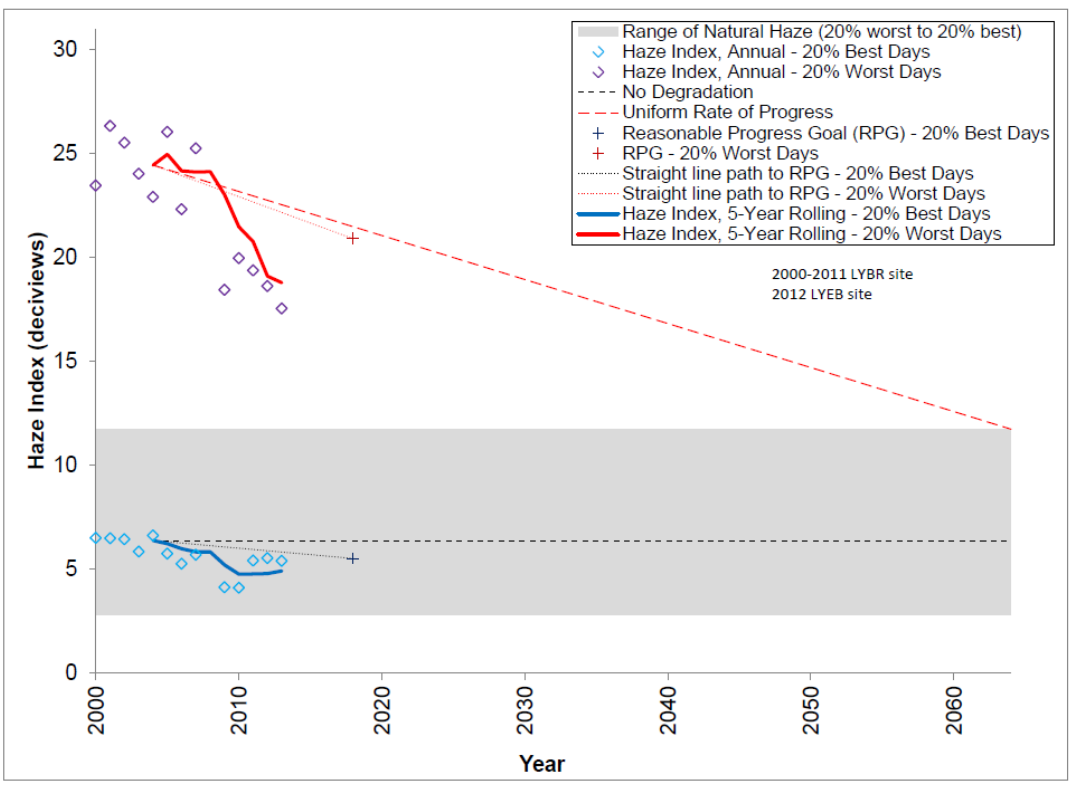
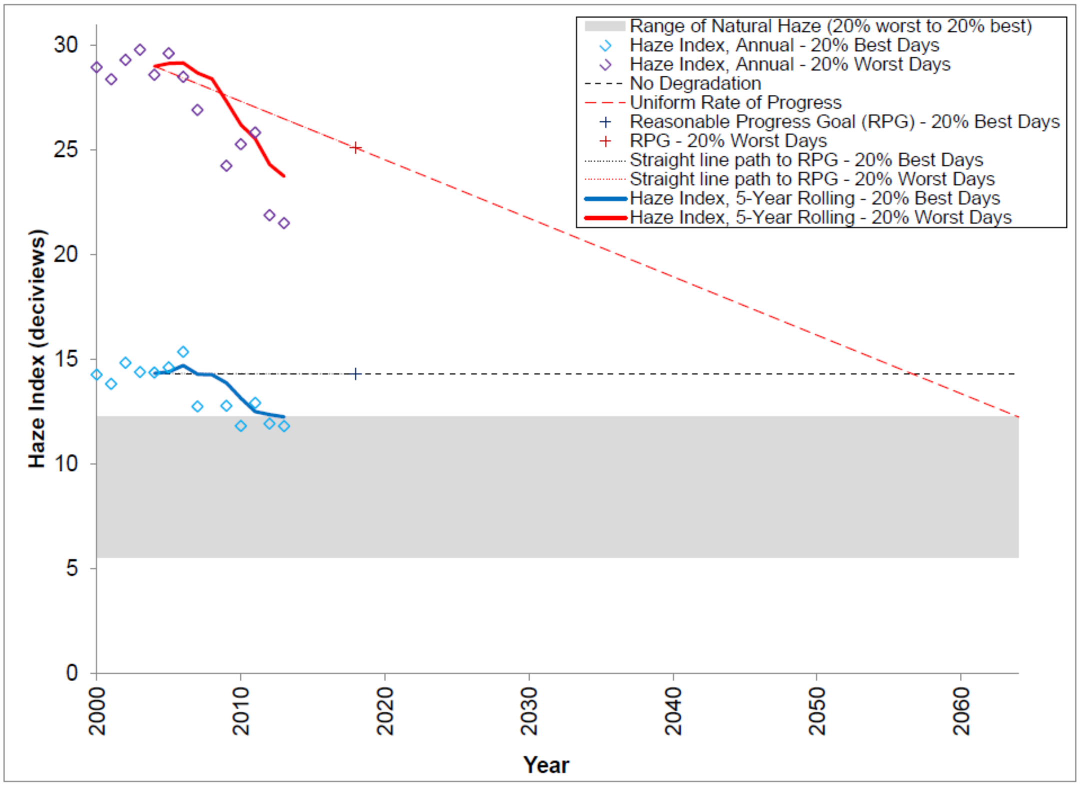


Figure 2-5. Visibility Progress at Brigantine Wilderness Area



2.3.2 Light Extinction Trends from Constituent PM

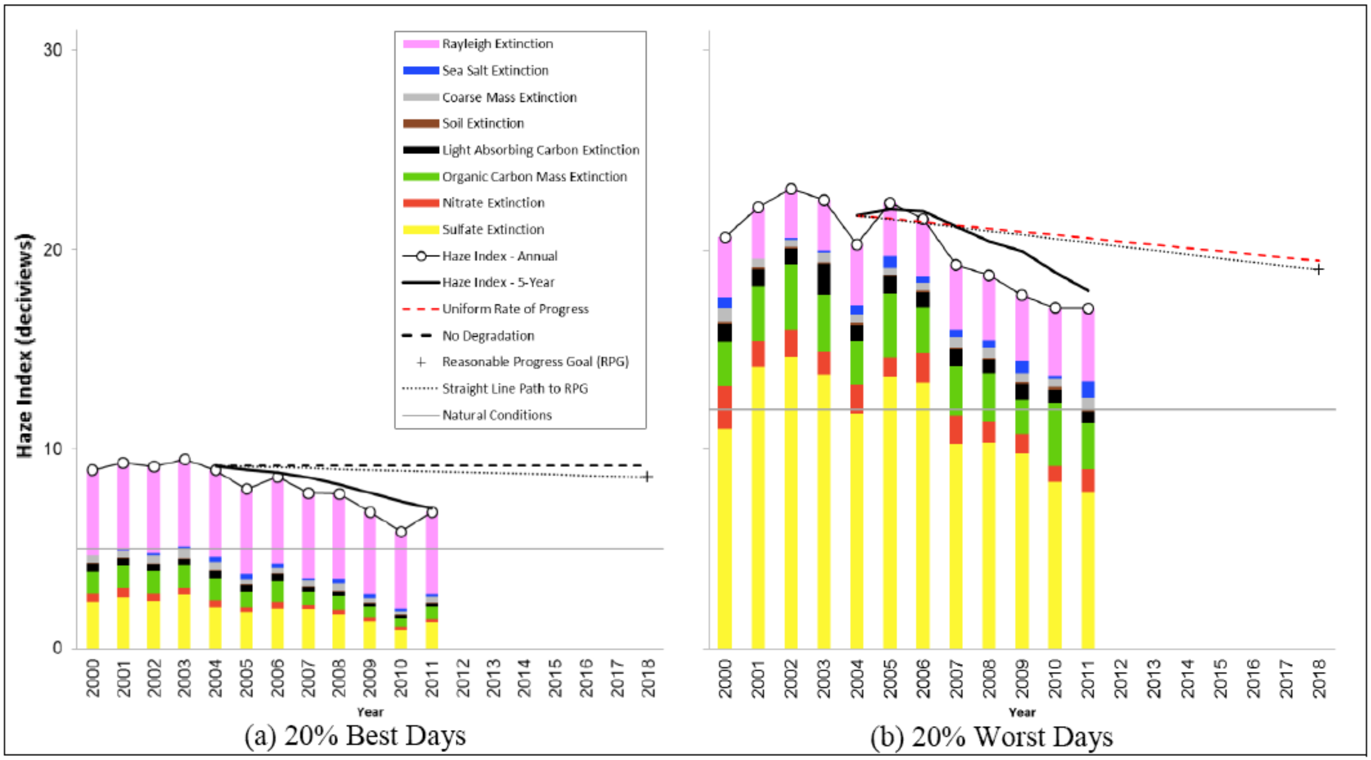
In addition to analyzing overall visibility trends at the Class I monitor sites, NESCAUM examined the underlying air quality data for changes in particulate matter (PM) constituent contributions to visibility impairment. The report "Tracking Visibility Progress, 2004-2011" (Attachment B) includes a series of figures depicting annual haze levels broken down by PM constituent contributions on the 20 percent best and 20 percent worst visibility days for each Class I area. Individual contributions are shown as stacked bar charts for sulfate, nitrate, OCM, LAC, soil, course mass, sea salt, and Rayleigh scattering (natural light extinction). The best- and worst-day charts for Acadia National Park, reproduced below in Figure 2-6, will serve to illustrate. Charts for the other Class I sites may be found in the attached report.

These graphical analyses confirm that improving visibility at MANE-VU Class I areas is due primarily to reductions in sulfate impacts on the most impaired days. At the same time, a general decline in sulfate, OCM, and nitrate impacts has resulted in improving visibility on the least impaired days.

NESCAUM's charts reveal that, for the two Class I area monitors in Maine (Acadia and Moosehorn), the average contribution from sulfate aerosol on the 20 percent worst days has fallen steadily since the baseline years of 2000-2004. At the other MANE-VU sites, a similar trend in sulfate contribution occurred until around 2008-2009, after which there were no notable changes in sulfate impact. Within the MANE-VU region overall, sulfate's contribution to total light extinction on the 20 percent worst days declined from about 60-75 percent to about 45-55 percent, depending on the Class I area location, over the period examined. As the absolute concentrations of sulfate aerosol have decreased, the other contributors to light extinction have assumed greater importance on a percentage basis.

In summary, sulfate continues to be the largest contributor to light extinction at all MANE-VU Class I areas, followed by OCM, nitrate, and light-absorbing carbon. Light extinction from soil and sea salt, which help indicate the extent to which natural processes contribute to overall haze levels, is relatively insignificant by comparison. Based on NESCAUM's analyses, reductions in sulfate and nitrate aerosols appear to be the main cause of trending improvements in best- and worst-day visibility. Additional details are available in the attached NESCAUM report.

Figure 2-6. PM Constituent Contributions to Haze Levels at Acadia National Park on Best and Worst Visibility Days



SECTION 3 – STATUS OF BART MEASURES IN THE REGIONAL HAZE SIP

3.1 Requirement to Track BART Implementation

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

40 CFR 51.308(g)(1) of the Regional Haze Rule requires that the state's 5-year progress report describe the implementation status of all measures included in the SIP for achieving reasonable progress goals for Class I areas within and outside the state. As noted in Section 1, New Hampshire and the other MANE-VU Class I states relied in part on the timely implementation of BART to meet these goals. Affected sources are required to comply with any BART determinations as expeditiously as practicable, but no later than five years after EPA's approval of the SIP. New Hampshire's regional haze SIP revision was more specific in that it required the state's two BART sources to implement BART control measures by July 1, 2013.

Thus, MANE-VU's Class I areas are already benefiting from implementation of BART controls in New Hampshire and elsewhere within the MANE-VU region. Further visibility benefits are likely to accrue from new emission controls at BART-eligible facilities located in states outside the MANE-VU region. However, the previously conducted MANE-VU modeling associated with the determination of reasonable progress goals did not account for BART control measures in the non-MANE-VU states. Consequently, the modeled visibility projections for MANE-VU's Class I areas do not include the additional visibility improvements that would result from such external efforts.

3.2 Status of BART Measures

EPA regulations and guidance allowed states to rely on the Clean Air Interstate Rule (CAIR) as satisfying BART requirements for SO_2 and NOx for certain electricity generating units. However, most CAIR states in the MANE-VU region made individual determinations for BART-eligible EGUs instead of more broadly relying on CAIR to meet the requirements of BART. CAIR was challenged in court and remanded to EPA for revision. In 2011, EPA replaced CAIR with the Cross-State Air Pollution Rule (CSAPR). CSAPR itself was challenged, then vacated, and finally reinstated following an appeal by EPA to the U.S. Supreme Court. (See Section 4.3.1 for details.)

New Hampshire was never a CAIR state and, consequently, did not rely on this program to meet SIP requirements for in-state BART-eligible units. However, New Hampshire has counted on the emission reductions that BART would produce in upwind states and therefore has an interest in the final resolution of CAIR/CSAPR.

Attachment C is a memorandum from Paul Miller of NESCAUM to MANE-VU summarizing states' actions relative to the MANE-VU Ask, including synopses of the individual states' BART determinations and implementation status as of March 28, 2013. The memo includes a few instances in which states employed alternatives to BART to fulfill regional haze SIP requirements. New Hampshire has two units subject to BART, both of which are EGUs owned and operated by Public Service of New Hampshire (PSNH): Merrimack Station Unit 2 and Newington Station Unit 1. The BART control measures for these units are enforceable through a combination of existing permit conditions and administrative rules, including New Hampshire Administrative Rule Env-A 2300: Mitigation of Regional Haze, which was adopted into the SIP with an effective date of September 21, 2012 (Table 3-1).[13]

Table 3-1. New Hampshire BART Controls and Implementation Status

Pollutant	BART Controls / Emission Limitations	NH Regulatory Citations	Compliance Deadline	Status
		PSNH Merrimack Station Unit 2		
SO_2	Fuel sulfur limits	Administrative Rule Env-A 1604.01: Maximum Sulfur Content Allowable in Coal	N.A.	Pre-existing requirement
	Flue gas desulfurization (FGD), with required SO_2 percent reduction set at maximum sustainable rate, but not less than 90% as a calendar monthly average	Administrative Rule Env-A 2300: Mitigation of Regional Haze, paragraph 2302.01(b)(1); Temporary permit for FGD system (TP-0008)	July 1, 2013	FGD is currently operating with 90+ percent SO_2 reduction. Maximum sustainable rate is being evaluated. Findings are December 31, 2014, and will be incorporated as permit condition ~ 2015.
NOx	SCR (pre-existing); NOx emission limit of 0.30 lb/MMBtu, 30-day rolling average	Administrative Rule Env-A 2300: Mitigation of Regional Haze, paragraph 2302.01(b)(2)	July 1, 2013	Emission limit is in effect. Reference to Env-A 2300 will be included in facility's Title V operating permit (TV-0055) ~ 2015.
PM	Two ESPs in series (pre-existing); TSP emission limit of 0.08 lb/MMBtu	Administrative Rule Env-A 2300: Mitigation of Regional Haze, paragraph 2302.01(b)(3)	July 1, 2013	Emission limit is in effect. Reference to Env-A 2300 will be included in facility's Title V operating permit (TV-0055) ~ 2015.
		PSNH Newington Station Unit 1		
SO_2	SO_2 emission limit of 0.50 lb/MMBtu, 30-day rolling average, applicable to any fuel type or mix	Administrative Rule Env-A 2300: Mitigation of Regional Haze, paragraph 2302.02(a)	July 1, 2013	Emission limit is in effect. Reference to Env-A 2300 will be included in facility's Title V operating permit (TV-0054) ~ 2015.
NOx	Low-NOx burners, overfire air, and water injection (pre-existing); NOx emission limits of 0.35 lb/MMBtu with oil and 0.25 lb/MMBtu with oil/gas, 24-hour calendar day average	Administrative Rule Env-A 2300: Mitigation of Regional Haze, paragraph 2302.02(b)	N.A. (Existing controls are BART.)	Emission limit is in effect. Reference to Env-A 2300 will be included in facility's Title V operating permit (TV-0054) ~ 2015.
PM	Electrostatic precipitator (pre-existing); TSP emission limit of 0.04 lb/MMBtu	Administrative Rule Env-A 2300: Mitigation of Regional Haze, paragraph 2302.02(c)	N.A. (Existing controls are BART.)	TSP emission limit is revised. Associated rule revision is submitted for inclusion in the SIP. Reference to Env-A 2300 will be included in facility's Title V operating permit (TV-0054) ~ 2015.

[13] A revision to Env-A 2302.02 provides for a new, lower TSP emission limit of 0.04 lb/MMBtu for Newington Station, as listed in the table. The adopted rule is submitted herewith for SIP approval; see Attachment E.

40 CFR 51.308(e)(1)(v) requires that each source subject to BART maintain the required control equipment and establish procedures to ensure such equipment is properly operated and maintained. New Hampshire's SIP meets this requirement by including in the Title V operating permit for each BART source provisions to ensure proper operation and maintenance of the control equipment. Note that, because New Hampshire does not have a merged construction permitting and Title V permitting program, requirements related to BART first need to be placed into a state temporary permit (*i.e.*, construction permit) before they can be incorporated subsequently into a Title V operating permit.

SECTION 4 – STATUS OF CONTROL MEASURES FOR EGUs

4.1 Requirement to Track Implementation of EGU Control Measures

As noted in the preceding section, 40 CFR 51.308(g)(1) requires that the 5-year progress report describe the implementation status of all measures included in the SIP for achieving reasonable progress goals for Class I areas within and outside the state. Section 1 of this report outlines the strategy adopted by New Hampshire and the other MANE-VU states for achieving these goals. The MANE-VU strategy relies in part on emission reductions by 2018 from the top 167 (targeted) EGU sources or equivalent control measures in the states where those sources are located. This section describes the status of those and other EGU control measures, with emphasis on New Hampshire's actions. Note that there is some overlap between units subject to BART (see Section 3) and the EGUs covered in this section.

4.2 Focus on Sulfates and EGUs

The MANE-VU Contribution Assessment[14] produced a conceptual model of regional haze in which sulfate emerged as the most important constituent of haze-forming fine particle pollution and the principal cause of visibility impairment across the region. This model is supported by NESCAUM's more recent analysis of light extinction trends described in Section 2.3.2.[15]

The Contribution Assessment found that, in 2002, SO_2 emissions originating within MANE-VU were responsible for approximately 25 percent of total sulfate aerosol at MANE-VU Class I areas. Sources in the Southeast and Great Lakes regions were responsible for about 15 to 25 percent each. Sources in the Midwest and Canada were responsible for most of the remainder. Point sources dominated the inventory of SO_2 emissions. In response to these findings, MANE-VU designed its long-term strategy to include additional control measures on SO_2 sources within the MANE-VU region and in neighboring states that contribute significantly to regional haze at MANE-VU Class I Areas. Electrical generating units were identified as the largest source category contributing to these emissions, and EPA's Clean Air Interstate Rule was the strategy of choice for most states to reduce SO_2 emissions from EGUs by 2018.

4.3 EGU Control Measures Included in the SIP

Since 2002, various control measures to reduce emissions from EGUs have been realized through a number of mechanisms, including CAIR, individual state programs, federal consent agreements, and source-specific permitting actions. The EGU emissions used in MANE-VU's modeling to help determine reasonable progress goals are described in an August 2009 document.[16] Changes in emissions since 2002 are summarized in Sections 6 and 7 of this report. The following information describes the status of EGU control measures included in the SIP that have been effective in reducing regional-haze-causing emissions.

---

[14] See footnote 4.

[15] Unlike NESCAUM's graphical analysis, the Contribution Assessment was based on particle mass. Light extinction and particle mass are two different ways of representing visibility impairment and do not yield identical results.

[16] Alpine Geophysics, LLC and MARAMA, "Documentation of 2018 Emissions from Electric Generating Units in the Eastern United States for MANE-VU's Regional Haze Modeling," final report, August 16, 2009; available at http://www.marama.org/publications_folder/EGU_Projections_Summary_Final_Aug_2009.pdf.

4.3.1 Clean Air Interstate Rule and Cross-State Air Pollution Rule

On May 12, 2005, the EPA promulgated CAIR, which required reductions in emissions of SO_2 and/or NO_X from large fossil-fuel-fired EGUs in 27 eastern states, including MANE-VU members Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, and Maryland, plus the District of Columbia. These emission reductions were among the many inputs to the MANE-VU 2018 modeling projections. The U.S. Court of Appeals for the D.C. Circuit ruled on petitions for review of CAIR and CAIR federal implementation plans, including their provisions establishing the CAIR NO_X annual, NOx ozone season, and SO_2 trading programs. On July 11, 2008, the court issued an opinion vacating and remanding these rules. However, parties to the litigation requested rehearing of aspects of the court's decision, including the vacatur. The court's subsequent ruling of December 23, 2008, to remand without vacatur left CAIR in place until EPA issued a new rule to replace CAIR in accordance with the July 11, 2008, decision.

In separate actions on July 6, 2011, and December 15, 2011, followed by a number of technical revisions and minor adjustments, the EPA finalized CSAPR as a replacement for CAIR. It was EPA's intention that, beginning in 2012, CSAPR would require 28 states in the eastern half of the United States to reduce power plant emissions: 20 states for annual SO_2, annual NOx, and ozone-season NOx; 3 states for annual SO_2 and annual NOx; and 5 states for ozone-season NOx only. The affected MANE-VU states were New York, New Jersey, Pennsylvania, and Maryland. EPA estimated that CSAPR would reduce EGU emissions by 6,500,000 tons of SO_2 and 1,400,000 tons of NO_X annually from 2005 levels. These estimates represented a 71 percent reduction in SO_2 and a 52 percent reduction in NO_X in the covered states.

On August 17, 2012, the U.S. Court of Appeals for the D.C. Circuit vacated CSAPR. On October 5, 2012, EPA requested a rehearing *en banc* of the CSAPR vacatur. The court denied this request on January 24, 2013. The U.S. Supreme Court agreed to hear EPA's appeal of the lower court's ruling, and, on April 29, 2014, reversed the D.C. Circuit opinion vacating CSAPR. This program will now be implemented under a revised schedule beginning in 2015.

4.3.2 State-Specific EGU Control Measures

As a complement to federal actions, the individual MANE-VU states adopted state-specific emission control measures beyond CAIR that will help to reduce emissions of haze-causing pollutants from EGUs. The regional modeling used to establish the MANE-VU reasonable progress goals included a large number of state control measures, including two New Hampshire regulations affecting local EGUs. These are listed in Table 4-1 along with brief descriptions of their current status.

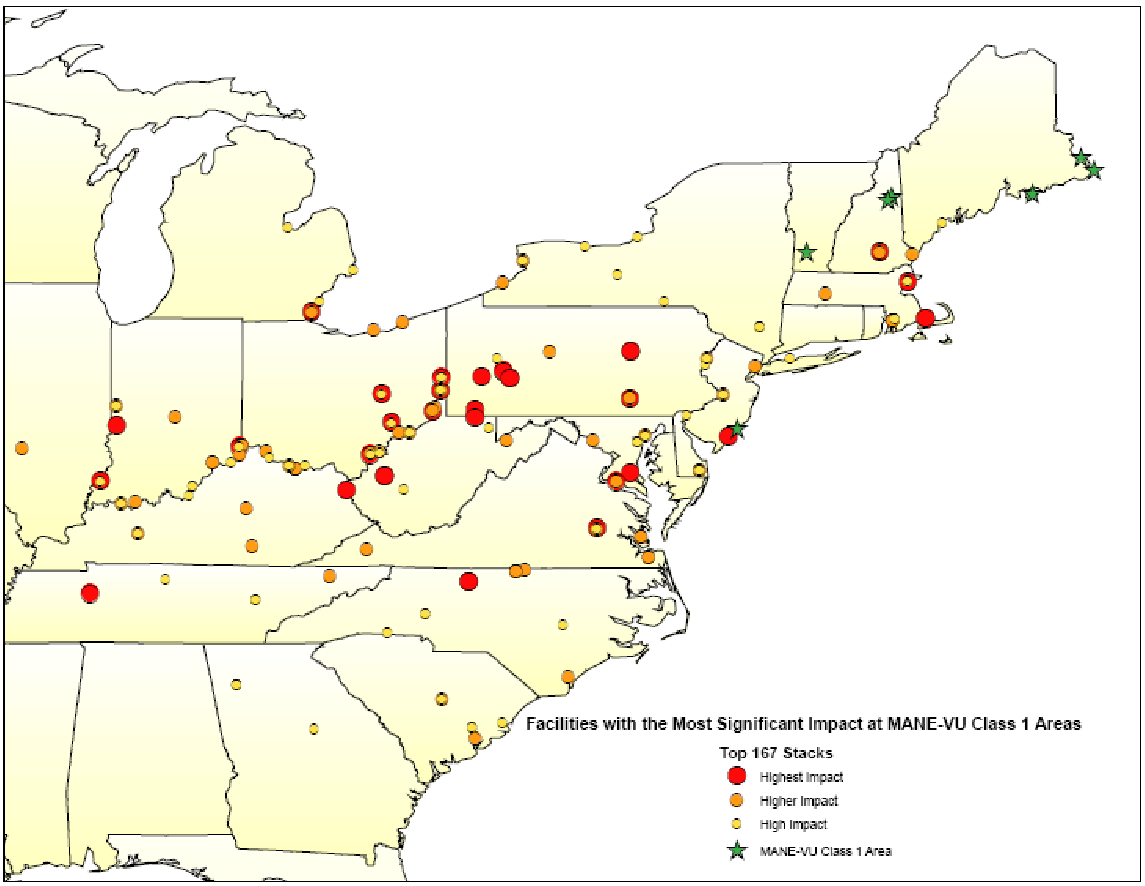
Table 4-1. Status of New Hampshire EGU Control Measures Included in MANE-VU Modeling

Control Measure	Status
Chapter Env-A 2900: Multiple Pollutant Annual Budget Trading and Banking Program, capping NO_X emissions at 3,644 tons per year, SO_2 emissions at 7,289 tons per year, and CO_2 emissions at 5,425,866 tons CO_2 per year for all existing fossil-fuel fired steam units by December 31, 2006.	Effective May 13, 2003; readopted October 1, 2011; not submitted to or approved by EPA as SIP revision.
Chapter Env-A 3200: *NO_X Budget Trading Program*, limiting ozone season NO_X emissions on all fossil-fuel-fired EGUs greater than 15 MW to 0.15 lb/MMBtu, effective November 2, 2007.	Effective July 17, 1998; readopted November 2, 2007; approved by EPA as SIP revision November 14, 2000.

4.3.3 Controls on Top 167 EGU Sources

With the focus on sulfate emissions and fossil-fuel-fired power plants, MANE-VU reasoned that large reductions in SO_2 could be obtained with the addition of cost-effective controls on the largest-contributing EGUs. Appendix D of MANE-VU's Contribution Assessment identified 167 EGU sources in the Northeast, Southeast, and Midwest whose 2002 emissions were most responsible for visibility impairment at MANE-VU Class I areas (Figure 4-1). Three New Hampshire EGUs were among the listed units: PSNH Merrimack Station Units 1 and 2, and PSNH Newington Station Unit 1. (Note that Merrimack 2 and Newington 1 are also BART units – see Section 3.) MANE-VU's long-term strategy called for a 90 percent reduction in SO_2 emissions from each of these sources, or equivalent measures where this level of reduction was infeasible for an identified unit.

Figure 4-1. Location of 167 EGU Stacks Contributing the Most to Visibility Impairment at MANE-VU Class I Areas



Note: Some facilities have more than one stack.

Emission controls such as SO_2 scrubbers have already been placed on many of the 167 targeted EGUs, while other units have seen lower utilization or been shut down entirely. As expected, measurable visibility improvements have occurred at Class I areas as a result of these actions. Attachment C includes summary descriptions of the actions taken by individual states within and outside MANE-VU to reduce SO_2 emissions from the targeted units. The status of New Hampshire's three sources is shown below (Table 4-2).

Table 4-2. Status of SO_2 Control Measures at Targeted EGUs in New Hampshire

Facility Name / Unit	Fuel Type	Control Method	BART Controls	Control Deadline	Control Status	2002-2013 Emission Reductions*
Merrimack Station (ORISPL 2364) Unit 1	coal	scrubber, 90% control (min.)	not required	July 1, 2013	implemented	9,390 tons/year (96%)
Merrimack Station (ORISPL 2364) Unit 2	coal	scrubber, 90% control (min.)	yes	July 1, 2013	implemented	19,866 tons/year (95%)
Newington Station (ORISPL 8002) Unit 1	fuel oil/ natural gas	0.50 lb/MMBtu SO_2 emission limit	yes	July 1, 2013	implemented	4,897 tons/year (94%)

* See Table 6-1 for details.

4.4 Additional Controls on EGUs Expected by 2018

New Hampshire's long-term strategy for regional haze did not identify additional controls on EGUs to reduce haze-causing emissions beyond those measures already described in Sections 3 and 4. However, it should be mentioned that the flue gas desulfurization system for Merrimack Station has its origins in state law RSA 125-O: Multiple Pollutant Reduction Program, which requires the reduction of mercury emissions by at least 80 percent from New Hampshire's fossil-fuel-fired power plants. The 90-percent-plus removal of SO_2 at Merrimack Station occurs as a co-benefit of FGD for mercury control that simultaneously fulfills New Hampshire's separate obligations under BART and the targeted EGU strategy.

More specifically, RSA 125-O set limits on the aggregate mercury emissions from PSNH's Merrimack and Schiller Stations.[17] Although Schiller has no post-combustion emission controls for either mercury or SO_2, the Merrimack Station scrubber, because of its size and performance, allows both plants to meet the statute's 80-percent reduction requirement on combined mercury emissions. Note that RSA 125-O: Sections 1 and 3, requiring an integrated, multi-pollutant reduction strategy for certain power plants, were submitted to EPA on September 13, 2013, as part of New Hampshire's infrastructure SIP for the 2010 SO_2 NAAQS.

Aside from this state standard, fossil-fuel-fired EGUs will be required to meet EPA's Mercury and Air Toxic Standards (MATS) for power plants by April 16, 2015,[18] and the 2010 primary 1-hour NAAQS for SO_2. The method(s) of compliance for Schiller Station have not yet been determined but could further reduce SO_2 emissions in New Hampshire that contribute to regional haze.

4.5 EGU Retirements or Replacements

40 CFR 51.308(d)(3)(v)(D) of the Regional Haze Rule requires New Hampshire to consider source retirement and replacement schedules in its long-term strategy. Of particular interest is the future disposition of New Hampshire's fossil-fuel-fired EGUs. While recent developments in the oil and gas industry have forced rapid changes in the power production sector, and some generating units have experienced sharp reductions in utilization, no retirements or replacements of New Hampshire's EGUs have occurred or been announced since the regional haze SIP was first submitted in 2010.

[17] Schiller Station, which has two coal-fired units and one wood-fired unit, is a smaller plant than either Merrimack Station or Newington Station and is not listed among New Hampshire's BART units or targeted EGUs.

[18] Schiller successfully petitioned EPA for a one-year extension to April 16, 2016.

SECTION 5 – STATUS OF ADDITIONAL CONTROL MEASURES IN THE SIP

5.1 Requirement to Track Implementation of Other Control Measures

As previously described, the New Hampshire long-term strategy for visibility improvement includes the timely implementation of BART controls (Section 3), reductions in SO_2 emissions from key EGUs (Section 4), and consideration of additional control measures. In compliance with 40 CFR 51.308(g)(1), this section reports on the status of additional controls not covered in Sections 3 and 4.

5.2 Low-Sulfur Fuel Oil Strategy

In pursuing a regional course of action, the MANE-VU states developed a low-sulfur fuel oil strategy to be implemented within the region by 2018. As described in Section 1.3.1, this strategy would reduce the sulfur content of distillate and residual fuel oils, which are used mainly for domestic space heating and for powering industrial, commercial, and institutional boilers. Several MANE-VU states have already adopted statutes or regulations implementing this strategy. Summary descriptions of individual states' efforts in this regard are included in Attachment C.

New Hampshire did not commit to implementing the low-sulfur fuel oil strategy in its regional haze SIP but did commit to further evaluation of this strategy for possible implementation by 2018. Accordingly, New Hampshire maintains an interest in pursuing the low-sulfur fuel oil strategy and is monitoring progress in surrounding states. Incremental fuel costs and the assurance of fuel supplies for the various grades of low-sulfur oil are real, but diminishing, concerns as other states' programs ramp up. To be successful in New Hampshire, any low-sulfur fuel oil requirement would most likely be implemented via legislative action rather than NHDES rulemaking. The prospects for such action are being evaluated at the time of this progress report. A low-sulfur requirement could set fuel sulfur content limits at levels varying between 25 and 90 percent or more below current standards, depending on the fuel grade.

Whether or not New Hampshire implements the low-sulfur fuel oil strategy, there will be visibility benefits resulting from regional adoption of this strategy. Should all neighboring states implement this strategy in full, it is anticipated that New Hampshire's fuel oil supply would simply default to low-sulfur content in response to market conditions.

5.3 State-Specific Control Measures

This section discusses implementation of additional state-specific control measures relevant to New Hampshire's regional haze SIP.

5.3.1 Control Measures for NOx Sources

In 2010, New Hampshire readopted, with minor amendments, administrative rule Env-A 1300: Nitrogen Oxides (NOx) Reasonably Available Control Technology (RACT). Previously numbered and approved into the SIP as Env-A 1211, this rule establishes RACT standards for certain NOx-emitting stationary sources located in New Hampshire, to comply with sections 172(c)(1) and 182(b)(2) of the CAA. The rule is applicable to the following stationary source categories: utility boilers, steam electric boilers, industrial boilers, auxiliary boilers, combustion turbines, internal combustion engines, asphalt plant rotary dryers, incinerators, wallboard dryers, calcining mills, calciners, gypsum rock dryers, emergency generators, load shaving units, and miscellaneous stationary sources. The rule also establishes the criteria and procedures by which a source can request alternative RACT emission limits and sets conditions for the use of NOx emission allowances. Env-A 1300 was readopted with an effective date of October 31, 2010, and subsequently submitted to EPA as a SIP revision. EPA's approval of this SIP revision was signed on July 29, 2014 (79 FR 49458).

5.3.2 Prevention of Significant Deterioration

Class I areas are protected under Title I, Part C of the CAA, which addresses Prevention of Significant Deterioration of Air Quality (PSD). In particular, section 160 of this part establishes the purpose "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value." PSD is applicable to all major sources (or existing sources making a major modification) located in an area that is in attainment of the National Ambient Air Quality Standards. All areas of New Hampshire are subject to PSD.

Administrative rule Env-A 619: Prevention of Significant Deterioration, which was previously codified as Env-A 623 and approved as a SIP revision on December 27, 2002, spells out the PSD requirements of New Hampshire's statewide permit system. The PSD permitting process requires modeling analyses to assess the potential air quality impacts, including those to visibility, at Class I areas. PSD permit applicants may conduct such analyses in consultation with NHDES and the relevant FLM. The most recent revisions to Env-A 600: Statewide Permit System, including Env-A 619, were readopted with an effective date of September 1, 2012. NHDES submitted the amended rule to EPA for SIP approval on November 15, 2012.

New Hampshire has received and processed only one PSD permit application since the original regional haze SIP submission. On December 16, 2009, Laidlaw Berlin BioPower, LLC (a.k.a. Burgess BioPower), Berlin, NH, filed an initial application for a proposed wood-fired power plant. Following a change in project ownership and NHDES's detailed review of the application, a temporary permit was issued allowing construction to proceed.[19]

Visibility modeling was performed as part of the application process for the BioPower facility. Initial modeling showed that the potential existed for the biomass boiler's exhaust plume to cause a noticeable color difference when viewed against the sky from inside nearby Class I areas. Subsequent, more-refined modeling showed that the meteorological conditions that might produce this effect would persist for no more than three hours at a time. Based on the strongest wind speed in the modeled meteorological data set, it was estimated that the shortest transport time to the Class I areas was five hours. This would not be enough time for a visible plume to reach those areas before full dispersion. Thus it was concluded from the modeling results that the power plant would not impair visibility at New Hampshire's Class I areas.

5.3.3 Agricultural and Forestry Smoke Management

40 CFR 51.308(d)(3)(v)(E) requires each state to consider smoke management techniques related to agricultural and forestry management in developing the long-term strategy to improve visibility at Class I areas. MANE-VU's analysis of smoke management in the context of regional haze is documented in "Technical Support Document on Agricultural and Forestry Smoke Management in

[19] Permit No. TP-0054, issued on July 26, 2010; reissued on November 18, 2011, and November 30, 2012; viewable at http://www2.des.state.nh.us/OneStopPub/Air/330079013712-0175TypePermit.pdf.

the MANE-VU Region," September 1, 2006.[20] As that report notes, fires used for resource benefits are of far less significance to the total inventory of fine-particle pollutant emissions than other sources of wood smoke in the region. With respect to $PM_{2.5}$ emissions, the largest wood smoke source categories in the MANE-VU region are residential wood combustion (73 percent); open burning (15 percent); and industrial, commercial, and institutional wood combustion (9 percent). Fires that are covered under smoke management plans, including agricultural and prescribed forest burning, constitute less than one percent of total wood smoke emissions in the MANE-VU states.

Wildfires within the region are also relatively small and infrequent contributors to regional PM emissions. MANE-VU's Class I areas are occasionally affected by wildfire smoke emissions from other regions, such as occurred from lightning-induced forest fires in Quebec Province in July 2002 and May 2010. These natural wildfire smoke emissions are not considered controllable – and, in fact, are counted as part of natural background conditions. In any case, unplanned fires make up only a minor fraction of wood burning emissions.

Smoke from all sources accounts for only a small percentage of the fine-particle mass that is the cause of regional haze. As documented in MANE-VU's Contribution Assessment, elemental carbon, the main ingredient of smoke, contributed 3 to 4 percent of fine-particle mass on days of worst and best visibility. Additionally, elemental carbon absorbs light more readily than it scatters light. When all facts are considered, it is reasonable to conclude that smoke emissions from controlled agricultural and forestry burning contribute, on an average annual basis, only a small fraction of one percent to total light extinction on days of both good and poor visibility.

This is not to say that individual events, including prescribed burns, will not have short-term visibility impacts. Such impacts are addressed by the New Hampshire Prescribed Fire Council in its recommended standards[21] for planning and implementing prescribed burns. The U.S. Forest Service and NHDES are members of the council and assisted in the development of these standards. Chapter 10 of the standards, which covers smoke management and air quality, recommends as follows: "The burn plan will screen for all smoke sensitive features within one and five miles of the planned burn, and identify measures for minimizing negative impacts of smoke to these features." Class I areas are not specifically identified as smoke sensitive features. However, both of New Hampshire's Class I areas are within the White Mountain National Forest; thus, the FLM (in this case, the U.S. Forest Service) would be informed of any planned burn in nearby lands. For any prescribed fire within the WMNF, the burn plan would have to meet the FLM's own requirements for protection of Class I areas, which are more stringent than the New Hampshire Prescribed Fire Council's standards.

Chapter 13 of the Fire Council's recommended standards includes a section on air quality, with references to the CAA, the NAAQS, PSD, and the Regional Haze Rule. The two Class I areas in New Hampshire are identified by name, and the following recommendation is made: "If any prescribed fires take place that could affect Class I Airsheds, the New Hampshire Department of Environmental Services Air Resources Division should be contacted early in the planning process." Also, NHDES's real-time air quality monitoring website (http://www2.des.state.nh.us/airdata/) is listed as a resource to help prescribed fire planners determine optimal times to conduct burns.

---

[20] Available as Attachment V to New Hampshire's Regional Haze SIP at http://des.nh.gov/organization/divisions/air/do/asab/rhp/documents/v.pdf.

[21] NH Prescribed Fire Council, "Planning for Prescribed Burning in New Hampshire," June 28, 2011; available at http://extension.unh.edu/resources/files/Resource001886_Rep2781.pdf.

5.3.4 Measures to Mitigate Impacts of Construction Activities

40 CFR 51.308(d)(3)(v)(B) of the Regional Haze Rule requires each state to consider measures to mitigate the impacts of construction activities on regional haze. Fugitive emissions caused by earth-moving activities and heavy vehicular traffic are the main concerns. However, MANE-VU's Contribution Assessment found that crustal material plays only a very minor role in visibility impairment at MANE-VU Class I areas. On the 20 percent best visibility days during the 2000-2004 baseline period, crustal material accounted for 6 to 11 percent of particle-related light extinction at MANE-VU Class I Areas. On the 20 percent worst-visibility days, however, the ratio was reduced to 2 to 3 percent. Furthermore, the crustal fraction is largely made up of pollutants of natural origin (e.g., soil or sea salt) that are not targeted under the Regional Haze Rule.

Nevertheless, the crustal fraction at any given location can be heavily influenced by the proximity of construction activities, and construction activities occurring in the immediate vicinity of MANE-VU Class I Areas could have a noticeable effect on visibility. NHDES does not perceive that construction activities are an ongoing or significant impediment to meeting the 2018 reasonable progress goals for Class I areas in the region. Consequently, no additional control measures tied directly to construction activities are proposed at this time.

Of relevance to construction activities is New Hampshire administrative rule Env-A 2800: Sand & Gravel Sources; Non-metallic Mineral Processing Plants; Cement & Concrete Sources, which was readopted with amendments, effective on October 1, 2010. NHDES sent the amended rule to EPA with a request for SIP approval on March 31, 2011. This rule establishes particulate matter, visible emissions, and fugitive dust standards for cement/concrete sources and sand/gravel sources. The rule revisions serve to 1) distinguish sources at which non-metallic minerals are subject to crushing or grinding from other sand and gravel sources, 2) separate the PM and visible emissions standards for non-metallic mineral processing plants from those for other sources, and 3) establish a permit-by-notification for non-metallic mineral processing plants to replace the General State Permit option. The permit-by-notification enables an operator to move a mobile crusher with only a notice to NHDES and the town, rather than undergoing a more extensive permit process each time. The amended rule requires emissions testing of all new equipment as well as existing equipment not previously tested.

5.3.5 Rule for Open Source Emissions

New Hampshire readopted administrative rule Env-A 1000: Prevention, Abatement, and Control of Open Source Air Pollution, with minor amendments, effective on May 1, 2011. It was submitted to EPA for SIP approval on Aug. 9, 2011. This rule establishes requirements for open burning, fugitive dust, and firefighter instruction and training activities. Although the rule does not make direct reference to visibility protection, the requirements it places on managing particulate emissions have, as one effect, that of protecting visibility. The open source rule aligns well with efforts to manage emissions from controlled agricultural and forestry burns and construction activities.

5.3.6 Miscellaneous Control Measures

New Hampshire is considering various other control measures that could be incorporated into the state's long-term strategy to mitigate regional haze but for which no commitment is made or implied at this time:

- Energy efficiency: A number of in-state energy efficiency programs are already reducing electric demand and, consequently, the power plants emissions that cause haze – mainly SO_2, NOx, and PM. The option exists to expand such programs and to make them a formal part of New Hampshire's SIP.

- Alternative clean fuels: New Hampshire has joined 10 other Northeast states in studying the possible implementation of a regional low-carbon fuel standard (LCFS) similar to the LCFS adopted by California. Such a measure would improve the efficiency of transportation fuels and reduce tailpipe emissions that contribute to regional haze. In the absence of a broader national program, interest in a low-carbon fuels standard remains high in many Northeast states, but support for a clean fuels program in New Hampshire is uncertain.

- Wood combustion standards: In addition to passage of a state law[22] regulating outdoor wood boilers, other measures to control particulate emissions from small wood combustion devices are under consideration. At the federal level, EPA has proposed new source performance standards (NSPS) for new residential wood heaters to reflect improvements in wood heater technologies and to broaden the range of devices covered by the regulation.[23]

---

[22] See HB 1405, Chapter 362, Laws of 2008; available at www.gencourt.state.nh.us/legislation/2008/HB1405.html.

[23] See 79 FR 6330.

SECTION 6 –EMISSION REDUCTIONS RESULTING FROM IMPLEMENTATION OF CONTROL MEASURES IN THE SIP

6.1 Requirement to Summarize Emission Reductions

40 CFR 51.308(g)(2) requires that the progress report summarize the emission reductions achieved throughout the state by implementation of the measures included in the SIP to meet reasonable progress goals for mandatory Class I federal areas.

6.2 Emissions Changes since 2002

Emissions reductions described in this section are constructed from emissions inventory data presented in Section 7. That section lists the 2002 and 2018 MANE-VU regional emissions estimates developed for the member states' regional haze SIPs and compares those values to the latest available estimates for the major categories of emissions sources. Although the estimates from one year to another are not always directly comparable because of differences in estimation methodology, rough approximations of emission reductions are still possible. From 2002 to 2007 (the most recent 5-year interval for which data are sufficiently complete to allow comparisons), the overall reductions in haze-causing pollutants throughout the MANE-VU region were approximately as follows: sulfur dioxide, 16%; nitrogen oxides, 13%; direct fine particulate matter, 7%; and volatile organic carbon, 33%.

The emissions estimates used to derive these regional emission reductions are found in Table 7-1 as the 2002 and 2007 category totals. Similar reductions, on a percentage basis, occur for emissions originating from New Hampshire sources (Table 7-2). The changes in both state and regional emissions during this period may be attributed to market forces in the power production sector and to emission control programs that were already on the books or on the way before the states' regional haze SIPs were completed, but not to control measures arising from those SIP revisions (which were completed after 2007). The emission reductions and attendant air quality benefits emanating from the regional haze SIPs have begun only recently and, for the most part, are not readily quantifiable thus far.

6.3 Emission Reductions from New Hampshire's EGUs

Electrical generating units are recognized as the largest group of SO_2 emitters and thus the leading contributors to regional haze. This source category is one for which emission reductions are more reliably determined than most because of federal reporting requirements for the power production sector. Several New Hampshire EGUs that participate in federally mandated air pollution control programs (such as the Acid Rain Program) are required to report to EPA's Clean Air Markets Division (CAMD). Table 6-1 lists the SO_2 and NOx annual emissions – along with heat input, gross load, and operating time – as recorded in the CAMD database for all reporting units in 2002 and 2013. The table is divided into two groups: units identified as being among the top 167 EGU sources affecting MANE-VU Class I areas (*i.e.*, targeted EGUs – see Subsection 4.4), and all other units. The total annual SO_2 and NOx emissions from New Hampshire EGUs are also shown graphically in Figure 6-1.

Table 6-1. SO_2 and NOx Emissions from New Hampshire EGUs in 2002 and 2013

Year	Facility Name	Facility ID (ORISPL)	Unit ID	SO_2 (tons)	NOx (tons)	Heat Input (MMBtu)	Gross Load (MW-hr)	Operating Time (hr)
TARGETED EGUs								
2002	Merrimack	2364	1	9,754.4	962.0	8,754,397	810,636	6,989
2002	Merrimack	2364	2	20,902.5	2,871.2	22,013,515	2,208,431	7,180
2002	Newington	8002	1	5,225.7	942.7	9,658,944	725,096	3,085
				35,882.6	**4,775.9**	**40,426,856**	**3,744,163**	
2013	Merrimack	2364	1	364.1	584.5	4,078,240	404,937	3,792
2013	Merrimack	2364	2	1,036.4	1,359.0	10,585,288	1,032,003	3,384
2013	Newington	8002	1	328.6	86.1	1,209,521	87,799	772
				1,729.1	**2,029.6**	**15,873,049**	**1,524,739**	
Emission Reductions, 2002-2013				34,153.5 *95.2%*	2,746.3 *57.5%*			
ALL OTHER UNITS								
2002	EP Newington Energy, LLC	55661	1	6. 1	151.1	4,302,511	318,729	3,391
2002	EP Newington Energy, LLC	55661	2	5.3	51.1	3,692,785	321,005	2,541
2002	Lost Nation	2362	CT1		5.7	21,580	768	83
2002	Merrimack	2364	CT1		7.4	23,711	1,149	99
2002	Merrimack	2364	CT2		6.6	21,447	964	90
2002	Schiller	2367	4	2,608.4	675.4	3,773,920	294,220	7,134
2002	Schiller	2367	5	2,796.5	598.7	3,936,700	318,110	7,538
2002	Schiller	2367	6	2,647.6	573.9	3,714,776	323,051	7,768
2002	Schiller	2367	CT1		19.2	47,477	2,047	168
2002	White Lake	2369	CT1		8.3	25,776	1,104	107
				8,063.9	**2,083.4**	**19,513,327**	**1,579,275**	
2013	EP Newington Energy, LLC	55661	1	1.2	17.6	2,288,855	308,832	1,451
2013	EP Newington Energy, LLC	55661	2	1.4	21.7	2,971,802	371,865	1,954
2013	Granite Ridge Energy	55170	1	4.0	55.4	13,290,207	1,149,716	6,371
2013	Granite Ridge Energy	55170	2	3.6	48.7	12,072,594	1,052,791	5,816
2013	Schiller	2367	4	804.2	165.2	1,233,100	104,242	3,041
2013	Schiller	2367	5	2.1	177.5	5,305,054	370,028	8,124
2013	Schiller	2367	6	621.1	143.3	1,066,811	89,975	2,418
				1,437.6	**629.4**	**38,228,423**	**3,447,449**	
Emission Reductions, 2002-2013				6,626.3 *82.2%*	1,468.0 *70.0%*			
ALL UNITS COMBINED								
2002				**43,946.5**	**6,873.3**	**59,987,539**	**5,325,310**	
2013				**3,166.7**	**2,659.0**	**54,101,472**	**4,972,188**	
Emission Reductions, 2002-2013				40,779.8 *92.8%*	4,214.3 *61.3%*			

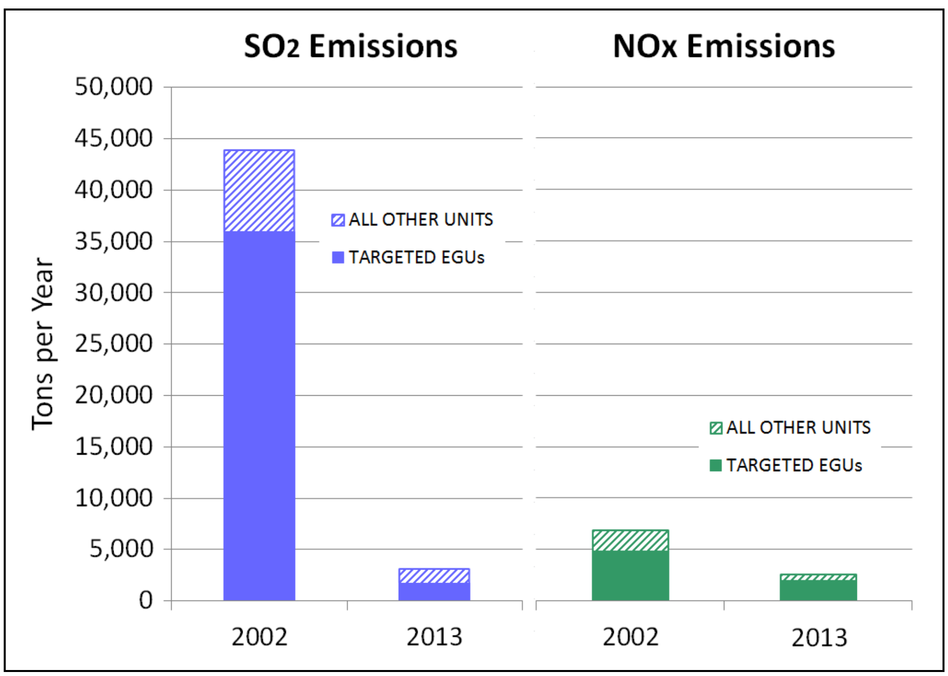
Source: EPA CAMD, http://ampd.epa.gov/ampd/. The annual unit-level emissions data for this summary were downloaded on August 19, 2014.

SO_2 and NOx emissions for all New Hampshire EGUs in the CAMD database were lower in 2013 than in 2002 by approximately 40,800 and 4,200 tons per year, respectively. These amounts equate to emission reductions of 93 and 61 percent. For the three targeted EGUs, the corresponding SO_2 and NOx reductions were approximately 34,200 and 2,700 tons per year, or 95 and 58 percent. The reductions in both pollutants occurred as gross load declined by 6.6 percent for all New Hampshire EGUs over the same interval. The major cause of the emission reductions was a regional shift away from coal-fired power (Merrimack and Schiller Stations) and oil-fired power (Newington Station) to EGUs running on natural gas (EP Newington Energy). Another important factor was operation of the recently installed flue gas desulfurization system (FGD, or scrubber) at Merrimack Station.

The FGD system at Merrimack Station is required to remove 90 percent or more of sulfur dioxide emissions. The scrubber began operation well in advance of the July 1, 2013, control deadline (and was functional during most of 2012). The 2013 CAMD data show that the two units emitted 1,401 tons of SO_2 versus a gross heat input of 14,663528 MMBtu. This translates to an average annual emission rate of 0.19 lb/MMBtu with the emission controls in place. For comparison, the average SO_2 emission rate (calculated from the data in Table 6-1) was 2.0 lb/MMBtu in 2002, the baseline year, when the facility had no post-combustion controls for this pollutant. On this simple basis alone, the SO_2 removal efficiency of the new control equipment is estimated to be at least 90 percent.

This finding is supported by stack test data obtained in conjunction with a quality assurance audit of the continuous emissions monitoring system (CEMS) for Merrimack Station.[24] Unit 1 was tested on January 29, 2013, at an uncontrolled emission rate of 3.67 lb/MMBtu. Unit 2 was tested on January 25, 2013, at an uncontrolled emission rate of 3.45 lb/MMBtu. Controlled emissions from the common stack in the period from February 1 to March 13, 2013, were measured at 0.23 lb/MMBtu. Taken together, these results indicate an SO_2 removal efficiency in the vicinity of 94 percent.

Figure 6-1. SO_2 and NOx Emissions from New Hampshire EGUs in 2002 and 2013



[24] EPA requires certification of CEMS where the data are used to demonstrate compliance with emission standards on a continuous basis. The certification tests must be performed by an independent entity, which temporarily installs an independent CEMS to collect emissions data in parallel with the plant CEMS. This procedure is known as a Relative Accuracy Test Audit (RATA).

SECTION 7 – CHANGES IN EMISSIONS OF HAZE-CAUSING POLLUTANTS

7.1 Requirement to Analyze and Track Changes in Emissions

Section 40 CFR 51.308(g)(4) of the Regional Haze Rule requires each state to analyze and track changes over the past five years in pollutant emissions contributing to visibility impairment from all sources and activities within the state. Emissions changes are to be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.

7.2 Data Sources for Analysis of Emissions Trends

MARAMA recently analyzed the regional emissions trends in a technical support document developed for MANE-VU (Attachment D). This document compiled emissions estimates for the years 2002, 2007, 2010, 2017, 2018, and 2020 and was produced by integrating data from multiple sources, including the following:

- The 2002 baseline modeling inventory with a projection to 2018 (MANE-VU Version 3.3),
- The 2007 baseline modeling inventory with projections to 2017 and 2020 (MARAMA Version 3), and
- The 2010 US EPA CAMD actual emissions as reported by the emitting entities.

Exhibit 2.1 in the MARAMA document lists the specific data sources, by source category (EGU point, non-EGU point, mobile, area, non-road, and MAR[25]), that were used for developing the baseline and projection inventories identified above.

For this regional haze progress report, NHDES has rearranged the emissions summary tables from MARAMA's analysis and substituted 2013 CAMD data in place of the 2010 CAMD data. The results appear in Tables 7-1 and Tables 7-2 at the end of this section. The first table presents the MANE-VU regional emissions, and the second table presents New Hampshire's emissions.

Caution is advised in making direct comparisons among different data sources and across years. As described in the MARAMA document, for any pollutant or source category, there are variations among the data sources in the manner of accrual and treatment of the data. Inconsistencies from one data source to another arise from differences in the specific emissions sources included in the inventories, differences in calculation methodologies (e.g., assumptions about growth and control rates), changes in emissions factors, unanticipated shutdowns or new sources, and introduction of new control measures.

Note that two different EPA models were used to calculate mobile source emissions: the MOBILE6.2 model was used for the 2002 and 2018 emissions estimates; and MOVES was used for the 2007, 2017, and 2020 estimates. Estimates between models are not directly comparable.

[25] Includes commercial marine vessels, airports, and railroad locomotives.

7.2.1 2002 Modeling Inventory with Projections to 2018

MARAMA prepared the 2002-based modeling inventory suite and released it in final version in 2006. The future-year emission projections for 2009 and 2018 were developed from the 2002 baseline emissions inventory. The 2018 projections included two scenarios:

- *On-the-Books / On-the-Way (OTB/OTW)* – These projections accounted for all emission control measures that were fully adopted into federal or individual state regulations or SIPs. On-the-way controls included the CAIR. Modelers often refer to this scenario as the "future base case."

- *Beyond-on-the-Way (BOTW)* – These projections accounted for all emission control measures in the OTB/OTW scenario plus additional controls that states committed to adopt or pursue as part of the SIP process. Modelers often refer to this scenario as the "future control case."

The BOTW projection for 2018 was used for this emissions trends analysis. Several versions of the 2002-based inventory suite were prepared, with improvements made to the emissions estimates in each successive run. The last and best of these is MANE-VU Version 3.3. This is the version that was used to perform air quality modeling and is the one used for this emissions trends analysis.

Details on the methods and assumptions behind the 2002-based inventory suite are found in documentation for the base year inventory[26] and future projections.[27]

7.2.2 2007 Modeling Inventory with Projections to 2017 and 2020

The 2007-based inventory suite was prepared by MARAMA and finalized in 2012. Future-year projections for 2013, 2017, and 2020 were developed from the 2007 baseline emissions inventory for all source categories except electric generation and on-road mobile.

The MANE-VU states used the 2007-based inventory suite to perform air quality screening modeling in 2011 through 2013. (This is known as the Ozone Transport Commission (OTC) Levels 1, 2, and 3 modeling.) For those runs, future-year EGU projections had not yet been completed. Therefore, for modeling purposes, provisional EGU estimates for year 2020 were prepared that were based on the CSAPR emission caps (as then established). Improved future-year modeling inventories for electric generating units are being developed in a separate effort lead by the Eastern Regional Technical Advisory Committee (ERTAC)[28] and are not included here.

On-road emissions were available only for base year 2007 and future year 2020. Use of the MOVES model proved so resource-intensive that no funds were available to develop a 2017 on-road inventory projection. In a separate effort, NESCAUM developed a 2007 on-road inventory using the MOVES model to support air quality modeling. Those runs were further revised by Virginia to adjust for the

---

[26] E.H. Pechan & Associates, Inc., "Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3," November 2006; available at http://www.marama.org/technical-center/emissions-inventory/2002-inventory-and-projections/mane-vu-2002-emissions-inventory.

[27] MACTEC Federal Programs, Inc., "Development of Emission Projections for 2009, 2012, and 2018 for NonEGU Point, Area, and Non-road Sources in the MANE-VU Region," February 2007; available at http://www.marama.org/technical-center/emissions-inventory/2002-inventory-and-projections/mane-vu-future-year-emissions-inventory.

[28] Information on the Electric Generating Utility Growth Model is available at http://www.ertac.us/index_egu.html.

altitude at which temperature was measured. This adjusted MOVES run was used by the OTC for its Level 3 screening modeling and also for this analysis.

Two scenarios for each projection year, 2017 and 2020, were prepared:

- *On-the-Books / On-the-Way (OTB/OTW)* – These projections accounted for all emission control measures that were fully adopted into federal or individual state regulations or SIPs. Modelers often refer to this scenario as the "future base case."

- *OTC Control Measures* – These projections accounted for all emission control measures in the OTB/OTW scenario plus the application of various control measures for which the OTC had developed model rules. Note that, at the time, states had not fully committed to adopting these measures through the SIP process.

The 2017 and 2020 OTB/OTW projections were used for this emissions trends analysis. Several versions of the 2007-based inventory suite were prepared, with improvements made to the emissions estimates in each successive run. The last and best of these is MARAMA Version 3. This is the version that was used for OTC's Level 3 modeling and for this emissions trends analysis.

The methods and assumptions employed in preparing the 2007-based inventory suite are described in documentation for the base year inventory[29] and future projections.[30]

7.2.3 CAMD Reported Emissions

EPA's CAMD is responsible for implementing 40 CFR 75, which requires hourly emissions monitoring and reporting by any major source that participates in an emissions cap-and-trade program under the Acid Rain Control Program, the NO_X Budget Trading Program, or CAIR. All sources participating in the CAMD programs are required to submit unit-level emissions of NOx, SO_2, and other information such as heat input, periodically to EPA. The agency reviews and certifies the submitted information before posting it at http://www.epa.gov/airmarkets/. Most of the sources reporting to CAMD are traditional power plants that sell electricity to the electrical grid. Other source types, such as petroleum refineries and cement kilns, are also required to report hourly emissions data to CAMD. Only the EGU data were used in this analysis of emissions changes.

7.3 Summary of Regional Emissions Changes

For this progress report, NHDES has identified trends in the emissions that cause regional haze by comparing emissions data from the referenced 2002 and 2007 baseline inventories and the 2013 CAMD database against projected emissions data from the 2017, 2018, and 2020 future inventories.

Table 7-1 provides a summary of emissions for the entire MANE-VU region for the four major pollutants of interest: NOx, SO_2, $PM_{2.5}$ and VOC. Emissions in tons per year are listed by source category and inventory year. Notes and color coding have been added to distinguish among the

[29] AMEC Environment & Infrastructure and SRA International, Inc., "Technical Support Document for the Development of the 2007 Emissions Inventory for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region, Version 3.3," January 23, 2012; available at http://www.marama.org/technical-center/emissions-inventory/2007-emissions-and-projections/version-3-2007-emissions-inventory.

[30] AMEC Environment & Infrastructure and SRA International, Inc., "Technical Support Document for the Development of the 2017/2020 Emission Inventories for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region, Version 3.3," January 23, 2012; available at http://www.marama.org/technical-center/emissions-inventory/2007-emissions-and-projections/future-year-inventory-version-3.

three data sources used for the analysis. The blue columns are from the 2002-based inventory suite, the tan columns are from the 2007-based inventory suite, and the gray column is from the 2013 CAMD database. The following are some general observations on regional emissions trends as revealed by the data presented.

7.3.1 Sulfur Dioxide

Regional SO_2 emissions are dominated by the EGU sector, accounting for about three-fourths of all such emissions in 2002 and 2007, but projected to be reduced to half by 2018. SO_2 emissions from EGUs were markedly lower in 2013 than in either of the baseline years. The decline from 2002 to 2007 was about 10 percent, but from 2002 to 2013 exceeded 80 percent. Actual 2013 emissions from the EGU sector were already below the projected 2018 emissions.

As regional efforts to reduce EGU emissions come to fruition, the contributions from other sectors will assume a growing proportion of the total SO_2 inventory. Note that there is negligible effect from any changes in methodologies for the calculation of SO_2 emissions among the two inventory suites and CAMD. (This is one exception in which the comparison of values between one dataset and another may be reasonable.) All evidence indicates that the observed SO_2 emission reductions are not a temporary phenomenon, and the downward trend in regional SO_2 emissions is expected to continue.

7.3.2 Oxides of Nitrogen

Regional NOx emissions are dominated by two source categories – on-road mobile and EGU point – with the former category representing half of all NOx in the baseline years. As with SO_2 emissions, tabulated values for the EGU sector indicate sizeable decreases in NOx emissions from 2002 to 2007 (by about one-quarter) and from 2002 to 2013 (by about one-half). The 2018 projection anticipates a further decline in NOx emissions from EGUs.

With respect to the on-road mobile category, EPA introduced a major revision in calculation methodology when it switched from MOBILE6 to MOVES as the preferred on-road emissions model. This change occurred between completion of the two different inventory suites. As a result, direct comparison of the 2002-based and 2007-based on-road mobile datasets complicates the analysis of emission trends within this sector. However, when examined separately, each dataset projects a decrease in NOx emissions in the range of 40-60 percent between base year and future year.

Despite any uncertainties arising from an incomplete EGU inventory suite and a revision in mobile emissions calculation methodology, there is a clear trend toward lower NOx emissions from all sources in the MANE-VU region.

7.3.3 Fine Particulate Matter

Directly emitted fine particulate matter is regionally dominated by area sources, in particular by residential wood combustion, in all years inventoried. For the residential wood combustion subcategory, changes in both estimation methodology and emission factors for direct $PM_{2.5}$ occurred between completion of the two inventory suites. This resulted in generally lower emissions estimates for the 2007 inventory suite. The methodologies used to estimate $PM_{2.5}$ emissions from the lesser contributing sectors – namely EGUs and mobile sources – also changed, making straight comparisons of the datasets difficult.

Overall, the trend for directly emitted fine particulate matter is not well-defined. Emissions from some source categories remain largely unchanged, while others, especially those dominated by engines, are projected to show reductions. Net changes in direct $PM_{2.5}$ emissions are anticipated to be small and of limited consequence to regional haze; total annual emissions of fine $PM_{2.5}$ are the lowest among the four pollutants analyzed and represent no more than 5-10 percent of the total inventory of emissions in any year.

7.3.4 Volatile Organic Compounds

Most regional VOC emissions originate from biogenic sources, which will remain largely unchanged over the foreseeable future. The summarized inventories in Table 7-1 include only anthropogenic emissions and thus do not count biogenic emissions in the category totals.

For anthropogenic emissions, the area source sector is the largest contributor to VOC, with much of that coming from residential wood combustion. As in the case of direct $PM_{2.5}$, changes occurred in both VOC estimation methodology and VOC emission factors for the residential wood combustion subcategory. These technical adjustments resulted in generally lower emissions estimates for the 2007-based inventory suite than for the 2002-based version. The calculation methodology also changed for mobile sources, which are next after area sources in emissions contributions to regional VOC. All of these changes make direct comparisons of VOC emissions between inventory suites difficult. However, when examined separately, each inventory suite shows declining emissions for the most important VOC source categories and substantial reductions in VOC emissions for all source categories combined.

Table 7-1. Annual Air Pollutant Emissions in the MANE-VU Region, 2002-2020 (tons/year)

Category	**2002**	**2007**	**2013**	**2017**	**2018**	**2020**
Data Source:	(1)(a)	(1)(b)	(1)(c)	(1)(b)	(1)(a)	(1)(b)
Sulfur Dioxide						
Point EGU(2)	1,670,176	1,546,335	315,675	---	365,024	---
Point Non-EGU(3)	239,400	129,615	---	112,784	201,478	112,828
Area(4)	316,287	212,471	---	119,215	190,437	116,511
On-road Mobile(4)	40,092	8,974	---	---	8,756	7,202
Non-road MAR(4)	32,123	30,318	---	4,870	8,172	4,183
Non-road NMIM(4)	24,774	14,167	---	420	466	443
Total	**2,322,851**	**1,941,879**	---	---	**774,333**	---
Oxides of Nitrogen						
Point EGU(2)	453,395	338,488	185,672	---	168,268	---
Point Non-EGU(3)	213,414	174,043	---	169,188	174,218	169,668
Area(4)	266,747	207,054	---	194,832	263,954	194,868
On-road Mobile(4)	1,308,235	1,175,916	---	---	303,956	471,558
Non-road MAR(4)	137,733	173,855	---	127,391	111,425	118,025
Non-road NMIM(4)	289,392	263,931	---	153,553	158,843	135,962
Total	**2,668,916**	**2,333,286**	---	---	**1,180,664**	---
Direct $PM_{2.5}$						
Point EGU(2)	20,670	44,921	---	---	51,109	---
Point Non-EGU(3)	33,948	29,881	---	29,659	38,393	29,868
Area(4)	332,676	259,938	---	262,887	339,518	264,959
On-road Mobile(4)	22,108	45,616	---	---	9,189	28,365
Non-road MAR(4)	7,929	7,430	---	3,906	7,927	3,503
Non-road NMIM(4)	27,922	24,701	---	16,536	15,952	14,421
Total	**445,253**	**412,486**	---	---	**462,087**	---
Volatile Organic Compounds						
Point EGU(2)	11,943	4,975	---	---	4,344	---
Point Non-EGU(3)	92,562	68,003	---	68,099	103,727	68,005
Area(4)	1,366,735	784,233	---	702,289	1,334,175	696,125
On-road Mobile(4)	789,560	600,638	---	---	269,979	269,647
Non-road MAR(4)	14,026	19,066	---	17,057	14,962	16,962
Non-road NMIM(4)	557,536	412,890	---	244,126	364,980	222,226
Total	**2,832,364**	**1,889,805**	---	---	**2,092,168**	---

(1) This summary is assembled from three sources – see Section 7.2 of report:
- (a) 2002 MANE-VU V3.3, with projection to 2018 (blue columns);
- (b) 2007 MARAMA V3, with projections to 2017 and 2020 (tan columns); and
- (c) CAMD actual 2013 emissions as reported to EPA (gray column). Data for this summary were downloaded from http://ampd.epa.gov/ampd/ on August 18, 2014.

(2) Data meet or exceed target of 90% completeness across all years for most states. Datasets for units with incomplete data have been completed by states or units have been removed so that consistency of data is maintained across all years.

(3) Data do not meet target of 90% completeness across all years. Total represents data for all units completed by states.

(4) Data are identical to modeled inventory and TSD for most states. No revisions were made to correct inconsistent methodologies. Non-road MAR includes commercial marine vessels, airports, and railroad locomotives. Non-road NMIM (National Mobile Inventory Model) includes equipment in EPA's NMIM/NON-ROAD model.

7.4 Summary of New Hampshire Emissions Changes

Presented in the same format as the tabulation of regional emissions above, Table 7-2 summarizes data from New Hampshire's annual emissions inventories for SO_2, NOx, $PM_{2.5}$ and VOC. Note that the column labeled 2013 shows the aggregated annual SO_2 and NOx emissions for that year for all New Hampshire EGUs participating in the CAMD programs. Both the aggregated and unit-level emissions for New Hampshire's EGUs appeared earlier with additional details in Table 6-1.

To a large degree, emission changes in New Hampshire mirror those within the entire MANE-VU region. Some general observations on statewide emissions trends are as follows:

- Historically, most of New Hampshire's SO_2 emissions originated from the EGU source category. There was little change in EGU emissions between 2002 and 2007, but SO_2 emissions from this sector in 2013 were more than 90 percent below the baseline – easily surpassing projected reductions. As projected for 2018, SO_2 emissions from all sources in New Hampshire would be less than one-third of baseline emissions.

- On-road mobile sources represent about half of baseline NOx emissions in New Hampshire, as in the entire MANE-VU region. Both the state and regional inventories project that, by 2018, on-road mobile NOx will be reduced by more than three-fourths and NOx from all sources will be reduced by more than one-half from 2002 levels. Area sources of NOx play a somewhat larger role in New Hampshire than they do in the region as a whole, but for point sources of NOx the opposite is true.

- As in the regional trends analysis of particulate matter emissions, little change is projected for emissions of direct $PM_{2.5}$ in New Hampshire. The area source category will continue to dominate emissions for this pollutant.

- Area sources and mobile sources (on- and non-road combined) each account for roughly half of total VOC emissions in New Hampshire and the MANE-VU region. VOC emissions from area sources are not projected to change much by 2018, but new emission controls on engines will have the intended effect of reducing VOC emissions from mobile sources. Largely because of emission reductions in the mobile source categories, total VOC emissions in New Hampshire and the region are projected to decline by 20 percent or more between 2002 and 2018.

***Note on mobile emissions*:** The 2020 MOVES analyses produced anomalous results for on-road mobile emissions for several states, including New Hampshire. Extensive review by NESCAUM / MARAMA was unable to determine the cause of these anomalies. Subsequently, NHDES performed an independent series of MOVES runs to obtain more reliable projections of on-road mobile emissions for New Hampshire in the year 2020. These adjusted values are the ones which appear in the last column of Table 7.2. The original, uncorrected on-road mobile values for New Hampshire were as follows: SO_2, 542 tons/year; NOx, 30,342 tons/year; $PM_{2.5}$, 3,010 tons/year; VOC, 14,629 tons/year.

Table 7-2. Annual Air Pollutant Emissions in New Hampshire, 2002-2020 (tons/year)

Category Data Source:	2002 (1)(a)	2007 (1)(b)	2013 (1)(c)	2017 (1)(b)	2018 (1)(a)	2020 (1)(b)
Sulfur Dioxide						
Point EGU(2)	43,962	42,524	3,167	---	10,766	---
Point Non-EGU(3)	5,607	2,743	---	2,655	3,086	2,658
Area(4)	7,076	5,283	---	4,176	3,123	3,991
On-road Mobile(4)	777	275	---	---	537	105*
Non-road MAR(4)	220	545	---	81	226	46
Non-road NMIM(4)	668	440	---	16	16	18
Total	**58,310**	**51,810**	---	---	**17,753**	---
Oxides of Nitrogen						
Point EGU(2)	6,894	4,754	2,659	---	3,089	---
Point Non-EGU(3)	3,576	2,694	---	3,388	1,086	3,467
Area(4)	10,992	4,737	---	4,152	12,243	4,111
On-road Mobile(4)	33,283	33,923	---	---	7,671	10,523*
Non-road MAR(4)	1,776	1,454	---	1,306	1,723	1,286
Non-road NMIM(4)	8,104	8,548	---	5,521	4,558	5,268
Total	**64,625**	**56,110**	---	---	**30,369**	---
Direct $PM_{2.5}$						
Point EGU(2)	1,973	602	---	---	2,156	---
Point Non-EGU(3)	426	499	---	1,169	940	1,179
Area(4)	17,534	8,623	---	8,598	18,089	8,633
On-road Mobile(4)	562	1,424	---	---	263	459*
Non-road MAR(4)	95	62	---	46	98	45
Non-road NMIM(4)	868	798	---	558	534	493
Total	**21,459**	**12,008**	---	---	**22,080**	---
Volatile Organic Compounds						
Point EGU(2)	101	110	---	---	73	---
Point Non-EGU(3)	1,815	768	---	1,445	998	1,431
Area(4)	65,374	22,343	---	20,894	62,687	20,807
On-road Mobile(4)	16,762	13,599	---	---	6,564	5,085*
Non-road MAR(4)	142	195	---	175	158	178
Non-road NMIM(4)	22,231	17,105	---	11,028	14,807	9,783
Total	**106,425**	**54,120**	---	---	**85,288**	---

(1) This summary is assembled from three sources – see Section 7.2 of report:
- (a) 2002 MANE-VU V3.3, with projection to 2018 (blue columns);
- (b) 2007 MARAMA V3, with projections to 2017 and 2020 (tan columns); and
- (c) CAMD actual 2013 emissions as reported to EPA (gray column). Data for this summary were downloaded from http://ampd.epa.gov/ampd/ on August 18, 2014.

(2) Data meet or exceed target of 90% completeness across all years for most states. Datasets for units with incomplete data have been completed by states or units have been removed so that consistency of data is maintained across all years.

(3) Data do not meet target of 90% completeness across all years. Total represents data for all units completed by states.

(4) Data are identical to modeled inventory and TSD for most states. No revisions were made to correct inconsistent methodologies. Non-road MAR includes commercial marine vessels, airports, and railroad locomotives. Non-road NMIM (National Mobile Inventory Model) includes equipment in EPA's NMIM/NON-ROAD model.

* Adjusted value – see note on mobile emissions in Section 7.4 of report.

SECTION 8 – ASSESSMENT OF SIGNIFICANT EMISSIONS CHANGES THAT HAVE IMPEDED VISIBILITY PROGRESS

8.1 Requirement to Assess whether Emissions Changes Have Impeded Progress

Section 40 CFR 51.308(g)(5) of the Regional Haze Rule requires an assessment of any significant changes in anthropogenic emissions within or outside the state that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

8.2 Assessment

The Regional Haze Rule provides no specific definition of what constitutes a significant change in emissions that would hinder progress in reducing regional haze. It is reasonable to assume that a significant change in emissions that impedes visibility progress could come about in any of three ways: 1) an unanticipated increase in emissions from one or more existing sources, 2) the unanticipated addition of one or more new sources, and 3) failure of one or more existing sources to adhere to expected emission reductions in accordance with the applicable SIP.

With respect to the first two possibilities, there are no new major sources or existing sources in New Hampshire that have significantly increased emissions of haze-causing pollutants. The noteworthy exception is gas-fired power plants, whose output has replaced electrical generation by coal-fired units. However, the net effect of this realignment among EGUs has been a *reduction* in the total emissions of the major pollutants that impair visibility, especially sulfur dioxide. (See Section 6.3.) Similar changes in the power sector have occurred in upwind states, to the benefit of visibility in New Hampshire. It is uncertain whether such benefit will be permanent. NHDES knows of no significant emission changes attributable to new or existing sources in other states that are impeding visibility progress at New Hampshire's Class I areas.

As to the third possibility, all of New Hampshire's major sources included in the regional haze plan (*i.e.,* the BART units and targeted EGUs) already have control measures in place that are operating to reduce emissions as required in the SIP. (See Sections 3, 4, and 6.) NHDES is not in a position to certify that all other states that contribute to visibility impairment at New Hampshire's Class I areas have adhered to the scheduled emission reductions as promised in their respective regional haze SIPs. Many of the emission reductions included in states' SIPs were scheduled to occur in a stepwise fashion (*e.g.,* in 2010 or 2014 or 2018) rather than in a continuous manner. Therefore, not all control measures will have been implemented in the earliest years of the planning period. As described elsewhere in this report, haze-causing emissions have been on a general decline throughout the MANE-VU region since 2002.

The following additional observations are relevant to the assessment of visibility progress as planned under New Hampshire's regional haze SIP:

- The regional transport of air pollutants, especially SO_2 and NOx, is an ongoing issue that CSAPR, the replacement rule for CAIR, addresses in part. The implementation of MATS and the revised SO_2 NAAQS may help to mitigate the delay in the implementation of CSAPR, at least for the control of SO_2 emissions. However, any setback in implementing a comprehensive regional or national program to address air pollution transport would slow the rate of visibility progress throughout MANE-VU.

- Some EGUs in upwind states are either not operating or are limiting operation of their existing air pollution control devices, and have elected instead to achieve compliance with federal requirements through the purchase of CAIR allowances (program now expired). While lawful, this practice has caused NOx emissions from some EGUs to exceed past levels, resulting in higher levels of NOx in portions of the Ozone Transport Region, which includes all of the MANE-VU states. This finding was the subject of a recent statement[31] from the OTC requesting that EPA take corrective action.

- NHDES anticipates that interstate transport of air pollutants will not impede visibility improvement to such an extent as to prevent Class I areas in New Hampshire and other states affected by New Hampshire's emissions from meeting their near-term visibility objectives. However, over the longer term, the statutory goal of re-establishing natural visibility conditions by the 2064 target date will demand that interstate transport, as a continuing impediment to visibility progress, be resolved. Visibility tracking thus far indicates that all five MANE-VU Class I areas affected by New Hampshire's emissions are on course or ahead of schedule to achieve their reasonable progress goals for 2018. (See Section 2.)

[31] Ozone Transport Commission, "Statement from The Ozone Transport Commission Requesting the Use and Operation of Existing Control Devices Installed at Electric Generating Units," June 13, 2013.

SECTION 9 – SUFFICIENCY OF SIP TO MEET REASONABLE PROGRESS GOALS

9.1 Requirement to Assess Sufficiency of Plan

Section 40 CFR 51.308(g)(6) of the Regional Haze Rule requires an assessment of whether the current implementation plan elements and strategies are sufficient to enable the state, or other states with mandatory Class I federal areas affected by emissions from the state, to meet all established reasonable progress goals.

9.2 Assessment

On the basis of the analyses described in this report, NHDES asserts that the New Hampshire Regional Haze SIP, as most recently amended on August 26, 2011, is sufficient to meet the 2018 reasonable progress goals established for the two mandatory Class I federal areas in the state and for the five other Class I areas in the MANE-VU states affected by emissions originating in New Hampshire. Visibility improvements to date indicate that New Hampshire is on track to meet these interim progress goals toward the national goal of restoring natural visibility conditions by 2064 as promulgated under the Regional Haze Rule.

SECTION 10 – MONITORING STRATEGY REVIEW

10.1 Requirement to Review Monitoring Strategy

Section 40 CFR 51.308(g)(7) of the Regional Haze Rules requires that each state with a mandatory Class I federal area review the state's visibility monitoring strategy and the need for any modifications to it. The original visibility monitoring strategy for New Hampshire's Class I areas is described in detail in Section 5 of the regional haze SIP.

10.2 Strategy Review

New Hampshire's visibility monitoring strategy relies upon participation in the Interagency Monitoring of Protected Visual Environments (IMPROVE) network.[32] The IMPROVE monitor for the Great Gulf Wilderness (GRGU1) is located at Camp Dodge, approximately 1 mile east of the wilderness boundary, in New Hampshire's White Mountain National Forest (Table 10-1). This monitor also serves as the monitor for the Presidential Range - Dry River Wilderness, whose northern-most limit lies only 5 miles southwest of the monitor location. It should be mentioned that New Hampshire has two other (recently added) IMPROVE sites, located at NHDES's monitoring stations at Pack Monadnock and Londonderry; but neither is considered representative of the Class I areas.

Table 10-1. IMPROVE Network Site for New Hampshire's Class I Areas

Site Name	Site Code	Latitude	Longitude	Elev. (m)	Dates of Operation
Great Gulf Wilderness	GRGU1	44.31°	-71.22°.	454	June 10, 1995 - present

As the central component of New Hampshire's visibility monitoring strategy, the IMPROVE network monitor GRGU1 has been in service since 1995. This monitor was deemed adequate in the SIP to meet EPA's Regional Haze Program requirements for the state's two mandatory Class I federal areas. Section 2 of this report provides a summary of visibility data developed from air quality measurements gathered by this monitor since 2000.

For this progress report, New Hampshire has evaluated the monitoring network for any needed changes from the original network described in the regional haze SIP. In reviewing the record, NHDES notes that the visibility database contains gaps in the data for GRGU1 in both 2009 and 2010. These gaps rendered the data incomplete for those years, in accordance with established protocol. While NHDES regularly reviews the IMPROVE data, this agency has no direct involvement in the operation and maintenance of the IMPROVE network. GRGU1 is operated under the management of the U.S. Forest Service.

The USFS has advised that the data gaps for GRGU1 were due to temporary problems with electricity delivery to the IMPROVE shed, which is located on an unmaintained road, during winter conditions. In periods when GRGU1 has had continuous functionality, it has shown itself to be adequate for assessing reasonable progress toward visibility goals at New Hampshire's Class I areas. There is no indication of a need for additional monitoring sites or equipment, unless redundancy is the purpose.

[32] A description of the IMPROVE program is available at http://vista.cira.colostate.edu/improve/.

SECTION 11 – ADEQUACY OF CURRENT REGIONAL HAZE SIP

11.1 Requirement to Determine Adequacy of Current SIP

Section 40 CFR 51.308(h) of the Regional Haze Rule requires the state to determine the adequacy of its regional haze SIP on the basis of the information presented in its 5-year progress report.

11.2 Determination of SIP Adequacy: Negative Declaration

Based on the evaluations conducted for this report, NHDES declares that the existing SIP is adequate for continued reasonable progress towards natural visibility conditions at all mandatory Class I federal areas affected by emissions from New Hampshire. Further revision of the existing implementation plan is therefore not needed at this time**.** This conclusion is supported by several and various findings, which may be summarized as follows:

- The Visibility Record: Since 2000-2004, visibility has improved at all locations in the MANE-VU region, including New Hampshire's Class I areas. The 5-year average deciview values indicate a general trend toward improved visibility on both best and worst days, and all areas appear to be on track to meet or surpass their 2018 reasonable progress goals.

- Sulfate Emissions: Sulfate accounted for one-half to two-thirds of total fine particle mass on the haziest days at MANE-VU Class I areas in 2000-2004. Reductions in emissions of this pollutant appear to be the biggest reason for trending improvements in visibility. It is projected that SO_2 emissions from all sources in the region will decrease by two-thirds or more over the period from 2002 to 2018, with most of those reductions coming from the EGU sector. Between 2002 and 2013, New Hampshire's EGUs reduced SO_2 emissions by 93 percent in the aggregate. Seismic changes in the industry have caused a shift away from coal-fired power production, the source of most SO_2 emissions in the region.

- Controls on EGUs: Emission controls have already been implemented to control SO_2, NOx, and particulate matter emissions at New Hampshire's two BART units and a third, targeted unit. A flue gas desulfurization system is operational and currently reducing SO_2 emissions by more than 90 percent at PSNH's Merrimack Station, where two of the three units are located. PSNH's Newington Station is using lower-sulfur fuels.

- NOx Emissions: A regional reduction in NOx emissions has been the second-largest factor in visibility improvements in the MANE-VU region thus far. Federal programs for mobile sources, which contribute the most to NOx emissions across the region, will further reduce NOx emissions and help to improve visibility in the years ahead.

- Other Emissions: Total emissions of fine particulate matter do not appear to be increasing, and emissions of VOC are projected to decline. Current controls and management practices for construction activities and prescribed agricultural and forestry burns serve to mitigate visibility impacts. Any impacts from these activities are likely to be short-lived and of relatively minor consequence for nearby Class I areas.

- Impediments to Progress: Possible impediments to continued visibility progress – especially unresolved aspects of interstate air pollution transport – do not appear to be great enough at this time to prevent Class I areas affected by New Hampshire's emissions from meeting their respective 2018 reasonable progress goals.

SECTION 12 – CONSULTATION WITH FEDERAL LAND MANAGERS

12.1 Requirement to Consult Federal Land Managers

The Regional Haze Rule at 40 CFR 51.308(i) requires that the state provide the FLMs responsible for Class I areas affected by emissions originating within the state an opportunity for consultation, in person, at least 60 days prior to any public hearing on the 5-year progress report SIP revision.

12.2 Consultation Process

NHDES sent a preliminary draft of the SIP revision to the FLMs and EPA for review purposes on May 22, 2014. A conference call with representatives from the National Park Service, the U.S. Fish and Wildlife Service, the U.S. Forest Service, EPA region I, and NHDES was held on July 17, 2014 (see notes in Attachment K). After receiving comments from the FLMs and EPA, NHDES revised the preliminary draft and reissued the document as a proposed SIP revision in keeping with EPA's usual requirements for public review.

NHDES notified the FLMs and EPA of a public hearing to be held on September 23, 2014, and sent the proposed SIP revision to the FLMs and EPA as part of the public review process and comment period, which closed on October 3, 2014. Comments submitted by the FLMs and EPA were addressed and incorporated into the final SIP revision before its submission to EPA for approval. Comments received from the FLMs and EPA are included in Attachment K along with NHDES's responses.

New Hampshire will continue to coordinate and consult with the FLMs on future regional haze SIP revisions and on the implementation of programs having the potential to affect visibility at the state's mandatory Class I federal areas.

ATTACHMENT A – Acronyms and Abbreviations

BART	Best Available Retrofit Technology
bbl	barrel (of oil)
BLM	Bureau of Land Management
BOTW	beyond-on-the-way
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CEMS	continuous emissions monitoring system
CENRAP	Central Regional Air Planning Association
CFR	Code of Federal Regulations
CSAPR	Cross-State Air Pollution Rule
EGU	electricity generating unit
EPA	US Environmental Protection Agency
ERTAC	Eastern Regional Technical Advisory Committee
FGD	flue gas desulfurization
FLM	federal land manager
FS	US Forest Service
FWS	US Fish and Wildlife Service
hr	hour
IMPROVE	Interagency Monitoring of Protected Visual Environments
LAC	light-absorbing carbon
lb	pound
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MAR	marine air rail
MARAMA	Mid-Atlantic Regional Air Management Association
MATS	Mercury and Air Toxics Standards
MMBtu	million British thermal units
MOVES	Motor Vehicle Emissions Simulator
MRPO	Midwest Regional Planning Organization
MW	megawatt
NAAQS	national ambient air quality standard(s)
NESCAUM	Northeast States for Coordinated Air Use Management
NHDES	New Hampshire Department of Environmental Services
NMIM	National Mobile Inventory Model
NOx	nitrogen oxides
NPS	National Park Service
NSPS	new source performance standard(s)
OCM	organic carbon mass
ORISPL	Office of Regulatory Information Systems Plant Location
OTB/OTW	on-the-books/on-the-way
OTC	Ozone Transport Commission
PM	particulate matter
$PM_{2.5}$	particulate matter of diameter 2.5 micrometers or less
ppm	parts per million
PSD	Prevention of Significant Deterioration
PSNH	Public Service of New Hampshire
RPG	reasonable progress goal
RPO	regional planning organization
RACT	reasonably available control technology
RATA	relative accuracy test audit
SIP	state implementation plan
SO_2	sulfur dioxide
TSD	technical support document
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOC	volatile organic compounds
WRAP	Western Regional Air Partnership

This page is intentionally left blank.

ATTACHMENT B

Tracking Visibility Progress, 2004-2011

http://www.nescaum.org/documents/manevu-trends-2004-2011-report-final-20130430.pdf

This page is intentionally left blank.

Tracking Visibility Progress 2004-2011

Prepared by
NESCAUM
for the
Mid-Atlantic/Northeast Visibility Union (MANE-VU)

April 30, 2013
Revised May 24, 2013

Members of Northeast States for Coordinated Air Use Management

Arthur Marin, Executive Director
Northeast States for Coordinated Air Use Management

Anne Gobin, Bureau Chief
Connecticut Department of Energy and Environmental Protection, Bureau of Air Management

Marc Cone, Bureau Director
Maine Department of Environmental Protection, Bureau of Air Quality

Christine Kirby, Division Director
Massachusetts Department of Environmental Protection, Bureau of Waste Prevention

Craig Wright, Acting Director
New Hampshire Department of Environmental Services, Air Resources Division

William O'Sullivan, Director
New Jersey Department of Environmental Protection, Office of Air Quality Management

David Shaw, Director
New York Department of Environmental Conservation, Division of Air Resources

Douglas L. McVay, Chief
Rhode Island Department of Environmental Management, Office of Air Resources

Richard A. Valentinetti, Director
Vermont Department of Environmental Conservation, Air Pollution Control Division

Tracking Visibility Progress 2004-2011

Prepared by
NESCAUM
for the
Mid-Atlantic/Northeast Visibility Union (MANE-VU)

April 30, 2013
Revised May 24, 2013

TRACKING VISIBILITY PROGRESS
2004-2011

Project Manager

Paul Miller

Principal Contributor

Leiran Biton

Acknowledgments

NESCAUM could not have completed this work without the IMPROVE Program and the long-term commitment of the National Park Service and other federal partners to maintain visibility monitoring networks and the VIEWS data system. NESCAUM also acknowledges the funding for this work through USEPA agreement number XA-96309001 to the Ozone Transport Commission in support of MANE-VU. Finally, special thanks to Tom Downs with the Maine Department of Environmental Protection for his assistance in compiling observational data. NESCAUM is solely responsible for the content of this report and any errors it may contain.

Printed: May 2013

TABLE OF CONTENTS

FIGURES

TABLES

Executive Summary

In this report, we present visibility trends at federal "Class I areas" in the Mid-Atlantic/Northeast Visibility Union (MANE-VU) region that are subject to the US Environmental Protection Agency's (USEPA's) Regional Haze Rule (RHR). This analysis was performed to determine the extent of progress in meeting short-term and long-term visibility goals under the RHR.

This technical document provides an analysis of visibility data collected at the Class I areas, starting in the historic baseline period of 2000-2004 through 2007-2011, the most recent five-year period with available data.

The results of this analysis show the following:

- There are definite downward trends in overall haze levels at the Class I areas in and adjacent to the MANE-VU region.
- Based on rolling-five year averages demonstrating progress since the 2000-2004 baseline period, the MANE-VU Class I areas appear to be on track to meet their 2018 Reasonable Progress Goals (RPGs) for both best and worst visibility days.
- The trends are mainly driven by large reductions in sulfate light extinction, and to a lesser extent, nitrate light extinction.
- Levels of organic carbon mass (OCM) and light absorbing carbon (LAC) appear to be approaching natural background levels at most of the MANE-VU Class I areas.
- In some cases, the levels set by 2018 RPGs have already been met, and progress beyond those goals appears achievable.
- Though the Brigantine Wilderness Area is on track to meet its 2018 RPGs, challenges remain. Sulfate light extinction levels are higher at this site than at others across the region. Additional sulfate reductions would be a significant driver in reducing overall haze levels at Brigantine.

1. INTRODUCTION

1.1. Background

Haze, or reduced visibility, occurs when ambient particulate matter and gases scatter or absorb light ("light extinction") that would otherwise reach an observer. The particles responsible for regional haze are produced naturally, from windblown dust, forest fires, and aerosolized sea salt; and by human-caused pollution from vehicles, power plants, and other combustion and dust-generating activities. Haze-forming particles can also cause serious health effects in the lungs and cardiopulmonary system, potentially leading to premature death. Some particle constituents contribute to acidic deposition and other environmental harms.

In 1999, the US Environmental Protection Agency (USEPA) issued a rule under Section 169A of the Clean Air Act (Visibility Protection for the Federal Class I Areas) to address human-caused regional haze: the Regional Haze Rule (RHR) [64 FR 35614 (July 1, 1999)]. The RHR is designed to improve visibility at certain national parks and wilderness areas (Class I areas) on the haziest days while not exacerbating haze on the clearest days. The RHR requires states to submit state implementation plans (SIPs) to USEPA every ten years, setting interim progress goals and strategies consistent with the long-term national visibility goal of achieving natural conditions at Class I areas by 2064. States submitted their first haze SIPs to USEPA beginning in 2008. States are additionally required to track their progress against their historic baseline period[1] in achieving reductions in regional haze, submitting reports every five years, and to adjust their emissions management strategies accordingly.

The Mid-Atlantic/Northeast Visibility Union (MANE-VU) was formed to support visibility planning efforts in the mid-Atlantic and northeastern portion of the country, and includes the members listed in Table 1-1. The seven Class I areas in the MANE-VU region are shown in Figure 1-1. This document also includes information for two Class I areas that are adjacent to the MANE-VU region: the Dolly Sods Wilderness Area in West Virginia and Shenandoah National Park in Virginia. The purpose of this report is to

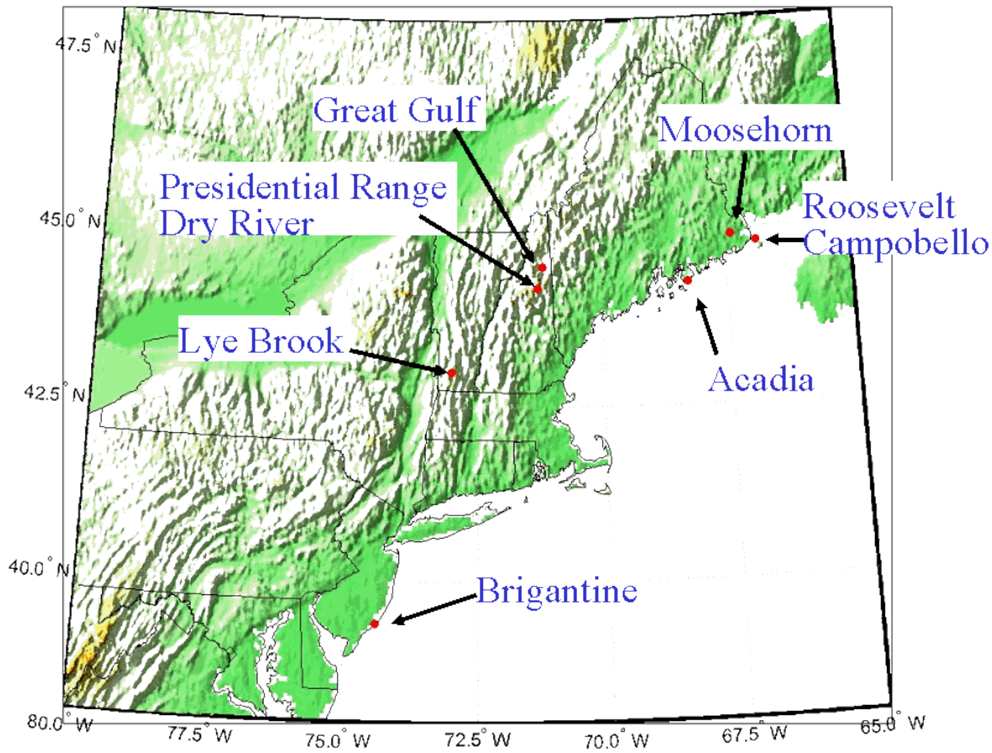
Table 1-1. Members of the Mid-Atlantic/Northeast Visibility Union (MANE-VU)

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

Source: MANE-VU Board Members, http://www.otcair.org/manevu/members.asp.

[1] The title of this and earlier trends reports use 2004 as the base year because the trend is based on rolling averages of 5-year periods, and 2004 was the end of the initial 5-year period used as the baseline.

Figure 1-1. Class I Areas of the MANE-VU Region



support MANE-VU states in meeting the tracking progress requirement of the RHR.

While this report provides readers with a basic background on regional haze, it does not include in-depth discussion of topics covered in previous reports. For a broader understanding of these topics, readers should visit the NESCAUM regional haze documents archive, located at the following web address:

http://www.nescaum.org/topics/regional-haze.

In the documents archive, readers may find the following of particular interest in understanding regional haze in the MANE-VU region:

- Regional Haze and Visibility in the Northeast and Mid-Atlantic States (2001)
- 2002: A Year in Review (2004)
- Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (2006)
- Public Health Benefits of Reducing Ground-level Ozone and Fine Particulate Matter in the Northeast U.S. (2008)
- MANE-VU Modeling for Reasonable Progress Goals (2008)
- 2018 Visibility Projections (2008)
- Tracking Visibility Progress, 2004-2008 (2010)
- Contribution of Non-Sulfate Aerosols to MANE-VU Regional Haze (2012)

- The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description (Updated July 31, 2012)

2. PROCESS FOR TRACKING PROGRESS

2.1. Long Term Goals and Natural Visibility

Even in the absence of emissions from human activities, some level of light extinction occurs from natural causes. This "natural haze" represents the best expectation for long-term progress at Class I areas, and is the goal for these areas by 2064.

The USEPA (2003a) has guidance for calculating natural haze levels based on measurements of particulate constituents at Class I areas during a baseline period. States combine measurements of several parameters to calculate a "Haze Index" in deciview (dv) units based on estimates of light extinction. A fuller explanation of tracking progress procedures is presented in a 2003 USEPA guidance document for tracking progress (USEPA 2003b; hereafter, "the Guidance"), though readers should note that the calculation for estimating total light extinction has since been updated. Details on the revised IMPROVE algorithm used to estimate light extinction are presented elsewhere (e.g., NESCAUM 2010).

Natural haze levels are calculated for both the least impaired (i.e., clearest or "best") days and the most impaired (i.e., haziest or "worst") days, because changing natural processes lead to variability in natural visibility. Natural visibility levels on least and most impaired (i.e., best and worst) days for the MANE-VU and adjacent Class I

Table 2-1. Natural Visibility Conditions for Class I Areas in and Adjacent to the MANE-VU Region

Class I Area	State Abbr.	Best Days (dv)	Worst Days (dv)
Acadia National Park	ME	4.66	12.43
Moosehorn Wilderness Area	ME	5.01	12.01
Roosevelt Campobello International Park*	ME	-	-
Great Gulf Wilderness Area	NH	3.73	11.99
Presidential Range/Dry River Wilderness Area*	NH	-	-
Lye Brook Wilderness Area	VT	2.79	11.73
Brigantine Wilderness Area	NJ	5.51	12.24
Dolly Sods Wilderness Area†	WV	3.63	10.39
Shenandoah National Park†	VA	3.14	11.35

Note: The Class I areas are arranged with the areas located in the MANE-VU region presented first, followed by those adjacent to MANE-VU.
** Natural haze values are not calculated for areas without baseline monitoring data. Visibility for the Presidential Range/Dry River Wilderness Area and Roosevelt Campobello International Park are represented by the IMPROVE monitors for Great Gulf and Moosehorn, respectively.*
Source: IMPROVE 2011 (IMPROVE Natural Haze Levels II version 2 workbook).
† Class I area adjacent to the MANE-VU region.

areas are presented in Table 2-1. Achievement of these goals through constant annual incremental improvement in the Haze Index (in dv) such that natural conditions will be reached by 2064 is termed a “uniform rate of progress.” Natural background haze levels are not available for some Class I areas without monitoring data, i.e., Presidential Range/Dry River Wilderness Area and Roosevelt Campobello International Park.

2.2. Reasonable Progress Goals

The RHR requires states to evaluate current regional haze conditions at Class I areas subject to the rule relative to conditions during a historic baseline period. The baseline period is the five-year period from 2000 through 2004. The state haze SIPs established reasonable progress goals (RPGs) for reduction of regional haze through 2018. Comparison between the five-year average Haze Index in 2018 (a back average of the previous five years’ annual Haze Index values) and the baseline Haze Index will determine whether a state has met its 2018 RPG.

A state sets RPGs for the 20 percent most impaired (i.e., the haziest or “worst”) days and for the 20 percent least impaired (i.e., clearest or “best”) days. The RPGs are designed to at least ensure no degradation for best-day visibility and achievement of uniform rate of progress for worst-day visibility. In most cases, states in the MANE-VU region have adopted RPGs that achieve lower Haze Index values by 2018 than would be achieved using either the “no degradation” and “uniform rate of progress” rates for best and worst days, respectively. Table 2-2 presents the best- and worst-day RPGs adopted

Table 2-2. 2018 Goals for Class I Areas in or Adjacent to the MANE-VU Region

		Best Days		Worst Days	
Class I Area	State Abbr.	No Degradation (dv)	Reasonable Progress Goal (dv)	Uniform Rate of Progress (dv)	Reasonable Progress Goal (dv)
Acadia National Park	ME	8.8	8.3	20.4	19.4
Moosehorn Wilderness Area	ME	9.2	8.6	19.4	19.0
Roosevelt Campobello International Park	ME	9.2	8.6	19.4	19.0
Great Gulf Wilderness Area	NH	7.7	7.2	20.3	19.1
Presidential Range/Dry River Wilderness Area	NH	7.7	7.2	20.3	19.1
Lye Brook Wilderness Area	VT	6.4	5.5	21.5	20.9
Brigantine Wilderness Area	NJ	14.3	14.3	25.1	25.1
Dolly Sods Wilderness Area†	WV	12.3	11.1	24.7	21.7
Shenandoah National Park†	VA	10.9	8.7	25.1	21.9

Note: The Class I areas are arranged with the areas located in the MANE-VU region presented first, followed by those adjacent to MANE-VU.
† Class I area adjacent to the MANE-VU region.
Sources: Maine: 76 FR 73956-73982; New Hampshire: 77 FR 11809-11826; New Jersey: 76 FR 49711-49724; Vermont: 77 FR 11914-11928; Virginia: 77 FR 3691-3711; West Virginia: 76 FR 41158-41177.

by states for each Class I area in or adjacent to the MANE-VU region per state haze SIPs.

2.3. Measurement and Data Support

The Haze Index is calculated using light extinction estimates based on measured concentrations of particulate matter (PM) species. Measurements are taken at a network of sites in the Interagency Monitoring of Protected Visual Environments (IMPROVE) program at or near Class I areas. IMPROVE is the result of coordination between the National Park Service, the Fish and Wildlife Service, the Bureau of Land Management, the Forest Service, and USEPA. IMPROVE has operated 17 sites within the MANE-VU region since 2002.

The Visibility Information Exchange Web System (VIEWS) team develops and maintains the IMPROVE website in addition to its other activities related to maintenance of air quality monitoring databases. Using the data from IMPROVE, the VIEWS team calculates and regularly posts updated metrics for tracking visibility across the country at the national parks and wilderness areas subject to the RHR. VIEWS is hosted at the Colorado State University's Cooperative Institute for Research in the Atmosphere (CIRA).

Another resource, the Federal Land Manager Database (FED), is an extensive database of environmental data and an integrated suite of online tools and resources to help Federal Land Managers assess and analyze the air quality and visibility in federally protected lands such as National Parks, National Forests, and Wilderness Areas.

For this analysis, we used data from IMPROVE (2011) downloaded through VIEWS for both the natural haze levels (calculated using the revised IMPROVE algorithm) and daily values, including patched values,[2] for 2000 through 2010. For 2011, we used unpatched data obtained from FED. We analyzed the individual missing constituent data for 2011 using the patching methodology described in the Guidance and determined that patching was unnecessary for all sites in and adjacent to the MANE-VU region for this analysis.

[2] "Patching" is a procedure for replacing missing values for individual or multiple measured PM constituents with appropriate values, per the Guidance.

3. RESULTS

We analyzed total Haze Index and individual constituent light extinction annual results for each site in or adjacent to the MANE-VU region for years between 2000 and 2011. The following sections describe the results of this analysis. Section 3.1 provides results for the total Haze Index for each site and discusses trends and progress toward short-term goals. Section 3.2 provides individual constituent analysis and trends for each site over the time period in the context of regional emissions reduction efforts and continued regional and federal policy directions. Finally, Section 3.3 summarizes conclusions based on these results. Results indicate consistent improvement in regional haze on the best and worst visibility days across the region.

3.1. Haze Index Trends

Figure 3-1 (page 3-2) through Figure 3-7 (page 3-8) present the annual Haze Index on the 20 percent most and least impaired days at MANE-VU and adjacent Class I areas between 2000 and 2011 in the context of short- and long-term visibility goals. The figures are arranged with the areas located in the MANE-VU region presented first, followed by those adjacent to MANE-VU. Table A-1 in Appendix A presents these data numerically.

Annual average best and worst visibility day Haze Index values are represented by blue and purple diamonds, respectively. Five-year back annual averages are represented by solid red (worst) and blue (best) lines. Red (worst) and black (best) plus signs represent the 2018 RPGs described in the state haze SIP. The red (worst) and black (best) dotted lines represent the glidepaths to meet 2018 RPGs. Red (worst) and black (best) dashed lines represent the glidepaths to meet long-term natural visibility goals; the worst-day glidepath is also called the "uniform rate of progress" line, and the best-day glidepath is also called the "no degradation" line.[3] The grey region denotes the range of 20-percent best to worst haze levels expected to occur under natural conditions. Thus, the uniform rate of progress line intersects with highest portion of the grey area in 2064.

These figures indicate that haze levels on the best and worst days from 2000 through 2011 have dropped across the entire region. Trends evident in our last report (NESCAUM 2010) for annual average haze levels on best and worst days through 2008 have largely continued through 2010. In 2011, most of the areas experienced around the same or slightly higher levels of haze on both best and worst days as compared to 2010. The steep drop in Haze Index values for the 20 percent worst days, therefore, appears to have occurred primarily during the period between 2007 and 2010 for these areas.

[3] For the Brigantine and Dolly Sods Wilderness Areas, whose haze levels on the 20 percent best days during the 2000 to 2004 baseline period were higher than estimated natural conditions on the 20 percent worst days, the no degradation line (representing the long-term best-day goal) is higher than the uniform rate of progress line (representing the long-term worst-day goal) at dates approaching 2064. This nonsensical situation by 2064 is an artifact of technical guidance and only represents stated haze level goals, not anticipated results.

Figure 3-1. Annual Haze Index Levels at Acadia National Park

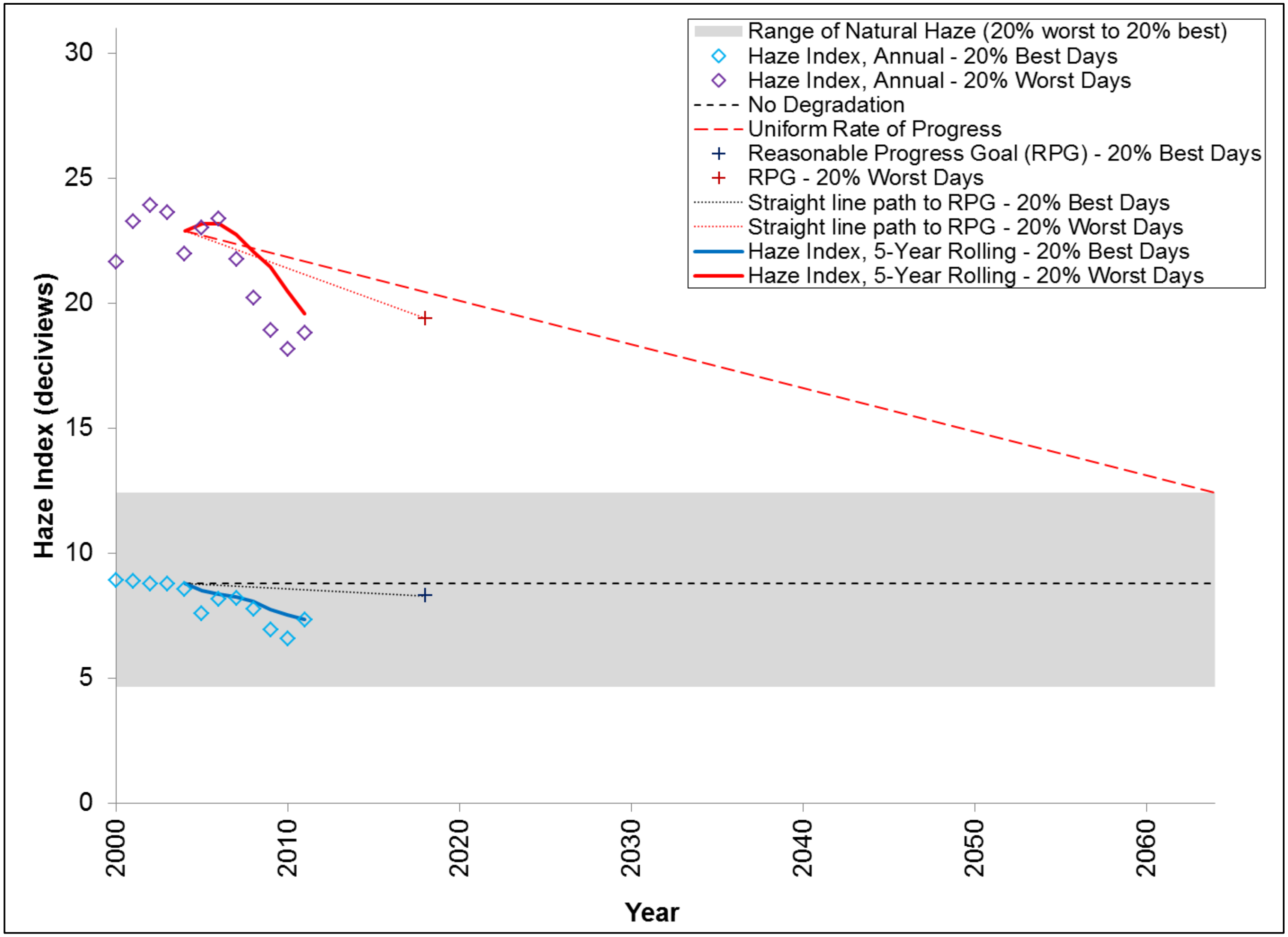


Figure 3-2. Annual Haze Index Levels at Moosehorn Wilderness Area

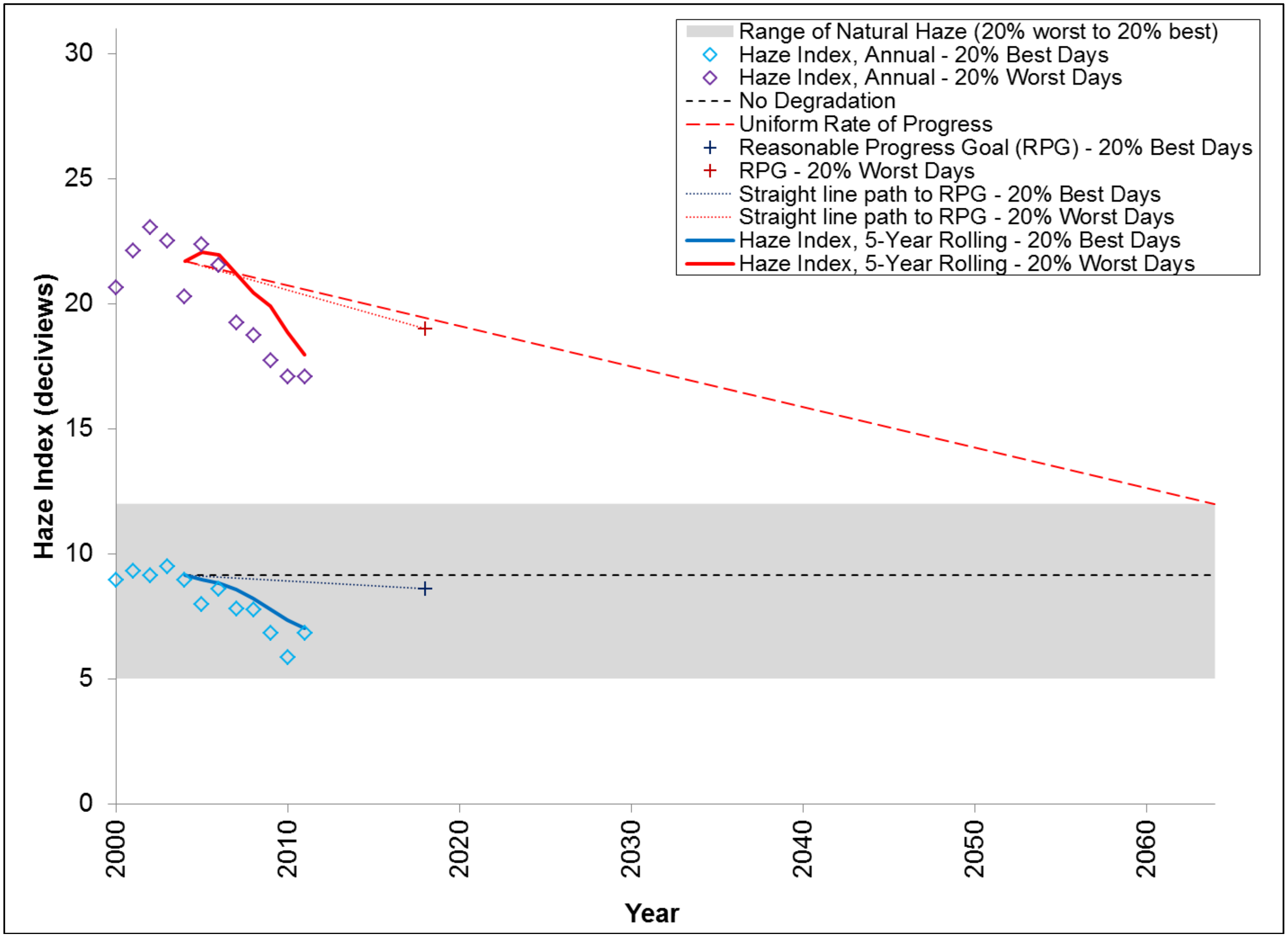


Figure 3-3. Annual Haze Index Levels at Great Gulf Wilderness Area

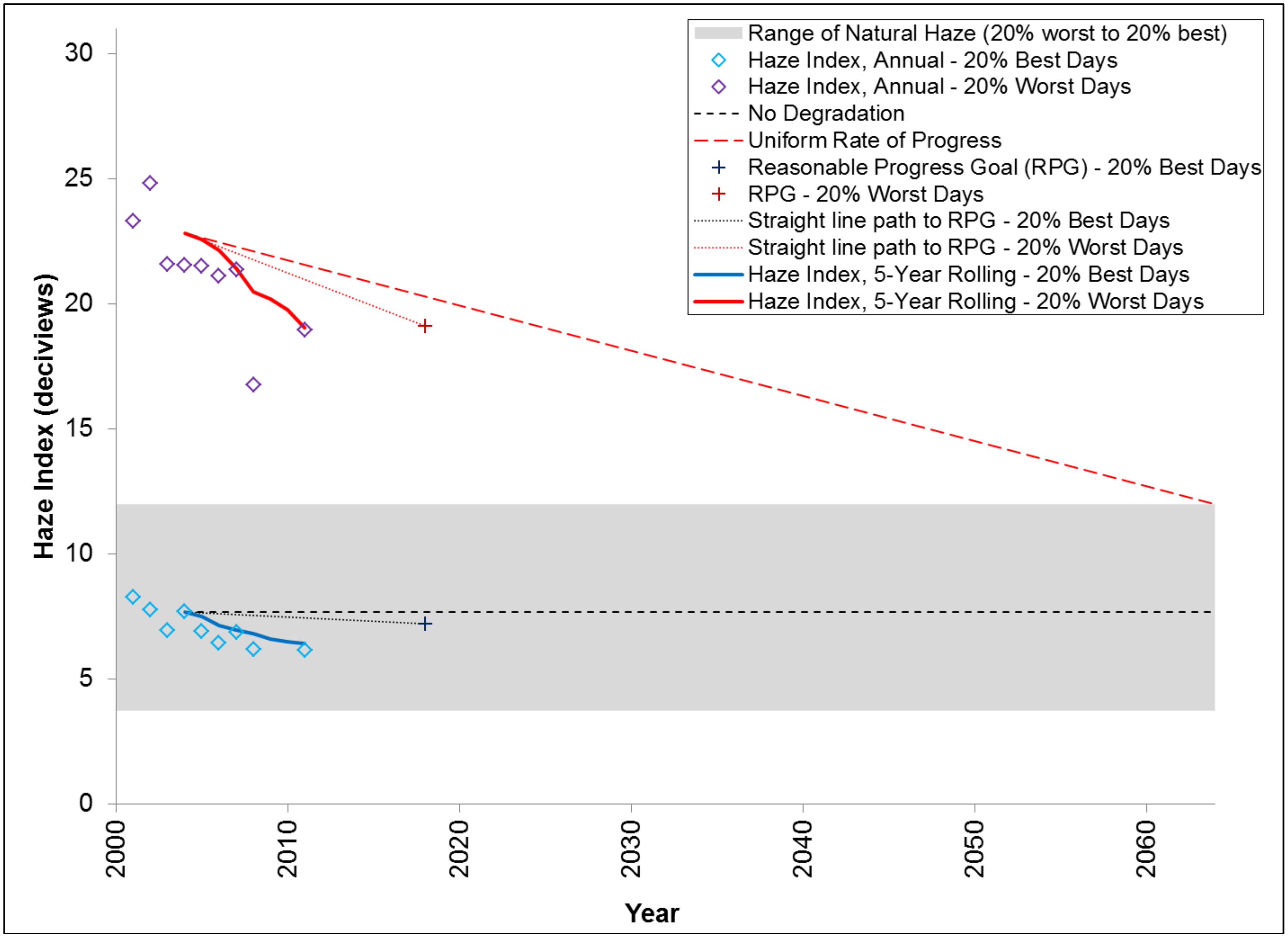


Figure 3-4. Annual Haze Index Levels at Lye Brook Wilderness Area

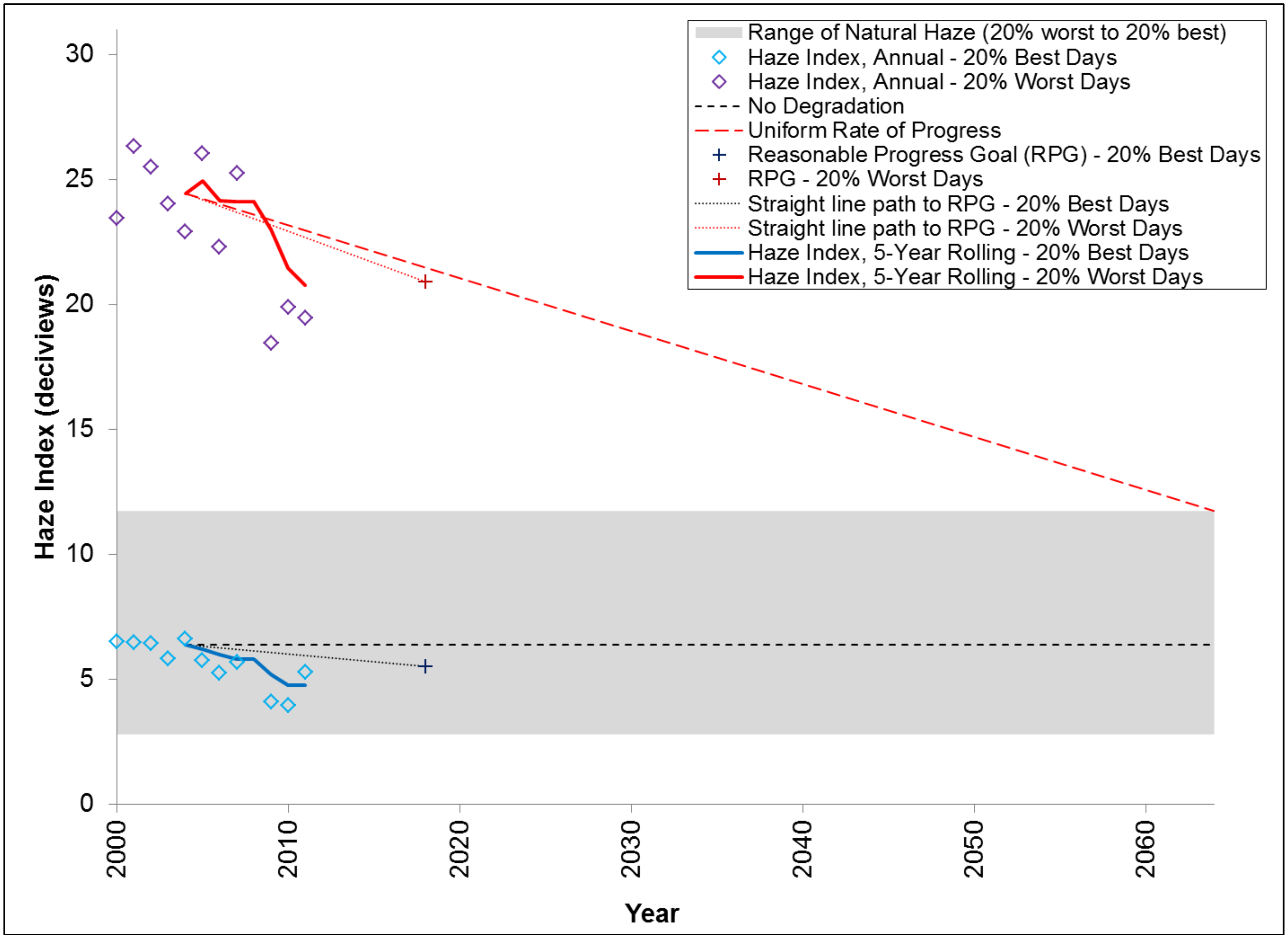


Figure 3-5. Annual Haze Index Levels at Brigantine Wilderness Area

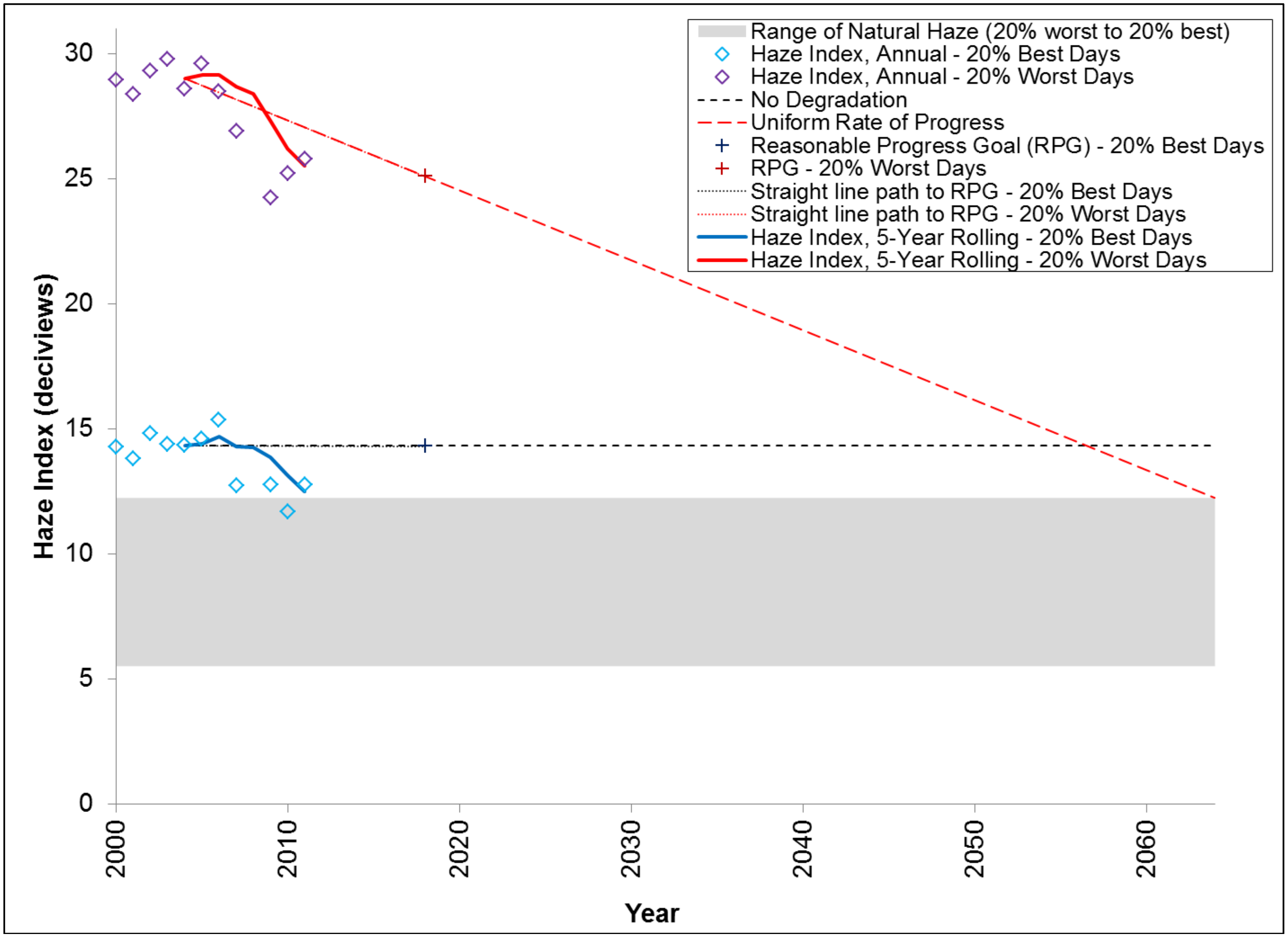


Figure 3-6. Annual Haze Index Levels at Dolly Sods Wilderness Area

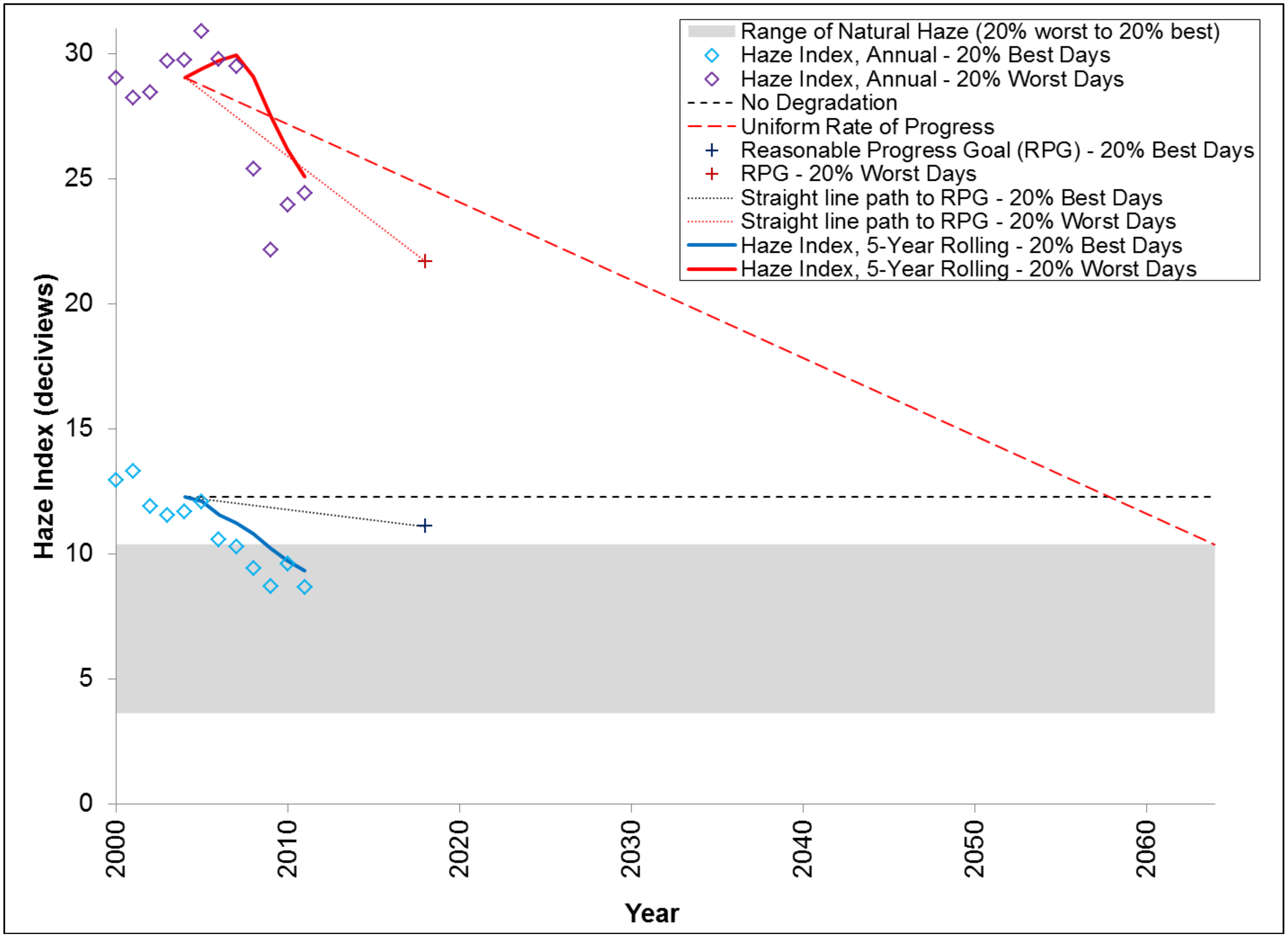
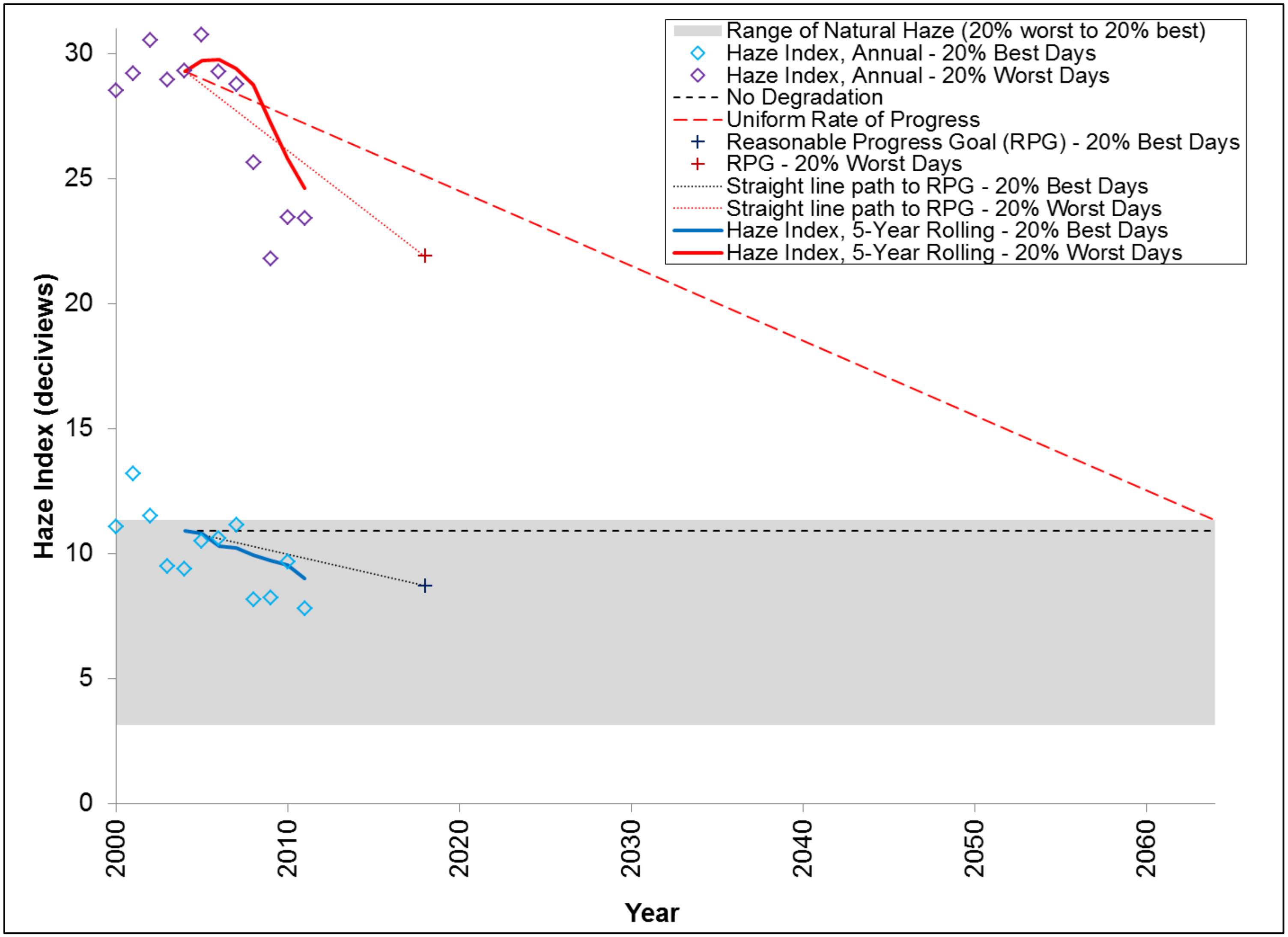


Figure 3-7. Annual Haze Index Levels at Shenandoah National Park



Comparison of the five-year annual average haze index to the glidepaths for the 2018 SIP commitments show that all areas in and adjacent to the MANE-VU region are on pace to meet those commitments. In fact, the 2018 RPGs will be met if 5-year average levels for best and worst days are maintained at Acadia National Park and at the Great Gulf, Lye Brook, and Moosehorn Wilderness Areas. However, the small uptick in annual average haze levels in 2011 for most areas in the MANE-VU region demonstrates that efforts are still needed to ensure that 2018 RPGs will be met and to prevent backsliding. The small relative increase for 2011 over the previous several years is almost certainly due, at least in part, to special and converging circumstances: the economic downturn followed by slow recovery, unusual meteorology, and the rapid shift toward natural gas.

At Brigantine Wilderness Area and both Class I areas adjacent to the MANE-VU region, best-day visibility levels are already below 2018 RPGs, but worst-day visibility levels require additional progress to meet the short-term goals.

3.2. Constituent Light Extinction Trends

In addition to analyzing trends in overall visibility changes at the sites, we also examined the data for changes in individual PM constituent contributions to visibility impairment. Figure 3-8 through Figure 3-14 present the annual Haze Index by constituent on the 20 percent least and most impaired days at MANE-VU and adjacent Class I areas between 2000 and 2011 in the context of RPGs. The figures are arranged with the areas located in the MANE-VU region presented first, followed by those adjacent to MANE-VU.

These figures show individual constituent values as stacked bar charts for sulfate, nitrate, organic carbon mass (OCM), light absorbing carbon (LAC), soil, coarse mass, sea salt, and Rayleigh extinction levels on best (left, “a”) and worst (right, “b”) days. The total of the stacked bars represent annual Haze Index values, and are marked by circles connected by a thin black line. The thick black line represents five-year back annual averages from 2004 to 2011. The 2018 RPG from the state haze SIP is marked with a black plus sign. Two red lines descend from the 2004 five-year back average (i.e., the baseline value): the red dotted line represents the glidepath to the 2018 RPG; and the red dashed line represents the glidepath to the 2064 natural visibility goal, or the “uniform rate of progress” line.

These figures confirm that large reductions in overall Haze Index values on the 20 percent worst days are primarily due to decreases in sulfate visibility impacts at MANE-VU Class I areas. Steady decreases in sulfate and nitrate contributions have also reduced overall haze levels on the least impaired days. These decreases occurred mainly from 2005 through 2011 at most of the studied areas, though in some locations (e.g., Dolly Sods Wilderness Area, Shenandoah National Park), the contribution from sulfate stopped its decline in 2009 and held steady or increased on the worst days through 2011.

Despite the reduced contribution from sulfate on the worst days at most of the MANE-VU Class I areas, the overall level of haze has remained largely unchanged since about 2009 on the worst days due to increases in contributions from sea salt and organic carbon mass, depending on the site. At Brigantine, the contribution from coarse mass in 2011 was unusually high, indicating a possible anomaly for that year (Pietarinen 2013).

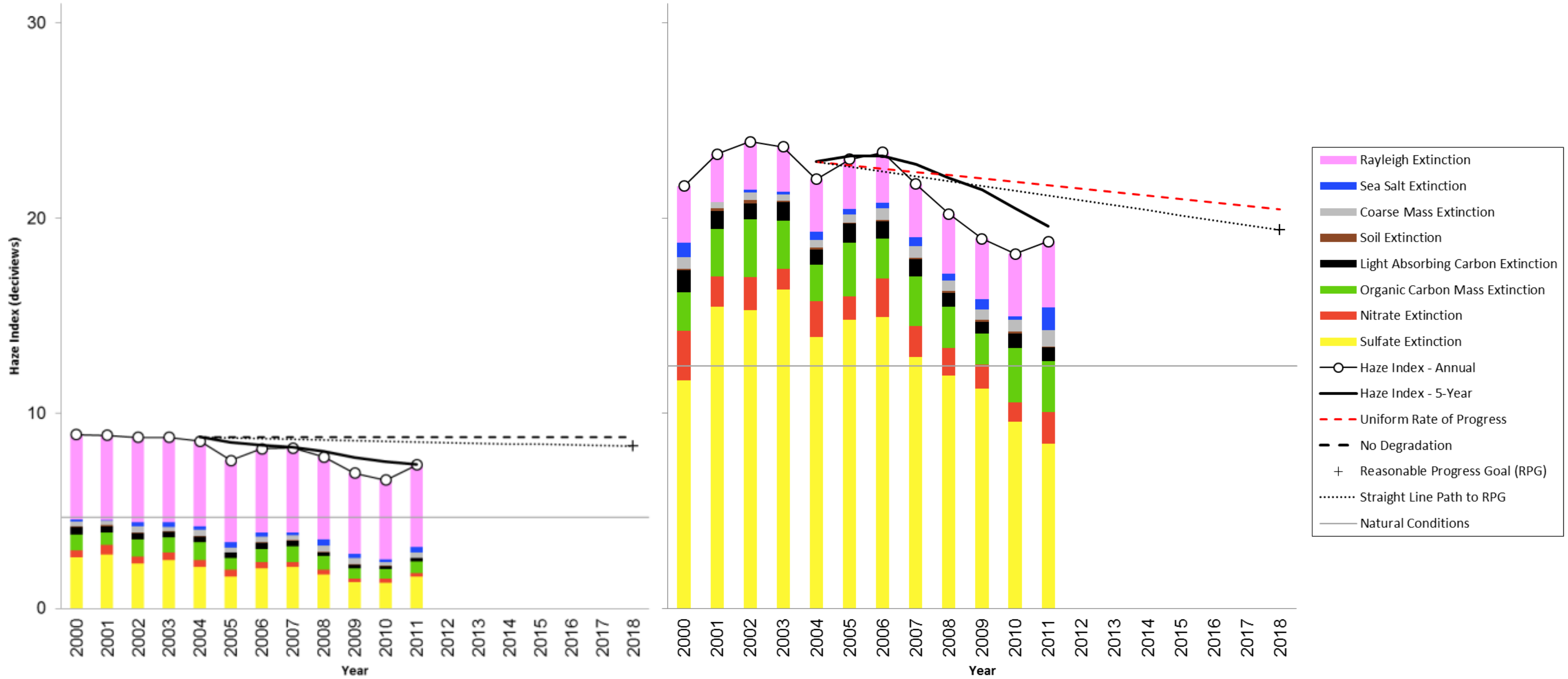
This increase in coarse mass contribution offset reductions in both nitrate and sulfate levels from the preceding years. Contribution from OCM appears to be highly variable from year to year at most sites. For instance, high OCM extinction levels at Brigantine and Lye Brook Wilderness Areas in 2002, and at Great Gulf Wilderness Area in 2011 on the worst days, undercut declines in contributions from sulfate to raise overall haze levels for those years.

Sulfate remains the most significant contributor to light extinction at all Class I areas on the most impaired days in and adjacent to the MANE-VU region, followed by OCM and nitrate. For the most part, light extinction from soil and sea salt, which help indicate the extent to which natural haze processes contribute to overall haze levels, are insignificant when compared to extinction from sulfate and nitrate. Based on these figures, continued progress in sulfate and nitrate levels appears to be driving the trend in overall improvement in worst- and best-day haze level reductions.

To examine the individual constituent trends more closely, we plotted the range of individual light extinction on best and worst days from 2000 through 2011 at the Class I areas against the estimated light extinction under natural conditions. Figure 3-15 through Figure 3-19 show the range of light extinction levels at the MANE-VU Class I areas (areas adjacent to the MANE-VU region are excluded from this analysis for simplicity) as compared to natural light extinction for selected constituents. Estimated natural light extinction is represented in each chart by the lighter grey band, and observed extinction by the other band. For the case of the carbonaceous species, OCM and LAC, the green band is observed OCM and the dark grey band is observed LAC. Note that the observations do not represent the range of the highest and lowest 20 percent light extinction levels for those constituents; rather, they represent the range of constituent light extinction levels on the 20 percent least and most impaired visibility days. For Great Gulf Wilderness Area, where observations were missing in 2009 and 2010, 2011 observations are presented as a broad range rather than a single data point for ease of visualization, but note that this is a visual distortion.

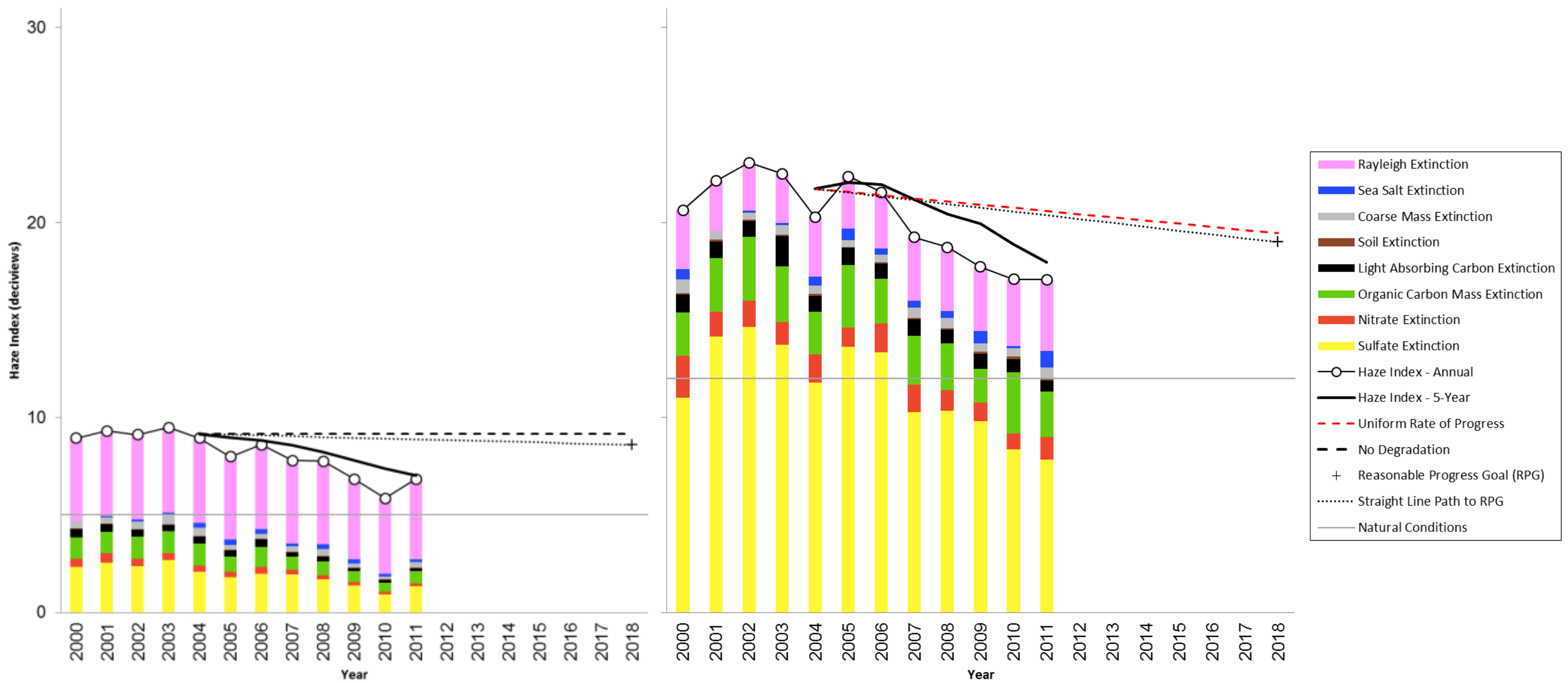
It is clear from these charts that levels of extinction from sulfate have dropped significantly since 2002 at all the MANE-VU Class I areas, although still remaining at levels much higher than the estimated natural range at all sites. Extinction due to nitrate has also dropped steadily, and at several sites is approaching natural levels on the best days. At Brigantine Wilderness Area, extinction due to nitrate remains considerably higher than the natural baseline. At Acadia National Park, levels of extinction due to carbonaceous constituents and coarse mass appear to be approximately at natural levels. At Great Gulf, Lye Brook, and Moosehorn Wilderness Areas, coarse mass extinction is approximately at natural levels, and carbonaceous matter has dropped from levels slightly above natural into the natural range. Prior peaks in carbonaceous matter extinction at these sites were driven by OCM levels. At Brigantine Wilderness Area, carbonaceous matter has been holding steadily above natural levels with little observable trend downward, and coarse mass light extinction levels also remain above natural levels, though the 2011 peak in coarse mass light extinction may be a result of construction activity near the monitor location (Pietarinen 2013).

Figure 3-8. Individual Constituent Contribution to Annual Haze Index Levels at Acadia National Park on 20 Percent Best and Worst Visibility Days



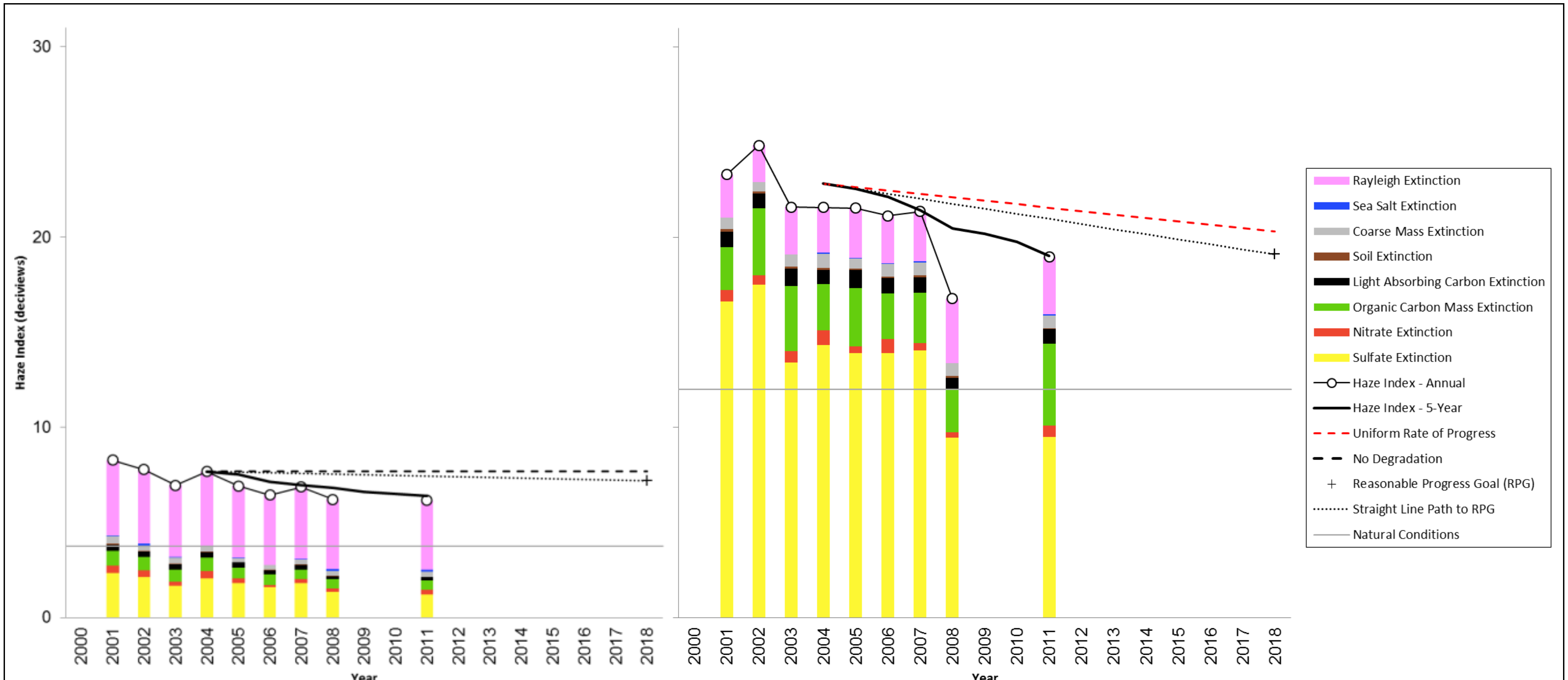
(a) 20% Best Days (b) 20% Worst Days

Figure 3-9. Individual Constituent Contribution to Annual Haze Index Levels at Moosehorn Wilderness Area on 20 Percent Best and Worst Visibility Days



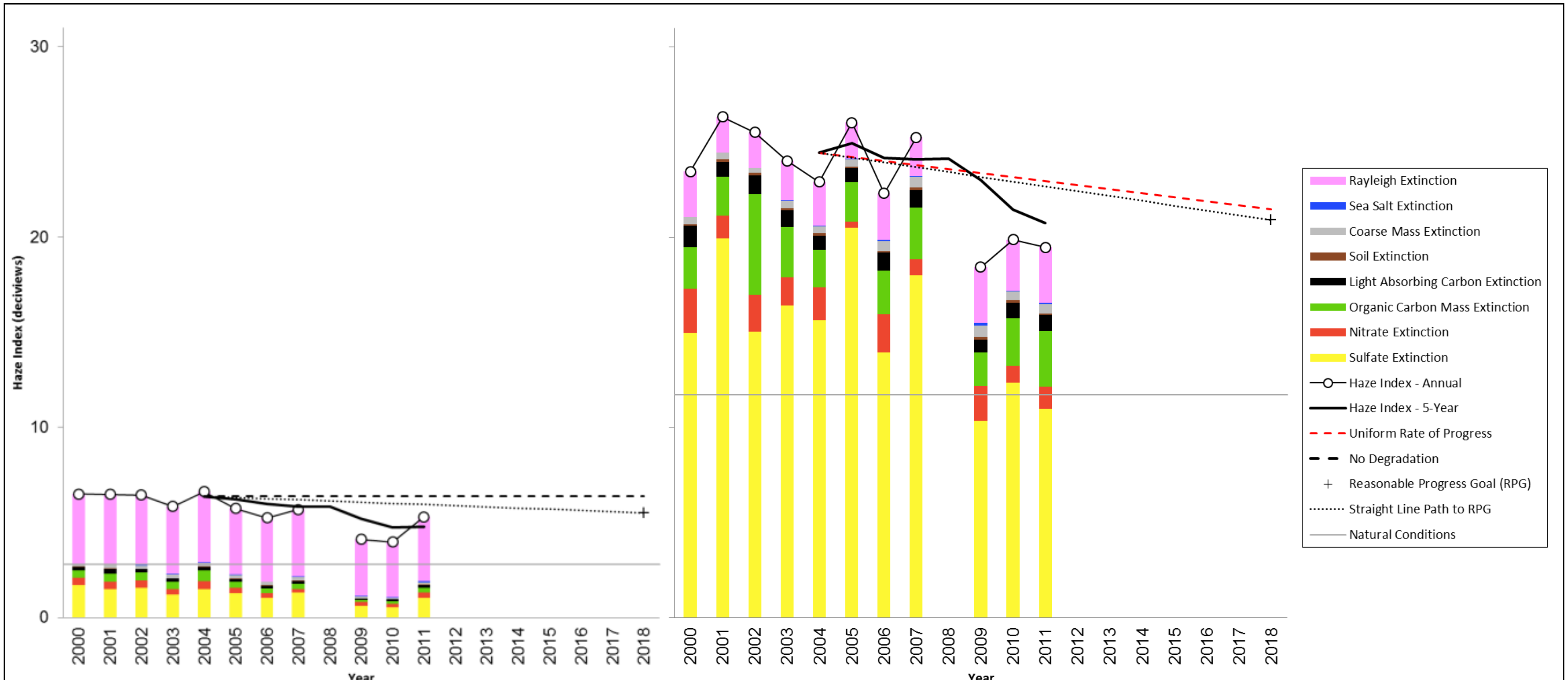
(a) 20% Best Days (b) 20% Worst Days

Figure 3-10. Individual Constituent Contribution to Annual Haze Index Levels at Great Gulf Wilderness Area on 20 Percent Best and Worst Visibility Days



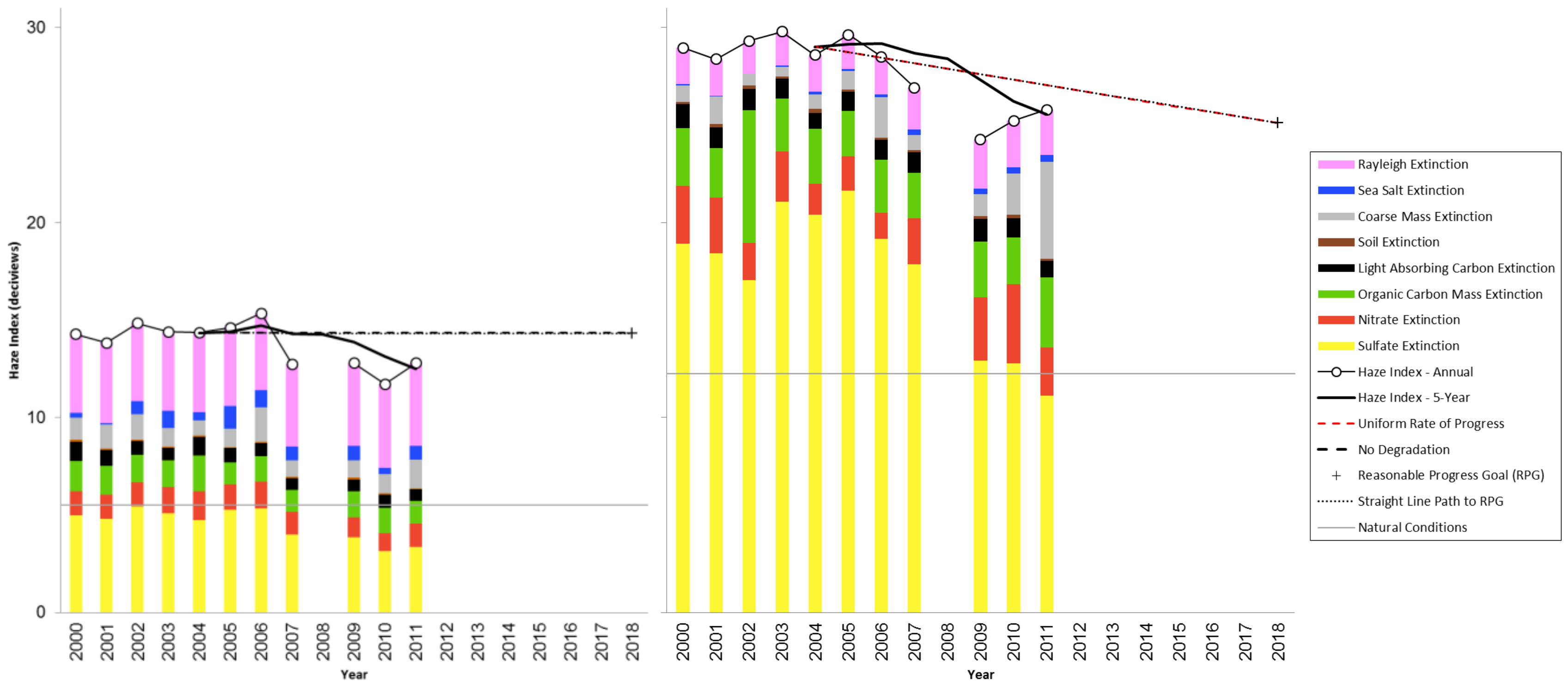
(a) 20% Best Days (b) 20% Worst Days

Figure 3-11. Individual Constituent Contribution to Annual Haze Index Levels at Lye Brook Wilderness Area on 20 Percent Best and Worst Visibility Days



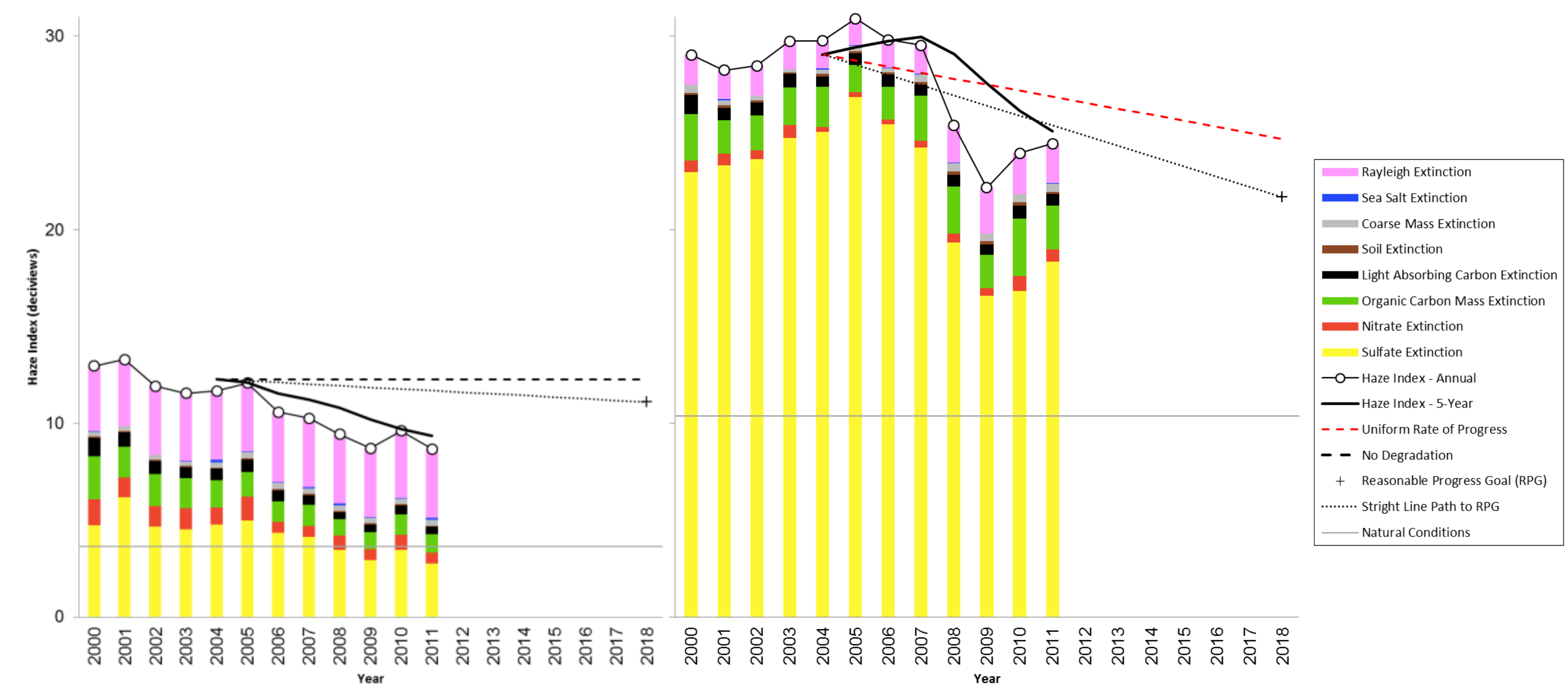
(a) 20% Best Days (b) 20% Worst Days

Figure 3-12. Individual Constituent Contribution to Annual Haze Index Levels at Brigantine Wilderness Area on 20 Percent Best and Worst Visibility Days



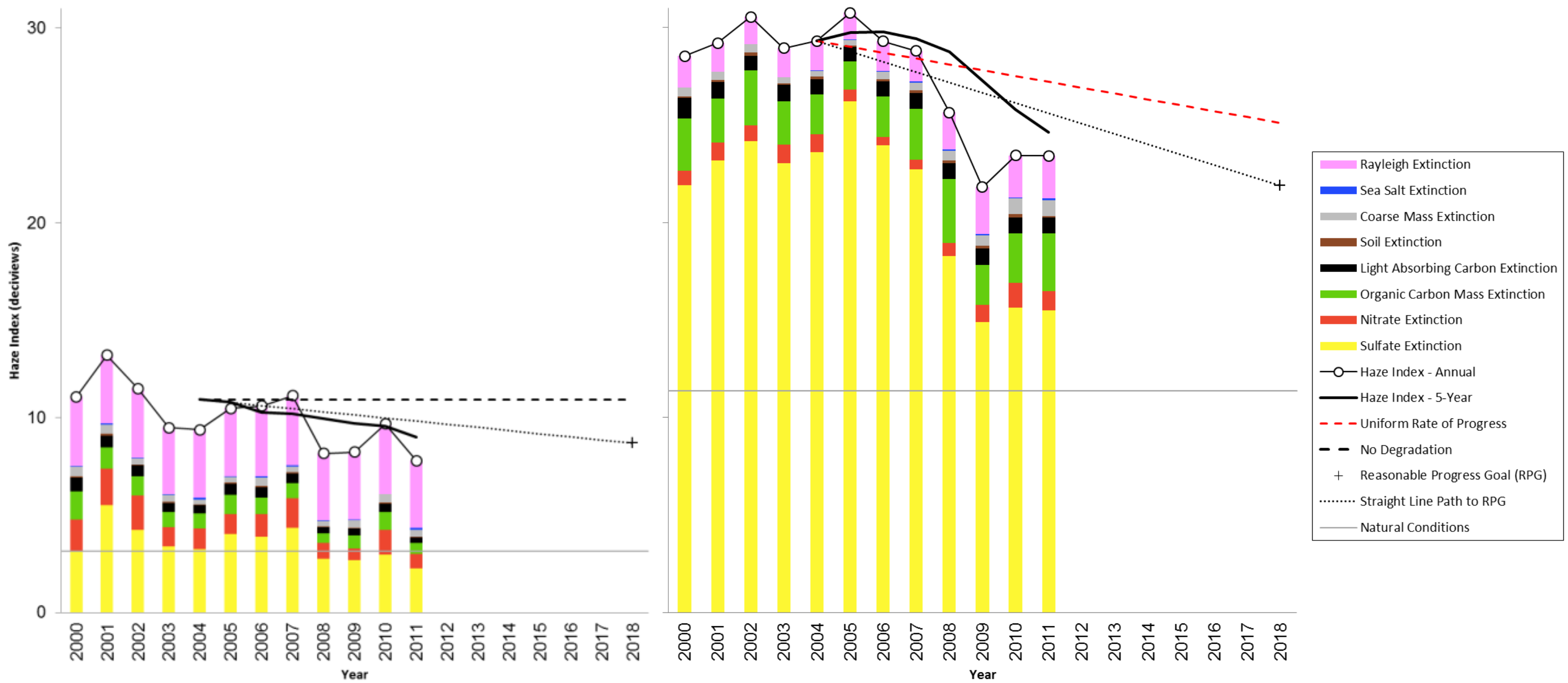
(a) 20% Best Days (b) 20% Worst Days

Figure 3-13. Individual Constituent Contribution to Annual Haze Index Levels at Dolly Sods Wilderness Area on 20 Percent Best and Worst Visibility Days



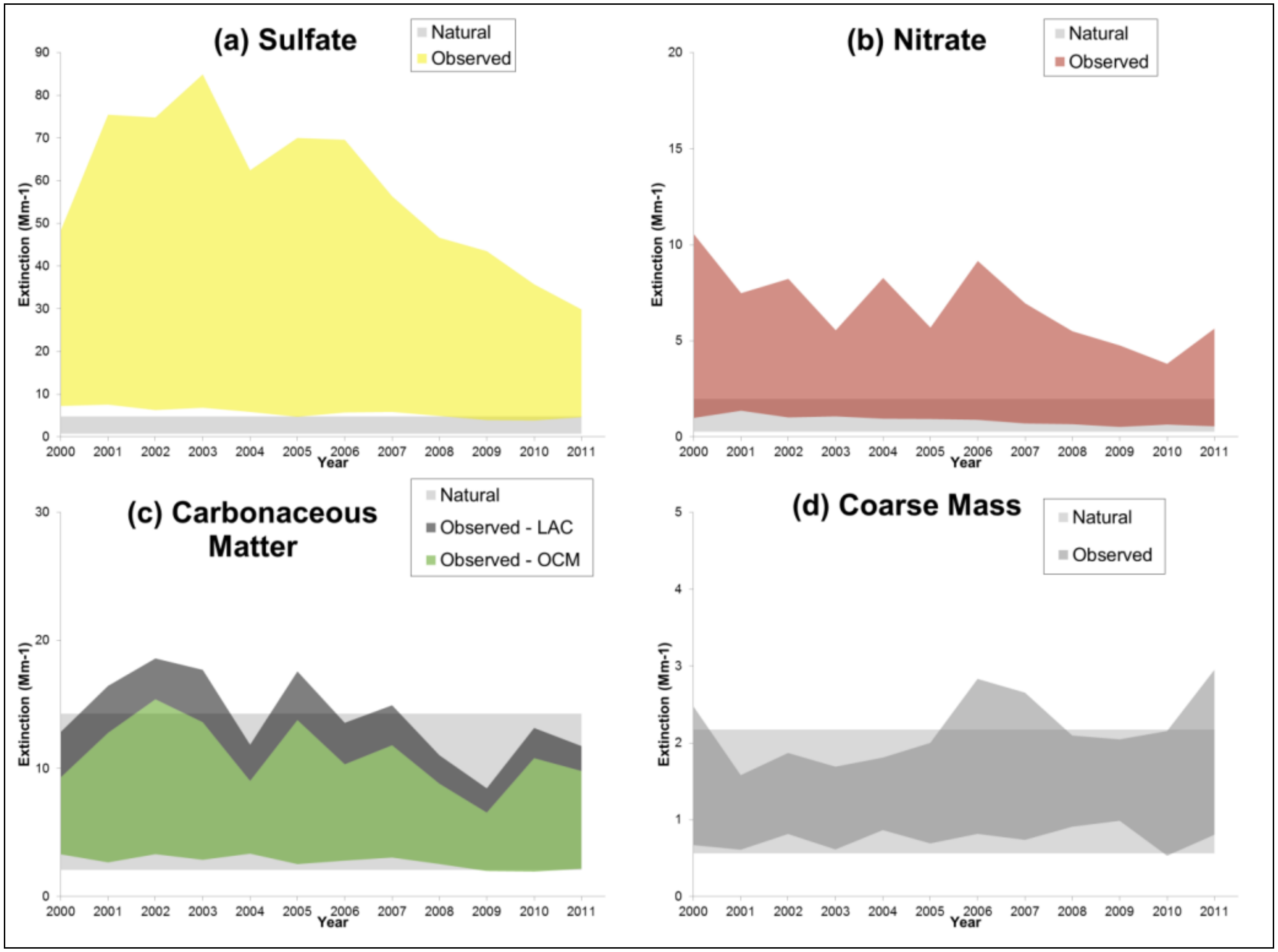
(a) 20% Best Days (b) 20% Worst Days

Figure 3-14. Individual Constituent Contribution to Annual Haze Index Levels at Shenandoah National Park on 20 Percent Best and Worst Visibility Days



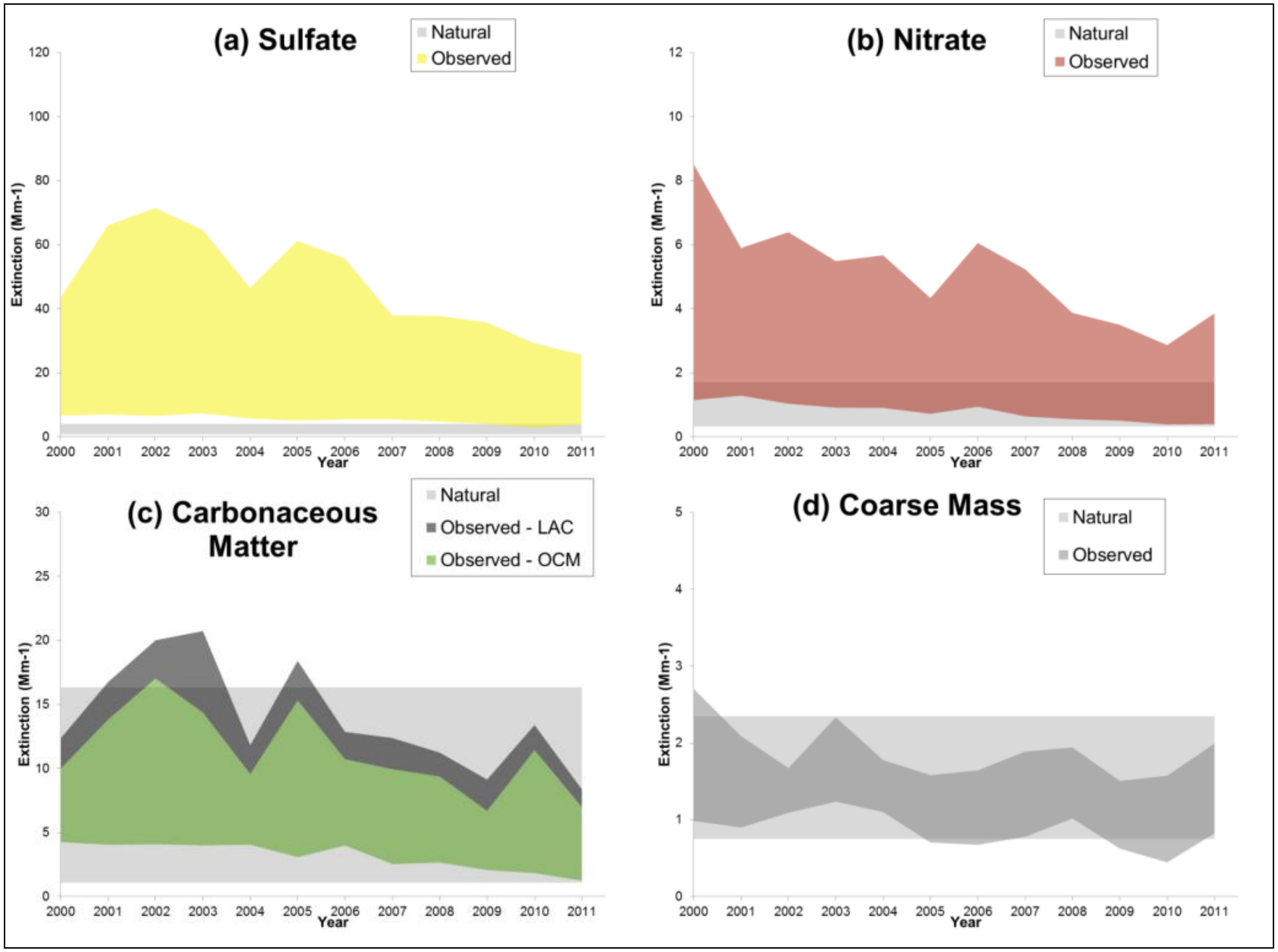
(a) 20% Best Days (b) 20% Worst Days

Figure 3-15. Range of Observed and Estimated Natural Light Extinction for Select Individual Constituents at Acadia National Park on 20 Percent Best and Worst Visibility Days



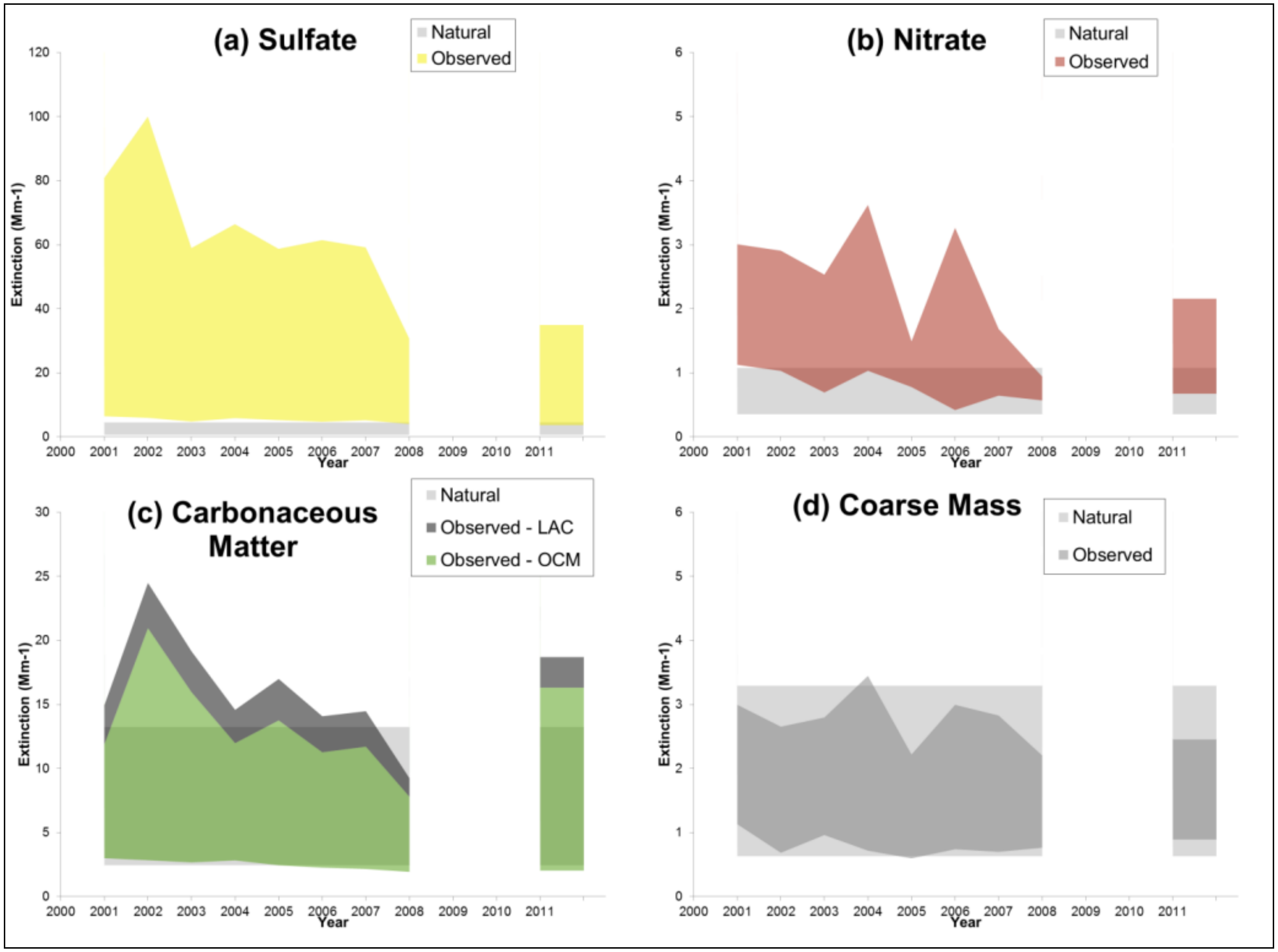
Notes: Light extinction from (a) sulfate, (b) nitrate, (c) carbonaceous matter (i.e., organic carbon mass or OCM and light absorbing carbon or LAC), and (d) coarse mass, alongside estimated natural light extinction from those constituents.

Figure 3-16. Range of Observed and Estimated Natural Light Extinction for Select Individual Constituents at Moosehorn Wilderness Area on 20 Percent Best and Worst Visibility Days



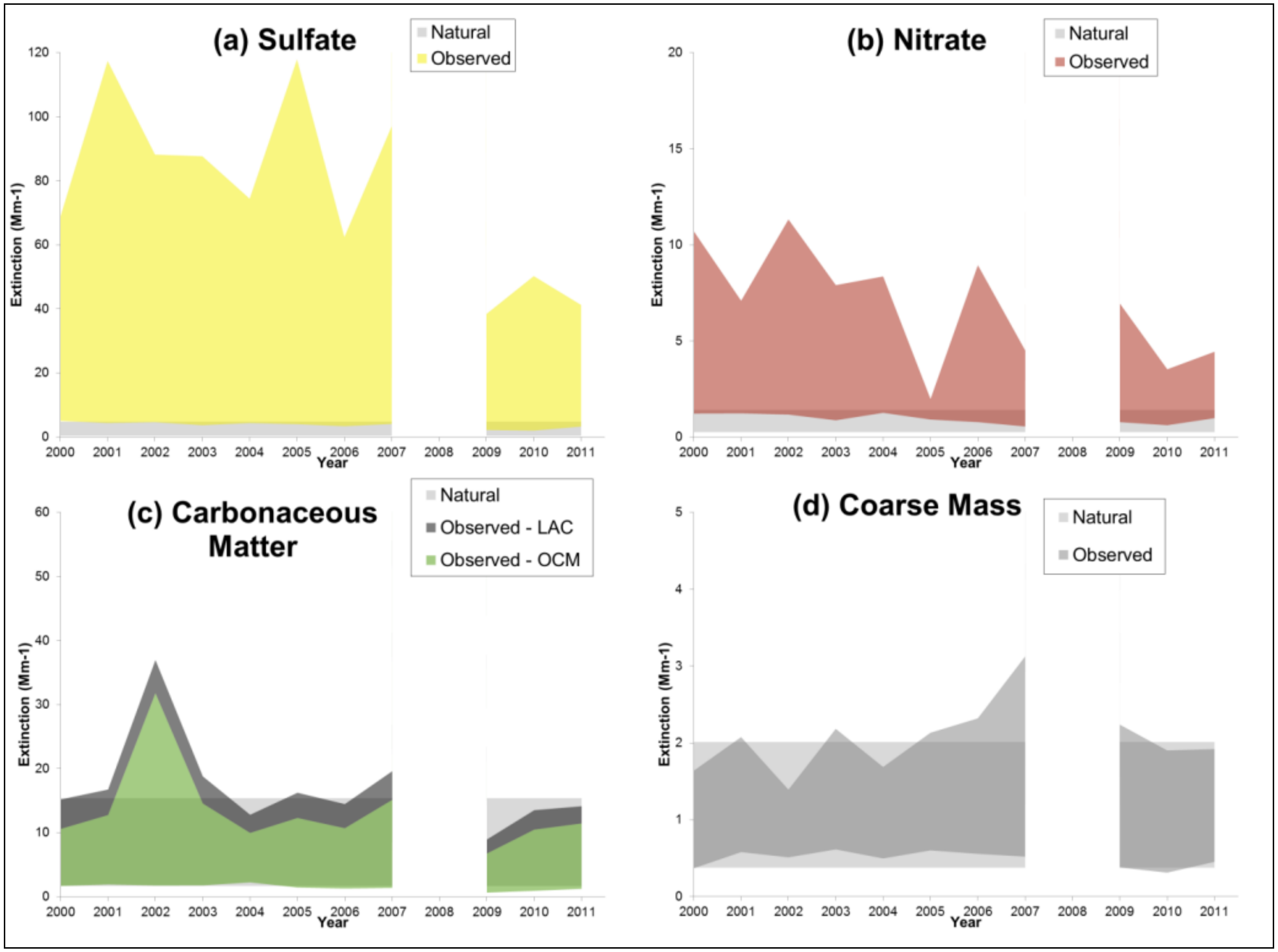
Notes: Light extinction from (a) sulfate, (b) nitrate, (c) carbonaceous matter (i.e., organic carbon mass or OCM and light absorbing carbon or LAC), and (d) coarse mass, alongside estimated natural light extinction from those constituents.

Figure 3-17. Range of Observed and Estimated Natural Light Extinction for Select Individual Constituents at Great Gulf Wilderness Area on 20 Percent Best and Worst Visibility Days



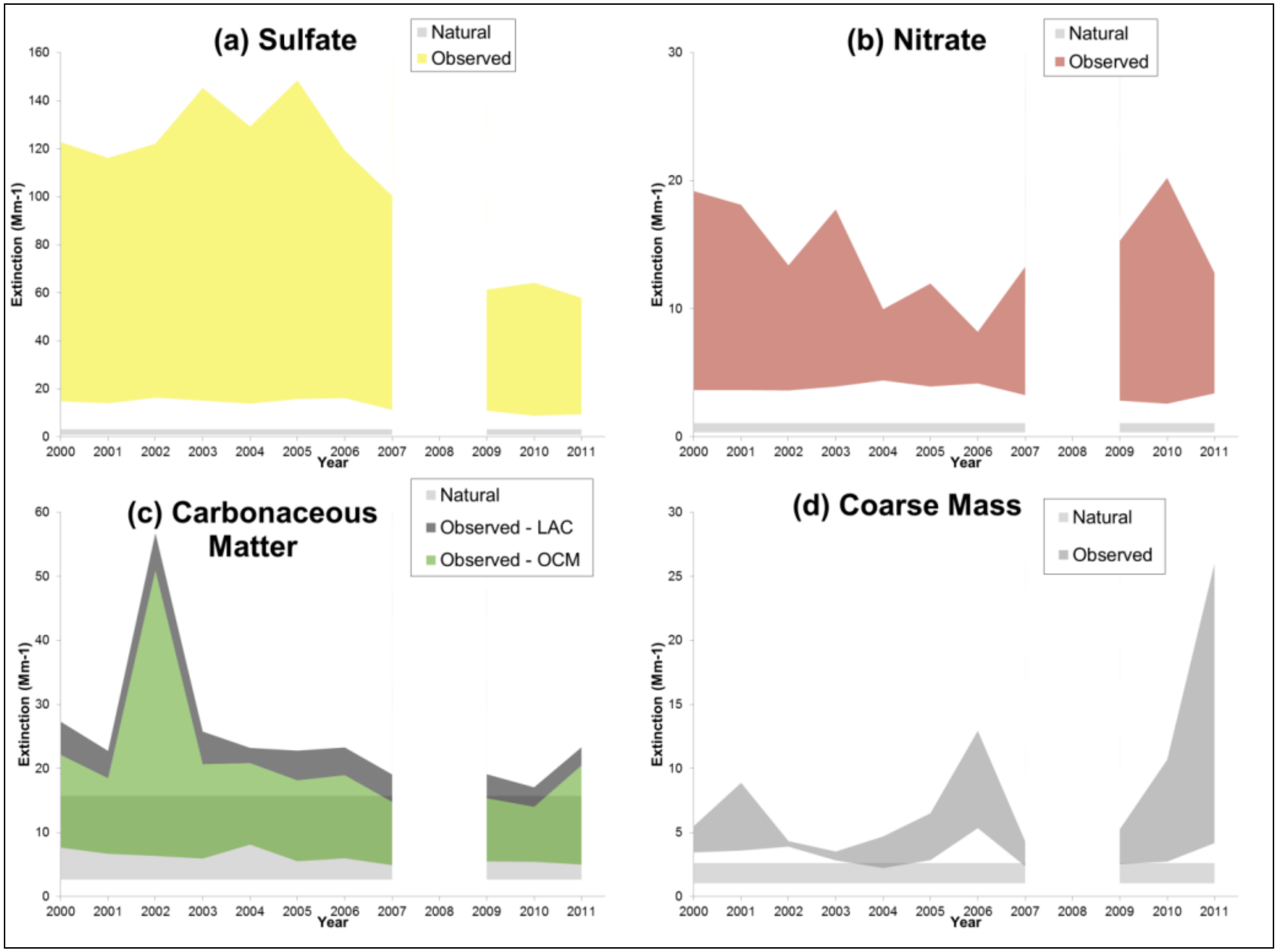
Notes: Light extinction from (a) sulfate, (b) nitrate, (c) carbonaceous matter (i.e., organic carbon mass or OCM and light absorbing carbon or LAC), and (d) coarse mass, alongside estimated natural light extinction from those constituents.

Figure 3-18. Range of Observed and Estimated Natural Light Extinction for Select Individual Constituents at Lye Brook Wilderness Area on 20 Percent Best and Worst Visibility Days



Notes: Light extinction from (a) sulfate, (b) nitrate, (c) carbonaceous matter (i.e., organic carbon mass or OCM and light absorbing carbon or LAC), and (d) coarse mass, alongside estimated natural light extinction from those constituents.

Figure 3-19. Range of Observed and Estimated Natural Light Extinction for Select Individual Constituents at Brigantine Wilderness Area on 20 Percent Best and Worst Visibility Days



Notes: Light extinction from (a) sulfate, (b) nitrate, (c) carbonaceous matter (i.e., organic carbon mass or OCM and light absorbing carbon or LAC), and (d) coarse mass, alongside estimated natural light extinction from those constituents.

3.3. Conclusions on Visibility Progress

Despite variability in the year-to-year data, there are definite downward trends in overall haze levels at the Class I areas in and adjacent to the MANE-VU region. Based on rolling five-year averages demonstrating progress since the 2000-2004 baseline period, the MANE-VU Class I areas appear to be on track to meet their 2018 RPGs for both best and worst visibility days. The trends are mainly driven by large reductions in sulfate light extinction, and to a lesser extent, nitrate light extinction. Levels of carbonaceous matter (OCM and LAC) appear to be approaching natural levels at most of the MANE-VU Class I areas. In some cases, the levels set by these goals have already been met, and progress beyond the 2018 RPGs appears achievable. Though it is on track to meet its 2018 RPGs, challenges remain for the Brigantine Wilderness Area. Sulfate light extinction levels are higher at this site than at others across the region, and continued sulfate reductions would be a significant driver in continuing to improve visibility at this site.

4. DISCUSSION

Reductions in air pollution continue to bring down levels of fine particulate matter in the eastern United States, which in turn are leading to improved visibility at federally protected Class I areas within and adjacent to the MANE-VU region. Since our last report (NESCAUM 2010), significant improvements in visibility at the MANE-VU Class I sites have been observed, and these changes have been largely driven by reductions in sulfate levels. Levels of nitrates and carbonaceous PM are also decreasing.

Large emission reductions of nitrogen oxides (NOx) and sulfur dioxide (SO_2) across the region in response to regional emission reduction requirements for power plants is likely a principal driver for these visibility improvements. Further reductions over the next several years should occur if the power sector continues to control or phase out coal plants across the eastern United States in response to competitive pressures from natural gas generation, overall reduced electricity demand, and more stringent requirements to reduce emissions of air toxics (e.g., acid gases, toxic metals).

In addition to addressing emissions from power plants, states across the Northeast have enacted or are in process of enacting low sulfur content requirements for fuel oils, which cover home heating oil (distillate) and residual oils (#4 and #6). At the federal level, USEPA has proposed the Tier 3 motor vehicle program that includes lowering sulfur content in gasoline. While gasoline combustion is a minor source of SO_2 emissions, the Tier 3 fuel requirements would significantly reduce NOx emissions from the existing fleet of on-road gasoline vehicles by reducing sulfur poisoning of the catalyst in catalytic converters, thus improving control technology performance. This would lead to lower nitrate levels, most notably during colder weather months when nitrates are more thermally stable. In warmer weather months, NOx promotes ground-level ozone formation, which in turn can enhance formation of visibility-limiting secondary organic aerosols (Carleton *et al.* 2010). Therefore, lower levels of NOx as a result of Tier 3 can also improve visibility by reducing ozone formation that leads to carbonaceous PM.

In summary, the visibility data examined in this report demonstrate that broad, regional efforts to reduce emissions of visibility-impairing pollutants are having a beneficial effect at the region's Class I areas. The most recent IMPROVE data indicate that the states continue to be on track to meet their 2018 reasonable progress goals for improved visibility. Further progress may occur through additional pollution reductions achievable under recently adopted or proposed regulatory programs.

5. REFERENCES

Carleton, A.G., R.W. Pinder, P.V. Bhave, and G.A. Pouliot. 2010. To What Extent Can Biogenic SOA be Controlled? 44 *Environ. Sci. Technol.* 3376-3380, doi: 10.1021/es903506b.

IMPROVE. 2011. IMPROVE and RHR Summary Data. Available at: http://vista.cira.colostate.edu/improve/Data/IMPROVE/summary_data.htm

NESCAUM. 2010. Tracking Visibility Progress, 2004-2008 (2010). MANE-VU Technical Memorandum, May 12, 2010. Available at http://www.nescaum.org/documents/tracking-progress-final-05-12-10.pdf

Pietarinen, C. 2013. Conversation with Charles Pietarinen, Chief of the Bureau of Air Monitoring at the New Jersey Department of Environmental Protection on March 11, 2013. Mr. Pietarinen indicated that construction activity at the Brigantine Visitor's Center, which is very close to the monitor, may have affected the monitoring site in recent years. Prescribed burns may also be having an influence at the site.

US Environmental Protection Agency (USEPA). 2003a. Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule. Research Triangle Park: Office of Air Quality Planning and Standards, September 2003. EPA-454/B-03-005.

US Environmental Protection Agency (USEPA). 2003b. Guidance for Tracking Progress Under the Regional Haze Rule. Research Triangle Park: Office of Air Quality Planning and Standards, September 2003. EPA-454/B-03-004.

Appendix A: Tracking Progress Data for Class I Areas in and Adjacent to the MANE-VU Region

Appendix A: Tracking Progress Data for Class I Areas in and Adjacent to the MANE-VU Region

Tracking progress data for sites in the MANE-VU region are presented in Table A-1, and for sites adjacent to it in Table A-2.

Table A-1. Tracking Progress Data for Class I Areas in and Adjacent to the MANE-VU Region (dv)

		Best Days		Worst Days	
Class I Area	Year	Haze Index, Annual	Haze Index, 5-Year Rolling	Haze Index, Annual	Haze Index, 5-Year Rolling
Acadia National Park	2000	8.90	-	21.64	-
	2001	8.87	-	23.28	-
	2002	8.77	-	23.91	-
	2003	8.77	-	23.65	-
	2004	8.56	8.78	21.98	22.89
	2005	7.58	8.51	23.01	23.17
	2006	8.17	8.37	23.37	23.19
	2007	8.21	8.26	21.74	22.75
	2008	7.76	8.06	20.21	22.06
	2009	6.92	7.73	18.93	21.45
	2010	6.57	7.53	18.16	20.48
	2011	7.35	7.36	18.80	19.57
Moosehorn Wilderness Area	2000	8.94	-	20.63	-
	2001	9.31	-	22.14	-
	2002	9.12	-	23.07	-
	2003	9.48	-	22.50	-
	2004	8.93	9.16	20.28	21.72
	2005	7.99	8.97	22.36	22.07
	2006	8.60	8.82	21.55	21.95
	2007	7.79	8.56	19.24	21.19
	2008	7.75	8.21	18.73	20.43
	2009	6.83	7.79	17.71	19.92
	2010	5.85	7.37	17.09	18.87
	2011	6.84	7.01	17.07	17.97
Great Gulf Wilderness Area	2000		-		-
	2001	8.26	-	23.29	-
	2002	7.77	-	24.84	-
	2003	6.94	-	21.59	-
	2004	7.68	7.66	21.56	22.82
	2005	6.90	7.51	21.53	22.56
	2006	6.43	7.14	21.12	22.13
	2007	6.86	6.96	21.35	21.43
	2008	6.20	6.81	16.78	20.47
	2009	*	6.60	*	20.19
	2010	*	6.50	*	19.75
	2011	6.15	6.40	18.96	19.03

Symbols: "-" = not applicable; "*" = missing data; "†" = Class I Area adjacent to the MANE-VU region

Table continued on next page.

Table A-1. Tracking Progress Data for Class I Areas in and Adjacent to the MANE-VU Region (dv), continued

Class I Area	Year	Best Days		Worst Days	
		Haze Index, Annual	Haze Index, 5-Year Rolling	Haze Index, Annual	Haze Index, 5-Year Rolling
Lye Brook Wilderness Area	2000	6.49	-	23.45	-
	2001	6.47	-	26.33	-
	2002	6.43	-	25.52	-
	2003	5.83	-	24.02	-
	2004	6.61	6.37	22.91	24.45
	2005	5.74	6.22	26.04	24.96
	2006	5.24	5.97	22.31	24.16
	2007	5.68	5.82	25.25	24.11
	2008	*	5.82	*	24.13
	2009	4.11	5.19	18.44	23.01
	2010	3.96	4.75	19.88	21.47
	2011	5.28	4.76	19.47	20.76
Brigantine Wilderness Area	2000	14.26	-	28.95	-
	2001	13.83	-	28.38	-
	2002	14.83	-	29.31	-
	2003	14.39	-	29.79	-
	2004	14.36	14.33	28.59	29.01
	2005	14.61	14.40	29.62	29.14
	2006	15.35	14.71	28.50	29.16
	2007	12.74	14.29	26.91	28.68
	2008	*	14.26	*	28.41
	2009	12.78	13.87	24.25	27.32
	2010	11.70	13.14	25.22	26.22
	2011	12.78	12.50	25.78	25.54
Dolly Sods Wilderness Area†	2000	12.96	-	29.03	-
	2001	13.30	-	28.24	-
	2002	11.91	-	28.47	-
	2003	11.54	-	29.73	-
	2004	11.67	12.28	29.76	29.05
	2005	12.09	12.10	30.89	29.42
	2006	10.57	11.56	29.80	29.73
	2007	10.27	11.23	29.52	29.94
	2008	9.44	10.81	25.39	29.07
	2009	8.70	10.21	22.17	27.55
	2010	9.62	9.72	23.94	26.16
	2011	8.67	9.34	24.44	25.09
Shenandoah National Park†	2000	11.08	-	28.53	-
	2001	13.21	-	29.21	-
	2002	11.49	-	30.54	-
	2003	9.48	-	28.94	-
	2004	9.37	10.93	29.32	29.31
	2005	10.48	10.81	30.75	29.75
	2006	10.59	10.28	29.30	29.77
	2007	11.13	10.21	28.79	29.42
	2008	8.16	9.95	25.65	28.76
	2009	8.23	9.72	21.81	27.26
	2010	9.67	9.56	23.44	25.80
	2011	7.80	9.00	23.42	24.62

Symbols: “-” = not applicable; “*” = missing data; “†” = Class I Area adjacent to the MANE-VU region

ATTACHMENT C

Overview of State and Federal Actions Relative to MANE-VU Asks

This page is intentionally left blank.

Memorandum

Date: March 28, 2013

To: MANE-VU

From: Paul Miller, NESCAUM

Re: Overview of state and federal actions relative to MANE-VU Asks

This memorandum provides a summary of certain elements in regional haze state implementation plans (SIPs) within and outside the Mid-Atlantic/Northeast Visibility (MANE-VU) regional planning area.[1] The SIPs covered are either from members of the MANE-VU regional planning organization (RPO), or from states outside the MANE-VU region that were identified as having emissions contributing 2% or more to sulfate levels at MANE-VU Class 1 areas.

The elements reviewed in each regional haze SIP were in the context of requests from MANE-VU in 2007 that certain measures, or their equivalents, be adopted within each jurisdiction by 2018 (referred to as the "MANE-VU Asks"). MANE-VU deemed these measures as appropriate for making reasonable progress towards achieving the national goal of natural background visibility in Class 1 areas by 2064. The MANE-VU Asks differed in some respects between the MANE-VU members and states outside of the MANE-VU region, but were intended to encompass comparable sulfur dioxide (SO_2) measures across all states. The specific elements of the MANE-VU Asks for inside and outside the MANE-VU region are given below according to two groupings of SIPs from inside and outside the MANE-VU region.

A common Ask element inside and outside the MANE-VU region was for a 90% or greater SO_2 emissions reduction by 2018 relative to 2002 from 167 electric generating unit (EGU) stacks. MANE-VU identified these specific stacks through modeling as having the largest impacts on visibility in its Class 1 areas among all modeled EGUs. This Ask element included flexibility for achieving the 90% reduction through alternative measures if not feasible at the stack.

This summary provides a "snap shot" of SO_2 emissions in 2011 at the individual stacks on the 167 EGU list. To provide additional context of state-wide reductions from

---

[1] NESCAUM thanks the following people for helpful assistance in reviewing and commenting on the state summaries: Robert Betterton, WV Department of Environmental Protection; James Boylan, GA Department of Natural Resources; John Hornback, SESARM; Wendy Jacobs, CT Department of Energy and Environmental Protection; Joseph Jakuta, OTC; Rob Kaleel, LADCO; Glenn Keith, MA Department of Environmental Protection; Martin Luther, KY Division for Air Quality; Charles Martone, NH Department of Environmental Services; Julie McDill, MARAMA; Doris McLeod, VA Department of Environmental Quality; Anne McWilliams, EPA Region 1; Albert Pearce, GA Department of Natural Resources; John Sipple, DE Department of Natural Resources and Environmental Control; Roger Thunell, MD Department of the Environment.

potential "alternative measures," we also use EPA's Acid Rain Program data to compare overall state-wide SO_2 reductions occurring in 2011 relative to 2002 against the requested amount from a state's stacks on the 167 EGU stack list. The comparison uses reported emissions from the Acid Rain Program rather than from the Clean Air Interstate Rule (CAIR) because not all states receiving a MANE-VU Ask are covered by CAIR. In addition, emissions reporting under CAIR started several years after the 2002 MANE-VU Ask baseline. A state-level comparison of 2011 SO_2 emissions reported in the Acid Rain Program and in the CAIR program found that reported SO_2 emissions in both programs were within about 5% for most states.

In addition to the MANE-VU Asks for states, MANE-VU also presented a federal ask to the U.S. Environmental Protection Agency (EPA) for additional national SO_2 reductions from power plants. The current status of federal efforts is summarized in the third section of this memorandum.

1. INSIDE MANE-VU REGION

For the MANE-VU members, the "MANE-VU Ask" requested the following actions:

- Timely implementation of BART requirements; and

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

- A low sulfur fuel oil strategy in the outer zone States (the remainder of the MANE-VU region) to reduce the sulfur content of distillate oil to 0.05% sulfur by weight (500 ppm) by no later than 2014, of #4 residual oil to 0.25 – 0.5% sulfur by weight by no later than 2018, and of #6 residual oil to no greater than 0.5% sulfur by weight by no later than 2018, and to further reduce the sulfur content of distillate oil to 15 ppm by 2018, depending on supply availability; and

- A 90% or greater reduction in sulfur dioxide (SO_2) emissions from each of the top 100 electric generating units (EGUs) identified by MANE-VU (comprising a total of 167 stacks) as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class 1 Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and

- Continued evaluation of other control measures including energy efficiency, alternative clean fuels, and other measures to reduce SO_2 and nitrogen oxide (NOx) emissions from all coal-burning facilities by 2018 and new source performance standards for wood combustion. These measures and other measures identified will be evaluated during the consultation process to determine if they are reasonable and cost-effective.

Connecticut

Submittal Date of Regional Haze SIP

November 18, 2009; February 24, 2012; March 12, 2012; November 23, 2012

Haze SIP Status as of January 24, 2013

EPA proposed approval, 77 FR 17367 (March 26, 2012); EPA supplemental proposed approval, 78 FR 5158 (January 24, 2013); final by April 26, 2013 (under extended consent decree).[2]

BART Requirements

Connecticut identified an initial list of ten BART-eligible sources. Three BART-eligible sources were subsequently capped by consent order at below BART-eligible levels, removing them from the list. Connecticut determined that its existing rules achieved greater reductions from its remaining BART-eligible sources than from application of BART alone.

Low Sulfur Oil Strategy Inner Zone

Does not apply.

Low Sulfur Oil Strategy Outer Zone

Connecticut adopted low sulfur fuel oil rules and statute but implementation of the statute is contingent upon adoption of rules by Massachusetts (enacted), New York (enacted), and Rhode Island (not yet proposed).

90% SO_2 reduction of 167 EGU stacks

Does not have listed stack.

Evaluation of other control measures

Connecticut agreed to continue evaluating other possible control measures consistent with the MANE-VU Ask, including investigating success of other state programs regulating outdoor wood burning furnaces, and adoption of the California Low Emission Vehicle (CA LEV) program revisions for mobile sources.

Delaware

Submittal Date of Regional Haze SIP

September 25, 2008

Haze SIP Status as of December 18, 2012

EPA final approval, 76 FR 42557 (July 19, 2011)

BART Requirements

[2] Communication from David Conroy, EPA Region 1 (December 18, 2012).

Delaware identified four EGUs and one steel mill as BART-eligible sources. Delaware established enforceable caps for the steel mill to limit emissions below BART-eligible levels. Delaware also considers that in the aggregate, DE Regulation 1146 achieves greater reductions from its EGUs than would be achieved by applying presumptive BART on the BART-eligible EGUs.

Low Sulfur Oil Strategy Inner Zone
Delaware has not yet adopted low sulfur fuel strategy, but considers equivalent reductions met by including SO_2 reductions from all Delaware EGUs (in excess of 90% reductions).

Low Sulfur Oil Strategy Outer Zone
Does not apply.

90% SO_2 reduction of 167 EGU stacks
Delaware has five stacks at two power plants among the MANE-VU 167 EGU stacks list. Delaware indicated that the 90% reduction in SO_2 from the Edge Moor Unit 5 and Indian River Units 1-4 was relative to a baseline of calendar year 2002 actual SO_2 mass emissions levels from those units. Based on the actual 2002 SO_2 mass emissions from the subject Delaware EGUs, and applying the 90% reduction factor, Delaware determined that the actual SO_2 reduction obligation for those units was 19,909 tons/year. However, Delaware's analysis indicated that it was not feasible to achieve an SO_2 mass emissions reduction of 19,909 tons/year from Edge Moor Unit 5 and Indian River Units 1-4 alone. Alternatively, in the 2008 Visibility SIP document Delaware indicated that SO_2 emissions reductions from all of the EGU units affected by Delaware's 7 DE Admin Code 1146, Electric Generating Unit (EGU) Multi-Pollutant Regulation, would exceed 19,909 tons of annual SO_2 reductions. Delaware indicated that the SO_2 emissions reductions achieved by 7 DE Admin Code 1146 demonstrated that Delaware had met its obligation. Subsequent to the promulgation of 7 DE Admin Code 1146 (and Delaware's 2008 SIP submittal), units subject to the regulation have come into compliance with the regulation in 2009 and 2012 (phase-in), or have come into compliance with consent decrees and permanent, federally enforceable permit conditions related to the regulation. Beginning in 2011, the annual SO_2 emission reductions of 21,906 tpy have exceeded the 2018 target level of 19,909 tpy (7 years early). This is consistent with reported emissions in the Acid Rain Program.

Evaluation of other control measures
Delaware is evaluating diversity of fuels for energy needs, electricity conservation programs, and efficient energy infrastructure, along with encouraging new energy efficient product makers and promoting renewables, among other measures.

District of Columbia[3]

Submittal Date of Regional Haze SIP

[3] The District of Columbia contributes less than 0.1 $\mu g/m^3$ or 2% sulfate at nearby Class 1 areas, so its long-term strategy consists of adopting the control measures in the MANE-VU "on-the-books/on-the-way" scenario and meeting the BART requirements.

October 27, 2011

Haze SIP Status as of December 18, 2012
EPA final approval, 77 FR 5191 (February 2, 2012)

BART Requirements
The District of Columbia has two BART-eligible sources that were to shut down by December 17, 2012.

Low Sulfur Oil Strategy Inner Zone
Does not apply.

Low Sulfur Oil Strategy Outer Zone
No rule proposed.

90% SO_2 reduction of 167 EGU stacks
Does not have listed stack.

Evaluation of other control measures
The District of Columbia plans to continue to pursue adoption of MANE-VU measures in "beyond-on-the-way" (BOTW) and "best and final" scenarios by 2018, as appropriate and necessary.

Maine

Submittal Date of Regional Haze SIP
December 9, 2010; supplemented September 14, 2011, November 9, 2011

Haze SIP Status as of December 18, 2012
EPA final approval, 77 FR 24385 (April 24, 2012)

BART Requirements
Maine identified 10 BART-eligible sources, and determined all 10 were subject to BART. In 2007, ME legislature adopted BART requirements and deadlines. BART controls must be installed and operating by January 1, 2013 and either (1) require low sulfur oil (1% or less) or (2) be equivalent to a unit-specific 50% reduction in sulfur emissions from baseline. Three BART sources capped out under permit limits. Maine determined that existing controls and lower sulfur oil (where applicable) satisfied BART for the remaining sources.

Low Sulfur Oil Strategy Inner Zone
Does not apply.

Low Sulfur Oil Strategy Outer Zone
Legislation passed. Distillate = 50 ppm in 2016; 15 ppm in 2018. #6 Fuel - 0.5% in 2018.

90% SO_2 reduction of 167 EGU stacks

Maine has one stack on MANE-VU 167 stacks list. Maine determined it was not cost-effective to add controls to the unit, and will use lower sulfur fuel to comply by 2013. Low sulfur fuel will get an 84% reduction. In 2011, the unit had SO_2 emissions 76% lower than its 2002 levels, and greater than 90% lower when including additional SO_2 reductions from other units at the same power plant. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 48%.

Evaluation of other control measures

Maine has adopted rules on outdoor wood and pellet boilers, an outdoor wood boiler replacement and buy-back program, and a wood stove replacement buy-back program.

Maryland

Submittal Date of Regional Haze SIP

February 13, 2012

Haze SIP Status as of December 18, 2012

EPA final approval, 77 FR 39938 (July 6, 2012).

BART Requirements

Maryland identified four EGUs and three non-EGUs as BART-eligible. Of the three non-EGUs, one was determined to not be a BART source based on start up date, one had existing and future selective non-catalytic reduction (SNCR) controls considered to satisfy BART, and one had additional requirements put in place to satisfy BART. For EGU BART-eligible sources, Maryland accepted existing controls and measures as satisfying BART on all units.

Low Sulfur Oil Strategy Inner Zone

Does not apply.

Low Sulfur Oil Strategy Outer Zone

No rule proposed. Maryland committed to pursuing a low sulfur fuel oil strategy as apporpriate and necessary.

90% SO_2 reduction of 167 EGU stacks

Maryland has nine stacks (12 units) at six power plants listed among the MANE-VU 167 stacks. Maryland's approach to the 90% MANE-VU Ask from its listed stacks is to use the state's Healthy Air Act (HAA) as approved in its SIP. Maryland operated from a total emissions baseline for the state's EGU units identified by the MANE-VU Ask. Maryland arrived at the total emissions needed to satisfy the Ask by totaling the 2002 base year emissions for the state's units on the 167 list and multiplying by 90%. This number is 211,892 tpy of SO_2. In 2011, Maryland achieved 208,941 tpy of reductions from the units in question and an additional 6,671 tpy from units regulated by the HAA but not included in the MANE-VU Ask. Maryland states that the Maryland HAA is obtaining SO_2 reductions in excess of the 90% MANE-VU Ask before 2018. This is consistent with reported emissions in the Acid Rain Program.

Evaluation of other control measures
Maryland committed to evaluating other measures per MANE-VU Ask. Maryland also cited the Maryland Strategic Energy Investment Fund as a funding source for renewables and energy efficiency.

Massachusetts

Submittal Date of Regional Haze SIP
December 30, 2011; supplemented August 9, 2012; August 28, 2012

Haze SIP Status as of December 18, 2012
EPA final approval signed in September 2012; FR notice pending.[4]

BART Requirements
Massachusetts identifed nine power plants and eight non-EGUs as BART-eligible, and subsequently subject to BART. Seven BART sources were determined to have *de minimis* impacts and did not justify controls. Massachusetts adopted an Alternative to BART program achieving greater emissions reductions than source-by-source BART for EGUs (permit restriction, cap, retirement, low sulfur fuel). Massachusetts determined additional SO_2 control for one non-EGU BART source was not cost-effective and would have minimal impact on visibility. Volatile organic compounds (VOCs) from three petroleum storage facilities were addressed under Massachusetts' ozone SIPs rather than BART.

Low Sulfur Oil Strategy Inner Zone
Does not apply.

Low Sulfur Oil Strategy Outer Zone
Massachusetts adopted rules for 15 ppm sulfur #2 oil, and 0.5% sulfur by weight for #4 and #6 residual oils by 2018.

90% SO_2 reduction of 167 EGU stacks
Massachusetts has 10 stacks at five power plants on the MANE-VU 167 stacks list. Massachusetts estimates that based on its Alternative to BART, EPA's Mercury and Air Toxics Standards (MATS), and EGU closures, 2018 EGU SO_2 emissions will be 87% lower than 2002 emissions. In 2011, seven stacks had SO_2 emissions more than 90% lower than 2002 levels when including plant-wide emission reductions at the stacks. The remaining three stacks were 50-80% lower in 2011. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 were 94% of the MANE-VU Ask amount.

Evaluation of other control measures

[4] Communication from David Conroy, EPA Region 1 (December 18, 2012).

Massachusetts is implementing controls on outdoor wood-fired boilers. Massachusetts will pursue other reasonable and cost-effective measures as needed.

New Hampshire

Submittal Date of Regional Haze SIP

January 29, 2010; supplemented January 14, 2011; August 26, 2011

Haze SIP Status as of December 18, 2012

EPA final approval, 77 FR 50602 (August 22, 2012)

BART Requirements

New Hampshire has two BART-eligible sources: Merrimack Unit 2 and Newington Unit 1, and both are included in the MANE-VU 167 stacks list. Control measures for these sources are described below in the 167 EGU stacks section. New Hampshire adopted BART in New Hampshire rule Env-A 2300: Mitigation of Regional Haze; effective date January 8, 2011.

Low Sulfur Oil Strategy Inner Zone

Does not apply.

Low Sulfur Oil Strategy Outer Zone

New Hampshire made commitment to continue evaluating strategy. No rule proposed.

90% SO_2 reduction of 167 EGU stacks

New Hampshire has three stacks at two power plants listed among the MANE-VU 167 stacks.

Merrimack Unit 1: No specific SO_2 limit given in haze SIP. Page 118 of the New Hampshire regional haze SIP indicates Merrimack Unit 1 required by rule to reduce mercury by 80% with flue gas desulfurization (FGD) that has an expected 90% minimum co-benefit in SO_2 reduction. 2011 SO_2 emissions were 17% below 2002 levels.

Merrimack Unit 2: Requires FGD operated at maximum sustainable reduction rate, but not less than 90% calendar month average, to be accomplished by July 1, 2013. 2011 SO_2 emissions were 32% below 2002 levels.

New Hampshire expects that controls at the Merrimack units will exceed the 90% MANE-VU Ask request.

Newington Unit 1: Requires an SO_2 limit of 0.50 lb/MMBtu by July 1, 2013; 2002 rate was 1.08 lb/MMBtu. 2011 SO_2 emissions were 94% below 2002 levels, in part due to lower utilization. New Hampshire determined that an enforceable 90% MANE-VU Ask reduction at this unit was not reasonable at this time.

EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 were 60% of the MANE-VU Ask amount.

Evaluation of other control measures

New Hampshire is seeking alternative measures for Newington Unit 1, including >90% SO_2 reduction at Merrimack Station, possible additional controls on other coal-burning units, and use of low sulfur fuel oil (p. 27 and Long Term Strategy, NH haze SIP).

New Jersey

Submittal Date of Regional Haze SIP

July 28, 2009; supplemented December 9, 2010; March 2, 2011; December 7, 2011

Haze SIP Status as of December 18, 2012

EPA final approval, 77 FR 19 (January 3, 2012)

BART Requirements

New Jersey identified four refineries and one EGU (Hudson) as BART-eligible and subject to BART. New Jersey believes that the state's adopted rules in its 8-hour ozone and $PM_{2.5}$ SIPs along with consent decrees to address NOx, SO_2, and particulate matter (PM) at these sources will likely address BART.[5] New Jersey did not rely on CAIR for the Hudson EGU (also a 167 EGU stack).

Low Sulfur Oil Strategy Inner Zone

The New Jersey regional haze SIP stated an intent to propose and adopt low sulfur rules in accordance with the MANE-VU Ask. Current rule N.J.A.C. 7:27-9 already meets #6 fuel oil sulfur levels in parts of state. New Jersey proposed a low sulfur fuel oil rule on April 4, 2011. The rule now is in effect and will meet MANE-VU Ask sulfur levels by July 1, 2016.

Low Sulfur Oil Strategy Outer Zone

Does not apply.

90% SO_2 reduction of 167 EGU stacks

New Jersey has four stacks among the MANE-VU 167 stacks list. New Jersey indicates that existing orders on all four will result in more than a 90% SO_2 reduction by December 15, 2012. All four New Jersey stacks had 2011 SO_2 emissions more than 90% below 2002 levels. This is consistent with reported emissions in the Acid Rain Program.

Evaluation of other control measures

New Jersey cites draft Energy Master Planning as including ways to increase energy efficiency. It also cites the state's Global Warming Response Act signed in 2007 that will decrease greenhouse gases, which will help reduce haze pollutants. New Jersey lists a number of other measures under consideration that would address fugitive dust, open burning, residential wood burning, VOCs, and diesel exhaust.

New York

[5] One refinery (Hess Port Reading) has since announced plans to shut down by the end of February 2013.

Submittal Date of Regional Haze SIP
March 15, 2010; supplemented August 2, 2010; April 16, 2012; July 2, 2012

Haze SIP Status as of December 18, 2012
EPA partial approval 17 BART sources/partial disapproval 2 BART sources, 77 FR 51915 (August 28, 2012)

BART Requirements
New York required source-specific analysis of all BART-eligible sources. BART-eligible EGUs under CAIR were not exempted from BART analysis. EPA approved 17 source-specific SIP revisions for New York's BART sources, and issued FIPs for 2 additional BART sources.

Low Sulfur Oil Strategy Inner Zone
New York committed to adopting low sulfur fuel oil rules under 6 NYCRR Part 225, and adopted the rules subsequent to the state's regional haze SIP submittal. A 15 ppm heating oil requirement became effective in 2012. The remaining distillates' effective date is in 2014.

Low Sulfur Oil Strategy Outer Zone
Does not apply.

90% SO_2 reduction of 167 EGU stacks
New York has 11 stacks listed among the MANE-VU 167 stacks list. With the exception of the Oswego unit, all listed New York stacks were expected to either shut down or be controlled in range of 80-95% for SO_2. In the aggregate, accounting for shutdowns, controls, and new EGUs, New York expects to achieve the 90% MANE-VU Ask. 2011 SO_2 emissions at most of the state's listed stacks were at or approaching levels more than 90% below 2002 emissions at the individual stack, or were greater than 90% below when including SO_2 reductions/shutdowns at other units at the same facility. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 27%.

Evaluation of other control measures
New York was to continue evaluating energy efficiency, alternative clean fuels, and other measures to reduce NOx and SO_2 at all coal-burning facilities, and new source performance standards for wood combustion. New York was also pursuing VOC measures under its ozone SIPs.

Pennsylvania

Submittal Date of Regional Haze SIP
December 20, 2010

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 41279 (July 13, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
Pennsylvania accepted CAIR as BART for EGU NOx and SO_2. Pennsylvania made BART determinations for EGU particulate matter (PM) and all non-EGU BART-eligible sources that did not elect to be not BART-eligible through permit limitations. Pennsylvania determined that existing controls at all BART-eligible sources met BART requirements.

Low Sulfur Oil Strategy Inner Zone
Pennsylvania committed to a low sulfur fuel strategy not less stringent than the outer zone MANE-VU Ask, based on supply concerns. It proposed a rule in September 2010, with a full effective date by 2016.

Low Sulfur Oil Strategy Outer Zone
Does not apply.

90% SO_2 reduction of 167 EGU stacks
Pennsylvania has 15 stacks among the MANE-VU 167 stacks. In 2011, SO_2 emissions at 2 of the 15 stacks were more than 90% below 2002 levels. The remaining 13 stacks all had lower 2011 SO_2 emissions than in 2002 at levels less than a 90% reduction. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 equaled the MANE-VU Ask amount.

Evaluation of other control measures
Pennsylvania lists a number of measures being undertaken in on-going programs that can address haze, including refinery consent decrees, rulemakings on cement kilns and glass furnaces, and state energy initiatives to address peak demand days, and promote renewables, energy efficiency, and energy conservation.

Rhode Island

Submittal Date of Regional Haze SIP
August 7, 2009

Haze SIP Status as of December 18, 2012
EPA final approval, 77 FR 30214 (May 22, 2012)

BART Requirements
Does not have BART-eligible sources.

Low Sulfur Oil Strategy Inner Zone
Does not apply.

Low Sulfur Oil Strategy Outer Zone
Rhode Island made a SIP commitment to adopt a low sulfur rule consistent with the MANE-VU Ask for the outer zone. A rule has not yet been proposed as of December 18, 2012.

90% SO_2 reduction of 167 EGU stacks
Does not have listed stack.

Evaluation of other control measures
Rhode Island stated an intent to adopt all reasonable control measures as expeditiously as practicable consistent with state law within 10 year planning period. It cited a possible state law to address outdoor wood boilers.

Vermont

Submittal Date of Regional Haze SIP
August 26, 2009; supplemented January 3, 2012

Haze SIP Status as of December 18, 2012
EPA final approval, 77 FR 30212 (May 22, 2012)

BART Requirements
Does not have BART-eligible sources.

Low Sulfur Oil Strategy Inner Zone
Does not apply.

Low Sulfur Oil Strategy Outer Zone
Vermont adopted low sulfur fuel oil requirements in the "Vermont Energy Act of 2011." Full implementation wil be by July 1, 2018.

90% SO_2 reduction of 167 EGU stacks
Does not have listed stack.

Evaluation of other control measures
Vermont stated an intent to continue investigating cleaner sources of energy.

2. OUTSIDE MANE-VU REGION

For states outside the MANE-VU region, the "MANE-VU Ask" requested:

- Timely implementation of BART requirements;

- A 90% or greater reduction in sulfur dioxide (SO_2) emissions from each of the top 100 electric generating units (comprising a total of 167 stacks) impacting any mandatory Class 1 Federal area in the MANE-VU region, or an equivalent SO_2 reduction from alternative measures within each State;

- The application of reasonable controls on non-EGU sources resulting in a 28% reduction in non-EGU SO_2 emissions, relative to on-the-books, on-the-way 2018 projections used in regional haze planning, by 2018, which is equivalent to the projected reductions MANE-VU will achieve through its low sulfur fuel oil strategy;

- Continued evaluation of other measures including measures to reduce SO_2 and nitrogen oxide (NOx) emissions from all coal-burning facilities by 2018 and promulgation of new source performance standards for wood combustion. These measures and other measures identified will be evaluated through consultation processes to determine if they are reasonable.

Georgia[6]

Submittal Date of Regional Haze SIP
February 11, 2010; supplemented September 19, 2010

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 38501 (June 28, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
Georgia accepted CAIR as BART for EGU NOx and SO_2. Georgia identified 24 BART-eligible sources, which included EGUs for PM only, and accepted exemption

[6] When contacted by MANE-VU states before the release of the "MANE-VU Ask" letters, The Georgia Environmental Protection Division (Georgia EPD) had the following response to those states:

> Georgia EPD is a member of the VISTAS Regional Planning Organization. Based on VISTAS SO_2 emissions sensitivity modeling for 2009 and VISTAS SO_2 Area of Influence (AOI) work for 2018, we have concluded that Georgia does not reasonably contribute to visibility impairment at [MANE-VU] Class I Area[s]. Furthermore, it should be noted that Georgia EPD is currently in the process of requiring 95% SO_2 controls to be installed on the seven largest coal fired power plants in Georgia. Not all of these controls were accounted for in the SO_2 emissions sensitivity modeling or the SO_2 AOI work; therefore, Georgia's contributions to [MANE-VU] Class I areas in these analyses will be a conservative upper bound leading to our conclusion that Georgia EGU and non-EGU SO_2 sources do not reasonably contribute to visibility impairment at [MANE-VU Class I Areas].

demonstrations from 22 of the 24 BART-eligible sources based on a 0.5 dv contribution threshold. A paper facility was required to use natural gas in one boiler. All other available BART control options were deemed not cost effective. The second BART facility was an EGU (Bowen), and no available BART control options for PM were deemed cost effective.

90% SO_2 reduction of 167 EGU stacks
Georgia has five stacks at two power plants listed in the MANE-VU Ask. Four of the stacks carry emissions from Bowen Units 1 through 4. The fifth stack carries the combined emissions from Harllee Branch Units 3 and 4. Georgia Rule 391-3-1-.02(2)(uuu) requires 95% removal of SO_2 from Bowen Units 1- 4 no later than January 1, 2012, and from Harllee Branch Units 1 – 4 no later than January 1, 2016.[7] Since the filing of the Georgia haze SIP, Georgia Power Company has filed requests to decommission Harllee Branch Units 1 and 2 in 2013 and Units 3 and 4 in 2015. In 2011, SO_2 emissions from the four units at Bowen were greater than 90% below 2002 emissions, with 2011 emissions at the Harllee Branch units about 25% below 2002 levels. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 73%.

28% SO_2 reduction in non-EGU emissions
Georgia required lower SO_2 permit limits for eight emissions units at five non-EGU facilities based on four-factor analysis. Georgia also required lower SO_2 permit emissions rates for two emissions units at one non-EGU facility for the purpose of BART exemption. Overall, 8,223 tons of SO_2 reductions are required between 2012 and 2018, which is approximately 15% of 2002 non-EGU facility SO_2 emissions.[7]

Evaluation of other control measures
No additional measures listed for further evaluation.

Illinois

Submittal Date of Regional Haze SIP
June 24, 2011

Haze SIP Status as of December 18, 2012
EPA final approval, 77 FR 39943 (July 6, 2012)

BART Requirements
Ilinois identified nine EGUs and two refineries as subject to BART. Illinois did not rely on CAIR for BART, and applied standards more stringent than CAIR to affected EGUs. Illinois considers federal consent decrees for the two refineries as BART for NOx and SO_2.

90% SO_2 reduction of 167 EGU stacks

[7] Communication from Georgia EPD – Air Protection Branch (March 5, 2013).

Illinois has one stack listed among the MANE-VU 167 stacks. The identified stack at Ameren-Coffeen has selective catalytic reduction (SCR) that will operate year-round, and a wet scrubber to comply with Illinois' multi-pollutant standards. Illinois states that the level of control required on the power plant will satisfy the MANE-VU Ask. In 2011, SO_2 emissions at the Ameren-Coffeen stack were more than 90% less than 2002 levels. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 267%.

28% SO_2 reduction in non-EGU emissions
Illinois expects on-the-books federal and state control measures will achieve sufficient reductions to satisfy MANE-VU Ask. Reductions not quantified.

Evaluation of other control measures
No additional measures listed for further evaluation.

Indiana

Submittal Date of Regional Haze SIP
January 14, 2011; March 10, 2011

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 34218 (June 11, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
Indiana identified 32 BART-eligible sources, which included EGUs. Initial analysis determined four non-EGU facilities and nine power plants were subject to BART. Of the four non-EGU BART sources, Indiana determined three were exempt based on additional modeling, and required BART measures on the fourth. For the power plants, Indiana accepted CAIR as BART for NOx and SO_2, and determined one EGU remained subject to BART for PM only (Alcoa Boiler 4). Indiana adopted a BART rule in 2010 for the EGU with a PM emission rate of 0.1 lb/MMBtu using an ESP.

90% SO_2 reduction of 167 EGU stacks
Indiana has 15 stacks at 9 power plants listed in the MANE-VU Ask; most of these stacks have or will have post-combustion emission controls (i.e., scrubbers). In 2011, 9 of the 15 listed stacks had SO_2 emissions more than 90% below 2002 levels. Another three stacks had decreases less than 90% relative to 2002. 2011 emissions at Clifty Creek (two stacks) increased, with about a doubling over 2002 emissions. The Rockport stack was about 7% higher in 2011 over 2002. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 were 86% of the MANE-VU Ask amount.

28% SO_2 reduction in non-EGU emissions
No additional measures identified. Indiana noted other existing federal requirements (e.g., low sulfur diesel) would result in additional reductions.

Evaluation of other control measures

No additional measures listed for further evaluation.

Kentucky

Submittal Date of Regional Haze SIP
June 25, 2008; revised May 28, 2010

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 19098 (March 30, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
Kentucky accepted CAIR as BART for EGU NOx and SO_2. Kentucky identified 26 BART-eligible sources of which 21 were exempted based on further analysis of impacts. BART analysis of five EGUs as subject to BART for PM provided for installing controls for visibility improvements.

90% SO_2 reduction of 167 EGU stacks
Kentucky has 10 stacks at 8 power plants on the MANE-VU 167 stacks list, comprising 14 units. Kentucky indicates that 13 of the 14 units (93%) have or will have SO_2 controls in 2015, including a unit which may instead opt to retire. The one remaining unit has plans to retire or to convert to natural gas by the federal Utility Mercury and Air Toxics Standards (MATS) deadline.[8] Kentucky believes that these controls more than adequately address MANE-VU's request. Of the ten stacks on the MANE-VU list, five had 2011 emissions more than 90% below 2002 levels at the plant level. Two other stacks had 2011 emissions more than 80% below 2002 levels, and one stack was 5% below 2002 levels. The remaining two stacks had 2011 emissions 1% and 49% higher than in 2002, of which respectively, one announced plans to retire, convert to natural gas, or install scrubbers, and the other has announced plans to replace the existing scrubber by the federal MATS deadline. This source also has plans to upgrade (replace or modify) two other existing scrubbers for the source's three non-167 Ask units.[8] EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 2%.

28% SO_2 reduction in non-EGU emissions
Kentucky believes that the significant existing and expected EGU emission controls more than adequately address MANE-VU's non-EGU emission control requests.

Evaluation of other control measures
Open burning regulation referenced, but not included in modeling.

Michigan

Submittal Date of Regional Haze SIP
November 5, 2010

[8] Communication from the Kentucky Division for Air Quality (March 8, 2013).

Haze SIP Status as of December 18, 2012
EPA partial approval with FIP for two BART sources, 77 FR 71533 (December 3, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
Michigan stated that CAIR addresses BART for EGUs. Michigan identified 35 non-EGUs as BART-eligible, and reduced the number of BART-eligible sources to six based on emissions and distance from Class 1 areas. Of the remaining six, one shut down and Michigan accepted mostly existing measures along with a few additional requirements as BART for the remaining sources. EPA determined Michigan failed to address two BART sources and issued a FIP.

90% SO_2 reduction of 167 EGU stacks
Michigan has five stacks at four facilities among the MANE-VU 167 list. Of the five listed stacks in Michigan, two had 2011 SO_2 emissions more than 90% below 2002 levels, and the remaining three had SO_2 emissions 2%-20% below 2002 levels. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 3%.

28% SO_2 reduction in non-EGU emissions
Michigan did not include additional measures beyond "on the books" requirements. Michigan listed potential reductions from its Renewable Energy Portfolio requirements, Mercury/multi-pollutants rules, $PM_{2.5}$ and ozone SIPs, and greenhouse gas programs. Reductions were not quantified.

Evaluation of other control measures
No additional measures listed for further evaluation.

North Carolina
Submittal Date of Regional Haze SIP
December 17, 2007

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 38185 (June 27, 2012); EPA limited disapproval with additional time given to revise SIP for CAIR deficiency, 77 FR 33642 (June 7, 2012)

BART Requirements
North Carolina accepted CAIR as BART for EGU NOx and SO_2 in addition to EGU requirements under the North Carolina Clean Smokestacks Act. North Carolina identified 17 BART-eligible sources. Of those, 15 were exempted based on further analysis. North Carolina determined that no additional controls were required at the BART-subject facilities.

90% SO_2 reduction of 167 EGU stacks

North Carolina has 12 stacks at 7 power plants in the MANE-VU 167 stacks list. Under the North Carolina Clean Smokestacks Act, 11 of those EGUs were controlled. Additionally, scrubbers are expected on 3 EGUs not identified by MANE-VU. North Carolina believes that these reductions satisfy the MANE-VU Ask. In 2011, 9 of the 12 EGUs had SO_2 emissions more than 90% lower than in 2002, and a 10th EGU retired in 2012. The remaining 2 EGUs had 2011 emissions 54% and 74% lower in 2011 than 2002 on a facility-wide basis. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 34%.

<u>28% SO_2 reduction in non-EGU emissions</u>
North Carolina indicated it believed that under the North Carolina Clean Smokestacks Act, additional reductions from EGUs not on the 167 list would satisfy the MANE-VU Ask. No additional non-EGU measures beyond existing and previously planned requirements were noted.

<u>Evaluation of other control measures</u>
Dust, methane, and ammonia controls from some non-EGU sector sources.

Ohio

<u>Submittal Date of Regional Haze SIP</u>
March 11, 2011

<u>Haze SIP Status as of December 18, 2012</u>
EPA limited approval, 77 FR 39177 (July 2, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

<u>BART Requirements</u>
Ohio identified 18 generating stations with 37 units as BART-eligible, and accepted CAIR as BART for NOx and SO_2. Ohio also determined that PM emissions from all BART-eligible EGUs did not contribute to visibility impairment above the 0.5 dv level at any Class 1 area, thus would not be subject to BART. Ohio identified 12 non-EGUs as BART-eligible. Ohio determined with additional modeling that it had one non-EGU source subject to BART. The source will implement an energy efficiency program as an alternative to BART that includes additional SO_2 controls or shut-downs.

<u>90% SO_2 reduction of 167 EGU stacks</u>
Ohio has 28 stacks at 15 power plants among the MANE-VU 167 EGU stacks list. Ohio listed a number of planned controls since 2002 in the context of the MANE-VU Ask. In 2011, 16 of the 28 EGU stacks had SO_2 emissions more than 90% below 2002 levels on a facility-wide basis. An additional seven EGU stacks indicated plans to install controls, convert to natural gas, or shut down prior to 2018. Another three EGU stacks had 2011 SO_2 emissions between approximately10-60% below 2002 levels. The remaining two EGU stacks increased emissions in 2011 relative to 2002, with one stack (Kyger Creek) doubling emissions, while planning to install scrubbers by mid-2012. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 were 61% of the MANE-VU Ask amount.

28% SO_2 reduction in non-EGU emissions
No additional non-EGU measures listed. Ohio believes on-the-books measures are currently sufficient to meet reasonable progress in MANE-VU.

Evaluation of other control measures
In response to MANE-VU Ask, Ohio believes on-the-books measures are currently sufficient to meet reasonable progress goals, and its emission sources have relatively insignificant impacts on MANE-VU Class 1 areas. No additional measures listed for further evaluation.

South Carolina[9]

Submittal Date of Regional Haze SIP
December 17, 2007

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 38509 (June 28, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
South Carolina accepted CAIR as BART for EGU NOx and SO_2. South Carolina identified 21 BART-eligible sources, including six EGUs for PM only. Of these 21 sources, 19 demonstrated exemptions to BART, including 4 of the 6 EGUs (for PM only). South Carolina determined no additional controls were needed on the remaining subject-to-BART sources.

90% SO_2 reduction of 167 EGU stacks
South Carolina has six stacks at four power plants listed in the MANE-VU 167 stacks list. In 2011, four stacks had SO_2 emissions that were approximately 90% below 2002 levels. The remaining two stacks were more than 70% below 2002 levels, with announced plans to retire at a date yet to be determined. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 43%.

28% SO_2 reduction in non-EGU emissions
None listed.

Evaluation of other control measures
No additional measures listed for further evaluation.

Tennessee

Submittal Date of Regional Haze SIP

[9] In its response to consultation requests from New Jersey and New Hampshire, South Carolina indicated it did not believe the state's emissions reasonably contributed to visibility impairment at Class 1 areas in the MANE-VU region.

April 4, 2008; revised May 14, 2012

Haze SIP Status as of December 18, 2012
EPA limited approval with no action on Eastman BART, 77 FR (April 24, 2012); EPA approval Eastman BART, 77 FR 70689 (November 27, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
Tennessee accepted CAIR as BART for EGU NOx and SO_2. Tennessee identified twelve operating BART-eligible sources, including two EGUs (for PM only), with eight subsequently exempted based on demonstrations that they did not cause or contribute to visibility impairment at any Class 1 area, including one of the two EGUs (Bull Run). The four subject-to-BART sources had additional BART limitations put into permits, with no additional controls required at the remaining EGU (Cumberland).

90% SO_2 reduction of 167 EGU stacks
Tennessee has five stacks at four power plants on the MANE-VU 167 list. The Tennessee Valley Authority (TVA) controlled or expects to control Kingston 1 & 2 and John Sevier. TVA plans to control Gallatin if needed to meet its CAIR obligations or to achieve possible more stringent proposed national ambient air quality standards, and repower or shut down Johnsonville by the next review period in 2018. In 2011, SO_2 emissions at one stack (Sevier) were more than 90% lower than in 2002 when including plant-wide reductions. The other four stacks had SO_2 emissions lower than in 2002 in the range of 40-70%. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 6%.

28% SO_2 reduction in non-EGU emissions
Tennessee does not believe MANE-VU's request is justified for the state's emissions. Tennessee believes that MANE-VU's 2018 modeling in its technical support document for the August 2007 meeting did not prove that the state's non-EGU emissions were adversely impacting any of the Class 1 areas in the MANE-VU region.

Evaluation of other control measures
MANE-VU did not identify TVA Bull Run as part of 167 stacks, which is getting scrubbers and is located closer to Great Smoky Mountains than Johnsonville and Gallatin.

Virginia
Submittal Date of Regional Haze SIP
Main plan and narrative: October 4, 2010. Permits: June 17, 2008; March 6, 2009; January 14, 2010. Revisions: November 19, 2010; May 6, 2011; December 21, 2012

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 35287 (June 13, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements

Virginia accepted CAIR as BART for EGU NOx and SO_2. Virginia has four EGU units that are BART eligible for PM: Units 5 and 6 at Chesterfield Power Station (ORIS 3797), Unit 5 at Possum Point Power Station (ORIS 3804), and Unit 3 at Yorktown Power Station (ORIS 3809). Units 5 and 6 at Chesterfield are coal-fired boilers. Both are controlled by SCR, wet FGD, and ESPs. Unit 6 is also controlled by a polishing baghouse. Unit 3 at Yorktown and Unit 5 at Possum Point are residual oil-fired units. Economic models such as IPM predicted the retirement of residual oil fired units; however, the most recent Integrated Resource Plan filed by Dominion did not suggest that these units will be retired. These residual oil-fired units are infrequently utilized.[10]

Virginia identified 13 facilities having a total of 72 BART-eligible units. Ten facilities with BART-eligible units were exempted from BART based on modeling. The three remaining subject-to-BART sources were O-N Minerals (Chemstone)-Strasburg, Georgia Pacific-Big Island, and Meadwestvaco-Covington.

The units at O-N Minerals (Chemstone)-Strasburg that are subject to BART are the rotary kiln (U5) and the calcimatic kiln (U12). The calcimatic kiln was permanently retired. The rotary kiln was retrofitted with an SO_2 CEMs for continuous monitoring of exhaust gases as part of the BART requirements. Beginning in 2010, the kiln was required to meet an SO_2 limitation of 0.29 lbs/ton stone feed.

The units subject to BART at Georgia Pacific-Big Island are two coal-fired boilers, #4 and #5. Boiler #4 was permanently retired. For BART, Boiler #5 was required to retrofit with FGD.

Units at Meadwestvaco-Covington that are subject to BART are Boiler #9, a coal-fired unit; Boiler #10, a predominantly natural gas-fired unit; Recovery Furnace #1; and Smelt Dissolving Tank #1. Emissions are predominantly from Boiler #9. This unit's BART determination required the upgrade of the existing FGD system for increased removal efficiency.

90% SO_2 reduction of 167 EGU stacks

Virginia has eight stacks at four power plants listed among the MANE-VU 167 stacks. Virginia estimates that based on federal consent decrees, knowledge of owner control program estimates, and IPM projections, these units will reduce SO_2 emissions approximately 82% by 2018 from 2002 levels. In 2011, five listed stacks had SO_2 emissions approximately 90% below 2002 levels. The other three stacks had 40%-60% lower emissions, and two of these three had announced plans to retire or convert to natural gas prior to 2018. EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 exceeded the MANE-VU Ask amount by 28%.

28% SO_2 reduction in non-EGU emissions

[10] Communication from VA DEQ, February 4, 2013.

Virginia notes that enforceable SO_2 reductions at two EGUs not on the MANE-VU Ask 167 list and additional reductions at one non-EGU industrial source would meet the MANE-VU Ask request by 2018.

Evaluation of other control measures
Included in the Virginia Regional Haze SIP was a commitment to finalize a reasonable progress review focusing on SO_2 emissions for Meadwestvaco Covington's Stack 25, the main power house boiler stack. This stack had calculated visibility impacts, as described in the Virginia Regional Haze SIP, on multiple Class 1 areas. The reasonable progress determination was submitted to EPA as a SIP revision on May 6, 2011. The units exhausting to Stack #25 are Boilers 6, 7, 8, and 9. Boilers 6 and 9 are predominantly coal fired units. Boilers 7 and 8 may burn coal as well as biomass and are generally fired on biomass. The reasonable progress determination resulted in the permitted limit of the stack being reduced from just over 8,000 tpy of SO_2 to approximately 6,800 tpy of SO_2 , representing a decrease of more than 1,200 tons of SO_2 annually.

West Virginia

Submittal Date of Regional Haze SIP
June 18, 2008

Haze SIP Status as of December 18, 2012
EPA limited approval, 77 FR 16937 (March 23, 2012); EPA limited disapproval with FIP to replace CAIR with CSAPR, 77 FR 33642 (June 7, 2012)

BART Requirements
West Virginia identified 22 BART-eligible sources, including 7 EGUs, with 19 able to demonstrate exemptions. West Virginia accepted CAIR as BART for EGU NOx and SO_2, with all BART-eligible EGUs installing scrubbers and NOx controls. For PM, only one of the seven EGUs demonstrated it significantly contributed to visibility impairment at a Class 1 area. The subject to BART sources have or will shut down, or had an emission rate lowered using existing controls.

90% SO_2 reduction of 167 EGU stacks
West Virginia has 14 stacks at 10 power plants in the MANE-VU 167 stack list, and expects all stacks to have at least 90% control efficiency by 2018. In 2011, nine stacks had SO_2 emissions more than 90% below 2002 levels. The remaining five stacks had 2011 SO_2 emissions 35%-70% below 2002 levels, with three of the five stacks announcing plans to retire prior to 2018.[11] EPA Acid Rain Program data indicate that state-wide SO_2 reductions in 2011 were 99% of the MANE-VU Ask amount.

28% SO_2 reduction in non-EGU emissions

[11] The two stacks at Pleasants are equipped with wet scrubbers with an SO_2 removal efficiency of greater than 90%. In 2007, Pleasants replaced its stacks, eliminating the 15% bypass that had been used for stack gas reheat, and is now scrubbing 100% of the flue gas. The elimination of the bypass allowed for the 70% reduction in emissions from 2002 levels (communication from WV DEP, January 10, 2013)

West Virginia believes that additional SO_2 controls and unit shutdowns at EGUs not among the MANE-VU 167 stacks list satisfy the MANE-VU Ask. No additional non-EGU measures were noted.

Evaluation of other control measures
No additional measures listed for further evaluation.

Wisconsin[12]

Submittal Date of Regional Haze SIP
January 18, 2012; supplemented June 7, 2012

Haze SIP Status as of 12/18/12
EPA final approval, 77 FR 46952 (August 7, 2012)

BART Requirements
Wisconsin identified four non-EGUs as BART-eligible, and one of the four subsequently determined as subject to BART. Wisconsin drafted an admistrative order for the BART source to cap NOx and SO_2 emissions from several boilers. Wisconsin accepted CAIR/CSAPR as BART for EGU NOx and SO_2, and determined existing controls and permit limits satisfied BART for EGU PM.

90% SO_2 reduction of 167 EGU stacks
Does not have listed stack.

28% SO_2 reduction in non-EGU emissions
None listed.

Evaluation of other control measures
Wisconsin plans to evaluate potential measures on agricultural ammonia sources post-2018. Wisconsin will also continue to evaluate potential additional reductions from ICI boilers, reciprocating internal combustion engines and turbines, and mobile sources, as needed to meet reasonable progress goals.

[12] Wisconsin does not have a listed 167 EGU stack, but Vermont listed it among the states identified as having at least a 2% modeled sulfate impact at a MANE-VU Class 1 area, and as a state to be invited to the MANE-VU consultation process (letter from Justin Johnson, VT DEC, July 17, 2007; *in* MANE-VU Inter-RPO Consultation Briefing Book, 2007, at pp. 16-18). The Wisconsin haze SIP does not indicate it received a MANE-VU Ask.

3. U.S. EPA

For additional national measures, the federal "MANE-VU Ask" requested "that EPA work with the eastern Regional Planning Organizations to develop a proposal for tightening the CAIR program to achieve an additional 18% reduction in SO_2 [from power plants[13]] by no later than 2018."

While EPA has not developed a new proposal with the RPOs in response to the MANE-VU Ask, it has sought to implement two new rules since CAIR requiring greater SO_2 reductions from power plants by 2018. The projected reductions from these rules can be placed in the context of the reduction request in the MANE-VU Ask to EPA.

The first rule was the Cross-State Air Pollution Rule (CSAPR), also known as the Transport Rule, which was finalized in August 2011, then subsequently vacated by the D.C. Circuit in August 2012. Although no longer in effect, it was an effort by EPA that would have resulted in additional SO_2 reductions from EGUs beyond CAIR. The second rule is EPA's Utility Mercury and Air Toxics Standards (Utility MATS) finalized in February 2012. While this rule's focus is on air toxics, EPA projected additional significant SO_2 reductions from EGUs beyond CSAPR (and by inference CAIR as well) as a co-benefit from additional controls needed to meet the new air toxics standards. The potential additional reductions of each rule are summarized in the following sections.

Cross-State Air Pollution Rule
A straightforward accounting of additional EGU SO_2 reductions from CSAPR compared to CAIR is not possible due to differences in the states covered under the two rules, and differences in the reduced scope of emissions trading allowed under CSAPR relative to CAIR. At a basic level, the overall emission caps under each program can be compared and are shown in the table below, with accompanying caveats as noted. Also note that the full implementation of CAIR is in 2015, while CSAPR would have imposed its final cap by 2014.

Program	SO_2 cap (million tons annually)
CAIR	2.6 (2015)*
CSAPR	2.4 (2014)**
CSAPR % reduction beyond CAIR	-7.6%

* Due to EGUs' ability to use banked allowances under CAIR, EPA estimated actual SO_2 emissions in 2015 would be 4.1 million tons.
**EPA provided a "variability limit" that is a fixed percentage above each state's emissions budget to allow for year-to-year fluctuations in electricity generation. Therefore, the state "budget" may be

[13] Bracketed text is not in original. The MANE-VU Ask to EPA does not explicitly mention power plants in the quoted text, but the preceding paragraphs in its request to EPA indicate that the focus of the additional 18% SO_2 reductions is on power plants.

exceeded in any given year within the variability limit, resulting in emissions above the overall program cap to a limited extent.

Utility Mercury and Air Toxics Standards
The Utility MATS address air toxics emitted by fossil fuel power plants, but EPA estimated that the projected controls needed to be installed on affected EGUs would result in an additional 41% reduction in SO_2 emissions beyond CSAPR nationally.[14] A listing of states and DC covered by the MANE-VU Ask is given in the following table, which shows EPA's projected EGU SO_2 emissions in a 2017 future baseline case that assumes CSAPR is in place and a 2017 MATS future control case.[15] The table indicates that while the overall regional SO_2 reduction beyond CSAPR resulting from Utility MATS among the MANE-VU Ask states is less than the relative national reduction, the regional reduction of 24% still exceeds the MANE-VU Ask to EPA of 18%. The 24% additional reduction in EGU SO_2 emissions would also be a conservative minimum relative to CAIR, as it allows more emissions than CSAPR.

State	2017 future baseline EGU SO_2 (tons)[15]	2017 MATS future control case EGU SO_2 (tons)[15]
CT	3,581	1,400
DE	2,835	4,160
DC	5	0
GA	96,712	78,197
IL	118,217	103,867
IN	200,969	156,781
KY	116,927	125,430
ME	2,564	1,372
MD	29,786	18,091
MA	15,133	5,033
MI	163,168	82,834
NH	6,719	2,102
NJ	9,042	6,404
NY	14,653	28,174
NC	71,113	59,551
OH	180,935	139,208
PA	126,316	93,606
RI	0	0
SC	103,694	40,901

[14] EPA Fact Sheet: Mercury and Air Toxics Standards, *Benefits and Costs of Cleaning Up Toxic Air Pollution from Power Plants*, December 21, 2011. Available at http://www.epa.gov/airquality/powerplanttoxics/pdfs/20111221MATSimpactsfs.pdf (accessed January 2, 2013).
[15] U.S. EPA, *Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards*, EPA-452/R-11-011, December 2011 (Table 5A-12).

TN	33,080	42,666
VT	264	264
VA	51,004	33,704
WV	84,344	66,857
WI	50,777	28,322
Subtotal MANE-VU Ask States only	1,478,257	1,117,524
MATS % reduction beyond CSAPR	---	-24%

ATTACHMENT D

Regional Emissions Trends Analysis for MANE-VU States

This page is intentionally left blank.

Regional Emissions Trends Analysis for MANE-VU States

Technical Support Document

Revision 3

Prepared by:

Mid-Atlantic Regional Air Management Association (MARAMA)
8600 LaSalle Road, Suite 636
Towson, MD 21286
(443) 901-1882

March 22, 2013

Acknowledgements

Funds for this project were provided by MARAMA's Memorandum of Agreement with the Ozone Transport Commission (OTC), which is funded by USEPA grant agreement XA96309001. The purpose of that Memorandum of Agreement is to support the Mid-Atlantic / Northeast Visibility Union (MANE-VU) in developing programs to control regional haze or visibility impairment in the Northeast and Mid-Atlantic states.

About MARAMA

The Mid-Atlantic Regional Air Management Association, Inc. is a voluntary, non-profit association of ten state and local air pollution control agencies. MARAMA's mission is to strengthen the skills and capabilities of member agencies and to help them work together to prevent and reduce air pollution in the Mid-Atlantic Region. MARAMA provides cost-effective approaches to regional collaboration by pooling resources to develop and analyze data, share ideas, and train staff to implement common requirements.

Table of Contents

List of Appendices

List of Exhibits

Acronyms and Abbreviations

Acronym	Description
AEO	Annual Energy Outlook
APU	Auxiliary Power Unit
BEIS	Biogenic Emissions Inventory System
BOTW	Beyond on the way
CAA	Clean Air Act
CMAQ	Community Multi-scale Air Quality Modeling System
CAMD	Clean Air Markets Division (USEPA)
CEM	Continuous emission monitoring
CAIR	Clean Air Interstate Rule
CMV	Commercial marine vessel
CO	Carbon monoxide
CSAPR	Cross-State Air Pollution Rule
EGU	Electric generating unit
EIA	Energy Information Agency
ERTAC	Eastern Regional Technical Advisory Committee
FIPS	Federal Information Processing Standard
GSE	Ground support equipment
IPM	Integrated Planning Model
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MAR	Marine, airport, rail
MARAMA	Mid-Atlantic Regional Air Management Association
MEGAN	Model of Emissions of Gases and Aerosols from Nature
MOBILE6	USEPA model used to estimate onroad mobile emissions, now outdated
MOVES	Motor Vehicle Emissions Simulator model
NAAQS	National Ambient Air Quality Standards
NCD	National County Database
NEI	National Emission Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NIF3.0	NEI Input Format Version 3.0
NMIM	National Mobile Input Model
NONROAD	USEPA model used to estimate off-road mobile emissions
NO_x	Oxides of nitrogen
OTB/OTW	On the books/On the way
ORL	One-record-per-line (SMOKE format)
OTAQ	Office of Transportation and Air Quality (USEPA)
OTC	Ozone Transport Commission
PFC	Portable fuel container
PM-CON	Primary PM, condensable portion only (< 1 micron)
PM-FIL	Primary PM, Filterable portion only
PM-PRI	Primary PM, includes filterable and condensable PM-PRI= PM-FIL + PM-CON
PM25-FIL	Primary $PM_{2.5}$, filterable portion only
PM25-PRI	Primary $PM_{2.5}$, includes filterable and condensable PM25-PRI= PM25-FIL + PM-CON

Acronym	Description
QAPP	Quality Assurance Project Plan
RPO	Regional Planning Organization
RWC	Residential wood combustion
SIP	State Implementation Plan
SCC	Source classification code
SMOKE	Sparse Matrix Operator Kernel Emissions
SO_2	Sulfur dioxide
TSD	Technical Support Document
USEPA	U.S. Environmental Protection Agency
VMT	Vehicle miles traveled
VOC	Volatile organic compounds

1.0 INTRODUCTION

This technical support document (TSD) explains the data sources and methods for analyzing the anthropogenic pollutant emissions trends since 2002 in the Mid-Atlantic / Northeast Visibility Union (MANE-VU) region. Results of the analysis are presented. The MANE-VU region includes Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont.

1.1 THE PURPOSE OF THIS EMISSION TREND ANAYSIS

States are required to submit a periodic report every five years beginning five years after submittal of the initial regional haze SIP. The Environmental Protection Agency's (EPA) regional haze rule requires states to prepare

> *"An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward, to account for emissions changes during the applicable 5-year period."*

To support MANE-VU states' preparation of their progress reports, the change in emissions in the region is evaluated. Reductions are evaluated by sector and state. It is anticipated that MANE-VU member states will use this report in conjunction with other information developed by Northeast States for Coordinated Air Use Management (`), the Ozone Transport Commission (OTC) and the MANE-VU member states to develop their first five-year progress report.

1.2 REPORT ORGANIZATION

Section 2 describes the methodology and data sources used to analyze emission trends. Sections 3 to 7 provide a detailed approach for each inventory sector: area sources; point sources; nonroad mobile sources included in the NMIM model; other nonroad mobile sources (marine vessels, aircraft, and railroad locomotives); and onroad mobile sources. Section 8 provides emission trend summaries. Section 9 provides the file name and a description of the electronic files developed as part of this project. References are provided in Section 10.

2.0 METHODOLOGY AND DATA SOURCES

2.1 GEOGRAPHIC AND TEMPORAL RESOLUTION

The geographic area for the inventory trend analysis is the MANE VU states including: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

The temporal resolution is annual.

2.2 POLLUTANTS

In other work, the OTC has established that SO_2 is the most important pollutant driving fine particle ambient concentrations and visibility impairment in the northeastern United States. (NESCAUM 2006a) However, other pollutants also play a role. Therefore, this study includes an analysis of emission changes for the following pollutants: oxides of nitrogen (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOC) and particulate matter less than 2.5 microns in size ($PM_{2.5}$).

Where Clean Air Market's Division (CAMD) data is used, only NO_x, and SO_2 emission data is available so only those two pollutants are compared. The fine particulate species in the inventory are categorized as particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$-PRI), which includes both condensable (PM-CON) and filterable particles ($PM_{2.5}$-FIL).

2.3 SOURCE CATEGORIES

The trend in emission is analyzed for the following inventory sector:

- **EGU Point Sources** are units that generate electric power and sell most of that power to the electrical grid.
- **NonEGU Point Sources** are individual industrial, commercial, and institutional facilities.
- **Stationary Area Sources** are facilities that in and of themselves are quite small, but in aggregate may contribute significant emissions. Examples include small industrial/commercial facilities, residential heating furnaces, VOCs volatizing from house painting or consumer products, gasoline service stations, and agricultural fertilizer/pesticide application sites.

- **Non-road Mobile Sources** are vehicles and equipment that are operated off public roadways. This includes equipment such as forklifts, lawn and garden equipment, and portable generators. Marine, air, and rail sources are not included in this sector.
- **Marine Air Rail (MAR) Sources** include marine vessels, airplanes, and railroad locomotives (MAR).
- **On-road Mobile Sources** include cars, trucks, buses, and other vehicles that operate on public roadways.

Biogenic/geogenic emissions are included in modeling, but are not considered to change over time. For the purposes of the Clean Air Act, biogenic emissions do not need to be considered in determining progress to meeting the State's visibility goals as only anthropogenic air pollution affecting visibility is addressed. In general, this trend analysis does not include any consideration of biogenic emissions. One exception is a discussion of biogenic emissions of VOC, which predominate in many rural environments.

2.4 DATA FORMATS

Besides this report, easy-to-review spreadsheets were prepared for each inventory sector that provides a more detailed look at the emissions for each year analyzed. State-level tabular and graphical summaries are also available. These are stored on the MARAMA FTP server, as described in Section 9, Electronic Files.

2.5 DATA SOURCES

A variety of data sources were integrated to produce the emissions trends reported in this document. These include two inventory suites prepared by MARAMA as inputs to the OTC multi-pollutant regional air quality modeling. Each inventory suite includes a base year and estimates of future year emissions. Within a given suite, the base year emissions are "actual" emissions from a year that was in the recent past at the time that the inventory suite was prepared. They are either measured values or estimates based on measured activity data. Examples of activity data include county population or numbers of cars registered in a county. Future year emissions key off the base year with growth and control factors applied to the base year emissions. Logically, the future year estimates include all of the assumptions and emissions estimation methodologies used for the associated base year. As a result, future years estimated in one suite may not align well with future years from a different suite because different growth and control assumptions, models, and methodologies were used from one suite to another. The two inventory suites included in this study are:

- 2002 base with projections to 2018 (MANE-VU 2006; MANE-VU 2007)
- 2007 base with projections to 2017 and 2020 (MANE-VU 2011a & b)

As will be discussed further below, the two suites underwent multiple renditions to incorporate comments and improvements.

Besides these inventory suites, an additional source of data integrated into the analysis is the 2010 Clean Air Markets Division (CAMD) actual emissions (CAMD 2010). Exhibit 2.1 shows the data sources, including specific inventory versions that were accessed for this project and how each data sources is used in the emissions trends analysis.

Exhibit 2.1 – Data Sources by Sector

	2002 Actual	2007 Actual	2010 Actual	2017 Projected	2018 Projected	2020 Projected
EGU Point	MANE-VU V3.3	MARAMA V3	CAMD **	MARAMA V3 *	MANE-VU V3.3	MARAMA V3 *
NonEGU Point	MANE-VU V3.3	MARAMA V3	---	MARAMA V3	MANE-VU V3.3	MARAMA V3
Mobile	MANE-VU V3.3	MARAMA V2	---	---	MANE-VU V3.3	MARAMA V3 *
Area	MANE-VU V3.3	MARAMA V3	---	MARAMA V3	MANE-VU V3.3	MARAMA V3
Nonroad (NMIM)	MANE-VU V3.3	MARAMA V3	---	MARAMA V3	MANE-VU V3.3	MARAMA V3
MAR	MANE-VU V3.3	MARAMA V3	---	MARAMA V3	MANE-VU V3.3	MARAMA V3

* Not currently complete. Will be included if complete in time for use in this project
** To the extent crosswalk matching of units allows.

The following sections provide more details on each of the data sources included in this study.

2.5.1 The 2002 Base Inventory with Projections to 2018 Version 3.3

The 2002 modeling inventory suite was prepared by MARAMA and finalized in 2006. Future year projections based on the base year 2002 inventory were prepared for 2009 and 2018. Two scenarios for the future year were prepared as follows:

On the Books /On the Way (OTB/OTW) – These projections reflect a scenario accounting for all in-place controls that were fully adopted into federal or individual state regulations or SIPs. This includes the anticipated effect of the Clean Air Interstate Rule (CAIR). Modelers often refer to this scenario as the "future base case".

Beyond On the Way (BOTW) - These projections reflect a scenario accounting for all measures in the OTB/OTW scenario and also additional controls that states commit to adopt as part of the SIP process. Modelers often refer to this scenario as the "future control case". The BOTW projection to 2018 was used by MANE VU states air quality modeling to support certain PM, ozone and visibility SIPs.

The Beyond on the Way (BOTW) projection for 2018 was used for this emissions trend analysis because this scenario was used in OTC regional photochemical air quality modeling to develop reasonable progress goals for visibility State Implementation Plans (SIP).

Several versions of the 2002 inventory suite were prepared. With each subsequent version improvements were made to the emissions estimation. The last and best version is called Version 3.3. This is the version that was used in air quality modeling and is also used in this emission trend analysis.

Details of the approach taken to prepare the 2002 modeling suite are found in the documentation for the base year (MANE-VU 2006) and future projections (MANE-VU 2007).

2.5.2 The 2007 Base Inventory with Projections to 2017 and 2020

The 2007 modeling inventory suite used in this analysis was prepared by MARAMA and finalized in 2012. (MANE-VU 2011a). Future year projections from base year 2007 were prepared for 2017 and 2020 (MANE-VU 2011b) for all sectors except the electric generation. In addition only a 2020 onroad future projection was prepared. The 2007 inventory suite was used by MANE VU states in photochemical air quality screening modeling in 2011 and 2012.

Electric Generating Units (EGU) emissions are only available for the base year, 2007. For preliminary modeling purposes, provisional EGU estimates were developed for future year 2020 based on the CSAPR caps (now abolished). High quality future year modeling inventories for EGUs are currently being developed under a separate effort lead by the Eastern Regional Technical Advisory Committee (ERTAC). These are not yet available for this study.

Onroad emissions are only available for base year 2007 and future year 2020. Use of the MOVES model proved so resource intensive that no funds were available to develop a 2017 onroad inventory. Under a separate effort, NESCAUM developed a 2007 onroad inventory using the MOVES model to support air quality modeling (NESCAUM 2011). Those runs were further revised by the Virginia Department of Environmental Quality to adjust for the height at which temperature was measured. This adjusted run (Version 2) was used in OTC Level 3 screening modeling and also in this analysis.

Two scenarios for the future year were prepared as follows:

> **On the Books /On the Way (OTB/OTW) –** This projection reflects a scenario accounting for controls that are fully adopted into federal or individual state regulations or SIPs. Also included in this scenario were some proposed (but not final) control programs that are reasonably anticipated by states to result in post-2007 emission reductions. Finally, low sulfur fuel rules were included in this inventory for New Jersey, Maryland and New York.
>
> **OTC Control Measures –** This suite of projections reflect a scenario accounting for all measures in the OTB/OTW scenario and, in addition, the application of nine control measures for which the OTC has developed model rules. This scenario is not addressed in this document.

For this emission trend analysis, the OTB/OTW projection for 2017 and 2020 was used. As noted above, EGU emissions were not prepared for either of these projection scenarios.

Several versions of the 2007 inventory suite were prepared. With each subsequent version, improvements were made to the emissions estimation. The last and best version is called Version 3.3 which was used in OTC Level 3 screening photochemical air quality modeling and also in this emission trend analysis.

Details of the approach taken to prepare the 2007 modeling suite are found in the documentation for the base year (MANE-VU 2011a) and future projections (MANE-VU 2011b)

2.5.3 The 2010 Clean Air Markets Division (CAMD) Reported Emissions

CAMD collects emissions of NO_x, SO_2 and heat input (HI) from large point sources in order to implement the emissions cap and trade program under the Acid Rain Control Program, the NO_x Budget Trading Program, or the Clean Air Interstate Rule found in Volume 40 Part 75 of the Code of Federal Regulations (CFR). These rules require hourly reporting of SO_2 and NO_X emissions from each participating unit. Most of the CAMD units are traditional power plants that sell electricity to the electrical grid (EGUs). There are, however, other types of units that report to CAMD that are not considered to be EGUs, such as petroleum refineries and cement kilns. For this report, only the EGU data was used. The annual unit level CAMD NO_X and SO_2 emissions files for 2010 were downloaded for use in this project. (CAMD2010)

2.6 ANTHROPOGENIC VERSUS BIOGENIC EMISSIONS

In general, this report deals only with anthropogenic emissions. However, biogenic VOC emissions are significant, particularly in rural areas where they can be many times the anthropogenic contribution. This can be seen comparing biogenic and anthropogenic VOC emissions for a rural state like Vermont where biogenic emissions are four times anthropogenic emissions, with an urban jurisdiction like the District of Columbia where, conversely, anthropogenic emissions are five times biogenic. Thus, when we examine VOC emission trends, it should be noted that we are only examining the change in anthropogenic emissions, which in some cases is a very small portion of the whole. In the OTC photochemical air quality modeling studies, biogenic emissions are assumed to be unchanged between base and future years.

Exhibit 2.2 – Biogenic versus Anthropogenic VOC Emissions

	2002 Biogenic	**2007 Biogenic**	**2007 Anthropogenic**
Data Source	**2002 V3**	**2007 V3**	**Total 2007 V3 without EGU**
CT	64,017	150,695	114,826
DE	46,343	46,598	31,147
DC	1,726	2,200	10,450
ME	600,205	484,376	82,517
MD	210,104	313,773	161,807
MA	113,958	211,136	177,998
NH	141,894	171,863	54,049
NJ	181,617	229,424	231,320
NY	492,487	878,461	485,262
PA	585,272	995,491	459,576
RI	19,233	34,177	42,304
VT	118,377	145,008	34,694
Total	**2,575,233**	**3,663,203**	**1,885,950**

Additionally, it should be noted that the difference between estimates of biogenic emissions for 2002 and 2007. The estimate for 2007 is much higher because of a change in the model used to estimate these emissions. For the 2002 inventory suite, BEIS was used while in the 2007 suite MEGAN was used. In states where biogenic emissions predominate, like Connecticut and Vermont, this difference may be significantly greater than anticipated anthropogenic reduction of VOC.

It is also important to note that Clean Air Act only requires reductions in manmade air pollution to achieve the national visibility goals. The visibility goal was established to prevent visibility impairment from manmade and not biogenic emissions.

2.7 CONSISTENCY OF DATA SOURCES

2.7.1 Consistency across Inventories

The data sources used in this analysis were developed at different times and for different purposes. The 2002 and 2007 inventory suites are calculated estimations prepared as input files for regional modeling. CAMD data are emissions measurements collected to demonstrate compliance with regulations. Different methodologies, suitable to the purpose of the inventory, were used for development.

Both between and within inventory suites, there are significant differences in methodology and in the sources inventoried. This may be a result of local custom or may result from regional differences in source importance. For example, the New Hampshire inventory includes emissions from industrial wood combustion but this Source Classification Code (SCC) is not included in the New Jersey inventory as it is unlikely that wood is used as an energy source in any New Jersey industry. Finally, the resources available to collect the data vary between states. For inventories suites, when resources are limited, states may consolidate minor SCCs. For this study, these discrepancies are handled differently depending on the source sector, as is further described in each section describing that sector.

2.7.2 Changes in Energy Information Agency (EIA) Growth Factors

Both the 2002 and 2007 inventory suites use the Energy Information Administration (EIA) *Annual Energy Outlook* (AEO) to develop growth factors for many SCCs, particularly those which involve fuel usage. Energy projections evolve over time with near-year projections being more certain than years farther in the future. In recent AEOs, there has been a significant shift in projected energy consumption toward natural gas. In addition, the economic downturn of 2009 and the emphasis on increased energy efficiency have resulted in lower future expectations for total energy usage.

Exhibits 2.3, 2.4 and 2.5 show the change from AEO2005 to AEO2012 of the expected use of coal, natural gas, and petroleum for power generation. The blue dashed line in each chart is AEO2005, which was used in the 2002 inventory suite to grow the base year to future projections. The blue solid line in each chart is AEO2010 which was used by most states in the 2007 inventory suite to grow the base year to future projections. Note that New Jersey used AEO 2011, and certain other SCC codes for other MARAMA states were updated to include AEO 2011. In Exhibit 2.3, it can be seen that the expected future coal use dropped significantly between AEO2005 and AEO 2010. It should be noted that the projected use of coal further declines in future years for the most recent AEO growth estimation. A similar pattern can be seen in Exhibit 2.4 for petroleum. The trend is less clear for natural gas as can be seen in Exhibit 2.5. AEO2005 predicted that stronger growth for natural gas was expected than in AEO2010; however more recent growth factors are closer to the strong growth predicted in AEO2005 as a result of the recent surge in natural gas exploration and production. Lower growth of coal electricity generation translates into lower expected future emissions. It is important to note that this difference in growth rate systemically reduces the future emissions from fuel burning in the 2007 inventory suite compared to the 2002 inventory suite.

Exhibit 2.3 – Change between 2008 and 2020 of the Energy Information Agency Projection of Coal Consumption for Energy Generation.

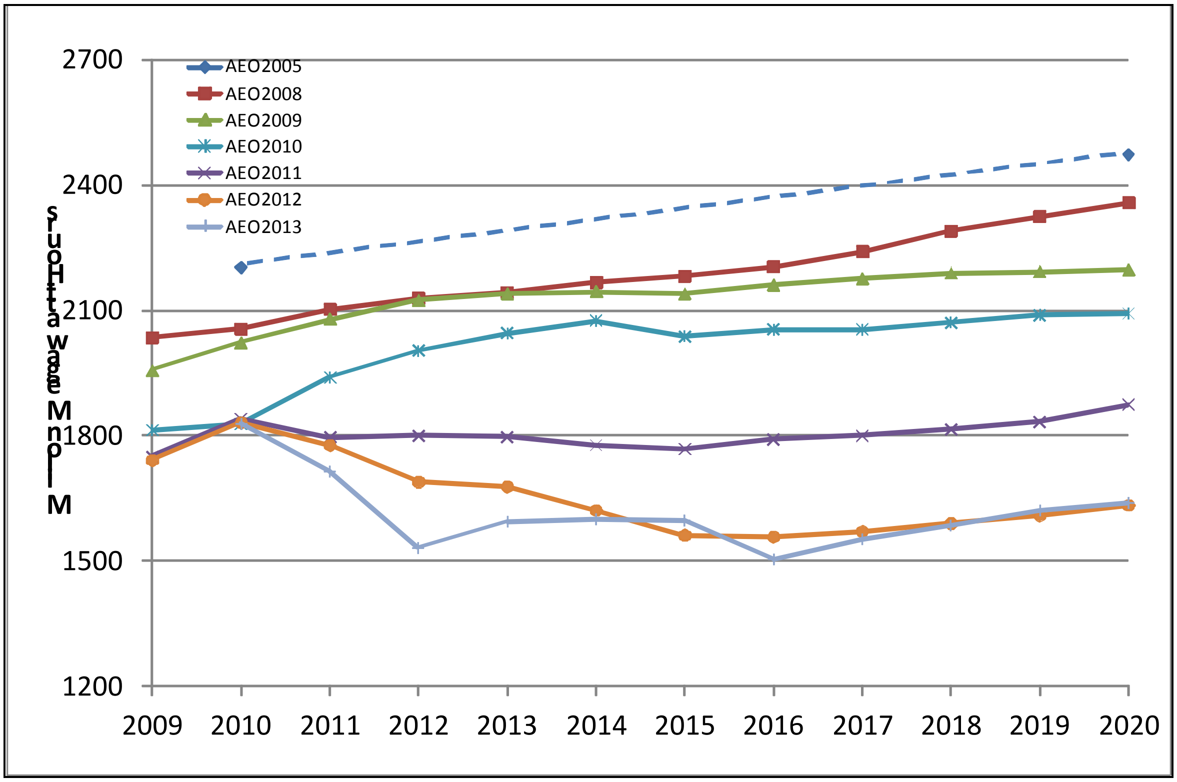


Exhibit 2.4 – Change between 2008 and 2020 of the Energy Information Agency Projection of Petroleum Consumption for Energy Generation.

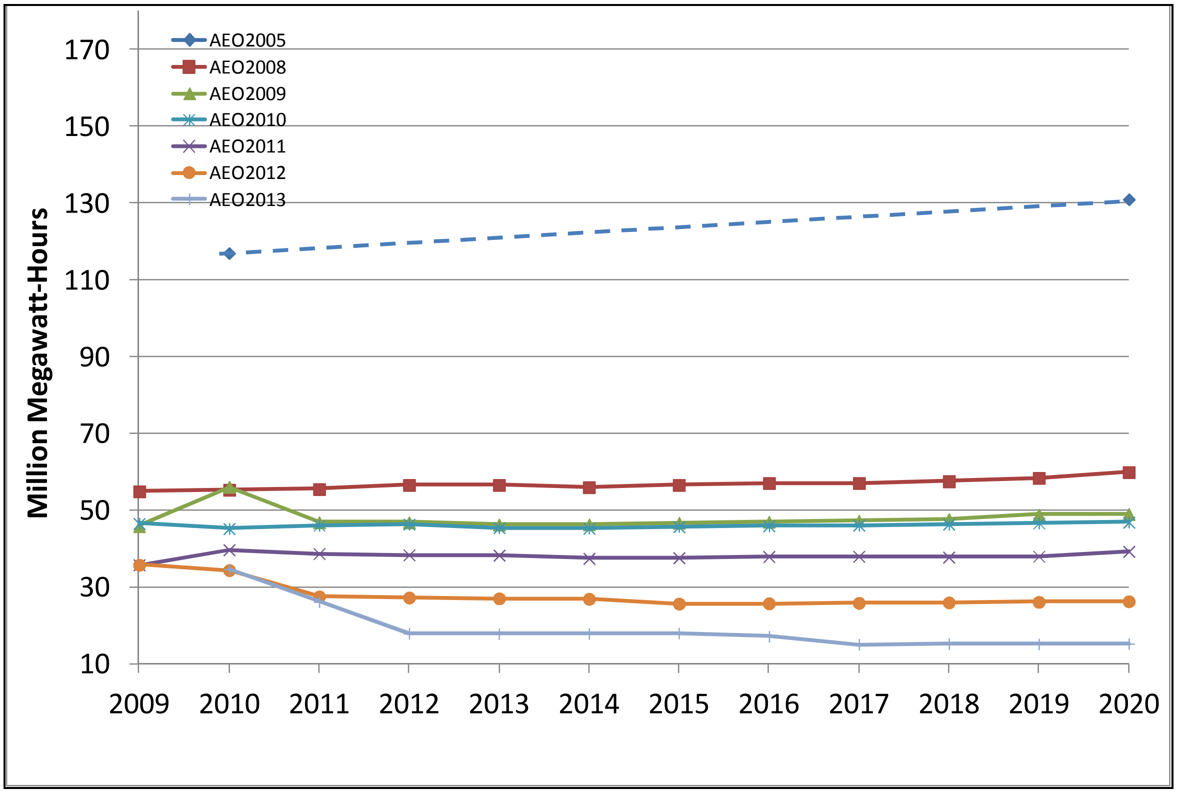
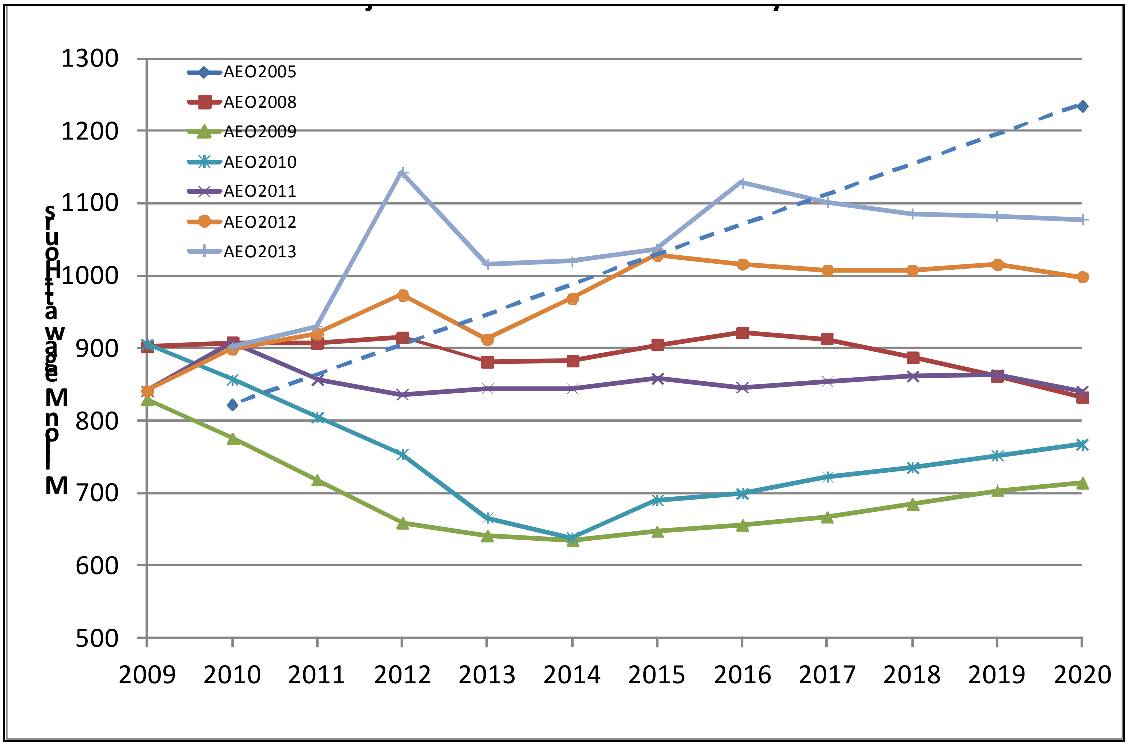


Exhibit 2.5 – Change between 2008 and 2020 of the Energy Information Agency Projection of Natural Gas Consumption for Energy Generation.



2.8 REGIONAL NATURE OF THE ANALYSIS

The emission trend analysis presented in this report is done at a regional level. As a result, larger states dominate the results. Trends for individual states, especially smaller states, may vary. State level data is provided in Section 8 in addition to the regional data that has been analyzed to present a regional emissions trend.

2.9 QUALITY ASSURANCE

The approach outlined in the Quality Assurance Project Plan (QAPP) was used to guide the project. (MARAMA 2012) An important element of quality control is review of work products by the state workgroup formed to guide the emissions trend analysis process. Participants of this group are listed in Appendix A. The workgroup met via teleconference on multiple occasions to discuss plans for the emissions trend analysis. In addition, members reviewed and commented on project work products.

3.0 AREA SOURCES

3.1 BACKGROUND

The area sector includes sources which individually are too small or too numerous to inventory as individual point sources. Area sources are estimated as an aggregate by county. Examples are emissions from home heating systems, house painting, consumer products usage, and small industrial/commercial operations not included in the inventory as point sources.

Two data sources were combined in this study to establish an emission trend for area sources. These are:

- 2002 MANE VU V3.3 modeling inventory with a projection to 2018
- 2007 MARAMA V3 modeling inventory with projections to 2017, and 2020

3.2 ISSUES WITH AREA SECTOR DATA SETS

3.2.1 Transport Fraction

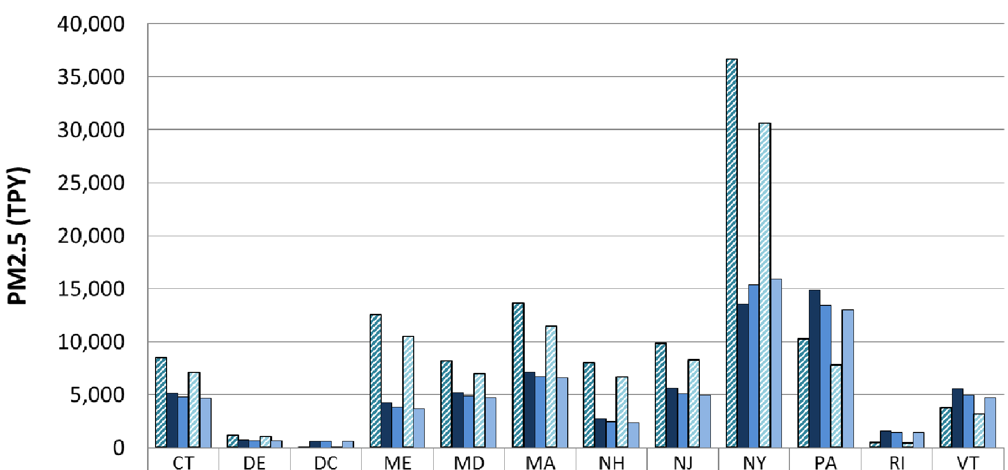
USEPA proscribed emission estimation methodologies overestimate fugitive dust in the ambient air. They are intended to estimate the emissions at the exact source of emission (dust from roadways or construction). However, fugitive dust does not transport far and is not measured in ambient air sampling monitors. To adjust the inventories, fugitive dust emissions of PM25-PRI for certain SCCs are reduced using a USEPA-developed methodology that accounts for the removal of fugitive particles near their emission point by vegetation and surface features. This is termed application of a "Transport Fraction." The largest categories adjusted are paved and unpaved roads, construction activity, and agricultural crop land tilling. In this inventory trend analysis, there have been no reductions to the inventory to account for this transport reduction for fugitive dust.

3.2.2 Inconsistencies between area data sources

Between development of the 2002 and the 2007 modeling inventories, significant improvements were made to estimation methodologies, and emission and growth factors used to estimate area source emissions. These are noted in this documentation, however, no attempt has been made to adjust the inventories to account for these changes. Changes affecting the area source sector include:

Residential Wood Combustion: Residential wood combustion is the largest contributor to regional fine particulate emissions. A new calculation tool was developed in advance of the 2007 inventory to estimate emissions from residential wood combustion. For the tool a new suite of SCC source categories was developed. In addition new emission factors and new calculation methodology were developed. Thus, the resulting emissions for this sub-category of area emissions are not comparable between the two inventory suites. Fine particulate emissions are particularly affected by this change as can be seen in Exhibit 3.1. While the effect of the new tool varies from state to state, the 2007 inventory suite residential wood combustion PM2.5 emission estimate is, on average, 40 percent lower than the 2002 inventory suite for the MANE VU region.

Exhibit 3.1 – Residential Wood Emissions of $PM_{2.5}$ from the 2002 versus the 2007 Inventory Suite.



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002 (02 Inv)	8,521	1,228	158	12,570	8,194	13,689	8,019	9,901	36,703	10,286	509	3,818
2007 (07 Inv)	5,146	719	626	4,229	5,201	7,176	2,747	5,606	13,530	14,855	1,597	5,559
2017 (07 Inv)	4,781	672	598	3,806	4,863	6,732	2,457	5,077	15,352	13,445	1,457	4,940
2018 (02 Inv)	7,137	1,044	140	10,481	7,012	11,481	6,694	8,286	30,654	7,807	414	3,198
2020 (07 Inv)	4,672	658	590	3,679	4,762	6,599	2,370	4,919	15,898	13,022	1,415	4,754

Inconsistency in the included source categories between inventory suites: In addition to residential wood, the estimation methodology for many other smaller sources was improved. In some cases several SCC codes were consolidated into a single combined SCC. In other cases new SCC codes were established. These shifts make a direct comparison of the inventories at the SCC level difficult. An analysis of the consistency between inventories was prepared by MARAMA to assist states in their review of this sector (MARAMA 2013).

Road dust PM25 Direct emissions: USEPA revised the recommended calculation methodology for road dust prior to completion of the 2007 inventory suite. As a result of this revision, the emissions from paved roads generally increased.

Energy use growth factor: The Energy Information Agency (EIA) Annual Energy Outlook (AEO) is used to project future area source fuel combustion emissions. As was described earlier, there has been an overall damping down of fuel use growth projected looking into the future and a significant fuel shift away from coal and toward natural gas. Both of these changes result in lower emissions in future projections. Thus, if 2018 had been projected from base year 2002 using current growth factors, estimated emissions from fuel combustion would have been lower.

Shift of sources between area and point source sector: For a variety of reasons, in some states emissions may be characterized as point sources in one inventory and area sources in another.

Natural variation in the base year: Emissions such as forest wildfires are dependent upon the year inventoried. These emissions are held constant in the future year for a particular inventory suite, but vary from suite to suite.

3.2.3 State Specific Issues

3.2.3.1 District of Columbia

The District of Columbia revised emissions for a variety of area source SCCs for all pollutants for both 2002 and 2007. No adjustments were made to future year projections (2017, 2018, 2020). Details of adjustments are available on the MARAMA ftp.

3.2.3.2 New Jersey

New Jersey revised 2007, 2017 and 2020 wildfire emissions from those presented in the 2007 2017 and 2020 Technical Support Documents. Emissions were averaged over a period of years, which provides for a more appropriate trend analysis evaluation. USEPA also uses this methodology in projection inventories and modeling.

3.3 OBSERVED REGIONAL AREA SOURCE TRENDS

This section describes regional trends. The regional data drawn on is presented in Section 8. In addition, Section 8 provides state level data, where the trends may be different than what holds true at the regional level. The regional data for area sources extracted from the larger Section 8 tables is summarized in Exhibit 3.2. Note that the three data sources are delineated by color differences:

- Blue - 2002V3 inventory suite
- Tan - 2007V3 inventory suite
- White – CAMD 2010 actual data (where available)

Exhibit 3.2 –Area Source - Air Pollution Emissions between 2002 and 2020

	2002	2007	2010	2017	2018	2020
	2002 V3	2007 V3	CAMD	2007 V3	2002 V3	2007 V3
NOX	266,747	207,054	---	194,832	263,954	194,868
PM2.5	332,676	259,938	---	262,887	339,518	264,959
SO2	316,287	212,471	---	119,215	190,437	116,511
VOC	1,366,735	784,233	---	702,289	1,334,175	696,125

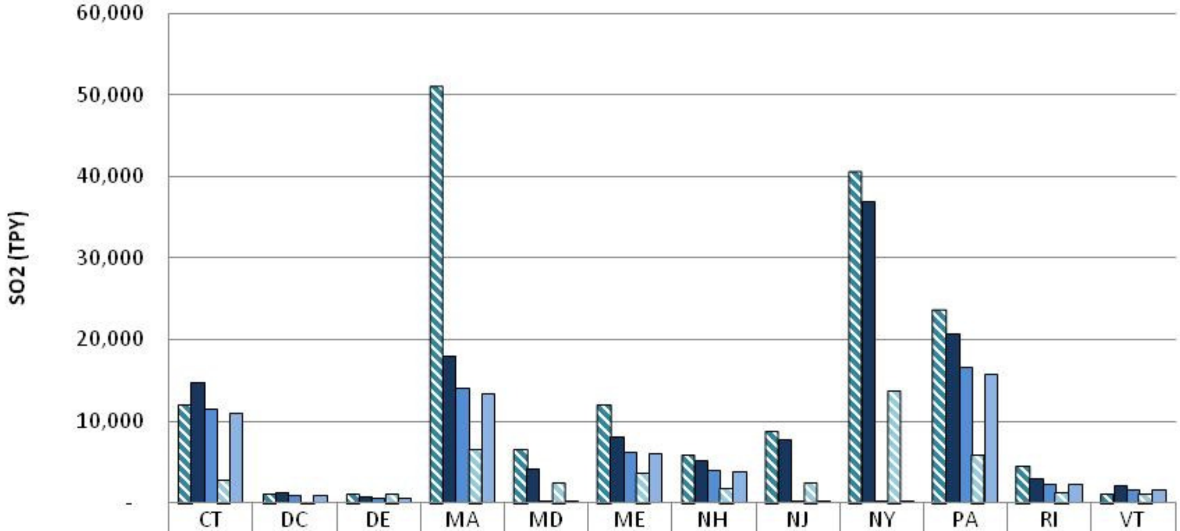
3.3.1 Nitrogen Oxides (NO_X)

In 2007 area sources accounted for approximately 10 percent of regional NO_X emissions and were already below the 2018 target set by regional air quality modeling. Furthermore, they are projected to decline further by 2017. Reductions are largely due to turn over to cleaner emission units in the future. However, without additional control programs or conservation measures, area sector NO_X emissions are projected to rise slightly again between 2017 and 2020. Projected 2020 emissions still remain below the 2018 regional target for this sector.

3.3.2 Sulfur Dioxide (SO_2)

Area sources account for approximately 10 percent of regional SO_2 emissions in 2007. These emissions are primarily from residential heating with distillate oil. Regional area source SO_2 emissions trend downward through 2020 and are projected to fall below the 2018 regional target by 2017. Expected future reductions are due to reduced fuel sulfur content and fuel use shifts to natural gas. Significant state differences exist with projected reductions more significant in New Jersey, Maryland and New York where the implementation of low sulfur rules are included in future year inventories, as can be seen in Exhibit 3.3.

Exhibit 3.3 –Number 2 Fuel Oil SO_2 Emissions Trend for MANE VU State 2002 to 2020



	CT	DC	DE	MA	MD	ME	NH	NJ	NY	PA	RI	VT
2002 (02 Inv)	12,089	1,197	1,249	51,075	6,598	12,059	6,028	8,810	40,637	23,766	4,533	1,210
2007 (07 Inv)	14,762	1,221	746	17,881	4,118	8,056	5,148	7,706	36,827	20,709	2,953	2,012
2017 (07 Inv)	11,541	972	601	14,062	23	6,252	4,046	43	138	16,542	2,301	1,595
2018 (02 Inv)	2,941	370	1,170	6,654	2,549	3,771	1,853	2,471	13,801	5,963	1,343	1,173
2020 (07 Inv)	10,991	930	569	13,418	24	5,946	3,863	41	132	15,816	2,187	1,529

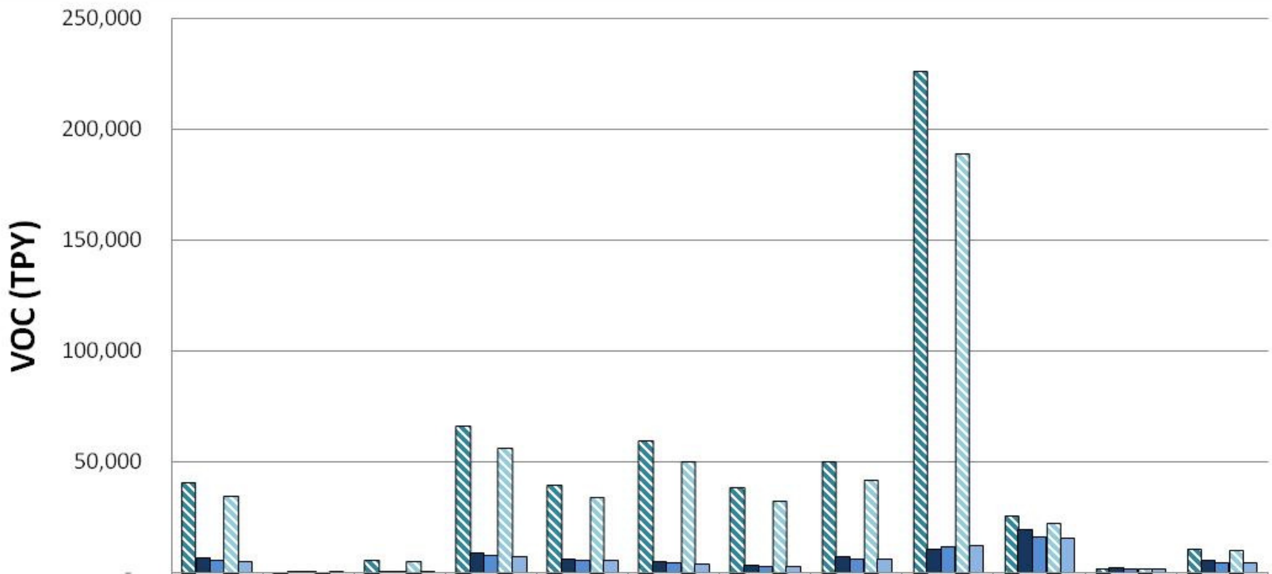
3.3.3 Fine Particulate ($PM_{2.5}$ – Direct)

Area sources account for approximately 65 percent of directly emitted regional fine particulate in 2007. Regionally, estimated area source emissions for fine particulate are generally lower in the 2007 inventory suite than the 2002 inventory suite. This is primarily because of a change in the emission factor used for residential wood combustion emissions as was shown in Exhibit 3.1. In addition, the road dust calculation method was revised, further confounding any possible conclusions. We therefore conclude that no trends can be drawn from the combined data set. However, by looking at the two individual inventory suites it can be seen that regionally $PM_{2.5}$ from area sources are expected to increase slightly in the future.

3.3.4 Volatile Organic Compounds (VOC)

Area sources account for approximately 41 percent of regional anthropogenic VOC emissions in 2007. Estimated emissions for VOC are generally lower in the 2007 inventory than the 2002 inventory because of a change in emission factor and calculation methodology used for residential wood combustion emissions. The difference in the two inventory suites for VOC from RWC is shown in Exhibit 3.4. We, therefore, conclude that no trends can be drawn from the combined data set. However, both inventory suites separately show anthropogenic VOC from area sources decreasing in the future.

Exhibit 3.4 –Residential Wood Combustion – Difference between 2002 and 2007 Inventory Suites



	CT	DC	DE	MA	MD	ME	NH	NJ	NY	PA	RI	VT
2002 (02 Inv)	41,068	733	5,952	66,595	39,434	59,843	38,838	49,989	226,18	25,537	1,982	10,998
2007 (07 Inv)	6,567	793	900	8,756	6,451	5,146	3,330	7,636	10,559	19,385	2,109	5,691
2017 (07 Inv)	5,676	706	787	7,671	5,661	4,412	2,979	6,505	11,958	16,497	1,799	4,846
2018 (02 Inv)	34,515	722	5,103	56,213	34,127	49,995	32,562	41,941	189,17	22,395	1,821	10,216
2020 (02 Inv)	5,409	680	753	7,346	5,424	4,191	2,873	6,166	12,379	15,630	1,706	4,594

4.0 POINT SOURCES

4.1 BACKGROUND

Point sources are those that are individually characterized within the inventory. In most cases, states track these sources through a permitting and emissions reporting process.

The point source sector has two subcategories: Electric Generating Units (EGU) and Non-Electric Generating units (Non-EGU). This distinction is drawn because the approach taken to estimate base and future emissions in the two subcategories is quite different. Non-EGUs emissions are reported by sources, but are generally estimated using emission factors rather than measured. They are projected based on expected business growth patterns.

EGU emissions of NO_X and SO_2 are generally measured using continuous emission monitors (CEMs). Emissions of VOC and $PM_{2.5}$ are estimated using emission factors. The approach taken for EGUs future projection varied between the two suites of modeling inventories, and will be discussed in detail later.

Three sources were combined in this study to establish an emission trend for point sources as follows:

- 2002 MANE VU V3.3 modeling inventory with a projection to 2018
- 2007 MARAMA V3 modeling inventory with projections to 2017, and 2020
- 2010 actual emissions as reported to CAMD (for EGU sources only)

4.2 ISSUES ENCOUNTERED WITH THE POINT SECTOR DATA SETS

4.2.1 Splitting the EGU and nonEGU files

Most, but not all, units that report hourly emissions to CAMD are classified as EGUs. The following criteria were used to classify units:

- An EGU sells most of the power generated to the electrical grid;
- An EGU burns mostly commercial fuel which is defined in this case as natural gas, oil, and coal. Wood is not considered a commercial fuel as some states identify wood as renewable. To avoid double counting, units that burn wood and other renewable sources (depending on each state's own definition) are not included in the EGU dataset as they are included in the nonEGU point source sector.
- In addition, the following units were <u>not</u> considered EGUs: (1) a unit that generates power for a facility but occasionally sells to the grid; (2) emergency generators; or (3) distributed generation units.

In the 2002 inventory, EGU and Non-EGU point sources were combined in a single file. Separate EGU and NonEGU files were developed for projection year 2018. For this project, the 2002 data was split into EGU and NonEGU using a crosswalk, developed with the 2002 inventory suite that identifies each unit as either EGU or nonEGU. After review by the states, additional units were removed from the 2002 EGU file and reclassified as nonEGU.

For the 2007 inventory suite, states classified point source units as either EGU or nonEGU and this classification was incorporated into the 2007 point source file. This classification was used to split the 2007 combined file into EGU and nonEGU point files.

The 2002 and 2007 inventory suites along with the 2010 CAMD data were combined to form a single file using ACCESS queries matching ORIS and/or state unit identifiers. For EGU emissions, a trend was established using 2002, 2007, 2010, and 2018 data. For Non-EGU sources, a trend was established using 2002, 2007, 2017, 2018 and 2020 data.

4.2.2 EGU point source growth

For the 2002 inventory suite, EGU emissions were projected to 2018 using the Integrated Planning Model (IPM) by ICF. ICF is both the owner/developer of the IPM model and the contractor that completed the work. Because IPM uses a different unit naming scheme and also includes a number of smaller units that are not in the base year most units cannot be matched with the 2002 base year. The additional units added by IPM are generally small and atypical such as generators located at landfills and firing landfill gas. Finally, the IPM model dramatically shifts unit utilization to minimize emissions for the least cost. In most states IPM predicted that many units, particularly oil burning units, would shut down and new replacement units would be built. In some cases, the projection was considered unrealistic and was adjusted (MARAMA 2009).

For the 2007 inventory, there are plans in place to project emissions using a new model being developed by an inter-Regional Planning Organization (RPO) cooperative team called ERTAC EGU. No EGU emissions results are yet available for use in this report. As a result, projection years 2017 and 2020 are not included for EGUs in this emissions trend analysis.

4.2.3 Missing Data from EGU Units

MARAMA noted that in the EGU combined datasets some units were missing emissions data from one or more of the trend years. States were asked to review the combined files and complete data for as many units as possible. If a unit was off-line or shut down they were asked to confirm the shutdown. In these cases a zero was entered for the years that the source was shutdown. Where states were unable to complete the data, the emission unit was removed from the analysis to maintain continuity between the analysis years. Because removal of data reduces the impact of the sector, a target of 90 percent complete records was set. All states were able to achieve 90 percent complete for NO_X, SO_2, and VOC emission data. In the summary tables in Section 8, values that represent 90 percent complete are indicated with a tag of "2". An analysis of the consistency between inventories was prepared by MARAMA to assist states in their review of this sector (MARAMA 2013)

The inventory year 2018 is an exception to this approach. Because of the above described difficulties in matching IPM generated files, no attempt was made to match the EGU emissions estimated for 2018. The 2018 emissions as projected by IPM were assumed to be complete without matching or adjustment.

4.2.1 Missing Data from NonEGU Units

MARAMA noted that in the Non-EGU combined datasets some units were missing emissions data from one or more of the trend years. States were asked to review the combined files and complete data for as many units as possible. If a unit was off-line or shut down they were asked to confirm that zero was the correct entry.

States that provided adjusted non-EGU data include Pennsylvania, Maine, District of Columbia, New Hampshire and Connecticut. Only Pennsylvania was able to achieve the target of 90 percent for non-EGU data. Connecticut declined to complete all non-EGU point source information because it would result in double counting of emissions that were accounted for in the area source inventory. Maryland was unable to align any of their Non-EGU point sources between the 2002 and 2007 inventory suites because the source identification system was changed in the intervening years.

While most states were unable to achieve the target of 90% complete for non-EGU point sources, no emission units was removed from the analysis. Instead, the non-EGU point inventory is presented regardless of completeness as the best available data.

4.2.2 Condensable Particulate Matter Emissions Factor

The PM species in the inventory are categorized as particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (PM25-PRI), which includes both condensable particles (PM-CON) and filterable particles (PM25-FIL). In many cases states provide an estimate for PM25-FIL but not PM-CON. For the 2002 inventory suite, in this situation an AP-42 emission factor (USEPA 1997) was used to estimate PM-CON. Prior to development of the 2007 inventory suite, MARAMA commissioned a study of condensable emissions from a variety of unit types. (MARAMA 2009) These new emission factors were used to augment the 2007 inventory suite. As a result, PM25-PRI emissions in the 2007 inventory suite cannot be compared to the 2002 suite.

4.2.3 Transport Fraction

The use of transport fractions to account for the difference in fugitive dust emissions and ambient concentrations was discussed in the area source sector part of this report (see Section 3.2.1). Similarly to area sources, no transport fractions were applied to point source emissions.

4.2.1 New Jersey 2002 PM2.5

New Jersey's 2002 PM2.5 inventory was calculated using PM10 as a base and using the USEPA PM calculator. Actual PM2.5 emission reports began in 2003 and were more than double what was estimated. Therefore, the actual decreasing trend in PM2.5 from 2003 into the future is not reflected in a comparison using 2002.

4.3 OBSERVED REGIONAL POINT SOURCE TRENDS

This section describes regional trends. The regional data drawn on is presented in Section 8. In addition, Section 8 provides state level data, where the trends may be different than what holds true at the regional level. The regional data for point sources extracted from the larger Section 8 tables is summarized in Exhibit 4.1 and 4.2. Note that the three data sources are delineated by color differences:

- Blue - 2002V3 inventory suite
- Tan - 2007V3 inventory suite
- White – CAMD 2010 actual data (where available)

Exhibit 4.1 – EGU Point Source - Air Pollution Emissions between 2002 and 2020

	2002	2007	2010	2017	2018	2020
	2002 V3	2007 V3	CAMD	2007 V3	2002 V3	2007 V3
NOX	453,395	338,488	214,623	---	168,268	---
PM2.5	20,670	44,921	---	---	51,109	---
SO2	1,670,176	1,546,335	620,183	---	365,024	---
VOC	11,943	4,975	---	---	4,344	---

4.3.1 Nitrogen Oxides (NO_X)

EGU point sources account for approximately 15 percent of total regional NO_X emissions in 2007. Regionally, EGU point source NO_X emissions declined over 50 percent from 2002 through 2010. Reductions are largely due to the installation of controls. To achieve the regional target for 2018, emissions will need to decline an additional 10 percent beyond what was achieved in 2010. Many EGU units are projected to shutdown or convert to more efficient natural gas units before 2018 which will result in substantial additional NO_X reductions.

Exhibit 4.2 –Non-EGU Point - Air Pollution Emissions between 2002 and 2020

	2002	2007	2010	2017	2018	2020
	2002 V3	2007 V3	CAMD	2007 V3	2002 V3	2007 V3
NOX	213,414	174,043	---	169,188	174,218	169,668
PM2.5	33,948	29,880	---	29,659	38,393	29,868
SO2	239,400	129,615	---	112,784	201,478	112,828
VOC	92,562	68,003	---	68,099	103,727	68,005

Non-EGU point sources account for approximately 8 percent of regional NO_X emissions in 2007. Regional non-EGU source NO_X emissions are projected to fall below the 2018 regional target by 2017. Trends vary by state, however. Reductions are largely due to unit shut-downs and the installation of controls. Without additional initiatives, emissions are projected to rise slightly between 2017 and 2020 but will still remain below the 2018 visibility target in 2020.

4.3.2 Sulfur Dioxide (SO_2)

EGU point sources account for approximately 80 percent of total regional SO_2 emissions in 2007. Regionally, EGU point source SO_2 emissions declined 60 percent between 2002 and 2010. Reductions are largely due to the installation of controls. To achieve the target for 2018, emissions must decline an additional 15 percent beyond what was already achieved in 2010. Many EGU units are projected to shutdown or convert to natural gas before 2018 which will result in substantial additional SO_2 reductions.

Non-EGU point sources account for approximately 7 percent of regional SO_2 emissions in 2007. Regional non-EGU source SO_2 emissions are projected to be below the 2018 target by 2017. Reductions are largely due to unit shut-downs and the installation of controls. Without additional initiatives, regional emissions are projected to rise slightly between 2017 and 2020 but will still remain below the regional 2018 visibility target in 2020. With the transition to natural gas and ultra-low sulfur distillate fuels and lower sulfur content residual fuel, in the MANE-VU states, this sector can be expected to decrease emissions from 2002 and 2007 levels.

4.3.3 Fine Particulate ($PM_{2.5}$-Direct)

EGU point sources account for approximately 10 percent of the total regional $PM_{2.5}$ inventory in 2007. In general 2002 and 2018 estimates are lower than was estimated for the 2007 inventory suite as a result of a change of estimation methodology. In 2002 most states did not collect total direct PM2.5 emissions from EGUs. Rather they used the EPA PM-Calculator to estimate PM2.5 emissions as a proportion of PM10. In the 2007 inventory suite states used a combination of source reported data and a new set of emission factors generated by MARAMA in a study of stack tests of similar units. (MARAMA 2009) There is inadequate data to indicate a $PM_{2.5}$ trend for this pollutant.

Non-EGU point sources account for approximately 10 percent of total regional $PM_{2.5}$-direct emissions in 2007. Regionally, non-EGU point source $PM_{2.5}$-Direct emissions have declined 11 percent from 2002 to 2007. Reductions are largely due to unit shut-downs and the installation of controls. Regional emissions are already well below the target for 2018 emission and are projected to drop further by 2017.

4.3.4 Volatile Organic Compounds (VOC)

EGU point sources account for less than one percent of total regional VOC emissions in 2007. There is inadequate data to indicate a VOC trend for this pollutant.

Non-EGU point sources account for less than five percent of total regional VOC emissions in all inventoried years and this proportion is expected to remain approximately the same in future years. Regionally, non-EGU point source VOC emissions have declined 28 percent from 2002 through 2007. Reductions are largely due to unit shut-downs and installation of controls. Regional emissions are already well below the target for 2018 emissions.

5.0 NONROAD MOBILE SOURCES INCLUDED IN NMIM

5.1 BACKGROUND

Non-road sources are mobile engine powered equipment operated off of public highways. Units include recreational marine vessels, recreational land-based vehicles, farm and construction machinery, lawn and garden equipment, aircraft ground support equipment, and rail maintenance equipment. This equipment is powered by diesel, gasoline, compressed natural gas, or liquefied petroleum gas engines.

Two data sources were combined in this study to establish an emission trend for the non-road sector as follows:

- 2002 MANE VU V3.3 modeling inventory with a projection to 2018
- 2007 MARAMA V3 modeling inventory with projections to 2017, and 2020

5.2 ISSUES ENCOUNTERED WITH NONROAD SECTOR DATA SETS

For most states, the EPA-developed NMIM/NONROAD model was used in both 2002 and 2007 inventory suites to estimate NONROAD sector emissions. While different versions of the model were used, with slightly different model adjustments, for the most part these differences did not change the resulting emission estimation substantially. The following sections describe the model adjustments used in the 2002 and 2007 modeling suites.

5.2.1 2002 inventory NonRoad Modeling

The NONROAD2005 model was used as a starting point for the 2002 inventory. Changes were made to the National County Database (NCD) database based on state review and comment. Complete documentation of the changes is available in the inventory documentation (MANE-VU 2006). A summary of the adjustments to the default NCD for the 2002 National Mobile Input Model (NMIM) model runs includes:

- Adjustments to fuel characteristics (Reid Vapor Pressure, sulfur and oxygenate fractions) to better represent county-specific fuel characteristics in 2002;
- Default diesel sulfur content values of 2457 parts per million (ppm) for land-based equipment, and 2767 ppm for recreational marine for all MANE VU counties.

5.2.2 2007 inventory NonRoad modeling

The NONROAD2008a (July 2009 NMIM20090504) and the NMIM County Database (version NCD20090531), were used as starting points for the 2007 inventory. Changes were made to the NCD20090531 based on state review and comment. Complete documentation of the changes is available in the inventory documentation (MANE-VU 2011a). A summary of the adjustments to the default NMIM County Database for the 2007 NMIM model runs includes:

- Adjustments to fuel characteristics (Reid Vapor Pressure, sulfur and oxygenate fractions) to better represent county-specific fuel characteristics in 2007;
- The housing and population data contained in the NONROAD model were updated using 2007 housing information and population estimates.
- Recreational marine vessel populations were revised using population data provided by the National Marine Manufacturers Association (NMMA). Total state populations for each of the three major categories contained in the NONROAD

model (outboard, inboard/stern drive and personal watercraft) were provided. Because the population files used by the NONROAD model (and thus NMIM) were configured with population values for various horsepower categories, the fraction of the total for each marine vessel type in each horsepower category was determined from the NONROAD default population files. These fractions were then used to allocate the total state population obtained from NMMA to the various horsepower categories.

- Airport ground Support: The Federal Aviation Administration's Emissions and Dispersion Modeling System (EDMS) model was used to estimate airport ground support emissions. They were included in the area source sector.

5.2.3 SCCs Included in Non-Road Sector

MARAMA determined that a different set of SCCs were included in the 2002 versus the 2007 non-road sector. Emissions for airport ground support equipment for 2002 and 2018 were moved from non-road to the area source sector. In addition, in 2007 the Marine, Air and Rail (MAR) sector was separated from the non road sector, but this was not done in 2002. Therefore, for this study, MARAMA separated out the 2002 and 2018 MAR data into a separate MAR sector.

5.2.4 Future Year Emissions Projection

For future year projections, the NMIM/NONROAD model applies controls to account for all USEPA non-road emission control programs. (USEPA 2011) Exhibit 5.1 is a summary of the emission control programs accounted for in the NMIM/NONROAD 2008a model that was used in the 2007 inventory suite. With one exception, all of these rules were also accounted for in the NMIM/NONROAD 2005 model. The only rule that is not accounted for in the 2005 version of NMIM/NONROAD is the final one listed in the table: 2008 Control of Emissions from non-road Spark-Ignition Engines and Equipment.

Exhibit 5.1 Nonroad Control Programs Included in 2007 Inventory Suite

Regulation	**Description**
Control of Air Pollution; Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression Ignition Engines At or Above 37 Kilowatts 59 FR 31036 June 17, 1994	This rule establishes Tier 1 exhaust emission standards for HC, NO_x, CO, and PM for nonroad compression-ignition (CI) engines ≥37kW (≥50hp). Marine engines are not included in this rule. The start dates and pollutants affected vary by hp category as follows: 50-100 hp: Tier 1,1998; NO_x only 100-175 hp: Tier 1, 1997; NO_x only 175-750 hp: Tier 1, 1996; HC, CO, NO_x, PM >750 hp: Tier 1, 2000; HC, CO, NO_x, PM
Emissions for New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts; Final Rule 60 FR 34581 July 3, 1995	This rule establishes Phase 1 exhaust emission standards for HC, N NO_x Ox, and CO for nonroad spark-ignition engines ≤19kW (≤25hp). This rule includes both handheld (HH) and non-hand-held (NHH) engines. The Phase 1 standards become effective in 1997 for: Class I NHH engines (<225cc), Class II NHH engines (≥225cc), Class III HH engines (<20cc), and Class IV HH engines (≥20cc and <50cc). The Phase 1 standards become effective in 1998 for: Class V HH engines (≥50cc)
Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts 61 FR 52088 October 4, 1996	This rule establishes exhaust emission standards for HC+ NO_x for personal watercraft and outboard (PWC/OB) marine SI engines. The standards are phased in from 1998-2006.
Control of Emissions of Air Pollution From Nonroad Diesel Engines 63 FR 56967 October 23, 1998	This final rule sets Tier 1 standards for engines under 50 hp, phasing in from 1999 to 2000. It also phases in more stringent Tier 2 standards for all engine sizes from 2001 to 2006, and yet more stringent Tier 3 standards for engines rated over 50 hp from 2006 to 2008. The Tier 2 standards apply to NMHC+ NO_x, CO, and PM, whereas the Tier 3 standards apply to NMHC+ NO_x and CO. The start dates by hp category and tier are as follows: hp<25: Tier 1,2000; Tier 2, 2005; no Tier 3 25-50 hp: Tier 1, 1999; Tier 2, 2004; no Tier 3 50-100 hp: Tier 2, 2004; Tier 3, 2008 100-175 hp: Tier 2, 2003; Tier 3, 2007 175-300 hp: Tier 2, 2003; Tier 3, 2006 300-600 hp: Tier 2, 2001, Tier 3, 2006 600-750 hp: Tier 2, 2002; Tier 3, 2006 >750 hp: Tier 2, 2006, no Tier 3 This rule does not apply to marine diesel engines above 50 hp.
Phase 2: Emission Standards for New Nonroad Non-handheld Spark	This rule establishes Phase 2 exhaust emission standards for HC+ NO_x for nonroad non-handheld (NHH) spark-

Regulation	Description
Ignition Engines At or Below 19 Kilowatts 64 FR 15207 March 30, 1999	ignition engines ≤19kW (≤25hp). The Phase 2 standards for Class I NHH engines (<225cc) become effective on August 1, 2007 (or August 1, 2003 for any engine initially produced on or after that date). The Phase 2 standards for Class II NHH engines (≥225cc) are phased in from 2001-2005.
Phase 2: Emission Standards for New Nonroad Spark-Ignition Handheld Engines At or Below 19 Kilowatts and Minor Amendments to Emission Requirements Applicable to Small Spark-Ignition Engines and Marine Spark-Ignition Engines; Final Rule 65 FR 24268 April 25, 2000	This rule establishes Phase 2 exhaust emission standards for HC+ NO_x for nonroad handheld (HH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards are phased in from 2002-2005 for Class III and Class IV engines and are phased in from 2004-2007 for Class V engines.
Control of Emissions From Nonroad Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based); Final Rule 67 FR 68241 November 8, 2002	This rule establishes exhaust and evaporative standards for several nonroad categories: 1) Two tiers of emission standards are established for large spark-ignition engines over 19 kW. Tier 1 includes exhaust standards for HC+ NO_x and CO and is phased in from 2004-2006. Tier 2 becomes effective in 2007 and includes exhaust standards for HC+ NO_x and CO, as along with evaporative controls affecting fuel line permeation, diurnal emissions and running loss emissions. 2) Exhaust and evaporative emission standards are established for recreational vehicles, which include snowmobiles, off-highway motorcycles, and all-terrain vehicles (ATVs). For snowmobiles, HC and CO exhaust standards are phased-in from 2006-2012. For off-highway motorcycles, HC+ NO_x and CO exhaust emission standards are phased in from 2006-2007. For ATVs, HC+NO_x and CO exhaust emission standards are phased in from 2006-2007. Evaporative emission standards for fuel tank and hose permeation apply to all recreational vehicles beginning in 2008. 3) Exhaust emission standards for HC+ NO_x, CO, and PM for recreational marine diesel engines over 50 hp begin in 2006-2009, depending on the engine displacement. These are "Tier 2" equivalent standards.
Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel; Final Rule (Clean Air Nonroad Diesel Rule – Tier 4) 69 FR 38958 June 29, 2004	This final rule sets Tier 4 exhaust standards for CI engines covering all hp categories (except marine and locomotives), and also regulates nonroad diesel fuel sulfur content. 1) The Tier 4 start dates and pollutants affected vary by hp and tier as follows: hp<25: 2008, PM only 25-50 hp: Tier 4 transitional, 2008, PM only; Tier 4 final, 2013, NMHC+ NO_x and PM 50-75 hp: Tier 4 transitional, 2008; PM only; Tier 4 final, 2013, NMHC+ NO_x and PM 75-175 hp: Tier 4 transitional, 2012, HC, NO_x, and PM;

Regulation	Description
	Tier 4 final, 2014, HC, NO_x, PM 175-750 hp: Tier 4 transitional, 2011, HC, NO_x, and PM; Tier 4 final, 2014, HC, NO_x, PM >750 hp: Tier 4 transitional, 2011, HC, NO_x, and PM; Tier 4 final, 2015, HC, NO_x, PM 2) This rule reduces nonroad diesel fuel sulfur levels in two steps. First, starting in 2007, fuel sulfur levels in nonroad diesel fuel will be limited to a maximum of 500 ppm, the same as for current highway diesel fuel. Second, starting in 2010, fuel sulfur levels in most nonroad diesel fuel will be reduced to 15 ppm.
Control of Emissions From Nonroad Spark-Ignition Engines and Equipment; Final Rule (Bond Rule) 73 FR 59034 October 8, 2008	This rule establishes exhaust and evaporative standards for small SI engines and marine SI engines: 1) Phase 3 HC+ NO_x exhaust emission standards are established for Class I NHH engines starting in 2012 and for Class II NHH engines starting in 2011. There are no new exhaust emission standards for handheld engines. New evaporative standards are adopted for both handheld and non handheld equipment. The new evaporative standards control fuel tank permeation, fuel hose permeation, and diffusion losses. The evaporative standards begin in 2012 for Class I NHH engines and 2011 for Class II NHH engines. For handheld engines, the evaporative standards are phased-in from 2012-2016. 2) More stringent HC+ NO_x and CO standards are established for marine SI PWC/OB engines beginning in 2010. In addition, new exhaust HC+ NO_x and CO standards are established for stern drive and inboard (SD/I) marine SI engines also beginning in 2010. High performance SD/I engines are subject to separate HC+ NO_x and CO exhaust standards that are phased-in from 2010-2011. New evaporative standards were also adopted for all marine SI engines that control fuel hose permeation, diurnal emissions, and fuel tank permeation emissions. The hose permeation, diurnal, and tank permeation standards take effect in 2009, 2010, and 2011, respectively.

Source: (USEPA 2010)

5.3 OBSERVED REGIONAL NONROAD SECTOR TRENDS

This section describes regional trends. The regional data drawn on is presented in Section 8. In addition, Section 8 provides state level data, where the trends may be different than what holds true at the regional level. The regional data for nonroad sources extracted from the larger Section 8 tables is summarized in Exhibit 5.2. Note that the three data sources are delineated by color differences:

- Blue - 2002V3 inventory suite
- Tan - 2007V3 inventory suite
- White – CAMD 2010 actual data (where available)

Exhibit 5.2 – Regional Nonroad Source - Emissions between 2002 and 2020

	2,002	2,007	2010	2,017	2,018	2,020
	2002 V3	2007 V3	CAMD	2007 V3	2002 V3	2007 V3
NOX	289,392	263,931	---	153,553	158,843	135,962
PM2.5	27,922	24,701	---	16,536	15,952	14,421
SO2	24,774	14,167	---	420	466	443
VOC	557,536	412,890	---	244,126	364,980	222,226

5.3.1 Nitrogen Oxides (NO_X)

The non-road sector accounts for approximately 10 percent of regional NO_X emissions in 2007. Regional non-road sources NO_X emissions are projected to trend downward through 2020 and are projected to fall below the 2018 target by 2017. Reductions are due to the turnover of old engines and bringing newer, cleaner engines online that meet recent federal emissions standards.

5.3.2 Sulfur Dioxide (SO_2)

The non-road sector accounts for less than one percent of regional SO_2 emissions in 2007. While insignificant, non-road source SO_2 emissions are projected to trend downward through 2020 and are projected to fall below the 2018 target by 2017. Reductions are due to reduced sulfur content in fuels.

5.3.3 Fine Particulate ($PM_{2.5}$ – Direct)

The non-road sector accounts for approximately six percent of directly emitted regional fine particulate emissions in 2007. Regional non-road source $PM_{2.5}$ emissions are projected to trend downward through 2020 and are projected to fall below the 2018 target by 2020. Reductions are due the reduced sulfur content in fuels and the turnover of old engines bringing newer, cleaner engines online that meet recent federal emissions standards.

5.3.4 Volatile Organic Compounds (VOC)

The non-road sector accounts for approximately 20 percent of regional VOC emissions in 2007. Regional non-road source VOC emissions are projected to trend downward through 2020 and are projected to fall below the 2018 target by 2017. Reductions are due to the turnover of old engines bringing newer, cleaner engines online that meet recent federal emissions standards.

6.0 MARINE VESSELS, AIRPORTS, AND RAILROADS

6.1 BACKGROUND

This category of sources is collectively referred to as the MAR (marine, airports, and railroads) sector. Although MAR sources are generally nonroad engines, estimation of these emissions are not included in the NONROAD model, therefore emission estimates and projections are developed as a separate effort. The MAR sector includes non-road engines associated with the following activities:

- **Marine Vessels** - The Commercial Marine Vehicle (CMV) sector includes boats and ships used either directly or indirectly in the conduct of commerce or military activity. The majority of these vessels are powered by diesel engines that are either fueled with distillate or residual fuel oil blends.

- **Airports** - The aircraft sector includes all aircraft types used for public, private, and military purposes. This includes four types of aircraft 1) Commercial; 2) Air Taxis; 3) General Aviation; and 4) Military. Ground support equipment (GSE) and auxiliary power units (APU) are not included in this sector. Rather, they have been included in the area sector.

- **Railroads** - The railroad sector includes railroad locomotives powered by diesel-electric engines. Locomotives are divided into Class I line haul, Class II/III line haul, commuter/passenger, and Class I yard. Rail maintenance equipment is included in this sector.

Two data sources were combined in this study to establish an emission trend for the MAR sector as follows:

- 2002 MANE VU V3.3 modeling inventory with a projection to 2018
- 2007 MARAMA V3 modeling inventory with projections to 2017 and 2020

6.2 ISSUES ENCOUNTERED WITH MAR SECTOR DATA SETS

The methodology used to estimate MAR sources was significantly revised between development of the 2002 and the 2007 inventory suites. ERTAC prepared a study of rail emissions based on industry supplied activity data and new emission factors that was adopted by many states, and the USEPA contracted for a major new study to improve the airport inventory (USEPA 2009a). In the 2002 inventory suite, the methodologies used to estimate this category were as described in EPA's "Documentation for Aircraft, Commercial Marine Vessel, Locomotive, and other Non-road Components of the National Emissions Inventory". (USEPA, 2005) New studies by ERTAC (ERTAC 2009) and EPA

(USEPA 2009) resulted in a reset to a generally higher emissions basis for NO_X and VOC emissions in the 2007 inventory suite from the sector. At the same time, the trend for $PM_{2.5}$ Direct and SO_2 for the MAR sector remains largely unchanged. Details of the approach to each inventory are contained in the base and future documentation for each modeling suite. (Base: MANE-VU 2012a; MANE VU 2006) (Future MANE-VU 2012b, MANE-VU 2007).

6.3 OBSERVED REGIONAL MAR SECTOR TREND

This section describes regional trends. The regional data drawn on is presented in Section 8. The regional data for MAR sources extracted from the larger Section 8 tables is summarized in Exhibit 6.1. Note that the three data sources are delineated by color differences:

- Blue - 2002V3 inventory suite
- Tan - 2007V3 inventory suite
- White – CAMD 2010 actual data (where available)

Exhibit 6.1 – Regional MAR Sources - Air Pollution Emissions between 2002 and 2020

	2002	2007	2010	2017	2018	2020
	2002 V3	2007 V3	CAMD	2007 V3	2002 V3	2007 V3
NOX	137,733	173,855	---	127,391	111,425	118,025
PM2.5	7,929	7,430	---	3,906	7,927	3,503
SO2	32,123	30,318	---	4,870	8,172	4,183
VOC	14,026	19,066	---	17,057	14,962	16,962

6.3.1 Nitrogen Oxides (NO_X)

The MAR sector accounts for approximately 7 percent of regional NO_X emissions in 2007. Estimated emissions for NO_X are generally higher in the 2007 than the 2002 inventory suite because of a change in estimation methodology rather than any real change in emissions. Therefore, no conclusions can be drawn from the combined data set. However, both inventory suites project NO_X from MAR sources to decrease in future years. Reductions are due to the turnover of old engines bringing newer, cleaner engines online that meet recent federal emissions standards.

6.3.2 Sulfur Dioxide (SO_2)

The MAR sector accounts for only 1 to 2 percent of regional SO_2 emissions in 2007. While insignificant, regional MAR sector SO_2 emissions are projected to trend downward through 2020 and are projected to fall below the 2018 target by 2017. Reductions are primarily due to reduced sulfur content in fuels.

6.3.3 Fine Particulate ($PM_{2.5}$ – Direct)

The MAR sector accounts for only 1 to 2 percent of directly emitted fine particulate emissions in 2007. While insignificant, MAR source $PM_{2.5}$-Direct emissions trend downward through 2020 and are projected to fall below the 2018 target by 2017. Reductions are primarily due to reduced sulfur content in fuels.

6.3.4 Volatile Organic Compounds (VOC)

The MAR sector accounts for only 1 percent of regional VOC emissions in 2007, and can be considered to be an insignificant portion of the inventory. Estimated regional emissions for VOC are generally higher in the 2007 than the 2002 inventory suite because of a change in estimation methodology rather than any real change in emissions. Therefore, no firm conclusions can be drawn from the combined data set. However, both inventory suites project VOC from MAR sources to decrease in future years.

7.0 ONROAD MOBILE SOURCES

7.1 BACKGROUND

Onroad mobile sector sources are mobile engine driven equipment operated on public highways. Sources include cars, buses, trucks, and motorcycles. This equipment is powered by diesel, gasoline, and a variety of alternative fuels including compressed natural gas or liquefied petroleum gas.

Two sources were combined in this study to establish an emission trend for the onroad mobile sector as follows:

- 2002 MANE VU V3.3 modeling inventory with a projection to 2018
- 2007 MARAMA V3 modeling inventory with projections to 2020. Unlike other sectors, no projection to 2017 was completed for mobile emissions.

The calculation of mobile emissions is complex because emissions vary with ambient temperature, vehicle type, age, travel speeds, operating modes, and fuel volatility. For this reason, inventory models have been developed by USEPA to perform the numerous calculations to estimate emissions from vehicle exhaust, evaporative and brake and tire wear. For many years, the MOBILE model was used to estimate onroad emissions. The MOBILE model was updated many times with the last version being MOBILE6.2. The term "MOBILE6" is generally used to refer to any of the suite of released MOBILE versions. For regional air quality modeling purposes to account for temporal and spatial meteorological differences, the MOBILE6.2 model was implemented as part of the Sparse Matrix Operator Kernel Emissions (SMOKE) gridded emissions model.

In recent years, USEPA has been developing a new model to estimate onroad mobile emissions called MOVES (**MO**tor **V**ehicle **E**mission **S**imulator). On March 2, 2010 EPA announced the release of MOVES2010 in the Federal Register (75 FR 9411). Starting in 2010 MOVES became the required model for SIP modeling, replacing MOBILE6.2. EPA subsequently released two minor revisions -- MOVES2010a in September 2010 and MOVES2010b in April 2012. Both revisions enhance model performance but do not significantly affect the criteria pollutant emissions calculated using MOVES2010. To smooth the transition to the new model, USEPA developed software tools to convert MOBILE6.2 inputs for MOVES. In addition, MOVES includes a preprocessing tool called the County Data Manager (CDM) to convert spreadsheet based information to MySQL database files required by the MOVES model.

There are two ways of running the MOVES model and they are known as:

- "Inventory" mode that provides emission estimates as mass, and
- "Emissions rate" or "Lookup table" mode that produces lookup tables of emission rates as mass per unit activity. a version of MOVES is available that can be run within SMOKE to account for temporal and spatial meteorological differences for regional air quality modeling purposes. For SMOKE implementation, emission rate tables must first be developed for a wide range of meteorological conditions.

For the 2007 and 2020 modeling inventories, MOVES was run in the emissions rate mode, which was necessary to be compatible with the regional air quality modeling.

7.2 ISSUES WITH MOBILE SECTOR DATA SETS

The shift from using MOBILE6.2 for the 2002 inventory suite, to using the MOVES model for the 2007 inventory suite to estimate onroad emissions represents a significant change in the estimation methodology. A large body of new research on emission factors; in addition to new source groupings were incorporated into the MOVES model. The effect on emissions, estimated by USEPA (USEPA 2009b), was expected to result in:

- Increased NO_X emission estimate by 5 percent
- Minor but lower estimates of VOC emissions
- Increased wintertime $PM_{2.5}$ emissions estimates
- Unchanged SO_2 emissions estimates.

7.2.1 2002 and 2018 inventory

For the 2002 MANE-VU inventory and future projection year 2018, onroad mobile emissions were estimated using MOBILE6.2 as it was implemented in SMOKE. Details of the assumptions used are provided in the inventory documentation. (NESCAUM 2006b)

7.2.2 2007 and 2020 inventory

For the 2007 MARAMA V3 inventory and the future projection year 2020, onroad mobile emissions were estimated using the MOVES 2010a model run in the emission rate mode. To reduce run time, states grouped counties and identified a representative county to represent each group. County groupings and their representative counties remained within state lines. In addition, months were grouped by season and a single month was selected to represent each group. NESCAUM, Pennsylvania, New York and Virginia partnered to perform the runs for the region which resulted in a Version 1 of the mobile inventory. Version 1 was documented by Huiyan Yang of NESCAUM, who led the modeling effort. (NESCAUM 2011)

A number of revisions were made to Version 1. Input files were revised and SMOKE-MOVES was rerun for the MANE VU region by Virginia DEQ for Delaware, Maryland and New Jersey. In addition, a systematic adjustment of all pollutants in all states and counties was made to revise the temperature used in Version 1. The temperature at 2 meters was used for the revised estimates. No new MOVES runs were made to address this revision; rather emission rates were interpolated using Version 1 tables. After all of the adjustments were completed, a Version 2 of the mobile emissions inventory was prepared. Version 2 of the northeast MOVES mobile inventory is used in this analysis. Additional improvements may be made in the future if resources permit.

7.3 OBSERVED REGIONAL ONROAD MOBILE SECTOR TREND

This section describes regional trends. The regional data drawn on is presented in Section 8. The regional data for onroad sources extracted from the larger Section 8 tables is summarized in Exhibit 6.1. Note that the three data sources are delineated by color differences:

- Blue - 2002V3 inventory suite
- Tan - 2007V3 inventory suite
- White – CAMD 2010 actual data (where available)

Exhibit 7.1 – Regional Mobile Onroad Sources - Air Pollution Emissions between 2002 and 2020

	2002	2007	2010	2017	2018	2020
	2002 V3	2007 V3	CAMD	2007 V3	2002 V3	2007 V3
NOX	1,308,235	1,175,916	---	---	303,956	471,558
PM2.5	22,108	45,616	---	---	9,189	28,365
SO2	40,092	8,974	---	---	8,756	7,202
VOC	789,560	600,638	---	---	269,979	269,647

7.3.1 Nitrogen Oxides (NO_X)

The onroad mobile sector accounts for approximately 50 percent of 2007 regional NO_X emissions. Emissions in 2020 are estimated to be higher than 2018, however this is due to a change in estimation methodology rather than any real change in emissions. Because of the significant change in calculation methodology no conclusions can be drawn from the combined data set. However, both inventory suites show regional NO_X from onroad mobile sources decreasing over time. Reductions are due to the turnover of old engines bringing newer, cleaner engines online that meet recent federal emissions standards.

7.3.2 Sulfur Dioxide (SO_2)

The onroad mobile sector accounts for an insignificant portion of SO_2 emissions accounting for less than one percent of regional SO_2 emissions in 2007. Regional onroad mobile sector SO_2 emissions trend downward through 2020 and are projected to fall below the 2018 target by 2020. Reductions are primarily due to reduced sulfur content in fuels.

7.3.3 Fine Particulate ($PM_{2.5}$ – Direct)

The onroad mobile sector accounts for approximately 10 percent of directly emitted fine particulate emissions in the region in 2007. Estimated emissions for fine particles are generally higher in the 2007 than the 2002 inventory suite because of a change in estimation methodology rather than any real change in emissions. Therefore, no conclusions can be drawn from the combined data set. However, both inventory suites show regional fine particles from onroad mobile sources decreasing in future years. Reductions are due to the turnover of old engines bringing newer, cleaner engines online that meet recent federal emissions standards.

7.3.4 Volatile organic compounds (VOC)

The onroad mobile sector accounts for approximately 30 percent of regional VOC emissions in 2007. Estimated emissions for VOC are generally lower in the 2007 than the 2002 inventory suite. However, the actual inventory percentage of VOC from the onroad sector is higher in 2007. Because of a change in estimation methodology no conclusions can be drawn from the combined data set. However, both inventory suites show regional VOC from onroad mobile sources decreasing in future years. These reductions are due to fleet turnover bringing cleaner cars into service that comply with significant federal rules.

8.0 EMISSION SUMMARIES

Exhibit 8.1 summarizes the MANE VU regional emission trend for NO_X, SO_2, $PM_{2.5}$ and VOC by sector. Exhibits 8.2 to 8.12 provide the same information on a state basis. Color coding and footnotes have been added to distinguish between the three data sources used in the analysis. Blue columns are from the 2002 inventory suite, tan columns are from the 2007 inventory suite and the white column is from CAMD 2010. PM25 and VOC emissions from EGUs are still under review by states and, therefore not provided in the table. Some general regional observations by pollutant include:

NO_X - Regional NO_x emissions are dominated by two sectors: onroad mobile and EGU in all inventoried years.

Recently measured EGU emissions tabulated for 2007 and 2010 indicate annual emissions from this sector are declining rapidly. In addition, EGU NO_X is projected to decline further in future years for the 2002 inventory suites. The 2007 inventory suite is incomplete for this category.

The shift from MOBILE6 to MOVES represents a significant shift in methodology, which occurring between completion of the 2002 and 2007 inventory suite for mobile NO_X emissions. Therefore, combining these data sets does not add understanding to the mobile NO_X trend analysis. However, each individual suite shows a declining trend.

Therefore, overall NO_X emissions appear to be trending lower with some uncertainty due to changing mobile calculation methodologies and an incomplete EGU inventory.

- **$PM_{2.5}$** - Directly emitted fine particle emissions are regionally dominated by the area sector and in particular residential wood combustion in all years inventoried. For this critical source, changes in both estimation methodology and emission factors for direct $PM_{2.5}$ occurred between the 2002 and 2007 inventory suites. These changes result in generally lower emissions estimates for the 2007 inventory suite. Likewise, the methodology used to estimate smaller contributing sectors, namely EGU and mobile has also changed between 2002 and 2007. Therefore, combining these data sets does not add understanding to the $PM_{2.5}$ trend analysis.

  Overall, the trend for directly emitted fine PM is highly uncertain, with some sectors remaining largely unchanged, while others, particularly engine-based sectors, are projected to decrease.

- **SO_2** - Regional SO_2 emissions are dominated by EGU emissions. As with NO_X, regional EGU SO2 emissions in 2010 are significantly lower than were estimated for 2007. Further reductions are projected in the future for the 2002 inventory suite. SO2 emissions in 2007 were already below the estimate for 2018, well ahead of expectations. There is no significant impact of changing methodologies for any sector calculations.

  The combined evidence points towards a significant declining trend for SO_2.

- **VOC** - Regional VOC emissions are dominated by biogenic emissions which are estimated to remain unchanged in future years. The largest percentage of anthropogenic VOC emissions is from the area source sector in 2007 and in particular residential wood combustion in all years inventoried. For this critical source, changes in both estimation methodology and emission factors for VOC occurred between the 2002 and 2007 inventory suites. These changes result in generally lower emissions estimates for the 2007 inventory suite. In addition, the calculation methodology changed for mobile emissions, also a significant contributor of VOC emissions in the region. Therefore, combining these data sets does not add understanding to the VOC emission trend analysis. However, the individual inventories when evaluated separately, both indicate a declining trend for the most important sectors.

- Overall, the trend for anthropogenic VOC emissions are projected to decrease in the future, primarily due to mobile and area source controls in being implemented between 2007 and 2020.

Exhibit 8.1 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020 Regional Summary

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	266,747	207,054	---	194,832	263,954	194,868
Nonroad MAR(4)	137,733	173,855	---	127,391	111,425	118,025
Nonroad NMIM(4)	289,392	263,931	---	153,553	158,843	135,962
Onroad Mobile(4)	1,308,235	1,175,916	---	---	303,956	471,558
Point EGU(2)	453,395	338,488	214,623	---	168,268	---
Point nonEGU(3)	213,414	174,043	---	169,188	174,218	169,668
Total	**2,668,916**	**2,333,286**	**---**	**---**	**1,180,664**	**---**
Direct PM2.5 (TPY)						
Area(4)	332,676	259,938	---	262,887	339,518	264,959
Nonroad MAR(4)	7,929	7,430	---	3,906	7,927	3,503
Nonroad NMIM(4)	27,922	24,701	---	16,536	15,952	14,421
Onroad Mobile(4)	22,108	45,616	---	---	9,189	28,365
Point EGU(2)	20,670	44,921	---	---	51,109	---
Point nonEGU(3)	33,948	29,881	---	29,659	38,393	29,868
Total	**445,253**	**412,486**	**---**	**---**	**462,087**	**---**
Sulfur Dioxide (TPY)						
Area(4)	316,287	212,471	---	119,215	190,437	116,511
Nonroad MAR(4)	32,123	30,318	---	4,870	8,172	4,183
Nonroad NMIM(4)	24,774	14,167	---	420	466	443
Onroad Mobile(4)	40,092	8,974	---	---	8,756	7,202
Point EGU(2)	1,670,176	1,546,335	620,183	---	365,024	---
Point nonEGU(3)	239,400	129,615	---	112,784	201,478	112,828
Total	**2,322,851**	**1,941,879**	**---**	**---**	**774,333**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	1,366,735	784,233	---	702,289	1,334,175	696,125
Nonroad MAR(4)	14,026	19,066	---	17,057	14,962	16,962
Nonroad NMIM(4)	557,536	412,890	---	244,126	364,980	222,226
Onroad Mobile(4)	789,560	600,638	---	---	269,979	269,647
Point EGU(2)	11,943	4,975	---	---	4,344	---
Point nonEGU(3)	92,562	68,003	---	68,099	103,727	68,005
Total	**2,832,364**	**1,889,805**	**---**	**---**	**2,092,168**	**---**

1) This trend is built from three sources:
  2002 V3 with future projection to 2018 (Blue Columns)
  2007 V3 with a projection to 2017 and 2020 (Tan Columns)
  CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years for most states. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD for most states. No revision to correct inconsistent methodology.
  Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
  Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.2 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020 Connecticut

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
			Oxides of Nitrogen (TPY)			
Area(4)	12,745	12,421	---	11,101	11,821	11,048
Nonroad MAR(4)	7,601	9,001	---	5,934	6,475	5,344
Nonroad NMIM(4)	17,802	16,019	---	8,721	9,732	7,762
Onroad Mobile(4)	68,816	53,860	---	---	14,787	19,200
Point EGU(2)	6,106	4,706	2,901	---	2,809	---
Point nonEGU(3)	6,994	5,489	---	7,951	7,448	8,307
Total	**120,065**	**101,496**	**---**	**---**	**53,072**	**---**
			Direct PM2.5 (TPY)			
Area(4)	14,251	10,606	---	10,290	12,368	10,217
Nonroad MAR(4)	221	391	---	190	227	166
Nonroad NMIM(4)	1,569	1,338	---	919	906	815
Onroad Mobile(4)	1,042	1,969	---	---	500	978
Point EGU(2)	468	815	**---**	**---**	746	**---**
Point nonEGU(3)	832	433	---	483	902	493
Total	**18,383**	**15,552**	**---**	**---**	**15,649**	**---**
			Sulfur Dioxide (TPY)			
Area(4)	12,424	16,083	---	12,943	3,398	12,401
Nonroad MAR(4)	715	1,541	---	239	787	156
Nonroad NMIM(4)	1,366	799	---	30	28	32
Onroad Mobile(4)	1,667	401	---	---	366	340
Point EGU(2)	13,122	6,901	4,039	---	6,443	---
Point nonEGU(3)	2,466	1,170	---	1,212	2,371	1,228
Total	**31,760**	**26,895**	**---**	**---**	**13,393**	**---**
			Volatile Organic Compounds (TPY)			
Area(4)	87,308	57,253	---	46,364	68,398	45,849
Nonroad MAR(4)	371	752	---	633	392	633
Nonroad NMIM(4)	33,503	20,713	---	11,797	20,299	10,980
Onroad Mobile(4)	31,755	34,764	---	---	10,768	11,494
Point EGU(2)	396	251	**---**	**---**	122	**---**
Point nonEGU(3)	4,635	1,366	---	1,469	3,796	1,491
Total	**157,968**	**115,099**	**---**	**---**	**103,775**	**---**

1) This trend is built from three sources:

2002 V3 with future projection to 2018 (Blue Columns)

2007 V3 with a projection to 2017 and 2020 (Tan Columns)

CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.

Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives

Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.3 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020 Delaware

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	2,617	2,238	---	2,209	3,018	2,218
Nonroad MAR(4)	10,437	6,284	---	4,298	11,671	3,915
Nonroad NMIM(4)	5,781	4,997	---	3,095	2,956	2,723
Onroad Mobile(4)	21,341	22,026	---	---	5,917	21,258
Point EGU(2)	8,610	10,004	4,346	---	7,415	---
Point nonEGU(3)	8,084	5,692	---	3,328	4,246	3,271
Total	**56,870**	**51,241**	**---**	**---**	**35,223**	**---**
Direct PM2.5 (TPY)						
Area(4)	3,205	3,031	---	3,131	3,426	3,212
Nonroad MAR(4)	402	339	---	118	532	95
Nonroad NMIM(4)	523	453	---	284	276	243
Onroad Mobile(4)	415	670	---	---	191	1,938
Point EGU(2)	1,617	1,895	**---**	**---**	2,313	**---**
Point nonEGU(3)	2,059	1,219	---	876	1,254	848
Total	**8,221**	**7,607**	**---**	**---**	**7,992**	**---**
Sulfur Dioxide (TPY)						
Area(4)	1,589	1,144	---	946	1,545	911
Nonroad MAR(4)	3,471	2,139	---	280	3,288	139
Nonroad NMIM(4)	511	266	---	7	8	7
Onroad Mobile(4)	584	192	---	---	128	380
Point EGU(2)	30,626	32,699	14,499	---	8,077	---
Point nonEGU(3)	43,131	10,391	---	6,541	7,610	6,357
Total	**79,912**	**46,831**	**---**	**---**	**20,656**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	15,520	9,482	---	8,631	13,066	8,673
Nonroad MAR(4)	482	806	---	748	539	742
Nonroad NMIM(4)	7,527	7,157	---	3,888	5,113	3,498
Onroad Mobile(4)	10,564	10,289	---	---	5,037	11,965
Point EGU(2)	1,100	80	**---**	**---**	112	**---**
Point nonEGU(3)	4,674	3,413	---	2,588	1,987	2,572
Total	**39,867**	**31,227**	**---**	**---**	**25,854**	**---**

1) This trend is built from three sources:
- 2002 V3 with future projection to 2018 (Blue Columns)
- 2007 V3 with a projection to 2017 and 2020 (Tan Columns)
- CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.4 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020
District of Columbia

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
			Oxides of Nitrogen (TPY)			
Area(2)	1,390	1,547	---	1,560	2,229	1,592
Nonroad MAR(4)	506	512	---	358	372	326
Nonroad NMIM(4)	3,065	2,787	---	1,560	1,443	1,249
Onroad Mobile(4)	8,902	8,724	---	---	1,717	6,209
Point EGU(2)	539	177	510	---	103	---
Point nonEGU(3)	748	611	---	636	368	650
Total	**15,150**	**14,358**	**---**	**---**	**6,232**	**---**
			Direct PM2.5 (TPY)			
Area(2)	1,140	1,542	---	1,560	860	1,566
Nonroad MAR(4)	11	11	---	6	7	6
Nonroad NMIM(4)	288	234	---	132	117	102
Onroad Mobile(4)	153	374	---	---	58	590
Point EGU(2)	46	17	**---**	**---**	99	**---**
Point nonEGU(3)	60	36	---	21	98	21
Total	**1,699**	**2,214**	**---**	**---**	**1,239**	**---**
			Sulfur Dioxide (TPY)			
Area(2)	908	1,241	---	995	522	953
Nonroad MAR(4)	34	38	**---**	0	2	0
Nonroad NMIM(4)	341	196	---	3	3	3
Onroad Mobile(4)	271	88	---	---	41	124
Point EGU(2)	1,094	142	874	---	83	---
Point nonEGU(3)	1,026	470	**---**	379	553	380
Total	**3,674**	**2,175**	**---**	**---**	**1,204**	**---**
			Volatile Organic Compounds (TPY)			
Area(2)	5,705	5,568	---	5,324	4,991	5,369
Nonroad MAR(4)	20	35	---	24	18	21
Nonroad NMIM(4)	2,053	1,324	---	749	1,351	710
Onroad Mobile(4)	4,895	3,470	---	---	1,797	3,326
Point EGU(2)	9	6	**---**	**---**	5	**---**
Point nonEGU(3)	67	53	---	54	71	54
Total	**12,750**	**10,456**	**---**	**---**	**8,233**	**---**

1) This trend is built from three sources:
   2002 V3 with future projection to 2018 (Blue Columns)
   2007 V3 with a projection to 2017 and 2020 (Tan Columns)
   CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
   Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
   Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.5 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020
Maine

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	7,391	6,655	---	5,960	7,050	5,851
Nonroad MAR(4)	1,606	3,176	---	2,500	1,583	2,341
Nonroad NMIM(4)	8,184	7,425	---	5,206	4,946	4,774
Onroad Mobile(4)	54,687	36,922	---	---	12,828	18,203
Point EGU(2)	1,005	696	719	---	1,827	---
Point nonEGU(3)	19,055	17,050	---	20,373	13,688	20,422
Total	**91,928**	**71,924**	**---**	**---**	**41,922**	**---**
Direct PM2.5 (TPY)						
Area(4)	32,776	12,526	---	12,061	33,202	12,000
Nonroad MAR(4)	196	452	---	214	245	186
Nonroad NMIM(4)	1,131	1,078	---	755	732	656
Onroad Mobile(4)	934	1,454	---	---	266	2,564
Point EGU(2)	398	125	---	---	279	---
Point nonEGU(3)	5,422	3,727	---	3,628	5,622	3,623
Total	**40,857**	**19,362**	**---**	**---**	**40,346**	**---**
Sulfur Dioxide (TPY)						
Area(4)	13,153	9,812	---	7,870	4,940	7,609
Nonroad MAR(4)	146	296	---	33	63	28
Nonroad NMIM(4)	767	415	---	16	19	17
Onroad Mobile(4)	1,804	377	---	---	894	566
Point EGU(2)	2,013	1,677	820	---	7,422	---
Point nonEGU(3)	21,706	15,554	---	12,655	18,492	12,535
Total	**39,589**	**28,131**	**---**	**---**	**31,830**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	100,624	31,966	---	26,113	90,868	25,631
Nonroad MAR(4)	407	448	---	378	443	356
Nonroad NMIM(4)	30,734	29,877	---	19,301	21,543	16,727
Onroad Mobile(4)	23,037	15,239	---	---	10,414	18,052
Point EGU(2)	843	32	---	---	53	---
Point nonEGU(3)	5,250	4,987	---	4,733	5,598	4,561
Total	**160,895**	**82,549**	**---**	**---**	**128,919**	**---**

1) This trend is built from three sources:

2002 V3 with future projection to 2018 (Blue Columns)

2007 V3 with a projection to 2017 and 2020 (Tan Columns)

CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.

Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives

Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.6 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020 Maryland

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	15,842	10,312	---	10,948	17,822	11,184
Nonroad MAR(4)	9,706	22,727	---	15,421	8,528	13,870
Nonroad NMIM(4)	27,602	25,703	---	15,340	15,653	13,466
Onroad Mobile(4)	122,210	115,128	---	---	28,097	45,474
Point EGU(2)	77,062	54,686	22,610	---	14,567	---
Point nonEGU(3)	19,317	20,204	---	23,054	18,888	23,228
Total	**271,739**	**248,760**	**---**	**---**	**103,555**	**---**
Direct PM2.5 (TPY)						
Area(4)	27,330	19,789	---	20,884	30,158	21,201
Nonroad MAR(4)	1,490	786	---	382	1,662	324
Nonroad NMIM(4)	2,856	2,470	---	1,679	1,634	1,475
Onroad Mobile(4)	2,200	3,955	---	---	1,033	1,837
Point EGU(2)	2,365	12,064	---	---	6,431	---
Point nonEGU(3)	2,649	3,245	---	3,682	3,501	3,689
Total	**38,889**	**42,309**	**---**	**---**	**44,419**	**---**
Sulfur Dioxide (TPY)						
Area(4)	12,412	5,960	---	1,674	9,118	1,704
Nonroad MAR(4)	5,375	2,482	---	472	535	375
Nonroad NMIM(4)	2,548	1,434	---	36	42	38
Onroad Mobile(4)	4,058	932	---	---	656	977
Point EGU(2)	277,263	294,426	51,635	---	36,962	---
Point nonEGU(3)	16,544	10,957	---	14,058	38,886	14,069
Total	**318,200**	**316,191**	**---**	**---**	**86,199**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	120,272	64,429	---	57,045	104,624	57,042
Nonroad MAR(4)	3,301	2,012	---	1,659	3,867	1,642
Nonroad NMIM(4)	53,011	35,155	---	21,223	34,093	19,887
Onroad Mobile(4)	61,847	55,628	---	---	29,913	24,458
Point EGU(2)	5,193	428	---	---	575	---
Point nonEGU(3)	5,714	4,583	---	5,700	6,279	5,662
Total	**249,338**	**162,235**	**---**	**---**	**179,351**	**---**

1) This trend is built from three sources:
- 2002 V3 with future projection to 2018 (Blue Columns)
- 2007 V3 with a projection to 2017 and 2020 (Tan Columns)
- CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.7 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020
Massachusetts

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	31,567	20,252	---	18,984	36,296	19,151
Nonroad MAR(4)	12,729	12,576	---	9,101	10,949	8,540
Nonroad NMIM(4)	29,830	26,464	---	14,815	15,993	13,159
Onroad Mobile(4)	143,368	73,441	---	---	22,813	19,171
Point EGU(2)	31,701	11,274	8,563	---	18,157	---
Point nonEGU(3)	16,906	12,353	---	14,308	20,090	14,788
Total	**266,101**	**156,360**	**---**	**---**	**124,298**	**---**
Direct PM2.5 (TPY)						
Area(4)	42,082	30,438	---	29,945	43,086	29,883
Nonroad MAR(4)	569	651	---	435	541	404
Nonroad NMIM(4)	2,643	2,267	---	1,539	1,505	1,354
Onroad Mobile(4)	2,410	2,798	---	---	840	1,475
Point EGU(2)	1,491	2,433	---	---	3,233	---
Point nonEGU(3)	2,789	2,257	---	2,250	3,332	2,277
Total	**51,984**	**40,844**	**---**	**---**	**52,537**	**---**
Sulfur Dioxide (TPY)						
Area(4)	54,947	19,859	---	15,996	8,357	15,357
Nonroad MAR(4)	1,364	982	---	290	395	278
Nonroad NMIM(4)	2,403	1,376	---	41	47	44
Onroad Mobile(4)	4,399	767	---	---	1,937	341
Point EGU(2)	92,996	54,628	36,969	---	47,927	---
Point nonEGU(3)	13,965	8,603	---	7,713	16,544	7,719
Total	**170,074**	**86,215**	**---**	**---**	**75,207**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	162,039	85,870	---	66,211	134,974	65,306
Nonroad MAR(4)	1,915	1,926	---	1,624	2,122	1,569
Nonroad NMIM(4)	54,811	35,675	---	20,509	34,172	18,989
Onroad Mobile(4)	57,186	50,443	---	---	17,056	16,414
Point EGU(2)	584	486	---	---	484	---
Point nonEGU(3)	7,765	4,071	---	4,081	10,356	3,999
Total	**284,301**	**178,471**	**---**	**---**	**199,164**	**---**

(1) This trend is built from three sources:
- 2002 V3 with future projection to 2018
- 2007 V3 with a projection to 2017 and 2020
- CAMD actual 2010 emissions as reported to the US EPA CAMD

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory. No revision to correct inconsistent methodology.
- Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
- Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

The SO_2 emissions reported from area sources in Massachusetts match the value in the future year inventory documentation. This is because an error was corrected after final publication of the 2002 Version 3 documentation. However, the error was not corrected in the modeling files.

Exhibit 8.8 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020

New Hampshire

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	10,992	4,737	---	4,152	12,243	4,111
Nonroad MAR(4)	1,776	1,454	---	1,306	1,723	1,286
Nonroad NMIM(4)	8,104	8,548	---	5,521	4,558	5,268
Onroad Mobile(4)	33,283	33,923	---	---	7,671	30,342
Point EGU(2)	6,894	4,754	4,788	---	3,089	---
Point nonEGU(3)	3,576	2,694	---	3,388	1,086	3,467
Total	**64,625**	**56,110**	**---**	**---**	**30,369**	**---**
Direct PM2.5 (TPY)						
Area(4)	17,534	8,623	---	8,598	18,089	8,633
Nonroad MAR(4)	95	62	---	46	98	45
Nonroad NMIM(4)	868	798	---	558	534	493
Onroad Mobile(4)	562	1,424	---	---	263	3,010
Point EGU(2)	1,973	602	---	---	2,156	---
Point nonEGU(3)	426	499	---	1,169	940	1,179
Total	**21,459**	**12,008**	**---**	**---**	**22,080**	**---**
Sulfur Dioxide (TPY)						
Area(4)	7,076	5,283	---	4,176	3,123	3,991
Nonroad MAR(4)	220	545	---	81	226	46
Nonroad NMIM(4)	668	440	---	16	16	18
Onroad Mobile(4)	777	275	---	---	537	542
Point EGU(2)	43,962	42,524	36,835	---	10,766	---
Point nonEGU(3)	5,607	2,743	---	2,655	3,086	2,658
Total	**58,310**	**51,810**	**---**	**---**	**17,753**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	65,374	22,343	---	20,894	62,687	20,807
Nonroad MAR(4)	142	195	---	175	158	178
Nonroad NMIM(4)	22,231	17,105	---	11,028	14,807	9,783
Onroad Mobile(4)	16,762	13,599	---	---	6,564	14,629
Point EGU(2)	101	110	---	---	73	---
Point nonEGU(3)	1,815	768	---	1,445	998	1,431
Total	**106,425**	**54,120**	**---**	**---**	**85,288**	**---**

1) This trend is built from three sources:
    2002 V3 with future projection to 2018 (Blue Columns)
    2007 V3 with a projection to 2017 and 2020 (Tan Columns)
    CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
    Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
    Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.9 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020
New Jersey

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
			Oxides of Nitrogen (TPY)			
Area(3)	29,637	21,829	---	23,340	21,829	23,339
Nonroad MAR(4)	19,969	22,264	---	20,390	17,575	19,335
Nonroad NMIM(4)	40,583	36,340	---	20,710	23,457	18,358
Onroad Mobile(4)	152,076	135,339	---	---	30,150	42,168
Point EGU(2)	33,171	16,530	9,317	---	12,984	---
Point nonEGU(3)	18,599	13,517	---	11,879	17,091	12,092
Total	**294,035**	**245,819**	**---**	**---**	**123,086**	**---**
			Direct PM2.5 (TPY)			
Area(2)	19,071	18,961	---	18,441	17,322	18,568
Nonroad MAR(4)	1,047	866	---	453	920	442
Nonroad NMIM(4)	3,831	3,212	---	2,216	2,214	1,964
Onroad Mobile(4)	2,469	4,830	---	---	1,140	2,167
Point EGU(2)	1,504	4,410	---	---	2,825	---
Point nonEGU(3)	3,125	2,405	---	2,527	4,203	2,568
Total	**31,047**	**34,685**	**---**	**---**	**28,624**	**---**
			Sulfur Dioxide (TPY)			
Area(2)	10,923	8,812	---	706	4,374	704
Nonroad MAR(4)	12,162	7,274	---	937	765	1,009
Nonroad NMIM(4)	3,345	1,905	---	55	67	58
Onroad Mobile(4)	3,649	917	---	---	785	715
Point EGU(2)	50,898	37,299	15,076	---	15,918	---
Point nonEGU(3)	10,389	3,401	---	2,591	7,800	2,645
Total	**91,366**	**59,608**	**---**	**---**	**29,709**	**---**
			Volatile Organic Compounds (TPY)			
Area(3)	168,931	96,243	---	89,972	134,104	89,699
Nonroad MAR(4)	2,020	3,355	---	3,396	2,175	3,453
Nonroad NMIM(4)	80,884	47,520	---	27,429	51,435	25,801
Onroad Mobile(4)	89,753	72,224	---	---	31,415	24,123
Point EGU(2)	1,091	383	---	---	228	---
Point nonEGU(3)	13,431	10,100	---	10,080	19,902	10,035
Total	**356,110**	**229,826**	**---**	**---**	**239,259**	**---**

1) This trend is built from three sources:

2002 V3 with future projection to 2018 (Blue Columns)

2007 V3 with a projection to 2017 and 2020 (Tan Columns)

CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.

Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives

Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.10 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020

New York

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	99,463	72,053	---	63,711	93,946	63,082
Nonroad MAR(4)	31,278	55,900	---	39,249	27,033	36,309
Nonroad NMIM(4)	77,940	72,224	---	43,456	45,059	38,842
Onroad Mobile(4)	319,733	305,589	---	---	78,365	129,829
Point EGU(2)	84,206	46,826	27,018	---	24,175	---
Point nonEGU(3)	26,058	23,080	---	20,452	19,308	20,898
Total	**638,678**	**575,672**	**---**	**---**	**287,886**	**---**
Direct PM2.5 (TPY)						
Area(4)	87,202	63,906	---	68,408	84,231	70,000
Nonroad MAR(4)	1,150	2,258	---	1,134	1,090	986
Nonroad NMIM(4)	7,623	6,710	---	4,426	4,239	3,840
Onroad Mobile(4)	5,898	14,225	---	---	2,542	7,079
Point EGU(2)	3,826	3,553	---	---	9,258	---
Point nonEGU(3)	3,115	2,212	---	2,244	3,568	2,265
Total	**108,814**	**92,863**	**---**	**---**	**104,928**	**---**
Sulfur Dioxide (TPY)						
Area(4)	130,484	70,044	---	11,651	100,453	11,670
Nonroad MAR(4)	5,959	10,639	---	1,631	1,556	1,480
Nonroad NMIM(4)	6,886	3,955	---	118	129	126
Onroad Mobile(4)	10,640	2,177	---	---	1,794	1,866
Point EGU(2)	265,268	106,081	47,968	---	98,150	---
Point nonEGU(3)	15,815	14,696	---	13,110	18,374	13,187
Total	**435,052**	**207,592**	**---**	**---**	**220,456**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	507,365	195,976	---	184,269	440,927	183,721
Nonroad MAR(4)	2,149	4,599	---	4,045	2,345	4,001
Nonroad NMIM(4)	155,390	114,923	---	67,231	102,182	60,939
Onroad Mobile(4)	287,845	161,385	---	---	68,014	70,838
Point EGU(2)	1,433	2,339	---	---	731	---
Point nonEGU(3)	9,870	8,379	---	8,421	12,124	8,455
Total	**964,052**	**487,601**	**---**	**---**	**626,323**	**---**

1) This trend is built from three sources:
   2002 V3 with future projection to 2018 (Blue Columns)
   2007 V3 with a projection to 2017 and 2020 (Tan Columns)
   CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
   Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
   Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.11 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020 Pennsylvania

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
			Oxides of Nitrogen (TPY)			
Area(4)	47,991	47,545	---	45,925	50,015	46,318
Nonroad MAR(4)	41,622	35,853	---	25,801	25,017	23,969
Nonroad NMIM(4)	61,803	55,300	---	30,422	30,567	26,143
Onroad Mobile(4)	346,472	354,117	---	---	91,516	119,917
Point EGU(2)	203,175	187,981	133,095	---	82,461	---
Point nonEGU(2)	91,129	71,961	---	62,174	69,382	60,875
Total	**792,192**	**752,757**	**---**	**---**	**348,958**	**---**
			Direct PM2.5 (TPY)			
Area(4)	74,954	73,514	---	73,054	82,649	73,226
Nonroad MAR(4)	2,664	1,436	---	806	2,516	736
Nonroad NMIM(4)	5,747	5,338	---	3,506	3,280	3,025
Onroad Mobile(4)	5,331	12,461	---	---	2,064	4,614
Point EGU(2)	6,979	18,951	---	---	23,588	---
Point nonEGU(2)	13,036	13,609	---	12,557	14,548	12,677
Total	**108,711**	**125,309**	**---**	**---**	**128,645**	**---**
			Sulfur Dioxide (TPY)			
Area(4)	63,725	66,584	---	55,878	48,475	55,018
Nonroad MAR(4)	2,629	3,698	---	799	515	600
Nonroad NMIM(4)	5,240	2,968	---	84	92	86
Onroad Mobile(4)	10,924	2,509	---	---	1,436	896
Point EGU(2)	892,918	969,936	411,451	---	133,186	---
Point nonEGU(2)	105,189	59,813	---	50,208	83,637	50,371
Total	**1,080,625**	**1,105,508**	**---**	**---**	**267,341**	**---**
			Volatile Organic Compounds (TPY)			
Area(4)	240,829	176,781	---	164,863	230,033	162,374
Nonroad MAR(4)	3,106	4,519	---	3,949	2,780	3,941
Nonroad NMIM(4)	99,180	86,383	---	51,373	67,154	46,392
Onroad Mobile(4)	176,090	163,693	---	---	78,624	58,026
Point EGU(2)	1,033	765	---	---	1,916	---
Point nonEGU(2)	36,358	28,987	---	28,267	39,127	28,480
Total	**556,596**	**461,128**	**---**	**---**	**419,634**	**---**

1) This trend is built from three sources:
   2002 V3 with future projection to 2018 (Blue Columns)
   2007 V3 with a projection to 2017 and 2020 (Tan Columns)
   CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
   Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
   Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.12 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020 Rhode Island

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	3,897	3,469	---	3,301	4,252	3,329
Nonroad MAR(4)	449	3,262	---	2,196	437	1,956
Nonroad NMIM(4)	4,541	4,388	---	2,348	2,281	2,114
Onroad Mobile(4)	16,677	18,775	---	---	5,351	14,380
Point EGU(2)	659	426	574	---	576	---
Point nonEGU(3)	2,388	950	---	854	2,158	862
Total	**28,611**	**31,270**	**---**	**---**	**15,055**	**---**
Direct PM2.5 (TPY)						
Area(4)	2,065	3,896	---	3,922	2,068	3,936
Nonroad MAR(4)	74	128	---	80	78	71
Nonroad NMIM(4)	369	349	---	216	224	191
Onroad Mobile(4)	211	733	---	---	148	1,781
Point EGU(2)	28	56	---	---	156	---
Point nonEGU(3)	175	124	---	124	178	128
Total	**2,922**	**5,286**	**---**	**---**	**2,852**	**---**
Sulfur Dioxide (TPY)						
Area(4)	4,558	3,897	---	3,222	1,368	3,108
Nonroad MAR(4)	43	667	---	95	35	59
Nonroad NMIM(4)	333	211	---	7	7	7
Onroad Mobile(4)	425	161	---	---	100	393
Point EGU(2)	13	15	15	---	55	---
Point nonEGU(3)	2,659	1,501	---	1,415	2,998	1,437
Total	**8,031**	**6,452**	**---**	**---**	**4,563**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	31,403	24,214	---	20,292	23,306	19,750
Nonroad MAR(4)	84	184	---	217	89	214
Nonroad NMIM(4)	7,695	6,721	---	2,885	5,299	2,657
Onroad Mobile(4)	12,538	10,263	---	---	6,305	12,806
Point EGU(2)	37	73	---	---	42	---
Point nonEGU(3)	1,903	922	---	945	1,781	963
Total	**53,659**	**42,377**	**---**	**---**	**36,822**	**---**

1) This trend is built from three sources:

2002 V3 with future projection to 2018 (Blue Columns)

2007 V3 with a projection to 2017 and 2020 (Tan Columns)

CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.

Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives

Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Exhibit 8.13 Annual Air Pollutant Emission Trends by Sector between 2002 and 2020
Vermont

	2002	2007	2010	2017	2018	2020
Data Source(1)	**2002 V3**	**2007 V3**	**CAMD**	**2007 V3**	**2002 V3**	**2007 V3**
Oxides of Nitrogen (TPY)						
Area(4)	3,215	3,996	---	3,641	3,433	3,645
Nonroad MAR(4)	54	846	---	837	62	834
Nonroad NMIM(4)	4,156	3,736	---	2,359	2,198	2,104
Onroad Mobile(4)	20,670	18,072	---	---	4,744	5,407
Point EGU(2)	267	428	173	---	105	---
Point nonEGU(3)	560	441	---	791	466	808
Total	**28,922**	**27,519**	**---**	**---**	**11,008**	**---**
Direct PM2.5 (TPY)						
Area(4)	11,065	13,106	---	12,593	12,059	12,517
Nonroad MAR(4)	10	50	---	42	11	42
Nonroad NMIM(4)	475	454	---	306	291	263
Onroad Mobile(4)	483	723	---	---	144	332
Point EGU(2)	8	0.1	---	---	25	---
Point nonEGU(3)	259	114	---	98	246	97
Total	**12,300**	**14,447**	**---**	**---**	**12,776**	**---**
Sulfur Dioxide (TPY)						
Area(4)	4,088	3,752	---	3,158	4,764	3,085
Nonroad MAR(4)	5	17	---	13	5	13
Nonroad NMIM(4)	366	202	---	7	8	7
Onroad Mobile(4)	894	178	---	---	82	62
Point EGU(2)	3	7	2	---	35	---
Point nonEGU(3)	903	316	---	248	1,127	243
Total	**6,259**	**4,472**	**---**	**---**	**6,021**	**---**
Volatile Organic Compounds (TPY)						
Area(4)	23,266	14,108	---	12,311	26,197	11,904
Nonroad MAR(4)	29	235	---	209	34	212
Nonroad NMIM(4)	10,518	10,337	---	6,713	7,532	5,863
Onroad Mobile(4)	17,288	9,641	---	---	4,072	3,516
Point EGU(2)	122	22	---	---	3	---
Point nonEGU(3)	1,079	373	---	316	1,707	302
Total	**52,302**	**34,716**	**---**	**---**	**39,545**	**---**

1) This trend is built from three sources:
2002 V3 with future projection to 2018 (Blue Columns)
2007 V3 with a projection to 2017 and 2020 (Tan Columns)
CAMD actual 2010 emissions as reported to the US EPA CAMD (White Columns)

(2) Data meets or exceeds target of 90% complete across all years. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data does not meet target of 90% complete across all years. Total represents all units completed by state. Totals are not identical to modeled inventory or TSD.

(4) Data identical to modeled inventory and TSD. No revision to correct inconsistent methodology.
Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives
Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

9.0 ELECTRONIC FILES

Exhibit 9.1 lists the file names for all final deliverables. These files are stored on MARAMA ftp site available for access by states agency personnel.

Exhibit 9.1 Emission Inventory Data Files

File Name	Description
TSD_10_23_ETrend.docx	Regional Emissions Trends Analysis for MANE-VU
All MAR Data All states All Pollutants.xlsx	Complete set of data for MAR. This includes all MANE VU States and all pollutants.
[State] EGU - Reviewed.xlsx	An analysis of MANE VU NOX, SO2, PM25, and VOC emissions for electric generating units where the data has been reviewed and accepted by the state. Replace [State] with the abbreviation for the MANE VU state of interest. Example, for Delaware: DE_EGU-Reviewed.xlsx
[State] EGU.xlsx	An analysis of MANE VU NOX, SO2, PM25, and VOC emissions for electric generating units where the data has not yet been reviewed and accepted by the state. Replace [State] with the abbreviation for the MANE VU state of interest. Example, for New Jersey: NJ_EGU-Reviewed.xlsx
[Pollutant] Area Tier 3 Analysis.xlsx	An analysis of NO_X emissions from area sources by MANE VU state, pollutant and year. This dataset breaks the data into Tiers up to Tier 3. Replace [Pollutant] with NOX, SO2, PM25 or SO2. Example NOX Area Tier3 Analysis.xlsx.
[State] NonEGU.xlsx	An analysis for Non-EGUs by MANE VU state, this includes all pollutants for each MANE VU state. Replace [State] with the abbreviation for the MANE VU state of interest. Example for New York: NY NOnEGU.xlsx.
Nonroad _Complete_Analysis.xlsx	An analysis of Nonroad emission trend by pollutant, MANE VU state and year.
Onroad Analysis.xlsx	Summarized set of data for Onroad at the state level. This includes all pollutants for all MANE VU states and all years.

10.0 REFERENCES

CAMD 2010. Data downloaded on July 14th 2011.
http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard

EIA 2005. Annual Energy Outlook 2005 with Projections to 2025
ftp://tonto.eia.doe.gov/forecasting/0383 (2005).pdf

EIA 2008. Annual Energy Outlook 2008 with Projections to 2030.
http://www.eia.gov/oiaf/aeo/pdf/0383(2008).pdf

EIA 2009. Annual Energy Outlook 2009 with Projections to 2030
http://www.eia.gov/oiaf/aeo/pdf/0383(2009).pdf.

EIA 2010. Annual Energy Outlook 2010 with Projections to 2035
http://www.eia.gov/oiaf/aeo/pdf/0383(2010).pdf

ERTAC 2009. ERTAC Rail Emissions Inventory Part 3: Class II and III Locomotives. Michelle Bergin, GA Environmental Protection Division Matthew Harrell, IL Environmental Protection Agency Mark Janssen, Lake Michigan Air Directors Consortium http://www.gaepd.org/air/airpermit/downloads/planningsupport/regdev/locomotives/class2_3_doc2012.pdf

MANE-VU 2006. Prepared by E.H. Pechan & Associates, Inc. Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3. November 2006. http://www.marama.org/technical-center/emissions-inventory/2002-inventory-and-projections/mane-vu-2002-emissions-inventory

MANE-VU 2007. Prepared by MACTEC Federal Programs, Inc. Development of Emission Projections for 2009, 2012, and 2018 for NonEGU Point, Area, and Nonroad Sources in the MANE-VU Region. February 2007. http://www.marama.org/technical-center/emissions-inventory/2002-inventory-and-projections/mane-vu-future-year-emissions-inventory

MANE-VU 2011a. Submitted by AMEC Environment & Infrastructure and SRA International, Inc. Technical Support Document for the Development of the 2007 Emissions Inventory for Regional Air Quality Modeling in the Northeast/Mid-Atlantic Region Version 3.3. January 2011. http://www.marama.org/technical-center/emissions-inventory/2007-emissions-and-projections/version-3-2007-emissions-inventory

MANE-VU 2011b. Submitted by AMEC Environment & Infrastructure and SRA International, Inc. Technical Support Document for the Development of the 2017/2020 Emission Inventories for Regional Air Quality Modeling in the Northeast/Mid-Atlantic

Region Version 3.3. January 2012. http://www.marama.org/technical-center/emissions-inventory/2007-emissions-and-projections/future-year-inventory-version-3

MARAMA 2009a. Documentation of 2018 Emissions from Electric Generating Units in the Eastern United States for MANE-VU's Regional Haze Modeling. http://marama.org/publications_folder/EGU_Projections_Summary_Final_Aug_2009.pdf

MARAMA 2009b. Emissions Factors for Condensable Particulate Matter Emissions From Electric Generating Units. http://marama.org/publications_folder/TechnicalMemo_EFs_for_CPM_from_EGUsRevised_with_PAcomments_20090129.pdf

MARAMA 2012. Combined Quality Assurance Project Plan (QAPP) and Work Plan.

MARAMA 2013. MANE-VU States Emissions Inventory Completeness by State, Sector and Pollutant.

NESCAUM 2006. Contributions to Regional Haze in the Northeast and Mid-Atlantic United States. http://des.nh.gov/organization/divisions/air/do/asab/rhp/documents/b.pdf

NESCAUM 2006b. Development of MANE-VU Mobile Source Projection Inventories for SMOKE/MOBILE6 Application. http://www.nescaum.org/documents/nescaum-manevu-2002-and-future-onroad-inventory-20060620.pdf

NESCAUM 2011. Development of MANE-VU Onroad Mobile Source Emissions for 2007 and 2020 using MOVES. Prepared by Huiyan Yang of NESCAUM. http://www.nescaum.org/documents/nescaum-2007-2020-moves-modeling-tsd-20120118.pdf

USEPA 2005. Documentation For Aircraft, Commercial Marine Vessel, Locomotive, and other Nonroad Components of the National Emissions Inventory, Volume I – Methodology; EPA Contract No.: 68-D-02-063. Eastern Research Group (ERG) for E.H. Pechan & Associates, Inc. Prepared for the US EPA Emissions, Monitoring and Analysis Division, Sept. 30, 2005. ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002nei_mobile_nonroad_methods.pdf

USEPA 2009a. Documentation for Aircraft Component of the National Emissions Inventory Methodology. ERG No.: 0245.02.302.001. For Laurel Driver of OAQPS. http://www.epa.gov/ttnchie1/net/aircraft_component.pdf

USEPA 2009b. Air Pollution Emissions from Highway Vehicles: What MOVES Tells Us. M. Beardsley, D. Brzezinski, J. Koupal and J. Warila, US EPA OTAQ. Presented at the

2009 USEPA Emissions Inventory Conference in Baltimore MD.
http://www.epa.gov/ttn/chief/conference/ei18/session6/beardsley.pdf

USEPA 2010. U.S. Environmental Protection Agency. Transport Rule Emission Inventories Notice of Data Availability (NODA). Docket ID No. EPA-HQ-OAR-2009-0491. October 27, 2010. TR_EI_NODA_relevant_CoSTpackets_and_inventories.xls
ftp://ftp.epa.gov/EmisInventory/2005v4/tr_ei_noda

USEPA 2011. U.S. Environmental Protection Agency. Emission Standards Reference Guide.
http://www.epa.gov/oms/regs/nonroad/aviation/420f10013.pdf

USEPA 1997. AP-42. Compilation of Air Pollutant Emission Factors. Fifth Edition.
http://www.epa.gov/ttnchie1/ap42/

Appendix A

State Review Workgroup

State	Emission Inventory Contact	SIP Writer Contact
Delaware	David Fees	Jack Sipple
New Jersey	Judy Rand	Sharon Davis
	Danny Wong	Stella Oluwaseun-Apo
		Ray Papalski
Rhode Island	Karen Slattery	Karen Slattery
Vermont	Jeff Merrell	Rich Periot
Connecticut	Steven Potter	Wendy Jacobs
New Hampshire	David Healy	Jeff Underhill
New York	Ona Papageorgiou	Diana Rivenburgh
Maine	Kristen Colby	Jeff Crawford
Pennsylvania	Randy Bordner (stationary)	Randy Bordner
	Chris Trostle (mobile)	
Maryland	Roger Thunell	Brian Hug
		Mary Jane Rutkowski
District of Columbia	Jessica Daniels	Jessica Daniels
Massachusetts	Ken Santlal	William Lamkin

ATTACHMENT E

New Hampshire Administrative Rule Env-A 2302.02
Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers
(Amended)

Effective November 22, 2014, Env-A 2302.02 reads as follows (changes to intro and (c) only):

Env-A 2302.02 Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers. For any tangential-firing, dry-bottom boiler subject to this chapter, the following emission rates shall apply:

(a) Beginning on July 1, 2013, SO2 emissions shall not exceed 0.50 pound (lb) per million BTUs on a 30-day rolling average basis as recorded by a CEMS as specified in Env-A 2303;

(b) NOx emissions shall not exceed limitations specified in permit conditions established in accordance with Env-A 600; and

(c) TSP emissions shall not exceed 0.04 lb. per million BTUs, demonstrated by completion of stack tests as specified in Env-A 2304.02.

APPENDIX A: STATE STATUTES, FEDERAL STATUTES/REGULATIONS IMPLEMENTED

Rule Number(s)	**State Statute(s) Implemented**	**Federal Statute or Regulation Implemented**
Env-A 2302.02 intro, (c)	RSA 125-C:1 *et seq.*	42 U.S.C. §7491; 40 §CFR 51.308

ATTACHMENT F

Evidence of Plan's Adoption

[40 CFR Part 51, Appendix V, 2.1(b)]

EVIDENCE OF PLAN'S ADOPTION

The cover letter, signed by the Governor's designee, is evidence that the State of New Hampshire has adopted this revision to the State Implementation Plan (SIP). The only state requirement for SIP submittals is that, at least 30 days before the date of any public hearing related to SIP revisions, public notice shall be published in a newspaper of general daily statewide circulation (see Env-A 204.01). Then, if a hearing is held, it must be conducted in accordance with Env-C 205 (see Env-A 204.02). For evidence of the plan's adoption in accordance with Env-A 204, see the Evidence of Public Notice and the Certification of Public Hearing (Attachments I and J).

ATTACHMENT G

Evidence of Legal Authority

[40 CFR Part 51, Appendix V, 2.1(c)]

Laws of New Hampshire, RSA 125-C:6
Powers and Duties of the Commissioner

This page is intentionally left blank.

TITLE X
PUBLIC HEALTH

CHAPTER 125-C
AIR POLLUTION CONTROL

Section 125-C:6

125-C:6 Powers and Duties of the Commissioner. – In addition to the other powers and duties granted herein, the commissioner shall have and may exercise the following powers and duties:

I. Exercising general supervision of the administration and enforcement of this chapter and all rules adopted and orders promulgated under it;

II. Developing a comprehensive program and provide services for the study, prevention, and abatement of air pollution;

III. Conducting and encouraging studies relating to air quality;

IV. Collecting and disseminating the results of studies relating to air quality;

V. Advising, consulting, and cooperating with the cities and towns and other agencies of the state, federal government, interstate agencies, and other affected agencies or groups in matters relating to air quality;

VI. Encouraging local units to promote cooperation by the people, political subdivisions, industries, and others in preventing and controlling air pollution in the state;

VI-a. Encouraging the recycling of waste oil by allowing qualified marketers to sell, and qualified facilities to burn, a mixture that consists of at least 90 percent virgin no. 6 oil and the remainder complying with the used fuel oil specifications in 40 CFR, section 279.11, table 1;

VII. Entering at all reasonable times in or upon any private or public property, except private residences, for the purpose of inspecting or investigating any condition which is believed to be either an air pollution source or in violation of any of the rules or orders promulgated hereunder. Any information, other than emission data, relating to secret processes or methods of manufacture or production obtained in the course of such inspection or investigation shall not be disclosed by the commissioner without permission of the person whose source is inspected or investigated;

VIII. Accepting, receiving, and administering grants or other funds or gifts for the purpose of carrying out any of the functions of this chapter, including such monies given under any federal law to the state for air quality control activities, surveys, or programs;

IX. Consulting the air resources council established by RSA 21-O:11 on the policies and plans for the control and prevention of air pollution;

X. Exercising all incidental powers necessary to carry out the purposes of this chapter;

XI. Conducting emission tests and requiring owners or operators of stationary sources to install, maintain, and use emission monitoring devices and to make periodic reports to the commissioner on the nature and amounts of emissions from such stationary sources. The commissioner shall have the authority to make such data available to the public and as correlated with any applicable emission standards;

XII. Carrying out a program of inspection and testing of all modes of transportation, to enforce compliance with applicable emission standards when necessary and practicable and to control or limit the operation of motor vehicular and other modes of transportation when in the opinion of the commissioner such modes of transportation are producing or pose an imminent danger of producing levels of air pollutants that will result in a violation of an ambient air quality standard, or that will result in a significant deterioration, as defined in applicable federal regulations, of existing air quality in an area classified as a "clean air" area by state or federal regulations;

XIII. Coordinating and regulating the air pollution control programs of political subdivisions of the state and entering agreements with said subdivisions to plan or implement programs for the control and abatement of air pollution;

XIV. Establishing and operating a statewide system under which permits shall be required for the construction, installation, operation, or modification of air pollution devices and sources, which system shall be established pursuant to RSA 125-C:11 and the sections which follow. The authority vested in the commissioner by this section shall include the power to delay or prevent any construction, modification, or operation of said air pollution sources and modifications which, in the opinion of the commissioner, would cause the ambient air pollution level in the locality of such construction, modification, or operation to exceed limits for ambient concentrations established by the New Hampshire state implementation plan adopted pursuant to the Clean Air Act as amended, or which construction, modification, or operation would, in the opinion of the commissioner, violate any provision of any land use plan established by the New Hampshire state implementation plan;

XIV-a. Establishing fuel quality standards and testing requirements for biomass other than round wood and wood chips derived from round wood or waste wood such as limbs, branches, brush, slash, bark, stumps, sawdust, saw mill trimmings, clean pallets, and untreated wood scraps from furniture and other manufacture and eligible biomass fuel related to the combustion of such materials at stationary sources. The commissioner may establish such standards as necessary to maintain statewide compliance with Clean Air Act standards and RSA 125-I.

XV. Implementing a program of prevention of significant deterioration of ambient air quality by establishing air quality increments limiting the maximum allowable increases in the amounts of air pollutants provided such increments are not less stringent than those specified in the Clean Air Act and amendments thereto, and in regulations promulgated thereunder;

XVI. Establishing an air quality monitoring equipment replacement program to provide for sufficient annual replacement to meet federal Environmental Protection Agency guidelines and to assure the reliability and accuracy of the network equipment.

XVII. Implementing a program to control the emissions of air contaminants from consumer products for purposes of RSA 485:16-c, by establishing limits on the manufacture, use, or sale of such products, provided that such limits are not less stringent than those established under the Clean Air Act and amendments thereto, and in regulations promulgated under the Clean Air Act.

Source. 1979, 359:2. 1981, 332:3. 1986, 202:6, I(h), 9, 10. 1988, 277:1. 1995, 192:1. 1996, 228:104. 2001, 293:6, eff. July 17, 2001. 2008, 113:4, eff. Aug. 2, 2008. 2010, 183:8, eff. June 21, 2010.

ATTACHMENT H

Evidence That New Hampshire Followed All Procedural Requirements

[40 CFR Part 51, Appendix V, 2.1(e)]

EVIDENCE THAT NEW HAMPSHIRE FOLLOWED ALL PROCEDURAL REQUIREMENTS

The only state requirement for SIP submittals is that, at least 30 days before the date of any public hearing related to SIP revisions, public notice shall be published in a newspaper of general daily statewide circulation (see Env-A 204.01). Then, if a hearing is held, it must be conducted in accordance with Env-C 205 (see Env-A 204.02). For evidence of the plan's adoption in accordance with Env-A 204, see the Evidence of Public Notice and the Certification of Public Hearing (Attachments I and J).

ATTACHMENT I

Evidence of Public Notice

[40 CFR Part 51, Appendix V, 2.1(f)]

This page is intentionally left blank.

UNION LEADER CORPORATION

P O BOX 9513
MANCHESTER, NH 03108

RECEIVED
NEW HAMPSHIRE
AUG 25 2014
AIR RESOURCES DIVISION

0000059625
STATE OF NH – AIR RESOURCES CO
ATTN: ELAINE BOLDUC
PO BOX 95
CONCORD NH 03302–0095

I hereby certify that the legal notice: (0001232180) PUB HEARING 9/23 AT 11AM
was published in the New Hampshire Union Leader
On:
08/22/2014.

State of New Hampshire
Hillsborough County

Subscribed and sworn to before me this

22nd **day of** August 2014

Heidi A Gagnon
Notary Public

HEIDI A. GAGNON
MY COMMISSION EXPIRES JULY 13, 2016
NOTARY PUBLIC
NEW HAMPSHIRE

State S9625

Notices

Legal Notice

STATE OF NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES AIR RESOURCES DIVISION CONCORD, NH

NOTICE OF PUBLIC HEARING

In accordance with RSA 541-A:6 and N.H. Admin. Rule Env-A 204.01(b) and 40 CFR § 51.102, notice is hereby given that the New Hampshire Department of Environmental Services, Air Resources Division (the Department), will hold a public hearing on proposed amendments to the NH Code of Administrative Rules and the State Implementation Plan on **Tuesday, September 23, 2014.** The public hearing will be held in Rooms 213-214, second floor of the offices of the Department, 29 Hazen Drive, Concord, NH.

At **11:00 a.m. on Tuesday, September 23, 2014,** the Department will receive testimony from the public concerning the amendment to **Env-A 2302.02, Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers,** and the **draft Regional Haze Progress Report,** a component of the State Implementation Plan (SIP).

Env-A 2300 establishes standards for the mitigation of regional haze. Env-A 2302.02 specifically establishes emission standards that apply to tangential-firing, dry-bottom boilers. Paragraph (c) of this section is proposed to be amended to comply with EPA's conditional approval of New Hampshire's Regional Haze SIP submitted in 2010, as revised in 2011. EPA approved NH's Regional Haze SIP, including Env-A 2300, based in part on the condition that DES revise the PSNH Newington Station total suspended particulate (TSP) limit. The new TSP limit was to be established based on data obtained in a more recent stack test. The stack testing has been completed, so the Department is proposing a new, more stringent TSP limit for the boiler at Newington Station. The amended rule will be submitted to EPA for approval along with the Regional Haze Progress Report.

New Hampshire previously received conditional approval of its Regional Haze Plan from the U.S. Environmental Protection Agency (EPA) as a required component of the SIP. The Regional Haze Plan establishes reasonable progress goals for visibility improvement and includes strategies to reduce air pollutant emissions from sources contributing to visibility impairment at mandatory Class I federal areas, including certain national parks and wilderness areas.

New Hampshire is required to submit a report to EPA every 5 years that evaluates progress toward the reasonable progress goal for each mandatory Class I federal area located within the state and each mandatory Class I federal area located outside the state that may be affected by emissions from within the state. The progress report is intended to fulfill the requirements of 40 CFR 51.308(g), (h), and (i) and must be in the form of a SIP revision that complies with the procedural requirements of 40 CFR 51.102 and 51.103.

Testimony may be presented orally and/or in writing at the public hearing. The Department will receive written comments on the proposed rule and the draft Regional Haze Progress Report until **4:00 p.m. on Friday, October 3, 2014.** Please submit written comments regarding the rule amendment to Karla McManus, Planning and Rules Manager, at Karla.McManus@des.nh.gov. Please submit written comments regarding the Regional Haze Progress Report to Charles Martone at Charles.Martone@des.nh.gov. Alternatively, comments can be mailed to either of us at the Air Resources Division, NH Department of Environmental Services, 29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095, Fax (603) 271-1381.

Copies of all documentation pertaining to rulemakings for all air rules and the Regional Haze Progress Report are available for inspection at the offices of the Department at the address stated above. The proposed rule is also posted at http://des.nh.gov/organization/commissioner/legal/rulemaking/index.htm. The draft Regional Haze Progress report is posted at http://des.nh.gov/organization/divisions/air/do/asab/rhp/index.htm. Questions regarding the proposed rulemaking should be directed to Karla McManus at (603) 271-6854. Questions regarding the draft Regional Haze Progress Report should be directed to Charles Martone at (603) 271-1089.

Thomas S. Burack
Commissioner
NH Department of
Environmental Services

Dated: August 15, 2014
(UL - Aug. 22)

Legal Notice

Notice of Sale Pursuant to RSA 444 and RSA 450

On **September 28, 2014 at 9am,** Atlantic Auction Company will sell at auction the business personal property of the late Dick Plantier, and his businesses Big Beaver Contractors and Real Estate Concepts & Development, LLC. Auction to be held at 263 Dover Rd., Chichester, NH.
(UL - Aug. 18, 20, 22)

Legal Notice

Public Notice

The Mental Health Center of Greater Manchester is applying for Reapproval as a Community Mental Health Program to provide services and supports to people with serious mental illness in Region VII (covering the towns and cities of Auburn, Bedford, Candia, Goffstown, Hooksett, Londonderry, Manchester, and New Boston.). In considering this request for Reapproval, the Bureau of Behavioral Health (BBH), Department of Health and Human Services, is interested in comments from other agencies, consumers, family members, and the general public. Any interested individual, group, or agency is encouraged to send comments to BBH describing the Community Mental Health Program's ability to work within local communities and offer responsive and flexible services that meet the needs of adults with serious mental illness, children with serious emotional disorders, and their families.

Please comment in writing by Monday, September 8, 2014, to:

Michael Kelly, Quality Improvement
Bureau of Behavioral Health
105 Pleasant Street, Main Bldg.
Concord NH 03301

Or contact Michael Kelly at the Bureau of Behavioral Health at 271-5052 or 1-800-852-3345 ext. 5052.
(UL - Aug. 22, 24, 25)

Legal Notice

STATE OF NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES AIR RESOURCES DIVISION CONCORD, NH

NOTICE OF PUBLIC HEARING

In accordance with RSA 541-A:6 and N.H. Admin. Rule Env-A 204.01(b) and 40 CFR § 51.102, notice is hereby given that the New Hampshire Department of Environmental Services, Air Resources Division (the Department), will hold a public hearing on proposed amendments to the NH Code of Administrative Rules and the State Implementation Plan on **Tuesday, September 23, 2014.** The public hearing will be held in Rooms 213-214, second floor of the offices of the Department, 29 Hazen Drive, Concord, NH.

At **11:00 a.m. on Tuesday, September 23, 2014,** the Department will receive testimony from the public concerning the amendment to **Env-A 2302.02, Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers,** and the **draft Regional Haze Progress Report,** a component of the State Implementation Plan (SIP).

Env-A 2300 establishes standards for the mitigation of regional haze.

Legal Notice

NOTICE OF FINDING OF NO SIGNIFICANT IMPACT ON THE ENVIRONMENT AND NOTICE OF INTENT TO REQUEST RELEASE OF FUNDS

August 22, 2014
New Hampshire Housing Finance Authority
32 Constitution Drive
Bedford, NH 03110
603-472-8623

These notices shall satisfy two separate but related procedural requirements for activities to be undertaken by New Hampshire Housing Finance Authority (NHHFA).

REQUEST FOR RELEASE OF FUNDS

On or about September 8, 2014, NHHFA will submit a request to the U.S. Department of Housing and Urban Development (HUD) for the release of FHA Risk-Sharing funds (issue a Firm Approval Letter) under Section 524(c) of the Housing and Community Development Act of 1992 to undertake a refinancing on the following property: Mast Landing Senior Housing, 30 Grapevine Drive, Dover, NH 03820. The estimated cost for the project would be approximately $7,000,000.00 for Phase 1 and $5,000,000.00 for Phase 2 for an estimated total of $12,000,000.00.

FINDING OF NO SIGNIFICANT IMPACT

NHHFA has determined that such request for the issuance of a Firm Approval Letter will not constitute an action significantly affecting the quality of the human environment, and, accordingly, the above-named NHHFA has decided not to prepare an Environmental Impact Statement under the National Environmental Policy Act of 1969 (NEPA) based on the results of the Environmental Assessment completed for the project.

An Environmental Review Record (ERR) for the project has been made by NHHFA which documents the environmental review of the project and more fully sets forth the reasons why such statement is not required. The ERR is on file at the above address and is available for public review and/or copying weekdays 8:30 am to 4:00 pm.

No further environmental review of such project is proposed to be conducted prior to the request for the issuance of a Firm Approval Letter.

PUBLIC COMMENTS

All interested individuals, groups, or agencies disagreeing with this decision are invited to submit written comments for consideration by NHHFA's Management and Development Division. Such written comments should be received by NHHFA on or before September 6, 2014. All such comments so received will be considered and NHHFA will not request the issuance of a Firm Approval Letter, or take any administrative action on the project prior to September 8, 2014.

RELEASE OF FUNDS

NHHFA certifies to HUD that NHHFA and Dean J. Christon, in his official capacity as Executive Director of NHHFA, consent to accept the jurisdiction of the Federal Courts if an action is brought to enforce responsibilities in relation to the environmental review process and that these responsibilities have been satisfied. HUD's approval of the certification satisfies its responsibilities under NEPA and related laws and authorities, and allows NHHFA to use FHA mortgage insurance through the Risk Sharing Program.

the draft Regional Haze Progress Report until **4:00 p.m. on Friday, October 3, 2014.** Please submit written comments regarding the rule amendment to Karla McManus, Planning and Rules Manager, at Karla.McManus@des.nh.gov. Please submit written comments regarding the Regional Haze Progress Report to Charles Martone at Charles.Martone@des.nh.gov. Alternatively, comments can be mailed to either of us at the Air Resources Division, NH Department of Environmental Services, 29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095, Fax (603) 271-1381.

Copies of all documentation pertaining to rulemakings for all air rules and the Regional Haze Progress Report are available for inspection at the offices of the Department at the address stated above. The proposed rule is also posted at http://des.nh.gov/organization/commissioner/legal/rulemaking/index.htm. The draft Regional Haze Progress report is posted at http://des.nh.gov/organization/divisions/air/do/asab/rhp/index.htm. Questions regarding the proposed rulemaking should be directed to Karla McManus at (603) 271-6854. Questions regarding the draft Regional Haze Progress Report should be directed to Charles Martone at (603) 271-1089.

Thomas S. Burack
Commissioner
NH Department of
Environmental Services

Dated: August 15, 2014
(UL - Aug. 22)

Legal Notice

STATE OF NEW HAMPSHIRE
DEPARTMENT OF
ENVIRONMENTAL SERVICES
AIR RESOURCES DIVISION
CONCORD, NEW HAMPSHIRE

NOTICE OF PERMIT REVIEW PUBLIC HEARING AND COMMENT PERIOD

Pursuant to the New Hampshire Code of Administrative Rules, Env-A 621.02, notice is hereby given that the Director of the New Hampshire Department of Environmental Services, Air Resources Division (Director), has received an application for a state permit to operate from, and based on the information received to date, intends to **issue such permit to:**

Continental Paving, Inc.
16 Morgan Road
Litchfield, New Hampshire
For the Following Devices:
Hot Mix Asphalt Drum Plant #909

The application and draft permit are on file with the Director, New Hampshire Department of Environmental Services, Air Resources Division, 29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095, (603) 271-1370. Information may be reviewed at the office during working hours from 8 a.m. to 4 p.m., Monday through Friday. Additional information may also be obtained by contacting Sheila Rydel at the above address and phone number. Requests for a public hearing and/or written comments filed with the Director in accordance with Env-A 621.06, and received no later than **Monday, September 22, 2014,** shall be considered by the Director in making a final decision.

Craig A. Wright
Director
Air Resources Division

(UL - Aug. 22)

Env-A 2302.02 specifically establishes emission standards that apply to tangential-firing, dry-bottom boilers. Paragraph (c) of this section is proposed to be amended to comply with EPA's conditional approval of New Hampshire's Regional Haze SIP submitted in 2010, as revised in 2011. EPA approved NH's Regional Haze SIP, including Env-A 2300, based in part on the condition that DES revise the PSNH Newington Station total suspended particulate (TSP) limit. The new TSP limit was to be established based on data obtained in a more recent stack test. The stack testing has been completed, so the Department is proposing a new, more stringent TSP limit for the boiler at Newington Station. The amended rule will be submitted to EPA for approval along with the Regional Haze Progress Report.

New Hampshire previously received conditional approval of its Regional Haze Plan from the U.S. Environmental Protection Agency (EPA) as a required component of the SIP. The Regional Haze Plan establishes reasonable progress goals for visibility improvement and includes strategies to reduce air pollutant emissions from sources contributing to visibility impairment at mandatory Class I federal areas, including certain national parks and wilderness areas.

New Hampshire is required to submit a report to EPA every 5 years that evaluates progress toward the reasonable progress goal for each mandatory Class I federal area located within the state and each mandatory Class I federal area located outside the state that may be affected by emissions from within the state. The progress report is intended to fulfill the requirements of 40 CFR 51.308(g), (h), and (i) and must be in the form of a SIP revision that complies with the procedural requirements of 40 CFR 51.102 and 51.103.

Testimony may be presented orally and/or in writing at the public hearing. The Department will receive written comments on the proposed rule and the draft Regional Haze Progress Report until **4:00 p.m. on Friday, October 3, 2014.** Please submit written comments regarding the rule amendment to Karla McManus, Planning and Rules Manager, at Karla.McManus@des.nh.gov. Please submit written comments regarding the Regional Haze Progress Report to Charles Martone at Charles.Martone@des.nh.gov. Alternatively, comments can be mailed to either of us at the Air Resources Division, NH Department of Environmental Services, 29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095, Fax (603) 271-1381.

Copies of all documentation pertaining to rulemakings for all air rules and the Regional Haze Progress Report are available for inspection at the offices of the Department at the address stated above. The proposed rule is also posted at http://des.nh.gov/organization/commissioner/legal/rulemaking/index.htm. The draft Regional Haze Progress report is posted at http://des.nh.gov/organization/divisions/air/do/asab/rhp/index.htm. Questions regarding the proposed rulemaking should be directed to Karla McManus at (603) 271-6854. Questions regarding the draft Regional Haze Progress Report should be directed to Charles Martone at (603) 271-1089.

Thomas S. Burack
Commissioner
NH Department of
Environmental Services

Dated: August 15, 2014
(UL - Aug. 22)

OBJECTIONS TO THE RELEASE OF FUNDS

HUD will consider objections to its release of funds (issuance of a Firm Approval Letter) and NHHFA's certification for a period of fifteen days following the anticipated submission date or its actual receipt of the request (whichever is later) only if they are on one of the following bases: (a) the certification was not executed by the Certifying Officer of NHHFA; (b) NHHFA has omitted a step or failed to make a decision or finding required by HUD regulations at 24 CFR Part 58; (c) the grant recipients have committed funds or incurred costs not authorized by 24 CFR Part 58 before approval of an issuance of a Firm Approval Letter; or (d) another Federal agency acting pursuant to 40 CFR Part 1504 has submitted a written finding that the project is unsatisfactory from the standpoint of environmental quality. Objections must be prepared and submitted in accordance with the required procedures (24 CFR Part 58) and shall be addressed to HUD - Manchester Field Office, Norris Cotton Building, 275 Chestnut Street, Manchester, NH 03101. Objections to the issuance of a Firm Approval Letter on bases other than those stated above will not be considered by HUD. Potential objectors should contact HUD - Manchester to verify the actual last day of the objection period.

Dean J. Christon, Executive Director
New Hampshire Housing
Finance Authority
32 Constitution Drive
Bedford, NH 03110
603-472-8623

(UL - Aug. 22)

Legal Notice

STATE OF NEW HAMPSHIRE
DEPARTMENT OF
ENVIRONMENTAL SERVICES
AIR RESOURCES DIVISION
CONCORD, NEW HAMPSHIRE

NOTICE OF PERMIT REVIEW PUBLIC HEARING AND COMMENT PERIOD

Pursuant to the New Hampshire Code of Administrative Rules, Env-A 621.02, notice is hereby given that the Director of the New Hampshire Department of Environmental Services, Air Resources Division (Director), has received an application for a state permit to operate from, and based on the information received to date, intends to **issue such permit to:**

BAE SYSTEMS Information and Electronic Systems Integration, Inc.
95 Canal Street
Nashua, New Hampshire
For the Following Devices:
Two Boilers and One Emergency Generator

The application and draft permit are on file with the Director, New Hampshire Department of Environmental Services, Air Resources Division, 29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095, (603) 271-1370. Information may be reviewed at the office during working hours from 8 a.m. to 4 p.m., Monday through Friday. Additional information may also be obtained by contacting Patricia North at the above address and phone number. Requests for a public hearing and/or written comments filed with the Director in accordance with Env-A 621.06, and received no later than **Monday, September 22, 2014,** shall be considered by the Director in making a final decision.

Craig A. Wright
Director
Air Resources Division

(UL - Aug. 22)

ATTACHMENT J

Certification of Public Hearing

[40 CFR Part 51, Appendix V, 2.1(g)]

The State of New Hampshire
Department of Environmental Services

Thomas S. Burack, Commissioner

CERTIFICATION OF PUBLIC HEARING

**Revision to the State Implementation Plan (SIP):
Regional Haze Progress Report and Amendment to Env-A 2302.02,
Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers.**

I hereby certify that:

In accordance with New Hampshire Administrative Rule Env-A 204.01(b) and Federal regulations at 40 CFR § 51.102, public notice was given that the New Hampshire Department of Environmental Services (the Department) intended to submit for the approval of the U.S. Environmental Protection Agency (EPA) a revision to the State Implementation Plan (SIP): Regional Haze Progress Report and amendment to New Hampshire Administrative Rule Env-A 2302.02, Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers.

A public hearing on the SIP submittal was held at 11:00 a.m., Tuesday, September 23, 2014, in Rooms 213-214, second floor of the Department's offices at 29 Hazen Drive, Concord, NH 03301.

Opportunity was provided for members of the public to submit oral comments during the hearing or written comments at any time until 4:00 p.m. on Friday, October 3, 2014, for consideration by the Department in preparing the final SIP submittal.

A copy of the draft SIP submittal, including amended rule, was available for public inspection at the Department's offices at 29 Hazen Drive, Concord, NH, during regular working hours from 8:00 a.m. to 4:00 p.m., Monday through Friday, throughout the comment period. The draft SIP revision was also available for downloading from the Department's website at http://des.nh.gov.

The notice was published in the *Union Leader*, a newspaper of general, statewide circulation, on Friday, August 22, 2014, more than 30 days prior to the hearing date.

The above statements are true to the best of my knowledge and belief.

Craig A. Wright
Director
Air Resources Division

12/16/14
Date

www.des.nh.gov
29 Hazen Drive • PO Box 95 • Concord, NH 03302-0095
(603) 271-3503 • TDD Access: Relay NH 1-800-735-2964

ATTACHMENT K

Compilation of Public Comments and NHDES’s Response Thereto

[40 CFR Part 51, Appendix V, 2.1(h)]

Notes on Conference Call with Federal Land Managers

Subject: New Hampshire's Regional Haze 5-Year Progress Report

Date/Time: July 17, 2014 / 10:30 AM

Attendees: Holly Salazer, National Park Service
Tim Allen, US Fish and Wildlife Service
Ralph Perron, US Forest Service
Bret Anderson, US Forest Service
Anne Arnold, EPA Region I
Jeff Underhill, NHDES
Barb Hoffman, NHDES
Dave Healy, NHDES
Charlie Martone, NHDES

Discussion:

NPS had no substantive issues with the preliminary draft progress report but expressed interest in New Hampshire's intentions and future actions regarding regional haze. In particular, NPS was interested in the status of any effort by New Hampshire to adopt standards for low-sulfur fuel oil.

NHDES responded that the agency is interested in adopting requirements for use of low-sulfur fuel oil, but the situation is dependent on legislative action. NHDES's air director intends to begin such discussions with the legislature this fall, but NHDES cannot promise that a bill will be developed and passed in the next session. NHDES is positioned to push forward on this issue. Whether or not NH is successful in this endeavor, the adoption of similar requirements in surrounding states means that New Hampshire's fuel oil supply is likely to be *de facto* low-sulfur product.

NPS also expressed interest in the future disposition of New Hampshire's EGUs, especially the coal-fired units. Is there a possibility that recent emission reductions (attributable in part to a reduced reliance on coal) might be reversed?

NHDES reiterated that much of the recent reduction in New Hampshire's SO_2 emissions has been due to the installation of the flue gas desulfurization system at PSNH Merrimack Station, which will continue to provide emissions reductions even if there is a reversal in the trend away from coal. NHDES has little control over future operation, dispatch, or retirement of the fossil-fuel fleet. The future of these units will largely be determined by the marketplace and the decisions of the New Hampshire Public Utilities Commission. Lower utilization of coal-fired units has been tied to increasing use of natural gas for electrical generation. However, natural gas supplies in New England are severely constrained by pipeline capacities, so continued use of coal at some level is expected. Related to the question of coal unit retirements is the fact that NHPUC will soon be ruling on the possible divestiture of PSNH's power plants. (PSNH is the only electric utility in the state that owns generating units.)

USFWS thought the preliminary draft was a good effort and directed attention to the next round of regional haze planning. (The second 10-year planning period begins in 2018.) The agency believes that the planning process should be made more efficient and improved in other ways, with more attention to background haze levels and a greater emphasis on controllable emissions.

NHDES commented that it was familiar with NPS's recommendations to EPA and agrees with many of the recommendations for improving the planning process.

NPS indicated that written comments would be sent soon.

United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

TRANSMITTED VIA ELECTRONIC MAIL - NO HARDCOPY TO FOLLOW

N3615 (2350)

July 17, 2014

Charles H. Martone
New Hampshire Department of Environmental Services
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

Dear Mr. Martone:

Thank you for the opportunity to review and comment on New Hampshire's draft Regional Haze 5-Year Progress Report. We believe that NH has met the requirements for the periodic progress report as outlined in 40 CFR 41.508 (g). NH has demonstrated through technical analyses by the Mid-Atlantic/Northeast Visibility Union (MANE-VU) that sulfate is the major pollutant contributing to visibility impairment at Class I areas in NH and that reducing sulfur dioxide (SO_2) emissions is the most effective approach to improve visibility. Monitoring data demonstrate that at several Class I areas in the MANE-VU region, visibility on the 20% worst days in the 2007-2011 period is better than the 2018 visibility goals that were set by the MANE-VU states.

Three electric generating units (EGU) in NH were among the 167 EGU targeted by MANE-VU for SO_2 controls. All three EGU have installed controls and reduced SO_2 emissions by more than 90% compared to 2002 levels. Table 6-1 demonstrates that between 2002 to 2012, SO_2 and NO_x emissions from all EGU in NH dropped by 96 and 64%, respectively, due to a combination of emissions controls and shifts in generation from predominantly coal and oil to predominantly natural gas. Generation fuel mix is currently driven by market forces. For the 2018 regional haze plan, NH will need to consider how to assure that emissions reductions credited toward visibility progress goals are made enforceable.

MANE-VU states committed to implement low sulfur fuel requirements; however, to date, NH has not enacted such a requirement. In this progress report, NH indicates that as a result of market conditions, even without a specific NH requirement, actions by neighboring states could result in lower sulfur fuel supply being used in NH. Please clarify the magnitude of SO_2 emission reductions that could result from replacing current fuels with low sulfur fuel.

Section 4.3.1: Pennsylvania should be included in the list of MANE-VU states included in the Cross State Air Pollution Rule.

Section 7.4: For the summary, we suggest that you cite the same year and magnitude of EGU SO_2 emissions reductions as shown in Table 6.1 (e.g. 2012 rather than 2010 EGU emissions).

The controls and inventories documented in the draft progress report support NH's conclusion that the existing NH Regional Haze SIP is sufficient to meet the 2018 reasonable progress goals for Class I areas in NH and will not interfere with the ability of neighboring states to meet the reasonable progress goals set for their Class I areas.

We appreciate the opportunity to work closely with NH to improve visibility in our Class I national park and wilderness areas. If you have questions, please contact me at patricia_f_brewer@nps.gov or 303-969-2153.

Sincerely,

Pat Brewer

Pat Brewer

cc:
Anne McWilliams, EPA Region 1
Holly Salazer, NPS Northeastern Region

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

October 2, 2014

Charles Martone
Air Resources Division
Department of Environmental Services
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

Dear Mr. Martone:

Previously, EPA received New Hampshire's draft Regional Haze 5-Year Progress Report. EPA provided NH DES written comments on the draft in a letter dated June 25, 2014.

Subsequently, we received New Hampshire's proposed Regional Haze 5-Year Progress Report. We have reviewed the proposal and the Agency's comments are contained in the Enclosure.

New Hampshire is also proposing revisions to the TSP (total suspended particulate) emission limits in Env-A 2302.02 "Emission Standards Applicable to Tangential-Firing, Dry-Bottom Boilers." EPA does not have any comments on this proposed revision.

The adopted regulation revisions and the 5-Year Progress Report should be submitted to EPA as a State Implementation Plan revision by January 29, 2015.

If you have any questions on the enclosed comments, please contact Anne McWilliams of my staff at 617-918-1697.

Sincerely,

Anne Arnold

Anne Arnold, Manager
Air Quality Planning Unit

Enclosure

cc: Karla McManus
Jeff Underhill, NH DES

Enclosure
EPA's Comments on New Hampshire's Proposed Regional Haze 5-Year Progress Report
October 2, 2014

1) **Executive Summary – SIP Submittal**

For clarification, EPA suggests that the third paragraph of this section be revised as follows:

"It is noted that EPA approved New Hampshire's Regional Haze SIP on August 22, 2013 (77 FR 50602). New Hampshire submitted this SIP to meet the requirements of 40CFR 51.308 and the ~~because it meets the applicable~~ visibility-related requirements of CAA section 110(a)(2) including, but not limited to 110(a)(2)(D)(i)(II) and 110(a)(2)(J)."

2) **5.2 Low-Sulfur Fuel Oil Strategy**

In New Hampshire's Regional Haze SIP, the state included a commitment to evaluate a low-sulfur fuel oil strategy for possible implementation by 2018. In the 5-Year Progress Report, DES indicates that New Hampshire maintains an interest in pursuing a low sulfur fuel oil strategy. EPA encourages New Hampshire to move forward and adopt a low sulfur fuel oil strategy as outlined in the MANE-VU "Ask." At this point in time, all of the New England states, with the exception of New Hampshire, have adopted this strategy.

3) **12.2 Consultation Process**

The second paragraph should be revised as follows:

"… the public review and comment period, which closed on October ~~1~~3, 2014."

USDA United States Department of Agriculture | Forest Service | White Mountain National Forest

71 White Mountain Drive
Campton, NH 03223
Comm: (603) 536-6100
TTY: (603) 536-3665

File Code: 2580
Date: September 25, 2014

Charles H. Martone
State Implementation Plan Analyst
Air Resources Division
NH Department of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

RECEIVED
NEW HAMPSHIRE
SEP 29 2014
AIR RESOURCES DIVISION

Dear Mr. Martone:

The USDA Forest Service has completed our review of the document entitled "Revision to the New Hampshire State Implementation Plan Regional Haze 5-Year Progress Report" Draft dated August 22, 2014. We appreciated the opportunity to review the document and the chance to once again work cooperatively with your staff.

I concur with the New Hampshire Department of Environmental Services' declaration that New Hampshire's Regional Haze State Implementation Plan is sufficient in its current form to achieve the necessary emission reductions to meet the 2018 reasonable progress goals for visibility. Further revisions of the NH Regional Haze State Implementation Plan are not needed at this time. I am also pleased to note that the observed five year average for visibility, for the years 2009-2013, at the Class I areas located in the White Mountain National Forest, are already better than the 2018 reasonable progress goals.

We look forward to our continued close cooperation toward the national goal of no "man-made" visibility impairment to the Class I areas in our region by 2064.

Sincerely,

THOMAS G. WAGNER
Forest Supervisor

cc: Judi Henry, Bret A Anderson, Ralph Perron

NHDES's Response to Comments on New Hampshire's Regional Haze 5-Year Progress Report

The New Hampshire Department of Environmental Services (NHDES) held a public hearing on September 23, 2014, and provided a public comment period, extending from that date to October 3, 2014, to accept testimony on New Hampshire's draft Regional Haze Progress report and related amendments to administrative rule Env-A 2302.02. No members of the public attended the hearing, but letters containing written comments were received from three entities: the U.S. Environmental Protection Agency (EPA), the U.S. Department of the Interior, National Park Service (NPS); and the U.S. Department of Agriculture, Forest Service (FS). Copies of the letters are attached. The following is a summary of comments received and NHDES's responses thereto.

Comment: EPA requested a technical clarification in the SIP Submittal (page v) and the correction of a typographical error in Section 12. EPA also encouraged New Hampshire to move forward with adoption of a low-sulfur fuel oil strategy as outlined in the MANE-VU Ask.

> Response: NHDES has included the requested minor revisions in the final document. New Hampshire continues to be interested in pursuing a low-sulfur fuel oil strategy. Recently, the Oil Heat Council of New Hampshire requested that the New Hampshire legislature consider a bill in the 2015 legislative session to require the use of low-sulfur fuel oil throughout the state, effective in 2018. NHDES is actively engaged in the legislative process that would allow such a change to happen.

Comment: FS concurred that New Hampshire's regional haze plan is sufficient in its current form to achieve the 2018 reasonable progress goals for visibility. FS also noted that the observed 2009-2013 visibility data for New Hampshire's Class I areas are already better than the 2018 reasonable progress goals.

> (No response is needed.)

Comment: NPS commented that New Hampshire has met the regulatory requirements for regional haze progress reports and that New Hampshire's regional haze SIP is sufficient to meet the 2018 reasonable progress goals at Class I areas in New Hampshire and neighboring states. NPS requested a few minor adjustments to the text. NPS also asked for an estimate of the magnitude of SO_2 emission reductions that could result from adoption of a low-sulfur fuel oil strategy.

> Response: NHDES has made the requested revisions to the text. With respect to the low-sulfur fuel oil strategy, any estimate will depend on the assumptions applied. As a starting point, it may be assumed that 2012 was a typical year, in which state totals for distillate and residual fuel oil consumption for all sectors were 3,589,000 and 262,000 bbl, respectively.[33] Further, it may be assumed that the reductions in fuel sulfur content from a low-S strategy would average 0.3% for distillate oil and 1.0% for residual oil. Under this specific scenario, SO_2 emissions resulting from the combustion of both grades of fuel oil would be reduced by about 4,000 tons annually. The actual emission reductions could be smaller than this amount because current fuel oil in bulk storage already includes some lower-sulfur material whose exact specifications are unknown.

[33] Source: U.S. Energy Information Administration (EIA). At the time of this estimate, 2012 is the most recent year for which EIA annual data are available. See http://www.eia.gov/state/data.cfm?sid=NH#ConsumptionExpenditures.