

Revision to the

Vermont State Implementation Plan

Regional Haze Five-Year Progress Report



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

February 29, 2016

Acknowledgements

The Vermont Department of Environmental Conservation 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 Vermont's Regional Haze SIP Five-Year Progress Report.

Executive Summary

The Clean Air Act mandates actions to protect visibility, especially in Class I Federal areas. In 1999, the U.S. Environmental Protection Agency finalized the Regional Haze Rule (64 FR 35714, 40 CFR 51.300 et seq.). The rule calls for state, tribal, and federal agencies to work together to improve visibility in 156 national parks and wilderness areas designated as Class I Federal areas. The Lye Brook Wilderness Area in Vermont's Green Mountain National Forest is one of these Class I Federal areas afforded special visibility protection under the Clean Air Act and EPA Regional Haze Rule.

States are required to develop and implement 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.

Regional haze is caused by numerous sources over a broad area, and it obscures vistas integral to the value of our parks and wilderness areas. The predominant cause of haze pollution in the Mid-Atlantic/Northeast region is sulfate particles caused by emissions from burning coal and oil. 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 Vermont has committed to implement MANE-VU's long term strategy to improve visibility. The MANE-VU strategy for 2018 includes:

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

This document addresses the requirements of 40 CFR 51.308(g) requiring periodic reports evaluating progress in implementing the measures included in Vermont's Regional Haze SIP. The control strategies in the SIP are continuing to be implemented, emissions of sulfur dioxide have declined, concentrations of sulfate have declined, and visibility has improved at the Lye Brook Wilderness area, as well as in all other protected Class I areas in the MANE-VU region.

Based on the progress made in reducing emissions within Vermont and implementing other requirements of Vermont's Regional Haze SIP, Vermont submits a negative declaration to EPA specifying that its Regional Haze SIP is sufficient in meeting the requirements outlined in EPA's Regional Haze Rule.

¹ Vermont's Regional Haze SIP revision is available at <http://www.anr.state.vt.us/air/Planning/docs/Vermont%20Haze%20SIP.pdf>

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.

Table of Contents

Acknowledgements.....	i
Executive Summary.....	ii
Table of Contents.....	iii
List of Figures.....	vi
List of Tables.....	vii
SIP Submittal.....	viii
MANE-VU’s Class I Areas.....	ix
Completeness Checklist.....	xi
Section 1: Federal Regional Haze Program Requirements.....	1
1.1. Background.....	1
1.2. Summary of the Requirements for Periodic Progress Reports.....	3
1.2.1. General and Procedural Requirements.....	3
1.2.2. Required Elements of the Progress Report SIP.....	3
1.2.3. Required State Actions.....	4
1.3. MANE-VU Regional Course of Action.....	4
1.3.1. Requested Action within MANE-VU.....	5
1.3.2. Requested Action outside MANE-VU.....	6
Section 2: Changes in Visibility for each Mandatory Federal Class I Area in and near MANE-VU.....	7
2.1. Reasonable Progress Goals.....	7
2.2. Requirements to Track Changes in Visibility.....	8
2.3. Review of Recent IMPROVE Data.....	8
2.4. Tracking Visibility Progress – National Evaluation.....	13
Section 3: Status of BART Measures in the Regional Haze SIP.....	16
3.1. Requirement to Track BART Implementation.....	16
3.2. Status of BART Measures.....	16
Section 4: Status of EGU Controls including Controls at 167 Key Sources.....	17
4.1. Requirement to Track Implementation of EGU Control Measures.....	17
4.2. MANE-VU Focus on Sulfates and EGUs.....	17
4.3. Status of Implementation of EPA’s Clean Air Interstate Rule and other EGU Controls.....	17
4.3.1. Clean Air Interstate Rule and Cross State Air Pollution Rule.....	18
4.3.2. EGU Control Measures in MANE-VU States other than CAIR and CSAPR.....	18
4.4. Status of Controls at 167 EGU Sources.....	21

Section 5: Status of Additional Measures in the Regional Haze SIP	23
5.1. Requirement to Track Implementation of Other Control Measures	23
5.2. Status of Low Sulfur Fuel Oil Strategy	23
5.3. Status of Additional State-Specific Control Measures	25
5.3.1. Agricultural and Forestry Smoke Management	25
5.3.2. Measures to Mitigate Impacts of Construction Activities	25
5.3.3. Prevention of Significant Deterioration	26
5.3.4. Enforceability	26
5.3.6. Controls on Area Sources Expected by 2018	27
5.3.7. Controls on Mobile Sources Expected by 2018	28
5.3.8. Controls on Non-Road Sources Expected by 2018	29
5.4. Status of Vermont Secondary Sulfate Standards and Significant Impact Levels	30
Section 6: State Summary of Emission Reductions Resulting from Implementation of Control Measures	32
6.1. Requirement to Summarize Emissions Reductions	32
6.2. Summary of Emissions Changes Since 2002	32
6.2.1. Estimated Sulfur Emission Reductions from Low Sulfur Fuel Oil Strategy	32
Section 7: Analysis of Emission Changes in the Last Five Years from Visibility Impairing Pollutants	35
7.1. Requirement to Analyze and Track Changes in Emissions	35
7.2. MANE-VU Emissions Trends	35
7.2.1. 2002 Modeling Inventory with Projections to 2018	35
7.2.2. 2007 Modeling Inventory with Projections to 2017 and 2020	36
7.2.3. 2010 Clean Air Markets Division Reported Emissions	37
7.3. Vermont Emissions Trends – 2002 to 2011	40
Section 8: Assessment of Significant Anthropogenic Emission Changes In or Outside the State in the Last Five Years that Have Limited or Impeded Progress in Reducing Emissions and Improving Visibility	42
8.1. Requirement to Assess Whether Emissions Changes Have Impeded Progress	42
8.2. Assessment	42
Section 9: Assessment regarding whether Current Regional Haze State Implementation Plan (SIP) Elements and Strategies are Sufficient to Meet Reasonable Progress Goals	43
9.1. Requirement to Assess Sufficiency of Plan	43
9.2. Assessment	43
Section 10: Monitoring Strategy Review	44

10.1. Requirement to Review Monitoring Strategy	44
10.2. Review	44
Section 11: Determination of Adequacy of Current Regional Haze SIP	46
11.1. Requirement to Determine Adequacy of Current SIP	46
11.2. Determination of SIP Adequacy: Negative Declaration	46
Section 12: Consultation with Federal Land Managers	47
12.1. Requirement to Consult Federal Land Managers.....	47
12.2. Consultation Process	47
Appendix A : Acronyms	48
Appendix B : Regional Haze Rule Metric	49
Appendix C : Statement on Controls in MANE-VU	51
Appendix D : Statement on Controls Outside of MANE-VU.....	53
Appendix E : Statement on National Controls.....	55
Appendix F : Status of Emissions from 167 Key Stacks	57
Appendix G : Federal Land Manager Consultation and Public Comments.....	58
Appendix H : Evidence of Plan’s Adoption.....	62
Appendix I : Evidence of Legal Authority.....	63
Appendix J : Certification of Public Hearing.....	64
Appendix K : Public Notice	65

List of Figures

FIGURE 1.1. MID-ATLANTIC AND NORTHEAST CLASS I AREAS.	1
FIGURE 1.2. MAP OF U.S. REGIONAL PLANNING ORGANIZATIONS.....	2
FIGURE 2.1. CHARTS OF MANE-VU CLASS I AREA VISIBILITY 2000-2014, COMPARED TO RPGS FOR 2018.	10
FIGURE 2.1.A. ACADIA NATIONAL PARK.....	10
FIGURE 2.1.B. BRIGANTINE WILDERNESS	10
FIGURE 2.1.C. GREAT GULF WILDERNESS.....	11
FIGURE 2.1.D. LYE BROOK WILDERNESS	11
FIGURE 2.1.E. MOOSEHORN WILDERNESS	12
FIGURE 2.1.F. DOLLY SODS WILDERNESS	12
FIGURE 2.1.G. SHENANDOAH NATIONAL PARK.....	13
FIGURE 2.2. VISIBILITY IMPROVEMENTS THROUGH 2014 BY PARTICLE CONSTITUENTS ON HAZIEST 20% DAYS.....	15
FIGURE 2.3. VISIBILITY IMPROVEMENTS THROUGH 2014 BY PARTICLE CONSTITUENTS ON CLEAREST 20% DAYS.....	15
FIGURE 4.1. DISTRIBUTION OF 167 EGU STACKS IDENTIFIED AS AFFECTING MANE-VU CLASS I AREAS IN 2002.	21
FIGURE 4.2. 2002-2014 STATEWIDE SO ₂ EMISSIONS REDUCTIONS FROM 167 SOURCES IDENTIFIED IN MANE-VU ASK.....	22
FIGURE 6.1. THREE-YEAR AVERAGE OF 99TH PERCENTILE 1-HOUR SO ₂ CONCENTRATIONS IN RUTLAND, VT.....	34
FIGURE 10.1. MAP OF IMPROVE MONITORING LOCATIONS, LYBR1 AND LYEB1.	45
FIGURE 10.2. LYE BROOK IMPROVE SITES UNPAIRED Q-Q PLOT, AMMONIUM SULFATE EXTINCTION, JAN-SEPT 2012 (20% BEST AND WORST DAYS).....	45

List of Tables

TABLE 2.1. REASONABLE PROGRESS GOALS IN APPROVED REGIONAL HAZE PLANS	7
TABLE 2.2. VISIBILITY IMPROVEMENTS THROUGH 2014 AT CLASS I AREAS IN AND NEAR MANE-VU	9
TABLE 2.3. VISIBILITY IMPROVEMENTS BY PARTICLE CONSTITUENTS THROUGH 2014 ON HAZIEST 20% DAYS IN MANE-VU CLASS I AREAS	14
TABLE 2.4. VISIBILITY IMPROVEMENTS BY PARTICLE CONSTITUENTS THROUGH 2014 ON CLEAREST 20% DAYS IN MANE-VU CLASS I AREAS	14
TABLE 4.1. STATUS OF EGU CONTROL MEASURES IN MANE-VU STATES	19
TABLE 5.1. CURRENT STATE SULFUR IN FUEL LIMITS	24
TABLE 5.2. STATUS OF CONTROL MEASURES – AREA SOURCES	27
TABLE 5.3. STATUS OF CONTROL MEASURES – MOBILE SOURCES.....	28
TABLE 5.4. STATUS OF CONTROL MEASURES – NON-ROAD SOURCES	29
TABLE 6.1. VERMONT POINT SOURCE NO. 2 FUEL OIL USAGE AND SULFUR CONTENT 2010-2014.....	33
TABLE 7.1. EMISSIONS DATA SOURCES BY SECTOR.....	37
TABLE 7.2. AIR POLLUTANT EMISSION TRENDS BETWEEN 2002 AND 2020 FOR THE MANE-VU REGION.....	39
TABLE 7.3. VERMONT NEI 2002, 2008 AND 2011 EMISSIONS AND 2018 PROJECTIONS.....	41
TABLE 10.1. VISIBILITY MONITORING SITES IN THE STATE	44

SIP Submittal

Pursuant to the requirements of [40 CFR §51.308](#) (g), (h), and (i), Vermont submits this Progress Report as a SIP revision. Vermont has adopted this SIP revision in accordance with federal regulations at [40 CFR §51.102](#) and [§51.103](#).

EPA approved Vermont's Regional Haze SIP because it meets the applicable visibility related requirements of the CAA section 110(a)(2) including, but not limited to 110(a)(2)(D)(i)(II) and 110(a)(2)(J).³ Vermont's Regional Haze SIP contains the emission reductions needed to achieve Vermont's share of emission reductions agreed upon through the regional planning process. Furthermore, Vermont's Regional Haze SIP ensures that emissions from the State will not interfere with the reasonable progress goals for neighboring states' Class I areas. The requirements addressed in the following sections include the status of implementing committed control measures, summaries and analyses of emission and monitoring changes, and a determination that the SIP is adequate to achieve continued progress towards the goal of natural visibility conditions by 2064 in mandatory Class I areas in and/or impacted by sources in Vermont.

Per 40 CFR §51.102, Vermont offered the public an opportunity to request a hearing and/or comment on the proposed SIP revision. Vermont provided public notice of the opportunity to comment on the SIP revision and the opportunity for a public hearing on Monday, January 11, 2016. No request for a public hearing was received by the specified deadline on Monday, February 1, 2016, so no public hearing was held. Per 40 CFR §51.103 and §51.308(i), Vermont submitted this SIP revision to EPA and Federal Land Managers. Comment letters by EPA and Federal Land Managers are included in Appendix G of this SIP revision.

Vermont will continue to coordinate with the Federal Land Managers on future revisions to Vermont's Regional Haze SIP.

³ U.S. EPA, "Approval and Promulgation of Air Quality Implementation Plans; Vermont; Regional Haze," final rule. [FR 77 30212-30214 \(22 May 2012\)](#).

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 with the small and beautiful Spaulding Lake lying at its floor. From the cirque's low end, the West Branch of the Peabody River flows eastward.





Lye Brook Wilderness

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

Moosehorn Wilderness

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



Presidential Range/Dry River Wilderness



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

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

Completeness Checklist

The checklist below has been provided by the U.S. Environmental Protection Agency to help states submit complete Progress Reports. Vermont is using this checklist to direct the reader to the areas of the SIP that address the items required by EPA. Refer to the Table of Contents for page numbers.

Five-Year Progress Report Submittal Checklist		
Submitted under 40 CFR 51.308(g)-(h) and 40 CFR 51.309(d)(10)		
Regulation Citation	Regulation Summary (<i>not verbatim</i>)	Location in report
Report Requirements		
51.308(g)(1) 51.309(d)(10)(i)(A)	Status of Control Strategies in the Regional Haze SIP: Does the report include a list of measures the state relied upon?	Section 3 – BART Section 4 – EGU Controls Section 5-Add'l measures
51.308(g)(2) 51.309(d)(10)(i)(B)	Emissions Reductions from Regional Haze SIP Strategies: Does the report include estimated reduction estimates for these measures?	Section 6
51.308(g)(3) 51.309(d)(10)(i)(C)	Visibility Progress: Does the report include the summaries of monitored visibility data as required by the Regional Haze Rule?	Section 2
51.308(g)(4) 51.309(d)(10)(i)(D)	Emissions Progress: Does the report provide emissions trends across the entire inventory for a five-year period as required by the Regional Haze Rule?	Section 7
51.308(g)(5) 51.309(d)(10)(i)(E)	Assessment of Changes Impeding Progress: Does the report include an explicit statement of whether there are anthropogenic emissions changes impeding progress?	Section 8
51.308(g)(6) 51.309(d)(10)(i)(F)	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?	Section 9
51.308(g)(7) 51.309(d)(10)(i)(G)	Review of Monitoring Strategy: Does the report review the monitoring plan including any non-IMPROVE monitors the state is using?	Section 10
51.308(h) 51.309(d)(10)(ii)	Determination of Adequacy: Does the report (or the transmittal materials) provide the explicit determination required by the Regional Haze Rule?	Section 11

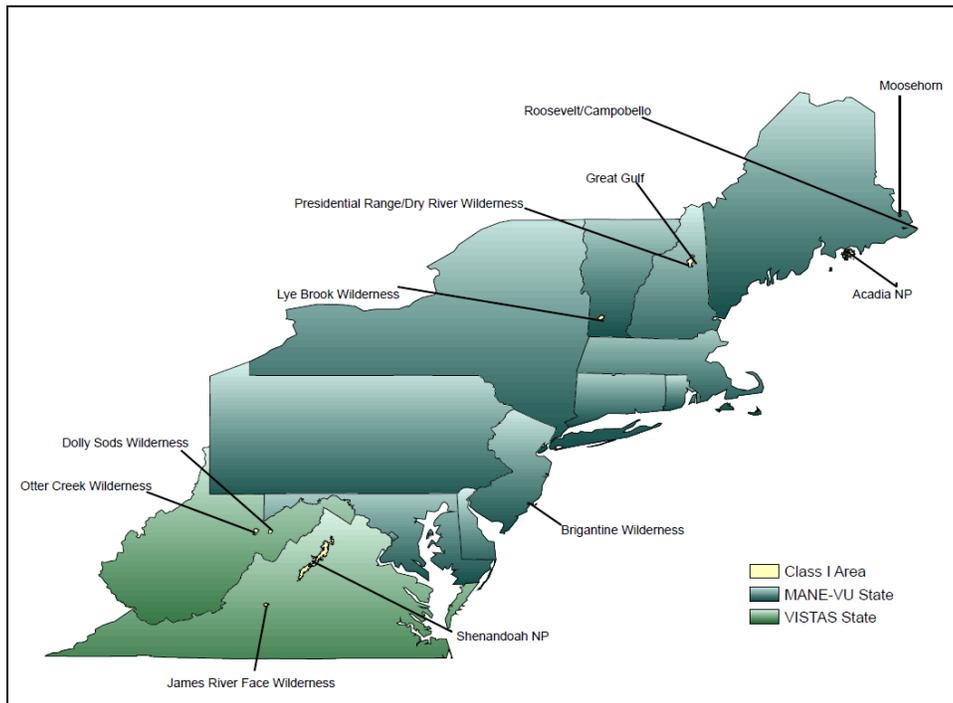
Section 1: Federal Regional Haze Program Requirements

1.1. Background

The U.S. Clean Air Act sets requirements to protect the air quality-related values of national parks and wilderness areas. Specifically, Section 169A of the CAA declares as a national goal the “prevention of any future, and the remedying of any existing impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution.”

Areas protected by this portion of the CAA 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 Class I areas in the United States, of which eleven are in or near the mid-Atlantic and northeast region (Figure 1.1).

Figure 1.1. Mid-Atlantic and Northeast Class I Areas.

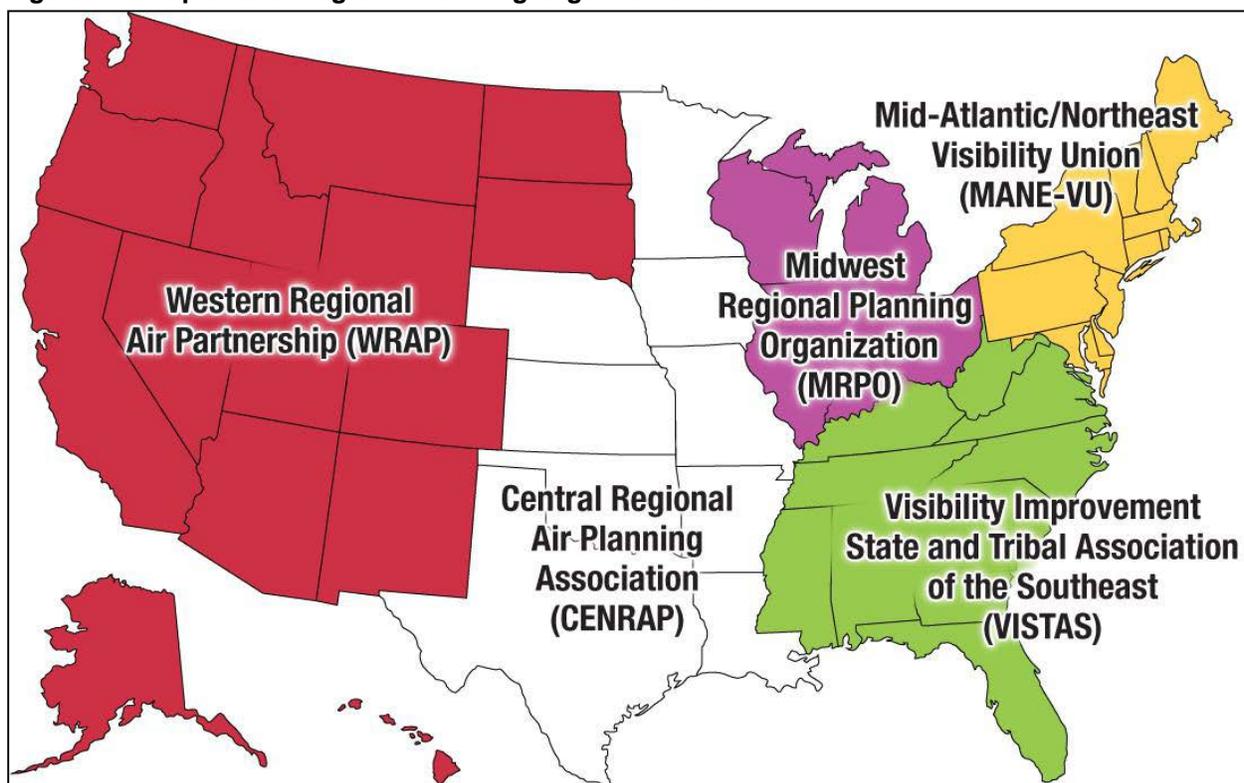


The CAA directed the U.S. Environmental Protection Agency to promulgate regulations to assure reasonable progress toward meeting the national goal of improved visibility in Class I areas. EPA finalized the Regional Haze Rule in 1999, which calls for state, tribal, and federal agencies to work together to improve visibility.⁴

In cooperation with the States, EPA designated five Regional Planning Organizations (RPOs) to assist with the coordination and cooperation states and tribes needed to address the visibility issue. Vermont is a member of the Mid-Atlantic/Northeast Visibility Union (MANE-VU).

⁴ See 64 FR 35714, 40 CR §51.300 et seq.

Figure 1.2. Map of U.S. Regional Planning Organizations



States and tribes in the northeast and mid-Atlantic region, along with federal land management agencies and the U.S. Environmental Protection Agency, work together through MANE-VU to develop and implement strategies for reducing the haze that obscures natural vistas in areas designated in the CAA as Class I areas. In 2006, MANE-VU determined that the predominant cause of haze pollution in northeast parks and wilderness areas is sulfate particles due to sulfur dioxide emissions from electricity generators burning fossil fuels. Additional pollutants contributing to regional haze are emitted by power plants, boilers, furnaces, motor vehicles, and other fuel-burning equipment as well as forest fires and wood combustion. (See [Contributions to Regional Haze in the Northeast and Mid-Atlantic States](#), NESCAUM, 2006.)

EPA's Regional Haze Rule requires States to develop and implement State Implementation Plans (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 area sources, mobile sources (both on-road and non-road sources), and point sources.

1.2. Summary of the Requirements for Periodic Progress Reports

This five-year progress report is a SIP revision which fulfills the requirements of EPA's Regional Haze Rule. The following paragraphs summarize those requirements. The primary purpose of this report is to provide an update on the status of implementing measures in the state's Regional Haze SIP.

1.2.1. General and Procedural Requirements

The federal Regional Haze Rule requires each five-year periodic progress report to be in the form of a SIP revision that complies with the procedural requirements of the CAA as well as the requirements of the Regional Haze Rule. The periodic report must address the following regulatory requirements:

- (1) 40 CFR §51.102 - public hearings;
- (2) 40 CFR §51.103 - EPA submittal requirements;
- (3) 40 CFR §51.308(g) - evaluate progress towards 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;
- (4) 40 CFR §51.308(h) - determine the adequacy of existing implementation plan; and
- (5) 40 CFR §51.308(i) - provide continued coordination with other states with Class I areas impacted by Vermont, as well as consult with Federal Land Managers and EPA in order to maintain and improve the visibility in the Class I area. States must give FLMs 60 days prior to the public hearing to review and submit comments on the proposed SIP.

1.2.2. Required Elements of the Progress Report SIP

According to 40 CFR §51.308(g), five-year 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) of this section.
- (3) For each mandatory Class I Federal area within the State, the State must assess the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of five-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 five years;
- (4) An analysis tracking the change over the past five 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 as necessary and appropriate, to account for emissions changes during the applicable five-year period.

- (5) An assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past five 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.

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). If the State finds that an additional substantive SIP revision is not required, then it may submit a "negative declaration" to EPA after opportunity for public review and comment. The EPA anticipates that if the State is implementing a reasonable set of strategies according to the schedule as developed in the previous comprehensive SIP revision, and that visibility trends show that reasonable progress goals should be achieved over the 10-year long-term strategy period, then the State should be able to certify, through a negative declaration, that no additional control measures are needed at the time of this mid-course review.

If the State finds that over the past five years there has been a substantial increase in emissions by intrastate sources, or there has been a deficiency in plan implementation, the Regional Haze Rule requires the State to revise the SIP via a mid-course correction within one year, rather than waiting for the next 10-year comprehensive review.

If the State finds that there is a substantial increase in emissions or a deficiency in plan implementation resulting primarily from interstate emissions, 40 CFR §51.308(h)(2) calls for the State to re-initiate the regional planning process with other States so that the deficiency can be addressed in the next comprehensive SIP revision due in five years.

If the State finds that international emissions sources are responsible for a substantial increase in emissions affecting visibility conditions in any Class I area or causing a deficiency in plan implementation, the State must submit a technical demonstration to EPA in support of its finding. If EPA agrees with the State's finding, EPA will take appropriate action to address the international emissions through available mechanisms.

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 the following documents:

- "Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress,"

- “Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Request for a Course of Action by States Outside MANE-VU Toward Assuring Reasonable Progress,”
- “Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Request for a Course of Action by the U.S. Environmental Protection Agency (EPA) toward Assuring Reasonable Progress,” and

These statements are commonly known as the MANE-VU Ask⁵ and are summarized below (see also Appendices C-E).

MANE-VU modeling demonstrated that certain control strategies described below, in addition to on-the-books/on-the-way (OTB/OTW) measures would enable all MANE-VU Class I areas to meet their reasonable progress targets in 2018.

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 designed to assure reasonable progress toward preventing any future, and remedying any existing impairment of visibility in mandatory Class I Federal areas within MANE-VU and to leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment. This course of action includes pursuing the adoption and implementation of the following “emission management” strategies by MANE-VU states, as appropriate and necessary:

- Timely implementation of BART requirements;
- 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;
- A 90% or greater reduction in sulfur dioxide (SO₂) emissions from each of the EGU stacks identified by MANE-VU (Appendix F) – comprising a total of 167 stacks as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and
- Continued evaluation of other control measures including energy efficiency, alternative clean fuels, and other measures to reduce SO₂ and nitrogen oxide (NO_x) emissions from all coal-burning facilities by 2018 and new source performance standards for wood combustion. These

⁵ Also available in Attachment D of Vermont’s 2009 Regional Haze SIP at: <http://www.anr.state.vt.us/air/Planning/docs/VT%20Regional%20Haze%20SIP%20Attachments.zip>

measures and other measures identified will be evaluated during the consultation process to determine if they are reasonable and cost-effective.

This long-term strategy to reduce and prevent regional haze will allow each state up to ten years to pursue adoption and implementation of reasonable and cost-effective NO_x and SO₂ control measures.

The control measures included in Vermont's SIP in response to the MANE-VU agreement are described in Sections 3 through 5 of this report.

1.3.2. Requested Action outside MANE-VU

Also on June 20, 2007, the MANE-VU states adopted a statement requesting that States outside of the MANE-VU region that had been identified as contributing to visibility impairment in the MANE-VU Mandatory Class I Federal areas pursue a course of action designed to assure reasonable progress toward preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas and to leverage the multi-pollutant benefits that such actions may provide for the protection of public health and the environment. This request for a course of action included pursuing the adoption and implementation of the following control strategies, as appropriate and necessary:

- Timely implementation of BART requirements;
- A 90% or greater reduction in SO₂ emissions from each of the EGU stacks identified by MANE-VU (Appendix F) – comprising a total of 167 stacks as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State;
- The application of reasonable controls on non-EGU sources resulting in a 28% reduction in non-EGU SO₂ 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;⁶ and
- Continued evaluation of other measures including measures to reduce SO₂ and NO_x 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 during the consultation process to determine if they are reasonable.

This long-term strategy to reduce and prevent regional haze will allow each state up to 10 years to pursue adoption and implementation of reasonable SO₂ and NO_x control measures.

⁶ The 28 percent emission reduction from non-EGU sources outside MANE-VU was intended to represent a similar emission reduction as the MANE-VU Low Sulfur Fuel Oil strategy in the areas inside MANE-VU. This strategy intentionally did not define a specific control measure. It was the intention of the MANE-VU states to enable contributing states to define how they would achieve this additional reduction in a way that is most reasonable for the sources in their state. Based on MANE-VU's initial analysis of available projection inventories for 2018, these targets were estimated as 151,000 and 308,000 tons per year reduction in non-EGU SO₂ emissions from the Midwest RPO and VISTAS RPO respectively. MANE-VU reached a consensus with the Midwest RPO during the consultation process that 131,6000 tons per year was a more accurate estimate of the magnitude of a 28 percent reduction relative to their projected 2018 non-EGU SO₂ emissions of 470,000 tons per year.

**Section 2: Changes in Visibility for each Mandatory Federal Class I Area in and near
MANE-VU**

2.1. Reasonable Progress Goals

The 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. Section 51.301(q) defines natural conditions: "Natural conditions includes naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration." The Regional Haze SIPs must contain measures that make "reasonable progress" toward this goal by reducing anthropogenic emissions that cause haze.

Regional haze impairs visibility. The deciview is a measure of visibility which is calculated from light extinction based on measurements of various air pollutants (see Appendix B). Each MANE-VU State with one or more Class I areas adopted a Regional Haze SIP identifying baseline visibility for the five-year period from 2000 through 2004 and establishing goals that provide for reasonable progress in improving visibility at Class I areas in the state by 2018. Baseline visibility and reasonable progress goals were established for the 20% of days with the worst visibility and the 20% clearest days.

MANE-VU states with Class I areas adopted the following goals for visibility improvement at Class I areas by 2018. These goals were approved by the U.S. Environmental Protection Agency as reasonable progress toward achieving natural visibility conditions by the year 2064.

Table 2.1. Reasonable Progress Goals in Approved Regional Haze Plans.⁷

	Class I Area	Baseline (2000–2004)	RPG (2018)	Natural Conditions
		All visibility values in deciviews		
20% Hazeiest Days	Acadia National Park (ME)	22.9	19.4	12.4
	Brigantine Wilderness (NJ)	29.0	25.1	12.2
	Great Gulf Wilderness & Presidential Range-Dry River Wilderness (NH)	22.8	19.1	12.0
	Lye Brook Wilderness (VT)	24.4	20.9	11.7
	Moosehorn Wilderness and Roosevelt Campobello International Park (ME)	21.7	19.0	12.0
20% Clearest Days	Acadia National Park (ME)	8.78	8.3	4.7
	Brigantine Wilderness (NJ)	14.3	14.3	5.5
	Great Gulf Wilderness & Presidential Range-Dry River Wilderness (NH)	7.7	7.2	3.7
	Lye Brook Wilderness (VT)	6.4	5.5	2.8
	Moosehorn Wilderness and Roosevelt Campobello International Park (ME)	9.2	8.6	5.0

⁷ Source: *Tracking Visibility Progress: 2004-2011*, NESCAUM, April 30, 2013 (Revised May 24, 2013)
<http://www.nescaum.org/documents/manevu-trends-2004-2011-report-final-20130430.pdf>

2.2. Requirements to Track Changes in Visibility

At 40 CFR §51.308(g)(3), 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 that to baseline visibility conditions for the 2000-2004 period, and assess the change in visibility impairment over the past five years. To mitigate the impacts of year-to-year variability in determining progress towards the reasonable progress goals, the Regional Haze Rule mandates the use of five-year-averaged values of both the annual mean 20% best and 20% worst days determined for each site.

For each Class I area, there are three metrics of visibility that are part of the determination of reasonable progress:

- (1) Baseline conditions,
- (2) Natural conditions (in 2064), and
- (3) Current conditions.

Progress in improving visibility at Class I areas within MANE-VU is measured via the IMPROVE 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 EPA established the Interagency Monitoring of Protected Visual Environments (IMPROVE) program in response to the 1977 amendments to the CAA. This monitoring network has collected speciated fine aerosol and related visibility data in or near Class I Federal areas in the United States since 1988.

2.3. Review of Recent IMPROVE Data

The only Class I area within the borders of Vermont is the Lye Brook Wilderness Area.

In 2013 NESCAUM prepared the report *Tracking Visibility Progress: 2004-2011*. The report analyzes visibility data from the 2000-2004 baseline through the 2007-2011 five-year period. The results of this analysis showed 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.

Since this report was released, visibility data became available for 2012, 2013 and 2014. Table 2.2 and Figures 2.1a-g below provide the most recent quality assured data for the Class I areas in and near MANE-VU in comparison to the baseline visibility measured for 2000-2004 using the same procedures used in the report. Table 2.2 also shows progress at nearby Class I areas. As required, visibility is reported as a five-year average in deciviews. (See Appendix B for a discussion of how deciviews are calculated). Visibility at all MANE-VU Class I areas has improved, and all areas are expected to meet 2018 reasonable progress goals.

In Figures 2.1a-g, the “Uniform Rate of Progress” line indicates the rate of progress needed to achieve natural visibility by 2064 (the target set by the CAA). If the reasonable progress goal for a Class I area for 2018 is below the Uniform Rate of Progress line, it indicates a faster rate of progress by 2018 than necessary to achieve the uniform rate of progress. None of the MANE-VU states established RPGs for 2018 that provided for a slower rate of improvement than the uniform rate.

Table 2.2. Visibility Improvements through 2014 at Class I Areas in and Near MANE-VU

	Class I Area	Baseline Visibility (2000 – 2004)	Current Visibility (2010-2014)	Change (Baseline – Current Visibility)
20% Hazeiest Days	Acadia National Park	22.9	17.5	5.4
	Brigantine Wilderness	29.0	23.3	5.7
	Great Gulf Wilderness & Presidential Range-Dry River Wilderness	22.8	16.6	6.3
	Lye Brook Wilderness*	24.4	18.5	5.9
	Moosehorn Wilderness and Roosevelt Campobello International Park	21.7	16.5	5.2
	Dolly Sods Wilderness	29.0	22.0	7.0
	Shenandoah National Park	29.3	21.4	7.9
20% Clearest Days	Acadia National Park	8.8	7.1	1.9
	Brigantine Wilderness	14.3	12.0	2.3
	Great Gulf Wilderness & Presidential Range-Dry River Wilderness	7.7	5.8	1.9
	Lye Brook Wilderness*	6.4	5.1	1.3
	Moosehorn Wilderness and Roosevelt Campobello International Park	9.2	6.7	2.5
	Dolly Sods Wilderness	12.3	9.0	3.2
	Shenandoah National Park	10.9	8.6	2.3

Units: Visibility in deciviews

*2000-2011 data from LYBR1 site and 2012-2014 data from LYEB1 site.

Figure 2.1. Charts of MANE-VU Class I Area Visibility 2000-2014, compared to RPGs for 2018.
Figure 2.1.a. Acadia National Park

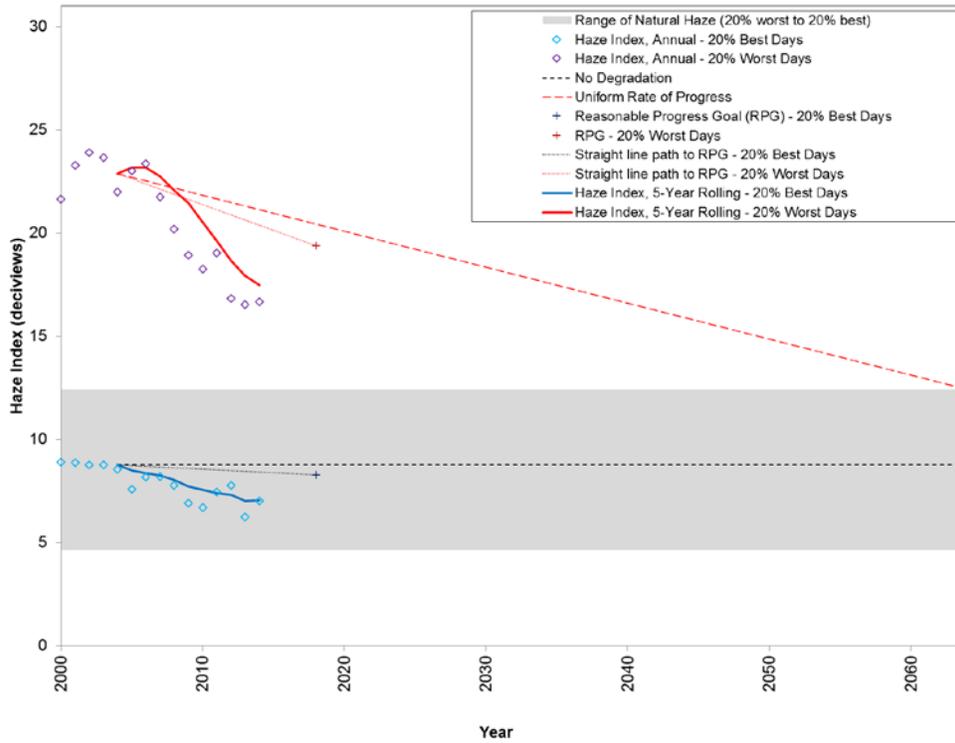


Figure 2.1.b. Brigantine Wilderness

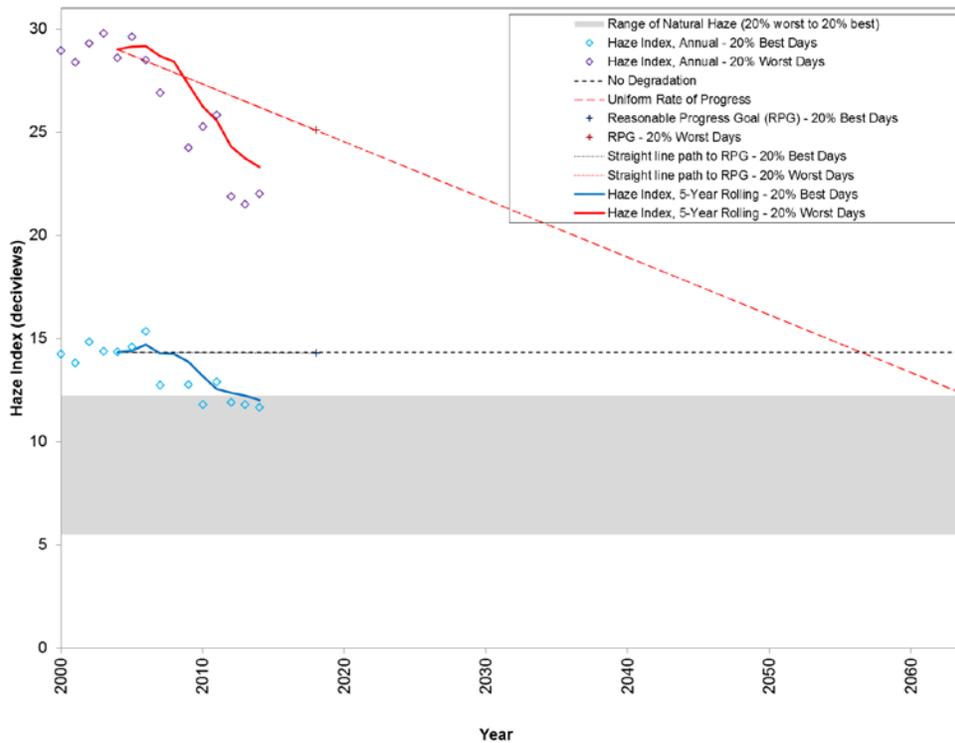


Figure 2.1.c. Great Gulf Wilderness

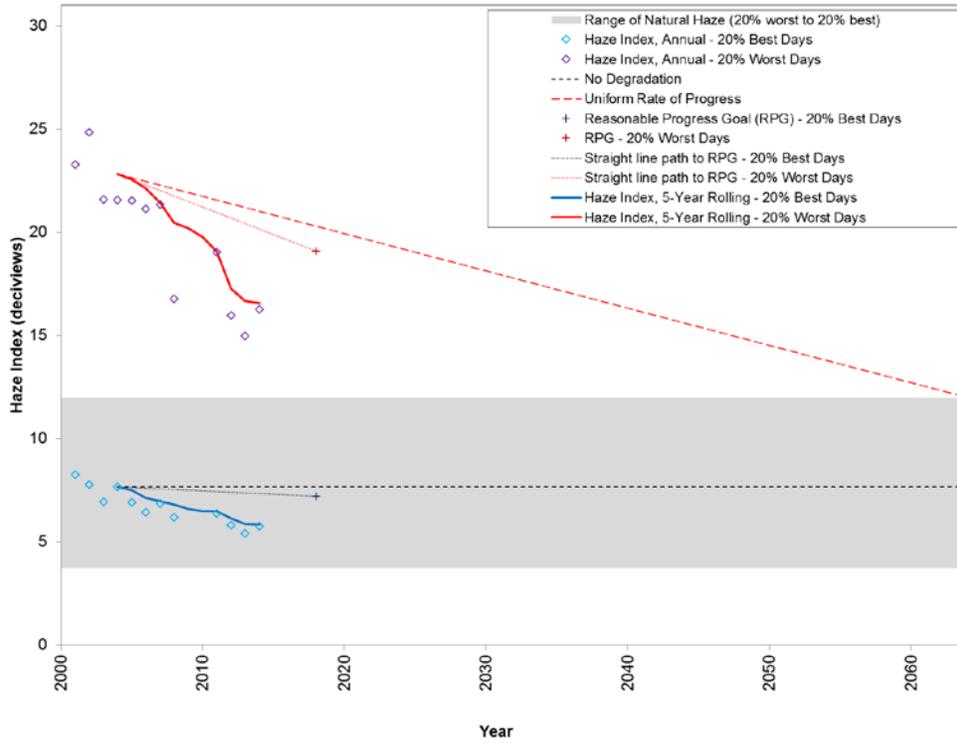


Figure 2.1.d. Lye Brook Wilderness

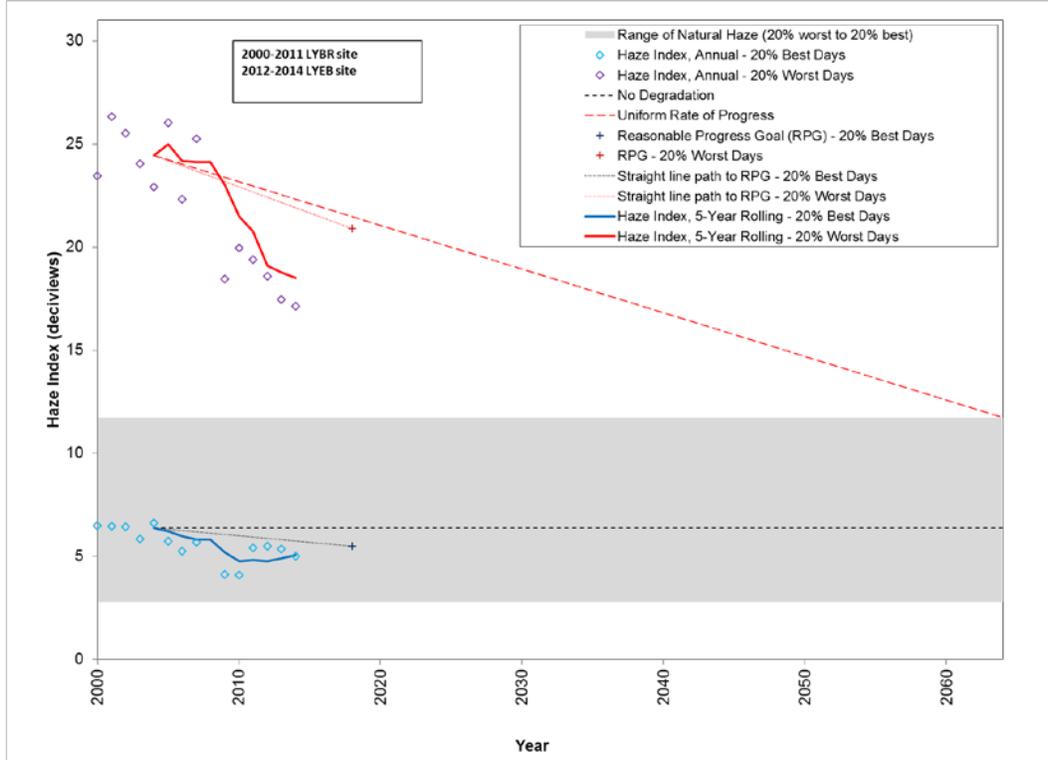


Figure 2.1.e. Moosehorn Wilderness

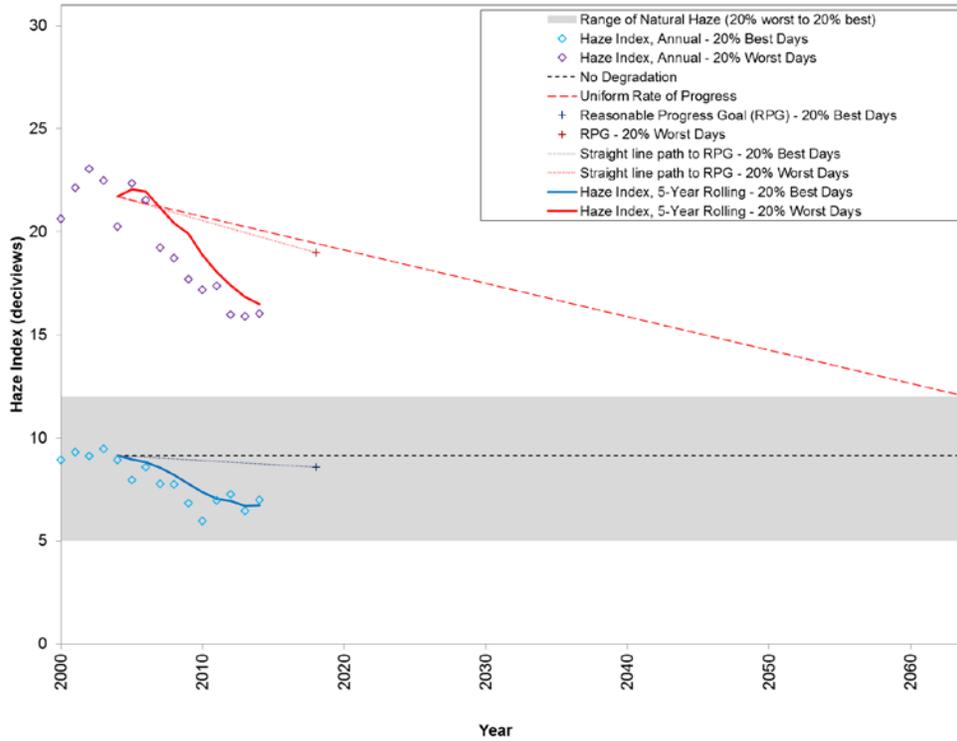


Figure 2.1.f. Dolly Sods Wilderness

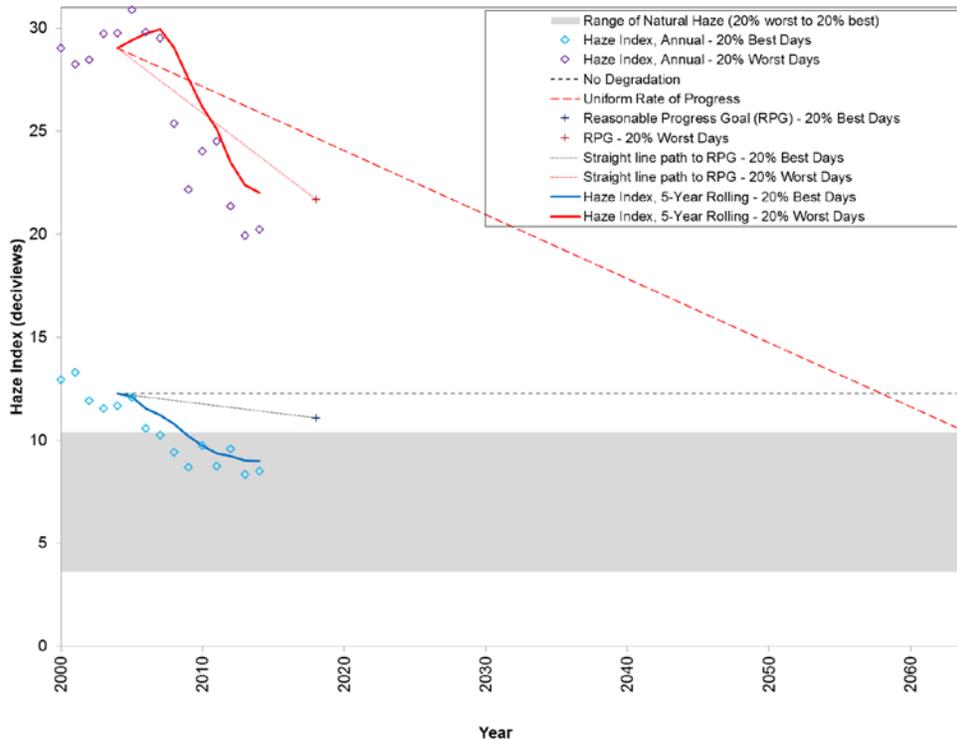
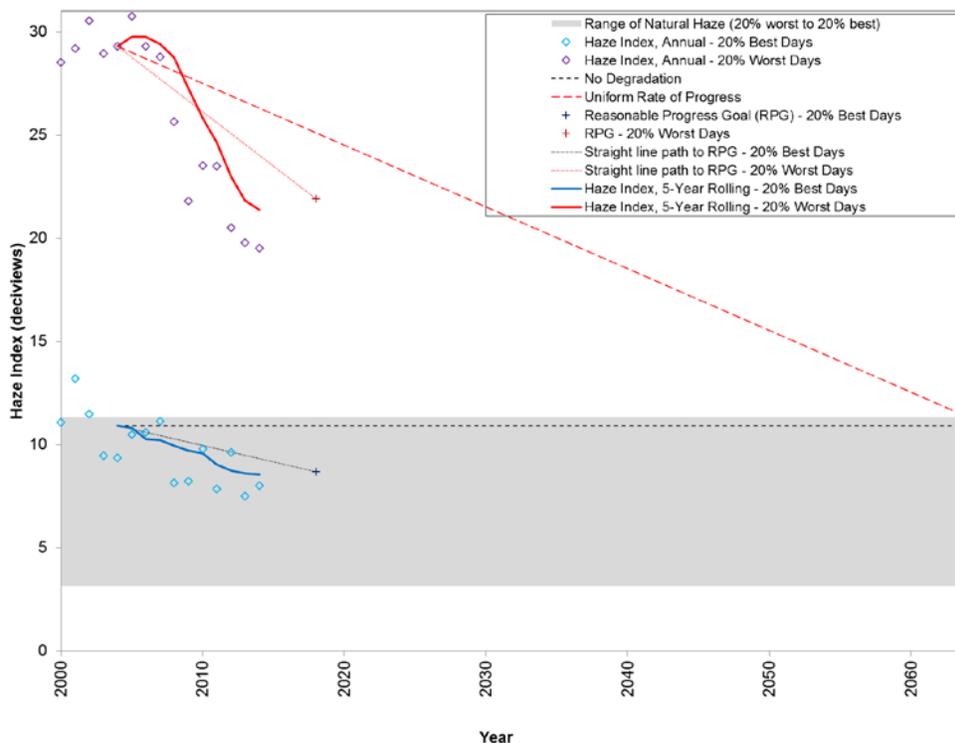


Figure 2.1.g. Shenandoah National Park



2.4. Tracking Visibility Progress – National Evaluation

In addition to NESCAUM’s analysis, a national report also documented progress in visibility improvement through 2009. The 2011 IMPROVE Report V: *Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States*, reported on five-year average reconstructed light extinction (the regional haze tracking metric) at IMPROVE sites for the baseline 2000-2004 period as well as for the next five-year period, 2005-2009.⁸ These five-year averages include total light extinction as well as the extinction contributed by separate pollutant species for the haziest 20% of days and for the clearest 20% of days for each of these five-year periods.

Visibility at all MANE-VU Class I area IMPROVE sites improved for the 2005-2009 period compared to the 2000-2004 baseline period. These improvements occurred for both the haziest 20% days (which are required to get gradually cleaner over time) as well as for the cleanest 20% days (which are required to get no worse over time). Improvements in total light extinction on both the haziest and the cleanest days resulted from reductions in light extinction from all four of the major visibility-impairing pollutant species: sulfates, nitrates, particulate organic matter, and elemental carbon. For more details, see Chapter 9 and Appendix G of the IMPROVE Report V.

The IMPROVE Report V defined the baseline period as 2000 through 2004 and the first trend period as being 2005 through 2009. Since that report was published data are available through 2014. IMPROVE

⁸ Jenny L. Hand, et al., *Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report V*, June 2011, posted on the IMPROVE website at <http://vista.cira.colostate.edu/improve/publications/Reports/2011/2011.htm>

2010-2014 data were downloaded from the FED database and updated five-year (2010-2014) regional haze conditions were calculated using the same procedures used in the IMPROVE Report V. The visibility index used is based on inverse megameters (Mm^{-1}), a measure of light extinction, and the deciview (dv) scale, a logarithmic transformation of light extinction, which for the Regional Haze Rule is derived from IMPROVE aerosol composition data (as described in Appendix B).

Figures 2.2 and 2.3 and Tables 2.3 and 2.4 present trends in visibility at Class I sites in the MANE-VU region from the baseline (2000-04) to the most recent (2010-2014) five-year period. All MANE-VU and nearby Class I areas continued to show progress from the 2005-2009 period beyond the 2005-2009 period examined in the IMPROVE V Report through the 2010-2014 period of most recently available data. Compared to the 2000-04 baseline, all sites continue to show reductions in all four major visibility-impairing pollutant species: sulfates, nitrates, particulate organic matter, and elemental carbon.

Table 2.3. Visibility Improvements by Particle Constituents through 2014 on Haziest 20% Days in MANE-VU Class I Areas

Haziest 20%	Brigantine		Lye Brook*		Great Gulf		Acadia		Moosehorn	
	2000-04	2010-14	2000-04	2010-14	2000-04	2010-2014	2000-04	2010-2014	2000-04	2010-2014
Sulfate B_{ext}	127.1	47.1	87.3	35.2	76.6	25.6	69.2	25.8	58.5	23.1
Nitrate B_{ext}	15.7	18.8	9.1	6.6	3.0	2.3	8.0	5.0	6.4	3.5
POM B_{ext}	24.2	13.8	15.3	8.8	14.4	10.6	11.2	8.6	11.9	8.7
EC B_{ext}	7.0	4.7	4.8	2.9	3.9	2.3	4.3	2.4	4.4	2.0
Soil B_{ext}	1.0	0.5	0.6	0.4	0.6	0.2	0.5	0.3	0.4	0.3
Coarse B_{ext}	5.4	10.9	1.8	2.0	3.0	2.5	1.9	2.7	2.1	2.0
Sea Salt B_{ext}	0.4	1.8	0.1	0.2	0.1	0.4	1.3	2.9	1.0	2.4
Total PM B_{ext}	180.7	97.5	119.0	56.0	101.6	44.0	96.4	47.6	84.6	41.8
Deciview (dv)	29.0	23.3	24.4	18.5	22.8	16.6	22.9	17.9	21.7	16.5

“ B_{ext} ” means light extinction, and values are given in inverse megameters (Mm^{-1}).

*2000-11 data from LYBR1 site and 2012-14 data from LYEB1 site.

Table 2.4. Visibility Improvements by Particle Constituents through 2014 on Clearest 20% Days in MANE-VU Class I Areas

Clearest 20%	Brigantine		Lye Brook*		Great Gulf		Acadia		Moosehorn	
	2000-04	2010-2014	2000-04	2010-2014	2000-04	2010-2014	2000-04	2010-2014	2000-04	2010-2014
Sulfate B_{ext}	14.8	8.8	4.4	2.9	5.8	3.8	6.8	4.3	6.7	3.8
Nitrate B_{ext}	3.9	2.9	1.2	0.8	1.0	0.6	1.1	0.6	1.1	0.5
POM B_{ext}	4.5	3.8	1.3	1.1	2.0	1.4	2.2	1.7	3.1	1.9
EC B_{ext}	2.4	1.5	0.6	0.4	0.8	0.5	0.9	0.5	1.0	0.5
Soil B_{ext}	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coarse B_{ext}	3.2	3.1	0.5	0.5	0.9	0.7	0.7	0.8	1.1	0.7
Sea Salt B_{ext}	1.4	1.5	0.1	0.1	0.2	0.2	0.4	0.6	0.3	0.5
Total PM B_{ext}	30.4	21.7	8.1	5.8	10.7	7.1	12.2	8.4	13.3	7.8
Deciview (dv)	14.3	12.0	6.4	5.1	7.7	5.8	8.8	7.1	9.2	6.7

“ B_{ext} ” means light extinction, and values are given in inverse megameters (Mm^{-1}).

*2000-11 data from LYBR1 site and 2012-14 data from LYEB1 site.

Note that on both the haziest days and the clearest days, the constituent causing the most light extinction was sulfate, and in each area the data for 2010-2014 show improvement over the baseline period of 2000-2004.

Figure 2.2. Visibility Improvements through 2014 by Particle Constituents on Hazyest 20% Days

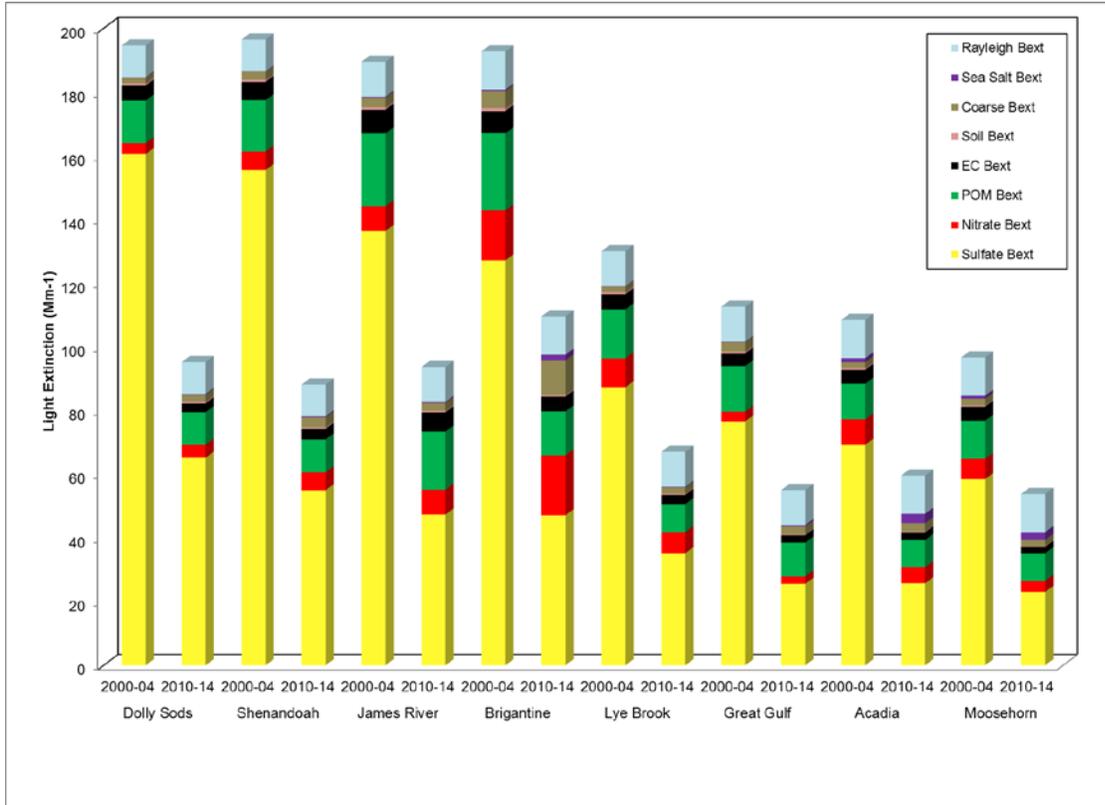
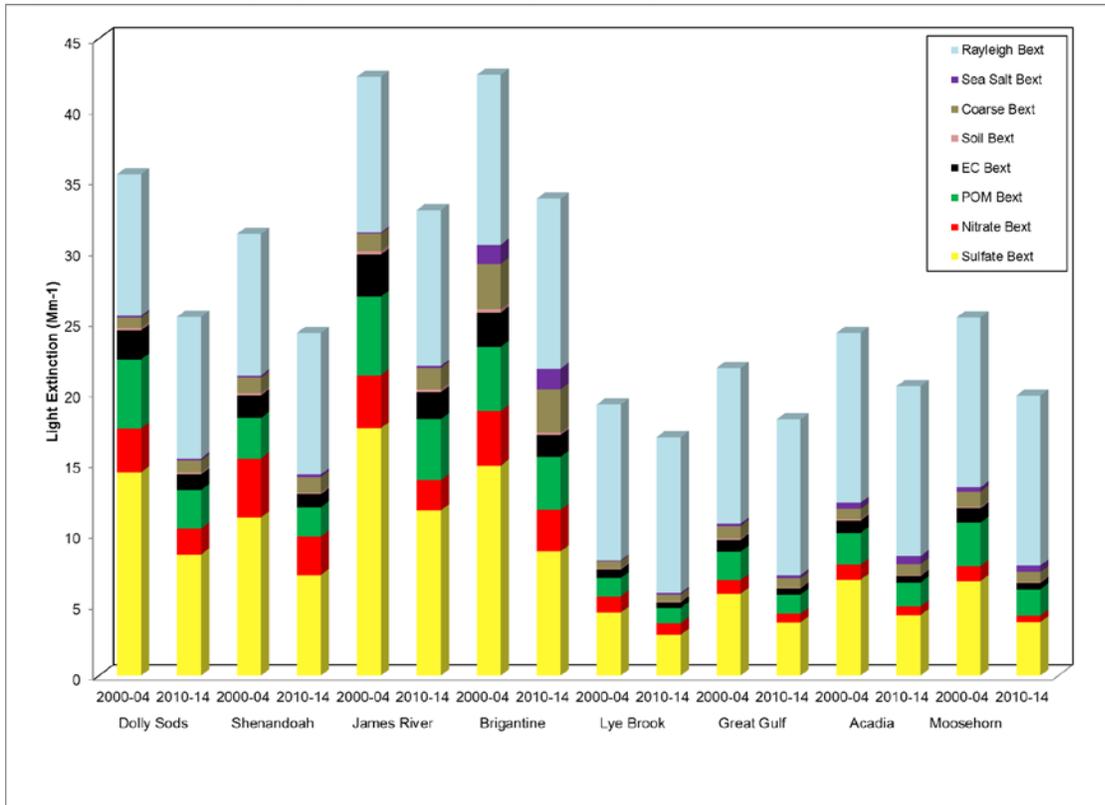


Figure 2.3. Visibility Improvements through 2014 by Particle Constituents on Clearest 20% Days



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, Congress directed EPA and the states to identify existing sources that had been in operation for no more than 15 years and that caused or contributed to visibility impairment in National Parks and Wilderness Areas designated as Class I 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) requires that this progress report describe the status of implementation of all measures included in the SIP for achieving reasonable progress goals for Class I areas (within and outside the State) that are affected by emissions from within the State. In establishing reasonable progress goals, MANE-VU Class I states relied in part on timely implementation of BART requirements.

The BART requirement is an important element of EPA's Regional Haze Rule. Initially promulgated in 1999 and revised most recently in 2005, the BART portion of EPA's rule required BART determinations to be part of the SIP. The state must require sources to comply with any BART determinations as expeditiously as practicable, but no later than five years after EPA approval of the SIP. Vermont has no BART-eligible sources, although it is likely that visibility in Lye Brook and other MANE-VU Class I areas is already benefiting from the implementation of BART elsewhere in the MANE-VU region.

Further visibility benefits are likely to result from installation of new emission controls at BART-eligible facilities located in neighboring states outside MANE-VU. However, the MANE-VU modeling did not account for BART controls outside MANE-VU and, consequently, did not include visibility improvements at MANE-VU Class I areas that would be likely to accrue from such measures.

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 SO₂ and NO_x for certain EGUs. 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). However, CAIR remained in place as EPA considered ways to implement CSAPR under a revised schedule. On November 19, 2012, EPA's then-Assistant Administrator Gina McCarthy provided guidance on the states' reliance on CAIR for purposes of implementing the Regional Haze Rule. This guidance was also the subject of ongoing legal challenges. CAIR was finally replaced by CSAPR starting January 1, 2015.

Vermont is not subject to CAIR or CSAPR and has no BART-eligible sources and, consequently, did not rely on these programs to meet SIP requirements for in-state BART-eligible units. However, Vermont has counted on the emission reductions that BART would produce in upwind states and therefore has an interest in resolution of the CAIR/CSAPR rulemaking and implementation, or other actions that would achieve equivalent emission reduction results.

Section 4: Status of EGU Controls including Controls at 167 Key Sources

4.1. Requirement to Track Implementation of EGU Control Measures

40 CFR §51.308(g)(1) requires that the progress report describe the status of implementation of all measures included in the SIP for achieving reasonable progress goals for Class I Federal areas within and outside the State that are affected by emissions from within the State. As noted in Section 1 of this report, in establishing reasonable progress goals MANE-VU Class I states relied in part on implementation of emissions reductions at 167 key EGU sources or other alternative measures by 2018.

Vermont's 2009 Regional Haze SIP (or other SIPs in other states) did not identify any EGU emissions from Vermont as significant contributors to visibility impairment in Lye Brook (or any other Class I areas). However, making reasonable progress toward improving visibility at Lye Brook is strongly dependent on reductions in sulfur emissions from EGU's in upwind states – both within and upwind of the MANE-VU region. This section provides information on the progress of reducing emissions from EGUs which impact Lye Brook and other MANE-VU Class I areas.

4.2. MANE-VU Focus on Sulfates and EGUs

The MANE-VU Contribution Assessment⁹ produced a conceptual model of regional haze in which sulfate emerged as the most important single constituent of haze-forming fine particle pollution and the principal cause of visibility impairment across the region. The report concluded that, during the baseline period, sulfate alone accounted for anywhere from one-half to two-thirds of total fine particle mass on the 20 percent haziest days at MANE-VU Class I sites. Even on the 20 percent clearest days, sulfate generally accounted for the largest fraction (40 percent or more) of total fine particle mass in the region. Sulfate has an even larger effect when one considers the differential visibility impacts of different particle constituents. It typically accounted for 70 to 82 percent of estimated particle-induced light extinction at northeastern and mid-Atlantic Class I sites.

The MANE-VU Contribution Assessment also indicates that SO₂ emissions from within MANE-VU in 2002 were responsible for approximately 25 percent of the sulfate at MANE-VU Class I areas. Sources in the Midwest and Southeast regions were responsible for about 15 to 25 percent each. Point sources dominated the inventory of SO₂ emissions. Therefore, MANE-VU's long-term strategy included additional measures to control sources of SO₂ both within the MANE-VU region and in other states that were determined to contribute to regional haze at MANE-VU Class I areas. The largest source category responsible for SO₂ emissions within these areas was determined to be EGUs, and EPA's Clean Air Interstate Rule (CAIR) was expected to reduce emissions from EGUs by 2018.

4.3. Status of Implementation of EPA's Clean Air Interstate Rule and other EGU Controls

Emissions from EGUs have been reduced since 2002 through a number of mechanisms, including Federal and State regulatory programs, consent agreements, and various source-specific permitting actions. The EGU emissions used in MANE-VU's modeling to help determine reasonable progress goals are documented in the August 2009 report: *Documentation of 2018 Emissions from Electric Generating Units in the Eastern United States for MANE-VU's Regional Haze Modeling*, which is posted on MARAMA's website at http://www.marama.org/publications_folder/EGU_Projections_Summary_Final_Aug_2009.pdf.

⁹ [Contributions to Regional Haze in the Northeast and Mid-Atlantic United States](#). NESCAUM, 2006

Changes in emissions from 2002 are summarized in Section 7 of this report. The following information discusses various control measures that have reduced emissions since 2002.

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

On May 12, 2005, the EPA promulgated the Clean Air Interstate Rule (CAIR), which required reductions in emissions of NO_x and SO₂ from large fossil fuel fired EGUs. Expected emission reductions were included as part of the MANE-VU 2018 modeling effort.

On July 6, 2011, the EPA finalized the Cross State Air Pollution Rule (CSAPR). EPA intended for this rule to replace CAIR beginning in 2012, requiring 27 states in the eastern United States to reduce power plant emissions. EPA also issued a supplemental proposal for six states to make summertime NO_x reductions. This supplemental proposal, when finalized, would bring the total number of states subject to the program to 28. CSAPR was estimated to reduce EGU emissions from 2005 levels by 6,500,000 tons of SO₂ annually and 1,400,000 tons of NO_x annually. These estimates represented a 71 percent reduction in SO₂ and a 52 percent reduction in NO_x from 2005 levels.

The U.S. Court of Appeals for the D.C. Circuit issued a ruling on December 30, 2011 to stay CSAPR pending judicial review. On August 17, 2012, the D.C. Circuit Court of Appeals vacated CSAPR. Then, on April 29, 2014, the Supreme Court reversed the D.C. Circuit Court opinion and on October 23, 2014, the D.C. Circuit Court of Appeals lifted the stay on CSAPR. On November 21, 2014, EPA issued a ministerial rule that aligns the dates in the CSAPR rule text with the revised court-ordered schedule, including 2015 Phase 1 implementation and 2017 Phase 2 implementation. CAIR remained in effect throughout these court reviews until finally being replaced by CSAPR on January 1, 2015.

EPA modeling in support of the proposed CAIR and CSAPR rules found that Vermont NO_x and SO₂ emissions did not contribute significantly (greater than 1%) to the formation of ozone and fine particle pollution in downwind states. Based on emissions of NO_x, Vermont emissions contributed less than 1% to 2012 “baseline” 8-hour ozone at sites exceeding the 1997 ozone NAAQS, and contributed less than 1% of the level of the 2008 ozone NAAQS at any site in any state regardless of attainment status.

Furthermore, CSAPR analysis of annual and 24-hour PM_{2.5} comprised of sulfate and nitrate (based on SO₂ and NO_x emissions, respectively) showed that Vermont emissions did not contribute significantly to nonattainment in downwind states. Therefore, Vermont does not currently have any obligations under CSAPR.¹⁰

4.3.2. EGU Control Measures in MANE-VU States other than CAIR and CSAPR

The following emission controls originating from specific measures to reduce emissions from EGUs were considered in the regional modeling used to establish the MANE-VU Reasonable Progress Goals (Table 4.1). Pennsylvania was not included in Table 4.1 because the state did not have control measures other than those in CAIR and CSAPR. The actual emissions for the state are included in Appendix F, Status of Emissions from 167 Key Stacks. Vermont had no EGU sources identified as significantly contributing to visibility impairment in any Class I area, and consequently had no EGU control measures included in regional modeling to achieve reasonable progress goals. However, EGU controls in upwind

¹⁰ U.S. EPA Cross-State Air Pollution Rule, Technical Information and Support Documents, [Contributions of 8-hour ozone, annual PM_{2.5}, and 24-hour PM_{2.5} from each state to each monitoring site.](http://www.epa.gov/airtransport/CSAPR/techinfo.html) <http://www.epa.gov/airtransport/CSAPR/techinfo.html>

states within (and outside of) the MANE-VU region, have had beneficial effects on visibility in Vermont's Lye Brook Wilderness Area.

Table 4.1. Status of EGU Control Measures in MANE-VU states.

Measure	Status
Connecticut	
<i>Regulations of Connecticut State Agencies (RCSA), section 22a-174-19a</i> , limiting the SO ₂ emission rate to 0.33 lb/MMBtu for fossil-fuel-fired EGUs greater than 15 MW that are also Title IV sources .	Effective 2003
<i>RCSA, section 22a-174-22</i> , limiting the non-ozone seasonal NO _x emission rate to 0.15 lb/MMBtu for fossil-fuel-fired EGUs greater than 15 MW (effective, 2007).	Effective 2003
<i>Connecticut General Statutes, section 22a-199</i> , limiting the mercury (Hg) emission rate to 0.0000006 lb/MMBtu for all coal-fired EGUs or alternatively coal-fired EGUs can meet a 90% Hg emission reduction.	Effective 2008
Delaware	
<i>Reg. 1144, Control of Stationary Generator Emissions</i> , requiring emission controls for SO ₂ , PM, VOC, and NO _x state-wide.	Effective January 2006
<i>Reg. 1146, Electric Generating Unit (EGU) Multi-Pollutant Regulation</i> , requiring SO ₂ and NO _x emission controls state-wide. SO ₂ reductions will be more than regulation specifies.	Effective December 2007
<i>Reg. 1148, Control of Stationary Combustion Turbine Electric Generating Unit Emissions</i> , requiring SO ₂ , NO _x , and PM _{2.5} emission controls state-wide.	Effective January 2007
Maine	
<i>Chapter 145, NO_x Control Program</i> , limits the NO _x emission rate to 0.22 lb/MMBtu for fossil-fuel-fired units greater than 25 MW built before 1995 with a heat input capacity between 250 and 750 MMBtu/hr, and also limits the NO _x emission rate to 0.15 lb/MMBtu for fossil-fuel-fired units greater than 25 MW built before 1995 with a heat input capacity greater than 750 MMBtu/hr.	Effective 2007
Massachusetts	
Based on the Massachusetts Department of Environmental Protection's 310 CMR 7.29, <i>Emissions Standards for Power Plants</i> , adopted in 2001, six of the largest fossil-fuel-fired power plants in Massachusetts must comply with emissions limitations for NO _x , SO ₂ , Hg, and CO ₂ . These regulations will achieve an approximately 50-percent reduction in NO _x emissions and a 50- to 75-percent reduction in SO ₂ emissions. Depending on the compliance paths selected, the affected facilities will meet the output-based NO _x and SO ₂ standards between 2004 and 2008. This regulation also limits the six grandfathered EGUs to a CO ₂ emission rate of 1,800 lb/MWh.	Effective between 2004 and 2008 depending on compliance path.

Measure	Status
New Hampshire	
<i>Chapter Env-A 2900, Sulfur Dioxide and Nitrogen Oxides Annual Budget Trading and Banking Program</i> , capping NO _x emissions at 3,644 tons per year and SO ₂ emissions at 7,289 tons per year for all existing fossil-fuel fired steam units.	Effective October 1, 2011
<i>Chapter Env-A 3200, NO_x Budget Trading Program</i> , limiting ozone season NO _x emissions on all fossil-fuel-fired EGUs greater than 15 MW to 0.15 lb/MMBtu.	Effective Nov. 2, 2007
New Jersey	
The New Jersey settlement agreement with PSEG required the following actions for specific EGUs:	
<i>Bergen Unit #2</i> : Repower to combined cycle by December 31, 2002.	Effective Dec. 31, 2002
<i>Hudson Unit #2</i> : Install dry FGD or approved alternative technology by Dec. 31, 2006, to control SO ₂ emissions and operate the control technology at all times the unit operates to limit SO ₂ emissions to 0.15 lb/MMBtu; install SCR or approved alternative technology by May 1, 2007, to control NO _x emissions and operate the control technology year-round to limit NO _x emissions to 0.1 lb/MMBtu; and install a baghouse or approved alternative technology by May 1, 2007, to control and limit PM emissions to 0.015 lb PM/MMBtu.	Effective May 1, 2007
<i>Mercer Unit #1</i> : Install dry FGD or approved alternative technology by Dec. 31, 2010, to control SO ₂ emissions and operate the control technology at all times the unit operates to limit SO ₂ emissions to 0.15 lb/MMBtu; and install SCR or approved alternative technology by 2005 to control NO _x emissions and operate the control technology during ozone season only in 2005 and year-round by May 1, 2006, to limit NO _x emissions to 0.13 lb/MMBtu.	Effective 2005, 2006, 2010
<i>Mercer Unit #2</i> : Install dry FGD or approved alternative technology by Dec. 31, 2012, to control SO ₂ emissions and operate the control technology at all times the unit operates to limit SO ₂ emissions to 0.15 lb/MMBtu; and install SCR or approved alternative technology by 2004 to control NO _x emissions and operate the control technology during ozone season only in 2004 and year-round by May 1, 2006, to limit NO _x emissions to 0.13 lb/MMBtu.	Effective 2004, 2006, 2010
The New Jersey settlement also requires that units operating an FGD use coal having a monthly average sulfur content no greater than 2 percent.	Effective with FGD as above
New York	
<i>Title 6 NYCRR Parts 237, Acid Deposition Reduction NO_x Budget Trading Program</i> , limits NO _x emissions on all fossil-fuel-fired EGUs greater than 25 MW to a non-ozone season cap of 39,908 tons in 2007.	Effective 2007

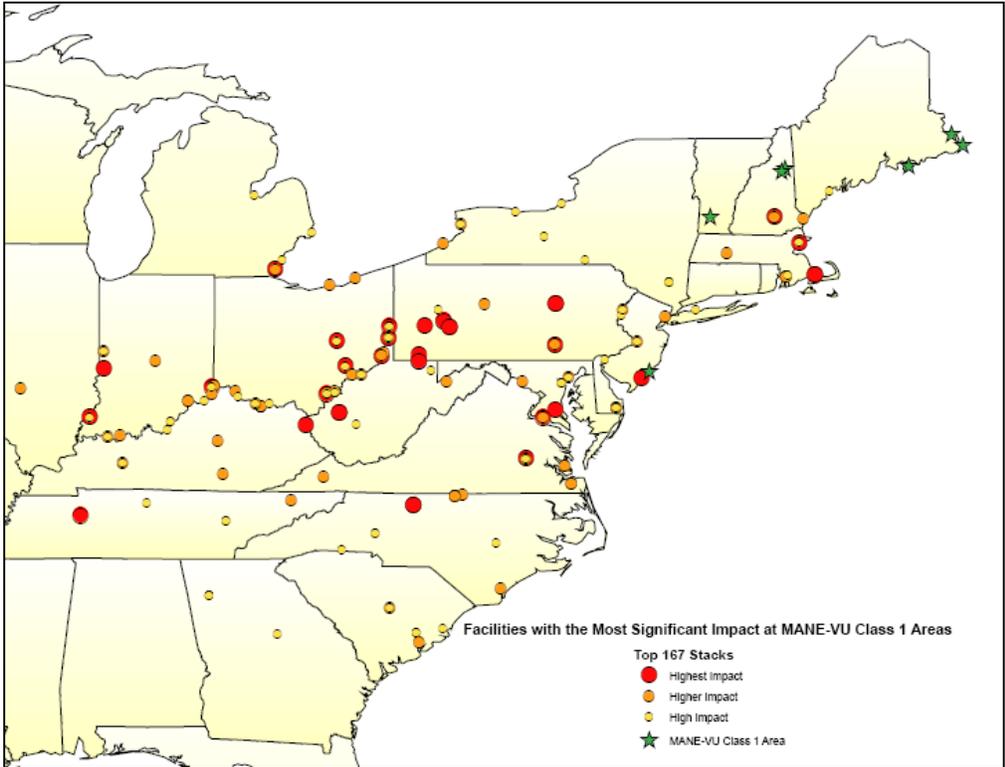
Measure	Status
<p><i>Title 6 NYCRR Parts 238, Acid Deposition Reduction SO₂ Budget Trading Program</i>, limits SO₂ emissions from all fossil-fuel-fired EGUs greater than 25 MW to an annual cap of 197,046 tons per year starting in 2007 and an annual cap of 131,364 tons per year starting in 2008.</p>	<p>Effective 2007, 2008</p>

The Maryland Healthy Air Act (HAA) regulations became effective on July 16, 2007 and required reductions in NO_x, SO₂, and mercury emissions from large coal burning power plants in Maryland. This was after completion of the MANE-VU Contribution Assessments, so it was not in the MANE-VU 2018 modeling. Emission reductions from the HAA come in two phases. The first phase required reductions in the 2009/2010 timeframe, and compared to a 2002 emission baseline, reduced NO_x emission by almost 70 percent and SO₂ emission by 80 percent. The second phase of emissions controls occurred in 2012/2013. At full implementation, the HAA will reduce NO_x emissions by approximately 75 percent from 2002 levels and SO₂ emissions by approximately 85 percent from 2002 levels. The reductions from the HAA exceed the reductions requested for 2018 by MANE-VU for the key EGU sources located in Maryland.

4.4. Status of Controls at 167 EGU Sources

MANE-VU identified 167 EGU sources whose 2002 emissions contributed to visibility impairment in MANE-VU Class I areas. The location of these sources is shown in Figure 4.1. The MANE-VU Long Term Strategy called for a 90% reduction in emissions at these sources, or if it was infeasible to achieve that level of reduction from a unit, alternative measures were to be pursued by the State.

Figure 4.1. Distribution of 167 EGU Stacks Identified as Affecting MANE-VU Class I Areas in 2002.



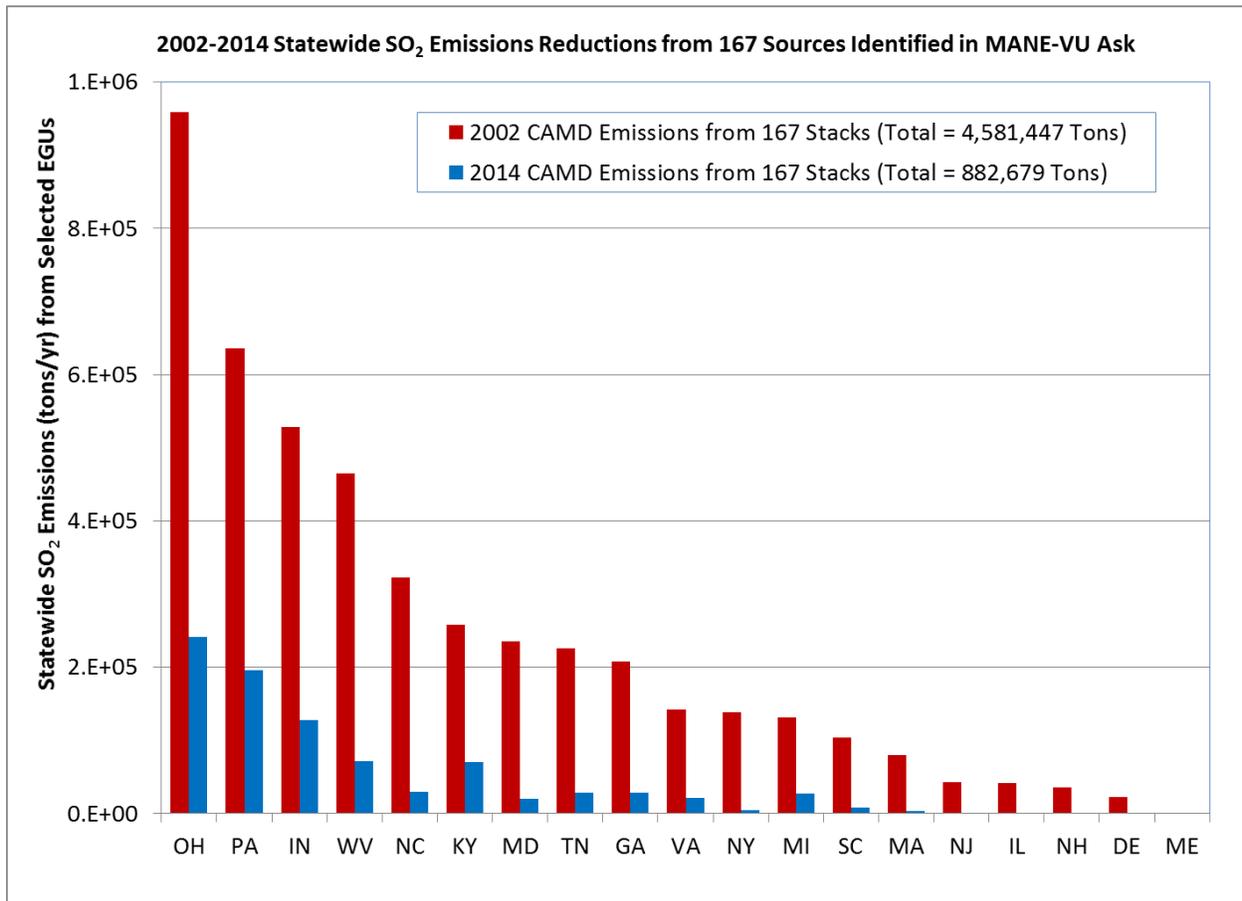
The “167 EGU strategy” could lead to large reductions in SO₂ emissions due to installation of stack control technologies such as SO₂ scrubbers. To determine the possible benefits of this EGU control program, NESCAUM modeled 2018 emissions for the 167 EGUs in the Northeast, Southeast, and Midwest at levels equal to 10 percent of their 2002 emissions. NESCAUM used CMAQ to model sulfate concentrations in 2018 after implementation of this control program and converted sulfate concentrations to PM_{2.5} concentrations.

NESCAUM reported on the status of emission reductions at those key sources. As shown in Figure 4.2 below, with additional detail provided in Appendix F, 2002 emissions from the 167 key stacks were nearly 4.6 million tons per year. Data from EPA’s Clean Air Markets Division (CAMD) indicate these emissions had dropped by nearly 3.7 million tons per year by 2014. Only 4 units increased emissions from 2002 to 2014 with the increase from these units being less than 10,000 tons. Overall, there was a 29% decline in heat input and an 81% drop in emissions.

Fifty eight of the 167 key EGU stacks are located in MANE-VU. Forty three of those had already achieved 90% emissions reductions by 2014 and another six had already achieved 90% emission reductions by 2014 when emissions reductions from other stacks at the 167 EGU facilities were included.

Emissions reductions from 2002 to 2014 from the 167 EGU stacks identified in the MANE-VU Ask are summarized on a statewide basis in Figure 4.2, and are presented on a stack-specific basis in Appendix F.

Figure 4.2. 2002-2014 Statewide SO₂ Emissions Reductions from 167 Sources Identified in MANE-VU Ask.



Section 5: Status of Additional Measures in the Regional Haze SIP

5.1. Requirement to Track Implementation of Other Control Measures

40 CFR §51.308(g)(1) requires that the progress report describe the status of implementation of all measures included in the SIP for achieving reasonable progress goals for Class I areas within and outside the State that are affected by emissions from within the State. In establishing reasonable progress goals, MANE-VU Class I states relied in part on a low sulfur fuel strategy to be implemented within MANE-VU as well as efforts to reduce emissions through other reasonable measures by 2018.

This section provides information on the progress of Vermont in implementing the measures included in Vermont's Regional Haze SIP for sources other than EGUs.

5.2. Status of Low Sulfur Fuel Oil Strategy

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

The MANE-VU states agreed that a low-sulfur oil strategy was reasonable to pursue by 2018, and by May 2015 nine MANE-VU states had adopted sulfur in fuel limits with various implementation dates through 2018 (Table 5.1).

Vermont committed to adopt the mid-Atlantic/northeast regional low-sulfur fuel oil strategy in Vermont's Regional Haze SIP. New limitations on sulfur in fuel were adopted on September 28, 2011 in Vermont's Air Pollution Control Regulations (VT APCR) §5-221(1), to take effect in two phases (Table 5.1). The first phase, to begin on July 1, 2014, lowered the allowable concentration of sulfur in No. 2 and lighter distillate fuels to 0.05% (500ppm) by weight. The second phase, to take effect on July 1, 2018, further lowered the sulfur limit for No. 2 and lighter distillate oils to 0.0015% (15ppm) by weight, lowered the sulfur limit for No. 4 residual oils to 0.25% (2500ppm) by weight, and lowered the sulfur limit for No. 5 and No. 6 residual oils, heavier residual oils, and used oils to 0.5% (5000ppm) by weight.

Table 5.1. Current State Sulfur in Fuel Limits

State	Limits Adopted as of May 1, 2015.	
	#2 Distillate Oil	#4 / #6 Residual Oil
Connecticut	500 ppm by 7/1/ 2014 15 ppm by 7/1/2018 for fuel combusted in stationary sources. (Anticipated final by 6/30/14.) CT General Statutes section 16a-21a was amended in 2013 and applies to heating oil. The same proposed limits and timing apply.	0.3% for EGUs subject to Regulations of CT State Agencies (RCSA) section 22a-174-19a. 0.5% for industrial boilers subject to RCSA section 22a-174-19a. 0.3% by 7/1/2018 for other stationary sources subject to proposed RCSA section 22a-174-19b, expected to be final by 6/30/2014.
Delaware	15 ppm by 2016	0.5% by 2016
Maine	0.005% by weight by July 2016 0.0015% by weight by January 2018	0.5% by 2018
Massachusetts	500 ppm by 7/1/2014 15 ppm by 7/1/2018	1% by 7/1/2014 (0.5% for power plants) 0.5% by 7/1/2018
New Jersey	500 ppm by 2014 15 ppm by 2016	3000-5000 ppm by 2014 depending on county
New York	15 ppm by 2012 - heating oil 15 ppm by 2014 - other sources	0.3% in NYC 0.37% in Nassau, Rockland, and Westchester Counties 0.5% in the rest of the state (Purchase date 7/1/14, Use date 7/1/16)
Pennsylvania	500 ppm by 2016	0.25% by weight (#4 oil) by 2016 0.5% by weight (#5, #6 oil) by 2016
Rhode Island	0.05% (500ppm) by weight by July 1, 2014 0.0015% (15ppm) by weight by July 1, 2018	0.5% by weight by July 1, 2018 (Residual oil)
Vermont	0.05% by weight by 7/1/2014 0.0015% by weight by 7/1/2018	0.25% by weight (#4 oil) by 7/1/2018 0.5% by weight (#5, #6 oil) by 7/1/2018

Source: MANE-VU Technical Support Committee summary of status of low sulfur fuel requirement

5.3. Status of Additional State-Specific Control Measures

This section discusses implementation of the state-specific provisions included in Vermont's Regional Haze SIP.

5.3.1. 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 the MANE-VU Region, September 1, 2006." 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. The largest MANE-VU wood smoke source categories, with respect to PM_{2.5} emissions, 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.

Wildfire emissions within Vermont and other MANE-VU states are also relatively small and infrequent contributors to regional PM emissions. However, Lye Brook and other MANE-VU Class I areas are occasionally impacted by wildfire smoke emissions from other regions, such as from the lightning-induced forest fires in Quebec Province in July 2002. These natural wildfire smoke emissions occasionally impair visibility at Lye Brook, but are not considered manmade or controllable – and in fact are considered as part of "natural background" conditions.

Vermont will continue to review the impacts from agricultural use of fire and prescribed fire for forest or ecosystem management. If those impacts become important for maintaining reasonable progress in the future, revisions to the Regional Haze SIP will include a smoke management plan. Vermont will continue to consult with the U.S. Forest Service regarding potential impacts of prescribed fire on visibility in the Lye Brook Wilderness.

5.3.2. 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. MANE-VU's Contribution Assessment found that, from a regional haze perspective, crustal material generally does not play a major 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.

For its first regional haze SIP, Vermont considered additional measures to mitigate the impacts of construction activities but decided to defer evaluation of further controls. Vermont committed to

document future deliberations on potential control measures for construction activities and their possible implementation in this progress report.

5.3.3. Prevention of Significant Deterioration

The VT APCR require permit review for new major stationary sources (emitting greater than 50 tons of any air contaminant) or major modifications to include an Air Quality Impact Evaluation that demonstrates the new allowable emissions will not result in an exceedance of the remaining increments for SO₂, NO₂, PM_{2.5}, or PM₁₀ in any Class I area. The applicant must also demonstrate “that the increase in allowable emissions will not cause an adverse impact on visibility in any sensitive area or in any Class I Federal area and will not interfere with reasonable progress toward the remedying of existing man-made visibility impairment in a sensitive area. Said demonstration shall be submitted to the Agency and the appropriate Federal Land Manager at least 60 days prior to the close of the public comment period on the source or modification,” (where “Sensitive Area” is defined as “any portion of the area comprising Lye Brook Wilderness Area and all other terrain in Vermont at or above the elevation of 2500 feet above mean sea level.”) (See VT APCR §5-502(4) and §5-101). In this manner, new major sources and existing sources making major modifications will be constructed and operated in a manner that will not degrade air quality or visibility. The PSD permitting program is an integral part of Vermont’s long-term strategy for meeting its regional haze goals.

5.3.4. Enforceability

40 CFR §51.308(d)(3)(v)(F) requires Vermont to consider the enforceability of emissions limitations and control measures in developing its long term strategy. All control measures incorporated into law or codified in administrative rules will be enforceable. Any facility subject to state or federal permit requirements, including Title V facilities, will be required to comply with the specific permit conditions that reference the applicable provisions of those laws and rules.

The key statutory provisions that allow for the enforceability of emissions limitations and control measures related to regional haze are:

- 10 V.S.A. Chapter 23, Air Pollution Control (see e.g., 10 V.S.A. §554, which authorizes the adoption and amendment of rules; 10 V.S.A. §556, which authorizes a permitting program for the construction or modification of air contaminant sources; 10 V.S.A. §556a, which authorizes a permitting program for the operation of air contaminant sources; 10 V.S.A. §558, which authorizes the establishment of emission control requirements that may be necessary to prevent, abate, or control air pollution; 10 V.S.A. §567, which authorizes rules to control emissions from motor vehicles; and 10 V.S.A. §568, which provides for penalties for the violation of 10 V.S.A. Chapter 23 or any rules adopted thereunder);
- 10 V.S.A. Chapter 201, Administrative Environmental Law Enforcement, which authorizes enforcement of 10 V.S.A. Chapter 23;
- 3 V.S.A. §2822(j)(1), which establishes fees for air pollution control permits and registrations issued under 10 V.S.A. Chapter 23.

Provisions of the VT APCR of particular relevance to the Regional Haze SIP are:

- §5-221(1) Prohibition of Potentially Polluting Materials in Fuel (Sulfur limitation in fuel);
- §5-312 Sulfates - Secondary Ambient Air Quality Standards;
- Subchapter V: Review of New Air Contaminant Sources;
- Subchapter X: Operating Permits

The VT APCR rules provide for enforceable emission control measures and compliance schedules to meet the applicable requirements of the CAA and rules promulgated by EPA. The VT APCR also define the permit program and fee structure for stationary sources to ensure that national ambient air quality standards are achieved.

In order to comply with and implement the MANE-VU low-sulfur oil strategy, Vermont revised the §5-221(1) of the VT APCR as described above.

Ultimately, Vermont’s Regional Haze SIP is dependent on the implementation of enforceable emission limitations and control measures, both within the state and in other states identified as contributing to visibility impairment at Vermont’s Lye Brook Wilderness Area. Because Vermont has no jurisdiction over other states, the attainment of regional progress goals will, to a large extent, be predicated on the good-faith efforts of contributing upwind states to meet their fair share of emission reductions through implementation of their own enforceable control measures. While Vermont can provide assurances regarding the implementation of in-state emission controls, the bulk of regional-haze-causing pollutants in the Lye Brook Wilderness will continue to come from out-of-state sources.

5.3.6. Controls on Area Sources Expected by 2018

In general, MANE-VU developed the 2018 inventory for area sources by applying growth and control factors to the 2002 Version 3.0 inventory. Area source control factors were developed for the following national or regional control measures for SO₂ or NO_x. VOC controls are not included here, as they were not expected to have significant visibility benefits.

Table 5.2. Status of Control Measures – Area Sources

Measure	Status
Residential woodstove NSPS	EPA revised the NSPS on February 3, 2015.

The MANE-VU emissions inventory and 2018 modeling did not consider the rapid development of oil and gas resources that has occurred in and near the region since 2007. MANE-VU states are collaborating with EPA and other states to estimate emissions from oil and gas development and to conduct additional modeling to assess impacts on air quality. At this time sufficient data are unavailable. Pennsylvania and West Virginia have adopted a general permit to mitigate potential impacts. Regional haze SIPs due in 2018 will consider emissions from this source category.

5.3.7. Controls on Mobile Sources Expected by 2018

MANE-VU's Version 3.0 emission inventory included the following emission control measures (Table 5.3):

Table 5.3. Status of Control Measures – Mobile Sources

Measure	Status
Tier 2 Vehicle and Gasoline sulfur program	See below
Low Emission Vehicle Regulations, which incorporate by reference California's emissions standards for motor vehicles	See below
An enhanced motor vehicle emissions inspection and maintenance (IM) program including an anti-tampering inspection for 1995 and older vehicles, and an on-board diagnostics (OBD) inspection for 1996 and newer vehicles.	Implemented in 2000. ¹¹
Federal Heavy-Duty Diesel Engine Emission Standards for Trucks and Buses	See below
Federal Emission Standards for Large Industrial Spark-Ignition Engines and Recreational Vehicles	See below

Tier 2 Vehicle and Gasoline Sulfur Program: (40 CFR Part 80, Subpart H; 40 CFR Part 85; 40 CFR Part 86): The EPA's Tier 2 fleet averaging program for on-road vehicles, modeled after the California LEV II standards, became effective in the 2005 model year. The Tier 2 program allows manufacturers the flexibility to produce vehicles with a range of emissions levels as long as the mix of vehicles that a manufacturer sells each year has average NO_x emissions below a specified value. Mobile emissions continue to improve from this program as motorists replace older, more polluting vehicles with cleaner vehicles. Emissions reductions are reflected in on-road and non-road mobile source emission estimates provided in Section 8, below.

Low Emission Vehicle Regulations: Vermont first adopted California's LEV Program in 1996 and has amended its LEV regulations periodically since then to stay consistent with California. Remaining consistent with California's standards will ensure that the cleanest cars are available for sale in Vermont. In addition, with respect to adopting California's labeling requirements, 10 V.S.A. §579 requires the Agency to adopt a vehicle emissions labeling program and requires consistency with California's labeling program.

The most recent amendments to the LEV Program, "LEV III," were adopted in January 2014 to include the next generation of criteria pollutant emission standards, revisions to vehicle labeling requirements, minor changes to the on-board diagnostics regulations (OBD II regulations), and the next generation of greenhouse gas emission standards. The LEV III criteria pollutant emission standards will reduce fleet average emissions from new passenger cars, light-duty trucks, and medium-duty passenger vehicles starting in model year 2015 to a level currently only achieved by a fraction of today's vehicle fleet by model year 2025.

¹¹ Additional information on Vermont's motor vehicle inspection and maintenance program can be found at: http://dmv.vermont.gov/sites/dmv/files/pdf/DMV-VN112-Vehicle_Inspection_Manual.pdf.

Heavy-Duty Diesel Engine Emission Standards for Trucks and Buses: EPA set a PM emissions standard of 0.01 grams per brake-horsepower-hour (g/bhp-hr) for new heavy-duty diesel engines in trucks and buses, to take full effect in the 2007 model year. This rule also includes standards for NO_x and non-methane hydrocarbons (NMHC) of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These NO_x and NMHC standards were phased in together between 2007 and 2010. Lowering sulfur in diesel fuel enables modern pollution control technology to be effective on the trucks and buses that use this fuel. EPA required a 97-percent reduction in the sulfur content of highway diesel fuel from its previous level of 500 parts per million (low-sulfur diesel) to 15 parts per million (ultra-low sulfur diesel). These requirements were successfully implemented on the timeline in the regulation. Emissions reductions are reflected in on-road mobile source emissions estimates for 2007 and later years (see Section 6).

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

5.3.8. Controls on Non-Road Sources Expected by 2018

Version 3.0 of the MANE-VU 2002 Emissions Inventory was used to model the impacts of projected 2018 emissions from non-road sources. Non-road mobile source emissions for the 2018 emission inventory were calculated with EPA’s NONROAD2005 emissions model as incorporated into the NMIM2005 (National Mobile Inventory Model) database. The NONROAD model accounts for emissions benefits associated with federal non-road emission control requirements such as the following:

Table 5.4. Status of Control Measures – Non-road Sources

Measure	Status
“Control of Air Pollution: Determination of Significance for Non-road Sources and Emissions Standards for New Non-road Compression Ignition Engines at or above 37 Kilowatts,” 59 FR 31306, June 17, 1994	Effective July 18, 1994
“Control of Emissions of Air Pollution from Non-road Diesel Engines,” 63 FR 56967, October 23, 1998	Phased in from 1999 to 2000, 2001-2006, and 2006-2008
“Control of Emissions from Non-road Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based),” Final Rule, 67 FR 68241, November 8, 2002	Final Rule November 8, 2002
“Control of Emissions of Air Pollution from Non-road Diesel Engines and Fuel,” Final Rule, April 29, 2004	Phased in starting in mid-2007

Non-road Diesel Emissions Program: The EPA adopted standards for emissions of NO_x, HC, and CO from several groups of non-road engines, including industrial spark-ignition engines and recreational non-road vehicles. Industrial spark-ignition engines power commercial and industrial applications and include forklifts, electric generators, airport baggage transport vehicles, and a variety of farm and construction applications. Non-road recreational vehicles include snowmobiles, off-highway motorcycles, and all-terrain vehicles. These rules were initially effective in 2004 and were fully phased in by 2012.

The non-road diesel rule set standards that reduced emissions by more than 90 percent from non-road diesel equipment and, beginning in 2007, the rule reduced fuel sulfur levels by 99 percent from previous levels. The reduction in fuel sulfur levels applied to most non-road diesel fuel in 2010 and applied to fuel used in locomotives and marine vessels in 2012. The effects of these rules are reflected in emissions estimates provided in Section 7, below.

Aircraft, Commercial Marine Vessels, and Locomotives: Because the NONROAD model used to develop the non-road source emissions did not include aircraft, commercial marine vessels, and locomotives, MANE-VU's contractor, MACTEC, developed the inventory for these sources. MACTEC used emissions projections developed by EPA for the Clean Air Interstate Rule and a linear interpolation methodology described in the February 2007 report: *Development of Emissions Projections for 2009, 2012, and 2018 for Non-EGU Point, Area, and Non-road Sources in the MANE-VU Region*. (posted on the MARAMA website) Regulations applicable to marine and locomotive engines include:

- Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines less than 30 Liters per Cylinder. Republication. Final Rule 73 FR 37096.
- Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder (75 FR 22895).>

These controls were phased in beginning in 2009 and affect new and remanufactured engines.

5.4. Status of Vermont Secondary Sulfate Standards and Significant Impact Levels

In its 1986 proposed *Implementation Plan for the Protection of Visibility*, Vermont established 6-month summer seasonal (April-September) and 24-hour state ambient air quality standards for particulate sulfate – both set equal to 2 µg/m³ - which apply in the Lye Brook Wilderness as well as in other areas of the state in excess of 2,500 feet elevation ASL. The 1986 plan also established levels of significant impact for violations of these sulfate standards of 2 µg/m³ for 24 hours and 0.2 µg/m³ for the 6-month summer season. The significant impact levels, included in Table 3 of VT APCR, have been used in reviewing potential impacts from proposed sources of air pollution in Vermont.

In its 2009 Regional Haze SIP submittal, Vermont expressed the intention of lowering these levels of significant impact to sulfate concentrations of 0.1 µg/m³ for 24 hours and 0.004 µg/m³ for the summer season. These sulfate concentrations were approximately equal to the smallest (100th largest) individual source impacts at Lye Brook identified in MANE-VU CALPUFF modeling that supported the MANE-VU Ask for emissions reductions from 167 upwind sources. The intent was to assure that no new source of air pollution in Vermont would have a sulfate impact as large as any of the sources from which reductions were requested in the MANE-VU Ask. Vermont was also hopeful that EPA might subsequently approve these significance levels as federally enforceable elements of Vermont's SIP, and

that they might then be used to assure that new (or existing) sources in upwind states did not exceed these significant impact levels at Lye Brook in the future.

Vermont has not made the indicated revisions to the sulfate significant impact levels, as subsequent analyses have indicated they would serve no useful purpose. Vermont's summer seasonal sulfate concentrations, which averaged about $4 \mu\text{g}/\text{m}^3$ in the early 1980s when Vermont's 1986 visibility plan was developed, have declined to less than $2 \mu\text{g}/\text{m}^3$ in recent years. Because the seasonal standard is being attained, there is no need for a significant impact level. The smallest of the top 100 out-of-state EGUs impacting Lye Brook and identified by CALPUFF modeling to have a maximum 24-hour impact as large as $0.1 \mu\text{g}/\text{m}^3$ had a 2002 annual emission rate of 2,840 tons, which is nearly 20 times larger than the largest SO_2 source currently operating in Vermont. It is highly unlikely that a source of this size would be built in Vermont in the future, given current New Source Performance Standards, Vermont's new sulfur in fuel limits, EPA's new Mercury and Air Toxics Standards (MATS), and the new 2010 1-hour SO_2 NAAQS.

Exploratory AERMOD modeling to assess the potential for existing Vermont sources to exceed the 75 ppb 1-hour SO_2 standard indicated no expected exceedances of the 1-hour SO_2 standard or of a revised significant impact level for sulfate from existing Vermont sources. Increasing the emission rates for a hypothetical source located in a mountain valley location suggested that an emission rate as low as 625 tons per year (four times larger than any current Vermont source) could potentially exceed the 1-hour SO_2 standard, but would not exceed a revised 24-hour significant impact level for sulfate at Lye Brook or other Vermont locations above 2,500 feet elevation. As indicated in Section 4.4, there has been an 81% reduction in SO_2 emissions from the 167 EGU sources identified in the MANE-VU Ask between 2002 and 2014, so it is unlikely that any of these out-of-state sources would exceed a lower $0.1 \mu\text{g}/\text{m}^3$ Vermont significant impact level for sulfate in the future, as additional upwind reductions are likely from CSAPR, the 1-hour SO_2 NAAQS, and MATS.

Section 6: State Summary of Emission Reductions Resulting from Implementation of Control Measures

6.1. Requirement to Summarize Emissions Reductions

40 CFR 51.308(g)(2) requires that the progress report summarize the emissions reductions achieved throughout the State through implementation of the measures included in the State's SIP for achieving reasonable progress at Class I areas (as described in the previous sections).

6.2. Summary of Emissions Changes Since 2002

Section 7 of this report lists emissions estimated by MANE-VU and the State of Vermont for 2002 and 2018 and compares those estimates to the 2011 emission inventory for all of the major categories of emissions sources. Changes in emissions from key EGUs located in the MANE-VU region are shown in Appendix F and discussed in Section 4 above.

Reductions from point sources in Vermont are summarized below. Reductions from area and mobile source categories are documented to the extent feasible in Section 7.

6.2.1. Estimated Sulfur Emission Reductions from Low Sulfur Fuel Oil Strategy

The largest emissions reductions from Vermont sources resulting from specific measures included in Vermont's 2009 Regional Haze SIP Revision are those resulting from low sulfur fuel requirements. As indicated in Section 5.2, Vermont's revised sulfur limitations in fuel (VT APCR §5-221(1)) include phased limits on the sulfur content of fuel oil sold and used in Vermont. For No. 2 and lighter fuel oils, a sulfur limit of 0.05% was required starting July 1, 2014. This limit will drop to 0.0015% on July 1, 2018, at which time the sulfur limit for No. 4 oil will drop to 0.25% and the limit for No. 5 and No. 6 oil will drop to 0.5%.

Vermont's Point Source Registration program (VT APCR §5-802) requires all sources emitting a combined total of more than five tons per year of all air contaminants to register and submit annual updates of emissions and related fuel use and operations data. For fuel burning sources exceeding the five ton threshold, the required annual information includes fuel type, sulfur content, and quantity burned. Sources pay an annual registration fee based on their annual emissions of criteria pollutants and hazardous air contaminants. These source registration data provide a good way to track changes in fuel use over time across a wide spectrum of stationary sources. The most recently available data apply to fuel burned in calendar year 2014.

Table 6.1 summarizes results for registered sources burning No. 2 fuel oil over the past five years. The average sulfur content of No. 2 oil declined from 0.2% in 2010-2012 to 0.14% in 2014 (for which the lower fuel requirement was instated half-way through the year). These average sulfur values are likely overestimates, since facilities not reporting fuel sulfur content are assumed to be using the maximum allowable sulfur content for registration fee purposes.

Table 6.1. Vermont Point Source No. 2 Fuel Oil Usage and Sulfur Content 2010-2014.

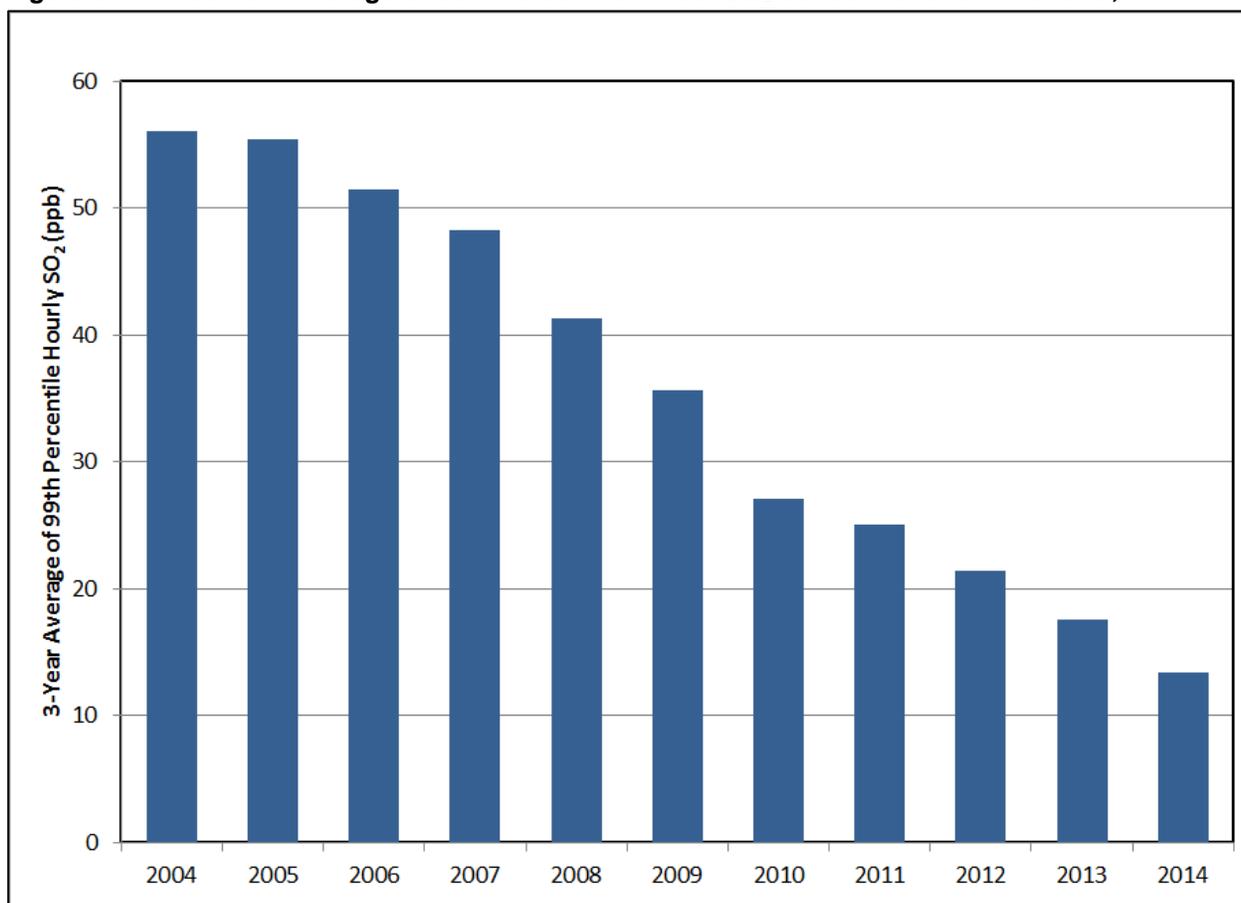
Year	Number of sources (No. 2 fuel use only)	No. 2 fuel usage (10³ gallons)	Average % sulfur (No. 2 fuel only)
2014	185	5,653	0.14
2013	194	6,889	0.17
2012	190	7,365	0.2
2011	175	7,182	0.2
2010	183	7,505	0.2

For those 185 sources reporting their No. 2 fuel sulfur content in 2014, 49% had sulfur content less than or equal to the new 0.05% sulfur standard and 16% had sulfur content for No. 2 oil less than or equal to the 2018 limit of 0.0015%.

In addition to the reductions in SO₂ emissions from Vermont “point sources” documented by the source registration program, there are also large reductions in area source residential and small commercial distillate oil burning emissions resulting from the recently imposed sulfur limits on distillate oil and other factors. Federal requirements for ultra-low sulfur ($\leq 0.0015\%$) diesel fuel, phased in from 2006 through 2010, have substantially reduced SO₂ emissions from mobile sources. These requirements have also resulted in much wider availability of ultra-low sulfur No. 2 heating oil in Vermont. The availability of this heating fuel, the increased efficiency and reduced furnace cleaning benefits from burning the fuel, and the current and pending Vermont requirements for lower sulfur content of heating oil are all contributing to a continuing decline in residential fuel-burning and SO₂ emissions. This is evident in the continuing decline in 1-hour SO₂ design value (three-year average of 99th percentile hourly ambient SO₂ concentrations) in Rutland, VT (Figure 6.1).

Peak hourly SO₂ concentrations in Rutland occur on cold, calm winter mornings, when local fuel burning emissions are highest, and generally reflect local rather than transported SO₂ emissions. As evident in Figure 6.1, SO₂ concentrations have been steadily declining over the past 10 years, including the past five year period when any benefits from reduced mobile source emissions would have run their course.

Figure 6.1. Three-Year Average of 99th Percentile 1-Hour SO₂ Concentrations in Rutland, VT.



Section 7: Analysis of Emission Changes in the Last Five Years from Visibility Impairing 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 emissions of pollutants 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 five-year period.

7.2. MANE-VU Emissions Trends

Several data sources were used to develop the information in this report, including:

- The 2002 based modeling inventory with a projection to 2018 (MANE-VU Version 3.3),
- The 2007 based modeling inventory with projections to 2017 and 2020 (MARAMA Version 3.3), and
- The 2010 U.S. EPA Clean Air Markets Division (CAMD) actual emissions as reported by sources.

While we present estimates of emissions for 2002, 2007, 2010 2017, 2018, and 2020, there are several reasons why it is difficult to make comparisons among those years. The pollutants and source sectors included in these data sources vary. For example, CAMD only collects data on NO_x and SO₂, not PM and VOC. Inconsistencies between data sources arise because of differences in calculation methodologies, because different emissions sources are included or emissions factors have changed, or due to differences in growth projections, unanticipated shutdowns or new sources, and new control programs.

Current estimates for the years 2007, 2017, and 2020 were developed using different methods and assumptions than estimates made in 2006 for the years 2002 and 2018. Notably, emissions models used to calculate mobile sources are different now than they were in 2006. Projections of future emissions always involve assumptions – for example, assumptions about population growth, growth in fuel consumption, and the balance among different fuels, such as coal and natural gas. Much has changed in the last few years as natural gas prices have declined and old coal-fired units have been shut down due to the relatively higher price of coal.

7.2.1. 2002 Modeling Inventory with Projections to 2018

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

- On the Books/On the Way – These projections reflect a scenario accounting for all in-place controls that are fully adopted into federal or individual state regulations or SIPs. On the way controls included the Clean Air Interstate Rule. 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 controlled case".

The BOTW projection for 2018 was used for this emission trend analysis.

Several versions of the 2002 inventory suite were prepared. Improvements were made to the emissions estimation with each subsequent version. Version 3.3 is the version that was used in air quality modeling and this emission trend analysis. Details of the approach taken to prepare the 2002 modeling inventory are found in the documentation for the base year and future projections.

7.2.2. 2007 Modeling Inventory with Projections to 2017 and 2020

The 2007 modeling inventory suite was prepared by MARAMA and finalized in 2012.¹² Future year projections were prepared based on the base year 2007 emissions for 2013, 2017 and 2020 for all sectors except the electric generation and on-road sectors.¹³ The inventory was used by MANE-VU states in screening air quality modeling in 2011 and 2012.

EGU emissions are only available for the base year, 2007. For modeling purposes, provisional EGU estimates were developed for future year 2020 based on the CSAPR allocations. High quality future year modeling inventories for EGUs are currently being developed under a separate effort led by the Eastern Regional Technical Advisory Committee (ERTAC).

On-road 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 on-road inventory. Under 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 height at which temperature was measured. This adjusted run (Version 2) was used in OTC Level 3 screening modeling and also in this analysis.

The OTB/OTW projection for 2017 and 2020 was used for this emission trend analysis.

Several versions of the 2007 inventory suite were prepared. Improvements were made to the emissions estimation with each subsequent version. Version 3.3 is the version used in OTC Level 3 screening air quality modeling and also in this emission trend analysis. Details of the approach taken to prepare the 2007 modeling inventory suite are found in the documentation for the base year and future projections.

¹² **MARAMA 2012a.** Prepared by AMEC Environment and Infrastructure and SRA International for the Mid-Atlantic Regional Air Management Association. *Technical Support Document for the Development of the 2007 Emission Inventory for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region Version 3_3.* January 23, 2012.

¹³ **MARAMA 2012b.** Prepared by AMEC Environment and Infrastructure and SRA International for the Mid-Atlantic Regional Air Management Association. *Technical Support Document for the Development of the 2013/2017/2020 Emission Inventories for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region Version 3_3.* January 23, 2012

7.2.3. 2010 Clean Air Markets Division Reported Emissions

CAMD implements the provisions of 40 CFR Part 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 the Clean Air Interstate Rule. Most of the CAMD sources are traditional power plants that sell electricity to the electrical grid. However, there are other types of sources that report to CAMD that are not considered to be EGUs, such as petroleum refineries and cement kilns. Emissions of NO_x, SO₂, and heat input (HI) are posted on the CAMD website (<http://www.epa.gov/airmarkets/>). The annual unit level CAMD NO_x and SO₂ emissions for 2010 were downloaded from this website for use as needed. Table 7.1 shows the data sources used for emissions trend analysis.

Table 7.1. Emissions 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
Non-road (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.

Table 7.2 summarizes the MANE-VU regional emission trends for NO_x, SO₂, PM_{2.5} and VOC by sector. Numbered columns and footnotes have been added to distinguish between the three data sources used in the analysis. Blue columns (1) and (5) are from the 2002 inventory suite, tan columns (2), (4), and (6) are from the 2007 inventory suite and the white column (3) is from CAMD 2010. Methods for estimating emissions from on-road mobile sources changed from MOBILE to MOVES. The 2002 and 2018 estimates in Table 7.2 were based on the MOBILE model, while the 2007 and 2020 estimates were based on MOVES. It is not possible to establish trends in mobile source emissions by comparing MOVES and MOBILE estimates. Similarly, there were significant improvements in methods used to calculate Marine and Rail (MAR) (part of non-road MAR) and area sources, which means that determining trends for those sectors was problematic.

Some general regional observations by pollutant include:

- **NO_x** - Regional NO_x emissions are dominated by two sectors: on-road mobile and EGU point. Regional EGU NO_x emissions decreased significantly between 2007 and 2010. The shift from the MOBILE6 model to the MOVES model represents a significant shift in methodology that occurred between completion of the 2002 and 2007 modeling inventory suite for mobile source NO_x emissions. Generally, future NO_x emissions estimated using the MOVES model results in higher emissions estimates than when using the MOBILE6 model. Therefore combining or comparing these data sets does not add understanding to the NO_x trend analysis. Overall, NO_x is projected to decline in future years for both individual inventory suites (i.e., from 2002 to 2018

and from 2007 to 2017 and 2020). Notably, recent measurements indicate that emissions from the EGU sector are declining rapidly.

- **PM_{2.5}** - Directly emitted fine particle emissions are regionally dominated by the area sector, particularly residential wood combustion. Improvements in both estimation methodology and emission factors occurred between the 2002 and 2007 inventory suites for residential wood combustion direct PM_{2.5}. These improvements generally result in much lower emissions estimates in the 2007/2017/2020 data than in the 2002/2018 inventory suite. Therefore combining these data sets does not add understanding to the PM_{2.5} source trend analysis. For many states, EGU emissions of fine particles have not been reviewed by states. Therefore, PM_{2.5} emission estimates for this sector are not included in Table 7.2. Overall, the trend for directly emitted PM_{2.5} is mixed, with some sectors remaining largely unchanged, while others, particularly engine-based sectors, are projected to decrease.
- **SO₂** - Regional SO₂ emissions are dominated by EGU emissions. All sectors are complete for SO₂ without any significant impact of changing methodologies for any sector. In addition, SO₂ emissions reductions are expected to be significant. As with NO_x, regional EGU SO₂ emissions in 2010 are significantly lower than were estimated for 2007. As a result, a clear overall regional SO₂ trend exists with emissions dropping dramatically every year.
- **VOC** - Regional VOC emissions are dominated by biogenic emissions which are estimated to remain unchanged in future years. EGU emissions are incomplete as not all states have had a chance to review the data. However, since EGU VOC emissions are very minor and the reductions from other sectors are so significant, it can be concluded that total anthropogenic emissions of VOC will drop.

Table 7.2. Air Pollutant Emission Trends between 2002 and 2020 for the MANE-VU Region.¹⁴

Category	(1)	(2)	(3)	(4)	(5)	(6)
	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
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
On-road 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
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
On-road 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
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
On-road 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
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
On-road 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 (Columns 1 and 5)

2007 V3 with a projection to 2017 and 2020 (Columns 2 and 6)

CAMD actual 2010 emissions as reported to the U.S. EPA CAMD (Column 3)

(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.

Non-road MAR – includes commercial marine vessels, airports, and railroad locomotives

Non-road NMIM – includes equipment included in USEPA’s NMIM/NONROAD model

¹⁴ Regional Emissions Trends Analysis for MANE-VU States: Technical Support Document, Revision 3, March 22, 2013 (posted on MARAMA website www.marama.org) Exhibit 8.1 p. 22.

7.3. Vermont Emissions Trends – 2002 to 2011

Vermont SO₂, NO_x, VOC and primary PM_{2.5} emissions from the 2002, 2008 and (the most recently available) 2011 National Emissions Inventory (NEI) are summarized in Table 7.3, along with projected 2018 emissions estimated in Vermont’s 2009 Regional Haze SIP submittal. The last two columns compare the “actual” emissions changes that occurred over the 9-year period from 2002 to 2011, with the “projected” emissions changes over the full 16-year period from 2002 to 2018.

The 2018 projections are taken directly from Table 6.4 in Vermont’s 2009 Regional Haze SIP revision, and include the MANE-VU “Beyond On The Way” 2018 projections with additions of the 167 EGU sources, BART applications, and low sulfur fuel provisions included in the “MANE-VU Ask” and used for modeling reasonable progress goals at Lye Brook and other MANE-VU Class I areas. The 2002 NEI emissions in Table 7.3 are similar to, but not identical to the 2002 emissions presented in Vermont’s 2009 SIP. The differences result from more recent revisions to the 2002 NEI, with the current estimates considered to be more accurate. It should also be noted that there have been improvements in inventory methodologies over time – such as the switch from Mobile 6.2 used in the 2002 NEI to use of MOVES 2010b in the 2008 and 2011 inventories. Similarly, EPA’s residential wood combustion (RWC) tool was employed for the 2008 and 2011 NEI, but not for the 2002 NEI or 2018 projections. Given these and various other methods changes, any comparisons of emissions over time will unavoidably be influenced by methods artifacts.

With these caveats, the changes in Vermont NEI emissions from 2002 to 2011 represent the best currently available estimates of Vermont emissions changes over that nine-year period – for comparison to the projected 16-year changes for 2018. Compared to 2002, Vermont’s 2011 SO₂ and VOC emissions have already decreased by percentages equal to or greater than those projected for 2018. Vermont’s 2011 NO_x emissions have decreased by 35%, or slightly more than half of the 64% reduction projected for 2018, and thus appear to be on track to meet the 2018 projections by 2018.

Vermont’s 2011 NEI PM_{2.5} emissions increased by 17%, while the 2018 modeling projection indicated a reduction of 31% from the 2002 baseline. This projected reduction was heavily influenced by the emissions reporting methods used in presenting the final MANE-VU 2018 inventory (for modeling reasonable progress goals) in Vermont’s 2009 SIP. The final 2018 modeling inventory PM_{2.5} and PM₁₀ data included application of a “transportable fraction” adjustment (see [Pace, 2005¹⁵](#)) to area source fugitive dust PM_{2.5} and PM₁₀ emissions. This adjustment is applied when fugitive dust PM_{2.5} and/or PM₁₀ emissions are used in regional modeling, to account for the substantial near-source removal of PM dust emissions from sources like unpaved roads. The NEI inventory PM data do not include this adjustment, and the Vermont projected 2018 PM_{2.5} emissions without the adjustment would have been 12,778 tons, similar to the Vermont 2011 NEI PM_{2.5} emissions. Residential wood combustion accounted for about half of Vermont’s 2011 NEI PM_{2.5} emissions. Vermont NEI residential wood burning PM_{2.5} emissions have nearly doubled from 2002 to 2011. Some of this increase is likely real and due to increases in total wood burned, while some of the increase is likely due to methods changes over time.

¹⁵Pace, T. G. (2005) Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses.

http://www.epa.gov/ttnchie1/emch/dustfractions/transportable_fraction_080305_rev.pdf

Table 7.3. Vermont NEI 2002, 2008 and 2011 Emissions and 2018 Projections

Vermont SO₂ Emissions (TPY)						
	2002 NEI	2008 NEI	2011 NEI	2018 Projection	2002-2011 % Change	2002-2018 % Change
Point	911	164	429	407	-53%	-55%
Non-road	374	83	29	13	-92%	-97%
On-road	622	73	65	82	-89%	-87%
Area/Nonpoint	5,386	3,732	2,927	2,990	-46%	-44%
Total VT SO₂	7,293	4,052	3,450	3,493	-53%	-52%

Vermont NO_x Emissions (TPY)						
	2002 NEI	2008 NEI	2011 NEI	2018 Projection	2002-2011 % Change	2002-2018 % Change
Point	790	498	645	572	-18%	-28%
Non-road	4,219	4,489	4,150	2,262	-2%	-46%
On-road	21,783	12,212	10,808	4,744	-50%	-78%
Area/Nonpoint	3,438	3,718	4,041	3,430	18%	0%
Total VT NO_x	30,231	20,918	19,644	11,008	-35%	-64%

Vermont VOC Emissions (TPY)						
	2002 NEI	2008 NEI	2011 NEI	2018 Projection	2002-2011 % Change	2002-2018 % Change
Point	1,097	486	463	1,711	-58%	56%
Non-road	10,499	10,132	9,154	7,566	-13%	-28%
On-road	18,139	6,274	5,305	4,072	-71%	-78%
Area/Nonpoint	18,900	12,437	13,099	26,197	-31%	39%
Total VT VOC	48,635	29,330	28,020	39,546	-42%	-19%

Vermont PM_{2.5} Emissions (TPY)						
	2002 NEI	2008 NEI	2011 NEI	2018 Projection	2002-2011 % Change	2002-2018 % Change
Point	237	135	147	271	-38%	14%
Non-road	511	462	450	303	-12%	-41%
On-road	465	477	405	144	-13%	-69%
Area/Nonpoint	10,234	13,281	12,404	7,214*	21%	-30%*
Total VT PM_{2.5}	11,446	14,355	13,406	7,932*	17%	-31%*

* 2018 MANE-VU modeling projection includes “transportable fraction” adjustment to fugitive PM_{2.5} area source emissions, while 2002-2011 NEI PM_{2.5} emissions estimates do not include this adjustment.

Section 8: Assessment of Significant Anthropogenic Emission Changes In or Outside the State in the Last Five Years that Have Limited or Impeded Progress in Reducing Emissions and Improving Visibility

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 five years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

EPA has indicated a significant change that can limit or impede progress could be either:

- (1) a significant unexpected increase in anthropogenic emissions that occurred over the five-year period (that is, an increase that was not projected in the analysis of the SIP), or
- (2) a significant expected reduction in anthropogenic emissions that did not occur (that is, a projected decrease in emissions in the analyses for the SIP that was not realized).

8.2. Assessment

In general, haze-causing emissions in MANE-VU have declined. (See Section 7 above for more details.) Furthermore, most of the emission reductions in the SIPs were anticipated to occur in a stepwise fashion (e.g., in 2010 or 2014 or 2018) rather than in a gradual trend. Therefore, in some sectors, emissions may not have declined in the last five years.

The analyses and summaries in the previous sections include all relevant significant emission sources and show there are none that have limited or impeded progress for the regional haze program during this report period.

Section 9: Assessment regarding whether Current Regional Haze State Implementation Plan (SIP) Elements and Strategies are Sufficient 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 Federal Class I areas affected by emissions from the State, to meet all established reasonable progress goals.”

9.2. Assessment

Vermont DEC determines that the elements and strategies in the existing Vermont Regional Haze SIP are sufficient to meet all established RPGs as demonstrated by the analyses in this report.

Section 10: Monitoring Strategy Review

10.1. Requirement to Review Monitoring Strategy

Section 40 CFR §51.308(g)(7) of the Regional Haze Rule requires each state with a Class I area to review the State's visibility monitoring strategy and any modifications to the strategy as necessary.

10.2. Review

As part of the original Regional Haze Program requirements, the following monitoring network was deemed adequate for Vermont. The monitoring strategy relies upon participation in the IMPROVE network. For the five-year progress report, Vermont has evaluated its monitoring network and any changes from the original SIP network are noted.

See Section 2 for a discussion of visibility changes from 2000-2004 baseline period to the current five-year period with quality assured IMPROVE data.

In 2012 a second IMPROVE site (LYEB1) was established on Mt. Snow in Dover, Vermont to replace the first Lye Brook IMPROVE site (LYBR1) due to discontinued site support on Mt. Equinox (Figure 10.1). Monitors at both sites collected data concurrently for a period of nine months to determine what differences, if any, existed in ambient air quality measurements from the original site to the second. The LYEB1 location at Mt. Snow is at a similar elevation as LYBR1 at Mt. Equinox (Table 10.1); however, there was concern that the higher valley floor at Mt. Snow, resulting in less vertical distance between local air pollution sources and the monitor, could result in overall worse ambient air quality measurements at LYEB1 than the original site.

Table 10.1. Visibility Monitoring Sites in the State

Site Name	Site Code	State	Latitude	Longitude	Elevation	Dates of Operation
Lye Brook Wilderness Area	LYBR1	Vermont	43.1482°	-73.1268°	1015m	1/1/1992-9/30/2012
	LYEB1	Vermont	42.9530°	-72.9102°	1093m	1/1/2012-present

Data collected from LYBR1 and LYEB1 during the period January 1, 2012 to September 30, 2012 were compared to assess whether LYEB1 would be a close approximation of the original LYBR1 site. On the 20% best and worst days, the two sites were found to have a nearly one-to-one relationship, as illustrated in the quantile-quantile (QQ) plot below (Figure 10.2).

Figure 10.1. Map of IMPROVE monitoring locations, LYBR1 and LYEB1.

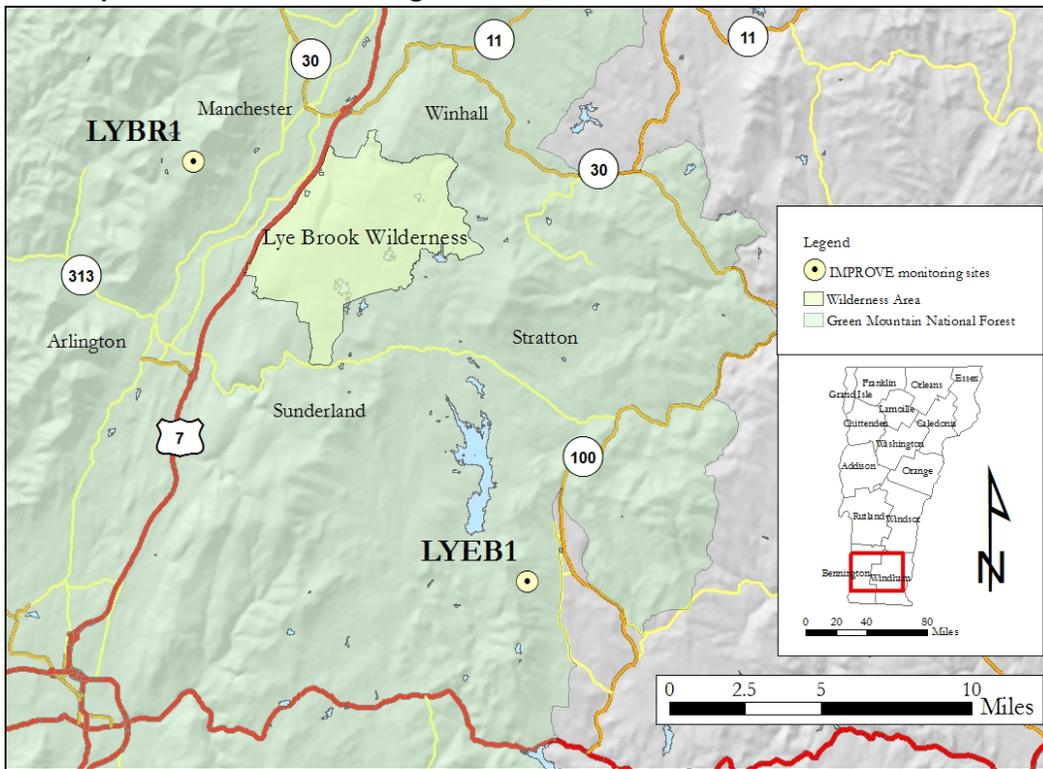
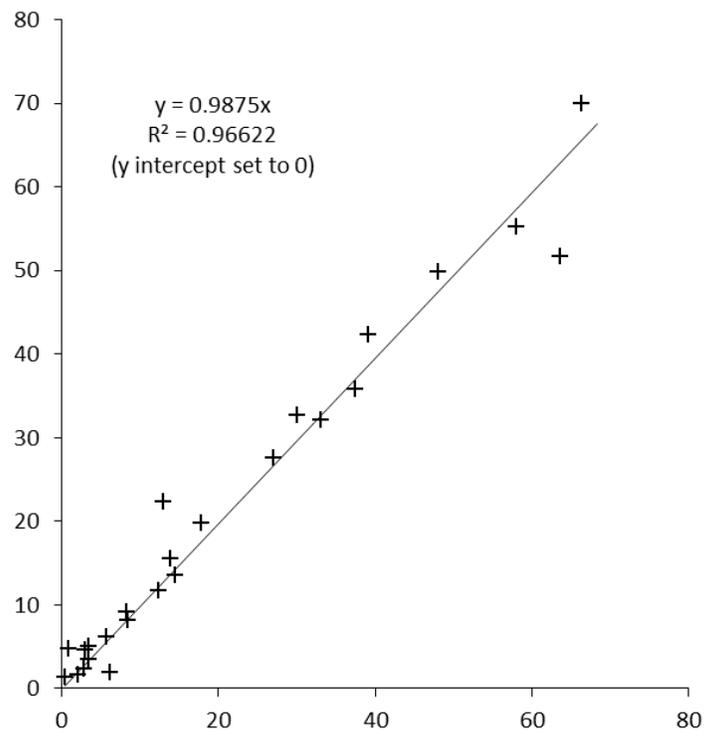


Figure 10.2. Lye Brook IMPROVE Sites Unpaired Q-Q Plot, Ammonium Sulfate Extinction, Jan-Sept 2012 (20% best and worst days).



Section 11: Determination of 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 based upon information presented in its progress report.

11.2. Determination of SIP Adequacy: Negative Declaration

Based on the analyses conducted for this Report, Vermont DEC determines that the existing SIP is adequate for continued reasonable progress towards natural conditions in all mandatory Class I Federal areas impacted by emissions from Vermont. Pursuant to 40 CFR §51.308(h)(1), Vermont submits this negative declaration that further revision of the existing SIP is not needed at this time.

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 Federal Land Managers responsible for Class I areas affected by emissions from within the state an opportunity for consultation, in person, and at least 60 days before holding any public hearing on this SIP revision.

12.2. Consultation Process

Vermont sent the draft SIP revision to the FLMs on October 12, 2015. Vermont will notify FLMs of public hearing dates if requested. Vermont has considered and responded to the comments from FLMs on the proposed SIP revision, along with other comments (Appendix G). Vermont will continue to coordinate and consult with the FLMs on future SIP revisions, including progress reports, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas.

Appendix A: Acronyms

ASL	Above sea level
BART	Best Available Retrofit Technology
BOTW	Beyond On the Way
CAA	Clean Air Act
CAMD	Clean Air Markets Division
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CO	Carbon monoxide
EC	Elemental carbon
EGU	Electricity Generating Unit
EPA	Environmental Protection Agency
FLM	Federal Land Manager
HAA	Healthy Air Act
HC	Hydrocarbons
HI	Heat input
IM	Inspection and Maintenance
IMPROVE	Interagency Monitoring of Protected Visual Environments
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MAR	Marine and rail
MARAMA	Mid-Atlantic Regional Air Management Association
MATS	Mercury and Air Toxics Standards
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NMHC	Non-methane hydrocarbons
NO _x	Nitrogen oxides
NPS	National Park Service
NSPS	New Source Performance Standards
OBD	On-board diagnostics
OTB/OTW	On the Books/On the Way
OTC	Ozone Transport Commission
PM	Particulate matter
PM _{2.5}	Particulate matter of diameter of 2.5 micrometers or less
POM	Particulate organic matter
RPO	Regional Planning Organization
RWC	Residential Wood Combustion
SIP	State Implementation Plan
SO ₂	Sulfur dioxide
TPY	Tons per year
URP	Uniform Rate of Progress
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VT APCR	Vermont Air Pollution Control Regulations

Appendix B: Regional Haze Rule Metric

IMPROVE aerosol sampling and filter analysis at MANE-VU Class I sites are conducted according to procedures described in “*IMPROVE Standard Operating Protocols: Particle Monitoring Network*”. (http://vista.cira.colostate.edu/improve/Publications/IMPROVE_SOPs.htm). Data are available from the Federal Land Manager Database: <http://views.cira.colostate.edu/fed/QueryWizard/Default.aspx> .

The haze-relevant aerosol measurements include PM₁₀ mass and PM_{2.5} mass (from which coarse mass is calculated), fine sulfate and nitrate ions (from which ammonium sulfate and ammonium nitrate are calculated), fine organic carbon (from which particulate organic matter is calculated), fine elemental carbon, fine elemental chlorine and chloride ion (from which sea salt mass is calculated), and fine crustal elements (Si, Al, Fe, Ca, Ti – from which fine soil is calculated). The calculated aerosol species concentrations are then combined with estimated dry light extinction efficiencies and enhanced by hygroscopic growth functions (for sulfate nitrate & sea salt) using climatologically derived monthly relative humidity and f(RH) growth functions. This “aerosol light extinction is added to Rayleigh Scattering from natural gaseous air molecules.

The equation presented below used for these extinction calculations – referred to as the IMPROVE Equation, Version II, and recommended by the IMPROVE Steering Committee is described in “*Review of the IMPROVE Equation for Estimating Ambient Light Extinction Coefficients - Final Report*,” J. L. Hand and W. C. Malm, March 2006, which is posted on the IMPROVE web site at http://vista.cira.colostate.edu/improve/Publications/GrayLit/gray_literature.htm .

$$\begin{aligned} B_{\text{ext}} \approx & 2.2 \times f_S (\text{RH}) \times [\text{Small } (\text{NH}_4)_2\text{SO}_4] + 4.8 \times f_L (\text{RH}) \times [\text{Large } (\text{NH}_4)_2\text{SO}_4] \\ & + 2.4 \times f_S (\text{RH}) \times [\text{Small } \text{NH}_4\text{NO}_3] + 5.1 \times f_L (\text{RH}) \times [\text{Large } \text{NH}_4\text{NO}_3] \\ & + 2.8 \times [\text{Small Organic Mass}] + 6.1 \times [\text{Large Organic Mass}] \\ & + 10 \times [\text{Elemental Carbon}] + 1 \times [\text{Fine Soil Mass}] \\ & + 1.7 \times f_{\text{SS}} (\text{RH}) \times [\text{Sea Salt Mass}] + 0.6 \times [\text{Coarse Mass}] \\ & + \text{Rayleigh Scattering (Site Specific)} + 0.33 \times [\text{NO}_2 (\text{ppb})] \end{aligned}$$

Where:

B_{ext} = The light extinction coefficient in inverse megameters [Mm^{-1}],

$f_S (\text{RH})$ and $f_L (\text{RH})$ = Humidity factor associated with small and large mode mass size distributions of $(\text{NH}_4)_2\text{SO}_4$ and NH_4NO_3 ,

$f_{\text{SS}} (\text{RH})$ = Humidity factor associated with Sea Salt,

NO_2 data are not available and concentrations are assumed to be negligible

Apportionment of the total concentrations of ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$) into the concentrations of small and large size fractions is accomplished using the following equations:

$$[\text{Large } (\text{NH}_4)_2\text{SO}_4] = [\text{Total } (\text{NH}_4)_2\text{SO}_4] / 20 \times [\text{Total } (\text{NH}_4)_2\text{SO}_4]$$

$$[\text{Small } (\text{NH}_4)_2\text{SO}_4] = [\text{Total } (\text{NH}_4)_2\text{SO}_4] - [\text{Large } (\text{NH}_4)_2\text{SO}_4]$$

Similar equations are used to apportion total ammonium nitrate (NH₄NO₃) and total particulate organic mass (POM = 1.8 x OC) concentrations into the small and large size fractions.

The above IMPROVE Equation replaced the equation in EPA's September 2003 *Guidance for Tracking Progress Under the Regional Haze Rule* (EPA-454/b-03-004) posted on EPA's website at <http://www.epa.gov/ttnamti1/files/ambient/visible/tracking.pdf>. Other aspects of that guidance are not affected by the IMPROVE Equation.

The resulting light extinction estimates (B_{ext} in Mm⁻¹) can be converted to deciviews using the following natural logarithm function:

$$\text{Deciviews (dv)} = 10 \ln (B_{\text{ext}}/10)$$

For each year meeting data completeness requirements, averages are calculated, in deciviews, for the 20% haziest days and for the 20% clearest days at each site. These annual means are aggregated into five-year averages for a "baseline" period (2000-2004) and for later five-year periods.

The EPA Regional Haze Rule target requires that the 20% clearest days not deteriorate over time, while the 20% haziest days are expected to improve visibility to the level of "natural background" by 2064. To achieve a "uniform rate of progress," consistent with reaching natural background by 2064, the haziest 20% days would need to improve at an annual rate of at least:

$$\text{Annual Uniform Improvement} = (\text{Baseline} - \text{Natural Background}) / 60$$

For each five-year period, uniform progress would be maintained if:

$$\text{Five-year Uniform Improvement} = (\text{Baseline} - \text{Natural Background}) / 12$$

Each state with a Class I area establishes a Reasonable Progress Goal for that Class I area for each 10-year period that is based on decisions about how much progress in reducing regional haze would be reasonable by that date. The first regional haze SIPs set Reasonable Progress Goals for 2018. The Uniform Rate of Progress is considered by the state in setting the Reasonable Progress Goal, but the goal must reflect what is considered reasonable, which may be more or less progress than would be expected based on the uniform rate of progress.

Appendix C: Statement on Controls in MANE-VU

Members Connecticut Delaware District of Columbia Maine Maryland Massachusetts New Hampshire New Jersey New York Pennsylvania Penobscot Indian Nation Rhode Island St. Regis Mohawk Tribe Vermont
Nonvoting Members U.S. Environmental Protection Agency National Park Service U.S. Fish and Wildlife Service U.S. Forest Service
MANE-VU Class I Areas ACADIA NATIONAL PARK ME BRIGANTINE WILDERNESS NJ GREAT GULF WILDERNESS NH LYE BROOK WILDERNESS VT MOOSEHORN WILDERNESS ME PRESIDENTIAL RANGE DRY RIVER WILDERNESS NH ROOSEVELT CAMPOBELLO INTERNATIONAL PARK ME/NB, CANADA

Mid-Atlantic/Northeast Visibility Union

MANE-VU



*Reducing Regional Haze for
Improved Visibility and Health*

STATEMENT OF THE MID-ATLANTIC/NORTHEAST VISIBILITY UNION (MANE-VU) CONCERNING A COURSE OF ACTION WITHIN MANE-VU TOWARD ASSURING REASONABLE PROGRESS

The federal Clean Air Act and Regional Haze rule require States that are reasonably anticipated to cause or contribute to impairment of visibility in mandatory Class I Federal areas to implement reasonable measures to reduce visibility impairment within the national parks and wilderness areas designated as mandatory Class I Federal areas. Most pollutants that affect visibility also cause unhealthy concentrations of ozone and fine particles. In order to assure protection of public health and the environment, any additional air pollutant emission reduction measures necessary to meet the 2018 reasonable progress goal for regional haze should be implemented as soon as practicable.

To address the impact on mandatory Class I Federal areas within the MANE-VU region, the Mid-Atlantic and Northeast States will pursue a coordinated course of action designed to assure reasonable progress toward preventing any future, and remedying any existing impairment of visibility in mandatory Class I Federal areas and to leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment. This course of action includes pursuing the adoption and implementation of the following “emission management” strategies, as appropriate and necessary:

- 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

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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 (SO₂) emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU (Attachment 1- comprising a total of 167 stacks – dated June 20, 2007) as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and
- continued evaluation of other control measures including energy efficiency, alternative clean fuels, and other measures to reduce SO₂ and nitrogen oxide (NO_x) 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.

This long-term strategy to reduce and prevent regional haze will allow each state up to 10 years to pursue adoption and implementation of reasonable and cost-effective NO_x and SO₂ control measures.

Adopted by the MANE-VU States and Tribes on 20 June 2007



David Littell, Commissioner – Maine Dept. of Environmental Protection
Chair

Appendix D: Statement on Controls Outside of MANE-VU

Members Connecticut Delaware District of Columbia Maine Maryland Massachusetts New Hampshire New Jersey New York Pennsylvania Penobscot Indian Nation Rhode Island St. Regis Mohawk Tribe Vermont
Nonvoting Members U.S. Environmental Protection Agency National Park Service U.S. Fish and Wildlife Service U.S. Forest Service
MANE-VU Class I Areas ACADIA NATIONAL PARK ME BRIGANTINE WILDERNESS NJ GREAT GULF WILDERNESS NH LYE BROOK WILDERNESS VT MOOSEHORN WILDERNESS ME PRESIDENTIAL RANGE DRY RIVER WILDERNESS NH ROOSEVELT CAMPOBELLO INTERNATIONAL PARK ME/NB, CANADA

Mid-Atlantic/Northeast Visibility Union
MANE-VU



*Reducing Regional Haze for
Improved Visibility and Health*

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

The federal Clean Air Act and the Regional Haze rule require States that are reasonably anticipated to cause or contribute to impairment of visibility in mandatory Class I Federal areas to implement reasonable measures to reduce visibility impairment within the national parks and wilderness areas designated as mandatory Class I Federal areas. Most pollutants that affect visibility also cause unhealthy concentrations of ozone and fine particles. In order to assure protection of public health and the environment, air pollutant emission reductions required to meet the 2018 reasonable progress goal for regional haze should be achieved as soon as practicable.

To address the impact on mandatory Class I Federal areas within the MANE-VU region, the Mid-Atlantic and Northeast States request that States outside of the MANE-VU region that are identified as contributing to visibility impairment in the MANE-VU mandatory Class I Federal areas pursue a course of action designed to assure reasonable progress toward preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas and to leverage the multi-pollutant benefits that such actions may provide for the protection of public health and the environment. This request for a course of action includes pursuing the adoption and implementation of the following control strategies, as appropriate and necessary:

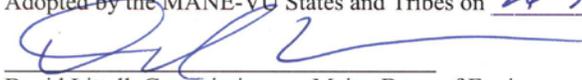
- timely implementation of BART requirements; and
- A 90% or greater reduction in sulfur dioxide (SO₂) emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU (Attachment 1- comprising a total of 167 stacks – dated June 20, 2007) as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region. If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and

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- the application of reasonable controls on non-EGU sources resulting in a 28% reduction in non-EGU SO₂ 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 ; and
- continued evaluation of other measures including measures to reduce SO₂ and nitrogen oxide (NO_x) 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 during the consultation process to determine if they are reasonable.

This long-term strategy to reduce and prevent regional haze will allow each state up to 10 years to pursue adoption and implementation, of reasonable NO_x and SO₂ control measures.

Adopted by the MANE-VU States and Tribes on 20 June 2007



David Littell, Commissioner – Maine Dept. of Environmental Protection
Chair

Appendix E: Statement on National Controls

Members
Connecticut
Delaware
District of Columbia
Maine
Maryland
Massachusetts
New Hampshire
New Jersey
New York
Pennsylvania
Penobscot Indian Nation
Rhode Island
St. Regis Mohawk Tribe
Vermont
Nonvoting Members
U.S. Environmental Protection Agency
National Park Service
U.S. Fish and Wildlife Service
U.S. Forest Service
MANE-VU Class I Areas
ACADIA NATIONAL PARK ME
BRIGANTINE WILDERNESS NJ
GREAT GULF WILDERNESS NH
LYE BROOK WILDERNESS VT
MOOSEHORN WILDERNESS ME
PRESIDENTIAL RANGE DRY RIVER WILDERNESS NH
ROOSEVELT CAMPOBELLO INTERNATIONAL PARK ME/NB, CANADA

Mid-Atlantic/Northeast Visibility Union

MANE-VU



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STATEMENT OF THE MID-ATLANTIC / NORTHEAST VISIBILITY UNION (MANE-VU) CONCERNING A REQUEST FOR A COURSE OF ACTION BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) TOWARD ASSURING REASONABLE PROGRESS

The US Clean Air Act and the EPA Regional Haze rule require States that are reasonably anticipated to cause or contribute to impairment of visibility in mandatory Class I Federal areas to implement reasonable measures to reduce visibility impairment within the national parks and wilderness areas designated as mandatory Class I Federal areas.

Most pollutants that affect visibility also cause unhealthy concentrations of ozone and fine particles, and contribute to other adverse environmental impacts. In order to assure protection of public health and the environment, air pollutant emission reductions required to meet the 2018 reasonable progress goal for regional haze should be achieved as soon as practicable.

MANE-VU assessments indicate that sulfur dioxide emissions from power plants in a broad region of the Eastern US are the most important contributor to regional haze at mandatory Class I Federal areas within MANE-VU.

By 2018, emissions from these plants will be substantially reduced under requirements of EPA's Clean Air Interstate Rule. This will result in improved visibility at MANE-VU Class I areas.

However, even after implementation of the CAIR rule, emissions from power plants will remain a substantial source of pollutants contributing to visibility impairment in MANE-VU Class I areas.

Furthermore, under more stringent national ambient air quality standards, these same pollutants will continue to contribute to ozone pollution and fine particle pollution in nonattainment areas within the region.

Therefore, it is an important responsibility of both EPA and the MANE-VU states to determine whether additional emissions reductions at power

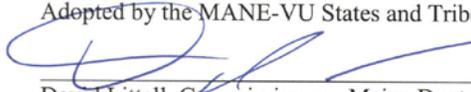
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plants should be a part of a reasonably available strategy to improve visibility in the MANE-VU region.

MANE-VU sponsored additional modeling using the Integrated Planning Model (IPM[®]). Results of this modeling indicate that an additional 18% emissions reduction in SO₂ emissions beyond CAIR levels could be achieved by 2018 at a reasonable cost.

The MANE-VU states and tribes request 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 SO₂ by no later than 2018.

Adopted by the MANE-VU States and Tribes on June 20, 2007



David Littell, Commissioner – Maine Dept. of Environmental Protection
Chair

53006
10/20/07
10/20/07

Appendix F: Status of Emissions from 167 Key Stacks

<See separate spreadsheet in MS Excel format prepared by NESCAUM,
“Appendix_F_Status_of_Emissions_from_167_Key_Stacks.xlsx”>

Appendix G: Federal Land Manager Consultation and Public Comments

The Federal Land Managers (FLMs) were provided 60 days to review and comment on Vermont's draft five-year progress report as required by 40 CFR §51.308(i). The document was sent electronically on October 12, 2015 to the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the National Park Service. This appendix contains letters that were received from the U.S. Forest Service and the National Park Service stating that they had no comments.

The proposed revision was sent electronically to EPA on January 8, 2016. This appendix includes a letter in response from EPA stating that EPA had no comments. No other comments were received from the public.



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)

December 9, 2015

Heidi Hales
Director, Air Quality and Climate Division
Vermont Department of Environmental Conservation
Davis 2- 2nd Floor, One National Life Drive
Montpelier, VT 05620-3802

Dear Ms. Hales:

Thank you for the opportunity to review and comment on Vermont's draft Regional Haze Five Year Progress Report. We agree that Vermont Department of Environmental Conservation has addressed all the requirements for the regional haze periodic progress report as outlined in 40 CFR 51.308(g) and (h). Visibility for the 2010-2014 period at all Class I areas in the MANE-VU area, including Lye Brook Wilderness Area in Vermont, is better than the visibility goals set by the MANE-VU states for 2018. Vermont has described the state and federal emissions control requirements that have been implemented in Vermont and demonstrated that emissions reductions are on track to meet the 2018 inventory projections and Vermont's contribution to the MANE-VU long-term strategy. We agree that Vermont is meeting its commitments and that revision of the existing state implementation plan is not necessary at this time.

We appreciate the opportunity to work closely Vermont to improve visibility in our Class I national parks and wilderness areas. If you have questions, please contact me at patricia_f_brewer@nps.gov or 303-969-2153.

Sincerely,

Pat Brewer

cc: Anne McWilliams, EPA Region 2

File Code: 2580
Date: December 7, 2015

Heidi Hales
Director, Air Quality and Climate Division
Vermont Dept. of Environmental Conservation
Davis 2-2nd Floor, One National Life Drive
Montpelier, VT 05620-3802

Dear Ms. Hales:

The USDA Forest Service has completed our review of the document entitled "Revision to the Vermont State Implementation Plan Regional Haze Five-Year Progress Report" draft that we received on October 12, 2015. We appreciated the opportunity to review the document and the chance to once again work cooperatively with your staff.

I concur with the Vermont Department of Environmental Conservation's declaration that Vermont'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 Vermont Regional Haze State Implementation Plan are not needed at this time. I am pleased to note that the observed five year average for visibility, for the years 2010-2014, at the Lye Brook Class I area located in the Green Mountain National Forest, is already better than the 2018 reasonable progress goals. I also was pleased to learn that peak hourly sulfur dioxide concentrations, which occur on cold, calm winter mornings, when local fuel burning emissions are highest, and generally reflect local rather than transported sulfur dioxide emissions, have been steadily declining over the past ten years in Rutland, due, in part, to lower sulfur concentrations of diesel fuel and home heating oil.

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,



JOHN A. SINCLAIR
Forest Supervisor

cc: Judi Henry, Bret Anderson, Chuck Sams, Ralph Perron



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 1

**5 Post Office Square, Suite 100
Boston, MA 02109-3912**

February 10, 2016

Bennet Leon
Air Quality and Climate Division
Department of Environmental Conservation
One National Life Drive, Davis 2
Montpelier, VT 05620

Dear Mr. Leon:

On January 8, 2016, the Vermont Department of Environmental Conservation (VT DEC) proposed its Regional Haze 5-Year Progress Report for public comment. Previously, EPA had reviewed a draft report provided to EPA October 12, 2015. In a letter dated December 3, 2015, EPA expressed support of the draft VT DEC Regional Haze 5-Year Progress Report.

The proposed VT DEC Regional Haze 5-Year Progress Report shows that the State is on track to meet all state emission reduction strategies included in the August 26, 2009 Regional Haze Plan submittal. In addition, monitoring data indicate that the VT Class I area (Lye Brook Wilderness Area) is on track to meet the 2018 reasonable progress visibility improvement goals.

EPA encourages DEC to submit the Regional Haze 5-Year Progress Report to EPA as a State Implementation Plan (SIP) revision as soon as possible.

If you have any questions, please contact Anne McWilliams of my staff at 617-918-1697.

Sincerely,


Anne Arnold, Manager
Air Quality Planning Unit

Appendix H: Evidence of Plan's Adoption

As required by 40 CFR Part 51, Appendix V, 2.1(b), the cover letter signed by the designee of the Secretary of Natural Resources is evidence that the State of Vermont has adopted this revision to the State Implementation Plan (SIP).

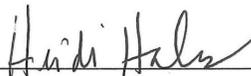
Appendix I: Evidence of Legal Authority

In accordance with 40 CFR Part 51, Appendix V, 2.1(c), Vermont statute 10 V.S.A. §554 authorizes the Secretary of the Agency of Natural Resources to “[a]dopt, amend and repeal rules, implementing the provisions” of Vermont’s air pollution control laws set forth in 10 V.S.A. chapter 23.

Appendix J: Certification of Public Hearing

**CERTIFICATION PURSUANT TO 40 CFR § 51.102 & APP. V OF 40 CFR PART 51 REGARDING
REVISIONS TO VERMONT'S STATE IMPLEMENTATION PLAN (SIP)**

As required by 40 CFR § 51.102(f), I hereby certify that the requirements of 40 CFR §51.102(a)-(d) were met and that the public notice and hearing procedure followed was consistent with the information provided in the public notice and the State's laws and constitution, as applicable. Public notice of the proposed revisions to Vermont's State Implementation Plan (SIP) was posted online on January 8, 2016 at <http://www.anr.state.vt.us/air/Planning/htm/StateImplementationPlan.htm> and published on January 11, 2016 in the following newspapers: Rutland Herald, Bennington Banner, and Times Argus. The public was provided with the opportunity to comment until February 11, 2016. The public notice provided the public an opportunity to request a hearing, however a public hearing was not held because no request was received during the 30 day notification period.



Heidi Hales

Director, Air Quality and Climate Division

Appendix K: Public Notice

State of Vermont, Agency of Natural Resources Notice of Intent to Revise the Regional Haze State Implementation Plan for Air Quality

Notice is hereby given that the Vermont Air Quality and Climate Division (AQCD) is providing the opportunity for interested persons to request a public hearing and provide comment on proposed revisions to the Vermont Regional Haze State Implementation Plan (SIP) that will be submitted to the US Environmental Protection Agency (EPA).

The Vermont AQCD has drafted a five-year progress report in the form of a SIP revision to address the regional haze program requirements set forth at 40 CFR §51.308. The proposed Regional Haze State Implementation Plan, Five-Year Progress Report is available on the AQCD's website at <http://www.anr.state.vt.us/air/Planning/htm/StateImplementationPlan.htm> and at the AQCD offices located in the Davis Building, Second Floor, 1 National Life Drive, Montpelier, VT 05620. You may also request a copy of the proposed Regional Haze SIP revisions using the contact information listed below.

If the Division receives a request for a hearing, the hearing will be held on Wednesday, February 10, 2016 from 6:00pm to 7:00pm in the Auditorium in the Pavilion Building located at 109 State Street in Montpelier, Vermont.

Those requesting a hearing must call (802) 828-1288. The deadline to submit a request for a hearing is Monday, February 1, 2016 by 5:00pm EST. If no request for a hearing is received prior to this date, the hearing will be cancelled. If the meeting is cancelled, a Notice of Cancellation of the hearing will be posted on Tuesday, February 2, 2016 on the AQCD's website at <http://www.anr.state.vt.us/air/Planning/htm/StateImplementationPlan.htm>. Interested persons may also call (802) 828-1288 to determine if the public hearing has been cancelled.

If requested, a hearing will be held to receive comments from interested persons regarding the proposed revisions. Attendance at the hearing is not necessary to submit written comments on the proposed SIP revisions. Written comments on the proposed SIP revisions must be received by the AQCD by 5:00pm EST on Thursday, February 11, 2016.

All written comments must be mailed, faxed, or emailed to:

Corie Dunn
Air Quality and Climate Division
Davis Building – 2nd Floor
1 National Life Drive
Montpelier, Vermont 05620

FAX: (802) 828-1250

Email: corie.dunn@state.vt.us