New Hampshire
Regional Haze Plan
Periodic Comprehensive Revision

DRAFT 10/31/2019

NEW HAMPSHIRE
DEPARTMENT OF
Environmental
Services

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Regional Haze Plan
Periodic Comprehensive Revision

DRAFT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

A. Regional Haze Metric Trends and HYSPLIT Trajectory Analyses, MANE-VU TSC, May 2017.

B. Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics), MANE-VU TSC December 18, 2018.

C. 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources, MANE-VU TSC, April 4, 2017.

D. MANE-VU Updated Q/d*C Contribution Assessment, MANE-VU TSC, April 6, 2016.

E. Selection of States for MANE-VU Regional Haze Consultation (2018), MANE-VU TSC, September 5, 2017.

F. Inter-RPO State/Tribal and FLM Consultation Framework, MANE-VU, May 10, 2006.

G. MANE-VU Regional Haze Consultation Report

H. MANE-VU Technical Support Committee Memo to MANE-VU Air Directors, **"**RE: Contribution Assessment Preliminary Inventory Analysis," Mid-Atlantic Northeast Visibility Union." October 10, 2016.

I. Baseline and Natural Visibility Conditions, NESCAUM, December 2006.

J. Tracking Visibility Progress 2004-2017 (1st RH SIP Metrics), MANE-VU TSC, December 18, 2018.

K. Memo from MANE-VU Technical Support Committee to MANE-VU Air Directors, "RE: Four-Factor Data Collection," MANE-VU TSC, March 30, 2017.

L. 2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas, Edward Sabo, SRA International, Inc., January 31, 2016.

M. Status of the Top 167 Electric Generating Units (EGUs) that Contributed to Visibility Impairment at MANE-VU Class I Areas during the 2008 Regional Haze Planning Period, MANE-VU TSC, July 25, 2016.

N. Statement of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028), August 25, 2017 (a.k.a. the Intra-Regional "Ask").

O. Statement of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028), August 25, 2017 (a.k.a. the Inter-Regional "Ask").

P. Statement of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028), August 25, 2017 (a.k.a. the EPA/FLM "Ask").

Q. Impact of Wintertime SCR/SNCR Optimization on Visibility Impairing Nitrate Precursor, MANE-VU TSC, November 20, 2017.

R. High Electric Demand Days and Visibility Impairment in MANE-VU, MANE-VU TSC, December 20, 2017.

S. Benefits of Combined Heat and Power Systems for Reducing Emissions in MANE-VU States, MANE-VU TSC, March 9, 2016.

T. GSP's Response to DES' Request for Information on MANE-VU "Ask" Associated with the Regional Haze Rule, August 31, 2018.

U. Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update

ACRONYMS AND ABBREVIATIONS

µg/m^3	Microgram per cubic meter
AERR	Air Emissions Reporting Requirements
AL	Alabama
AMPD	Air Markets Program Data
BACT	Best Available Control Technology
BART	Best Available Retrofit Technology
BenMap	Benefits Mapping and Analysis Program
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CASTNET	Clean Air Status and Trends Network
CenRAP	Central Regional Air Planning Association
CENSARA	Central States Air Resource Agencies
CFR.	Code of Federal Regulations
CoST	Control Strategy Tool
CSAPR	Cross State Air Pollution Rule
CT	Connecticut
CTDEEP	Connecticut Department of Energy and Environmental Protection
DE	Delaware
DC	District of Columbia
DLN	Dry low NOx
DOE	US Department of Energy
DSI	Dry Sorbent Injection
dv	Deciview, a logarithmic scaled unit of visibility
EGU	Electric Generating Unit
EIS	Emissions Inventory System
EMF	Emissions Modeling Framework
EPA	Environmental Protection Agency
ESP	Electrostatic Precipitator
FED	Federal Land Manager Environmental Database
FGD	Flue gas desulfurization
FL	Florida
FLM	Federal Land Manager
GA	Georgia
GHGER	Greenhouse Gas Emissions Reduction
GRGU	Great Gulf Wilderness Area
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
IC	Internal Combustion
ICI	Industrial/Commercial/Institutional
IL	Illinois
I&M	Inspection and Maintenance
IMPROVE	Interagency Monitoring of Protected Visual Environments
IN	Indiana
km	Kilometer
KY	Kentucky
LA	Louisiana
LAC	Light absorbing carbon
LADCO	Lake Michigan Air Directors Consortium
LAER	Lowest Available Emission Rate
MA	Massachusetts
MATS	Mercury and Air Toxics Standards
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association
MD	Maryland
ME	Maine
MEDEP	Maine Department of Environmental Protection
MI	Michigan

Mm^{-1}	Inverse Megameter
MMBtu	1,000,000 British thermal units
MO	Missouri
MOVES	Motor Vehicle Emissions Simulator
MRPO	Midwest Regional Planning Organization
MS	Mississippi
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NACAA	National Association of Clean Air Agencies
NNSR	Nonattainment New Source Review
NC	North Carolina
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NH	New Hampshire
NH_3	Ammonia
NHDES	New Hampshire Department of Environmental Services
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NO_3	Nitrate
NO_x	Oxides of Nitrogen
NY	New York
O_2	Oxygen
OCM	Organic Carbon Mass
OH	Ohio
ORVR	Onboard Refueling Vapor Recovery
OTC	Ozone Transport Commission
OWB	Outdoor Wood Boiler
PA	Pennsylvania
PAG	Policy Advisory Group
PSD	Prevention of Significant Deterioration
PM	Particulate Matter
$PM_{2.5}$	Fine Particulate Matter (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers)
PM_{10}	Course Particulate Matter (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers)
ppm	Parts per million
PSD	Prevention of Significant Deterioration
RACT	Reasonably Available Control Technology
RBLC	RACT/BACT/LAER Clearinghouse
RGGI	Regional Greenhouse Gas Initiative
RHR	Regional Haze Rule
RI	Rhode Island
RPG	Reasonable Progress Goal
RPO	Regional Planning Organization
RPS	Renewable Portfolio Standard
RSA	Revised Statutes Annotated
RWS	Residential Wood Stove
SESARM	Southeastern Air Pollution Control Agencies
SCC	Source Classification Code
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SNCR	Selective Noncatalytic Reduction
SO_2	Sulfur Dioxide
SO_4	Sulfate
SO_x	Oxides of Sulfur
SOA	Secondary organic aerosol
STN	Speciation Trends Network
TN	Tennessee
tpy	tons per year
TSC	Technical Support Committee
TX	Texas
ULSD	Ultra Low Sulfur Diesel

URP	Uniform Rate of Progress
U.S.C.	United States Code
VA	Virginia
VIEWS	Visibility Information Exchange Web System
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOC	Volatile Organic Compounds
VT	Vermont
VTDEC	Vermont Department of Environmental Conservation
WMNF	White Mountain National Forest
WRAP	Western Regional Air Partnership
WSARC	Western States Air Resources Council
WV	West Virginia

FOREWORD

This document fulfills U.S. Environmental Protection Agency's (EPA's) Regional Haze Rule 51.308(f) provision for the second implementation period (2018-28) to identify, for each in-state Federal Class I area: a) baseline, current and natural visibility conditions for the 20% most impaired days and the 20% clearest days; b) the state's long term strategy to address regional haze for each in-state Federal Class I area and each Federal Class I area outside the state that may be affected by emissions from the State; c) reasonable progress goals for attaining the visibility conditions that are projected to be achieved by the end of the implementation period; and d) an assessment of the current monitoring strategy. This document also contains elements to fulfill progress report requirements.

The plan is submitted ahead of the July 31, 2021, deadline by New Hampshire to enable the use of the current 2011-based modeling platform.

The Federal Class I areas that are addressed in this document are listed below along with the larger Federal area within which they are embedded:

MANE-VU Class I Areas

Acadia National Park, ME
Moosehorn Wilderness Area, ME (Moosehorn National Wildlife Refuge)
Roosevelt Campobello International Park, NB Canada
Great Gulf Wilderness Area, NH (White Mountain National Forest)
Presidential Range-Dry River Wilderness Area, NH (White Mountain National Forest)
Brigantine Wilderness Area, NJ (E.B. Forsythe National Wildlife Refuge)
Lye Brook Wilderness (Green Mountain National Forest)

Nearby Class I Areas

James River Face, VA (George Washington and Jefferson National Forests)
Shenandoah National Park, VA
Dolly Sods, WV (Monongahela National Forest)
Otter Creek, WV (Monongahela National Forest)

EXECUTIVE SUMMARY

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

This document fulfills the EPA's Regional Haze Rule 51.308(f) provision for the second implementation period (2018-28) to identify, for each Federal Class I area within the State: a) baseline, current and natural visibility conditions for the 20% most impaired days and the 20% clearest days, b) the state's long term strategy to address regional haze for each in-state Federal Class I area and each Federal Class I area outside the state that may be affected by emissions from the State; c) reasonable progress goals for attaining the visibility conditions that are projected to be achieved by the end of the implementation period; and d) an assessment of the current monitoring strategy. This document also serves as a second progress report to the first implementation period.

Visibility trends analyses in this document used EPA-recommended metrics in the December 2018 technical guidance[1] at IMPROVE monitoring sites at Federal Class I areas in and adjacent to the MANE-VU region.

New Hampshire has fulfilled the long-term strategy goals expressed in its EPA-approved Regional Haze SIP submission [77 FR 50602][2]and subsequent progress [81 FR 70360][3] report by:

- The timely implementation of BART requirements at targeted EGUs codified at Env-A 2300, *Mitigation of Regional Haze*.
- Implementing a statewide low sulfur fuel requirement (RSA 125-O C:10-d, *Sulfur Limits of Certain Liquid Fuels*).
- Requiring emission controls at targeted EGUs (RSA 125-O, *Multiple Pollutant Reduction Program*).
- Continued evaluation of other control measures such as expanding the use of alternative clean fuels, increasing energy efficiency, and further reducing emissions from coal and wood combustion.

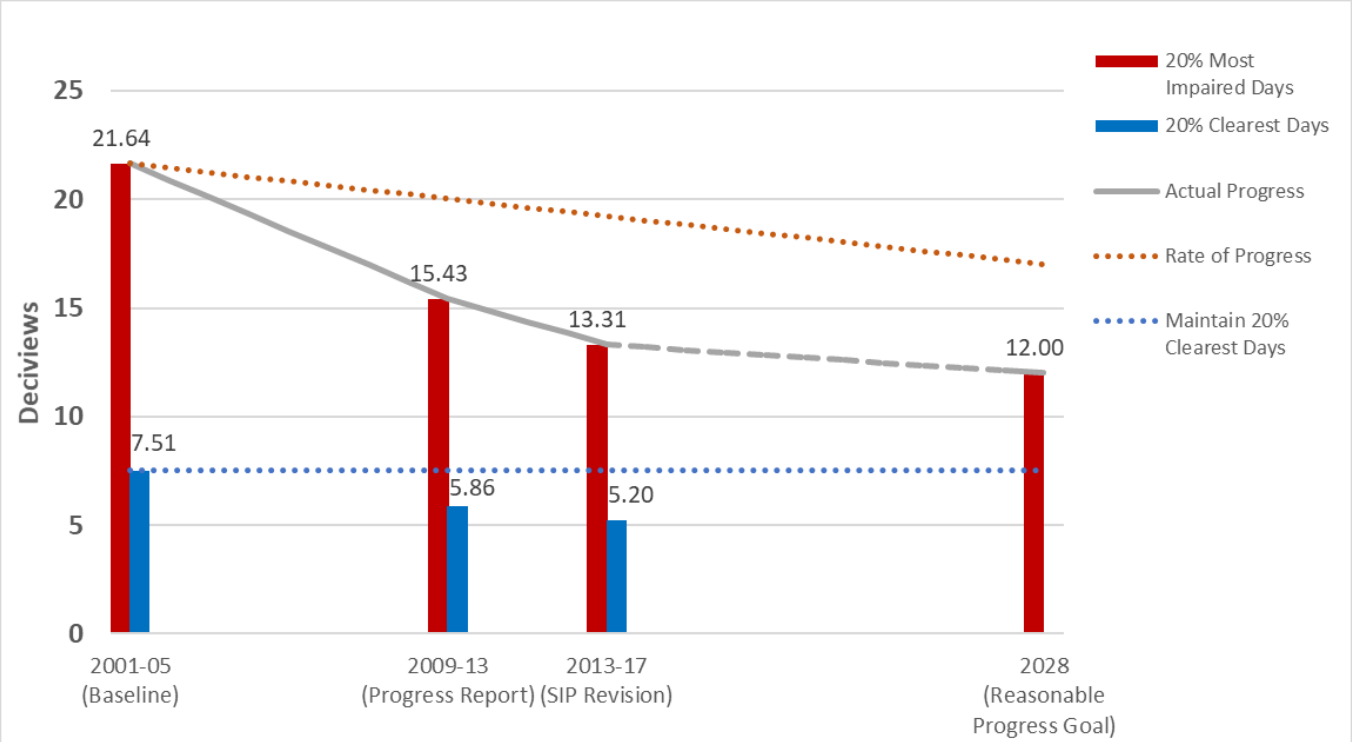
This document provides an analysis of visibility data collected at the IMPROVE monitoring site representing New Hampshire's Class I areas, starting in the baseline period of 2001-2005[4] through 2013-2017, the most recent five-year period with available data. The results of this analysis show definite reduction in overall haze levels at New Hampshire's Class I areas and corresponding rate of

1 https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf
2 https://www.federalregister.gov/documents/search?conditions%5Bterm%5D=77+FR+50602
3 https://www.gpo.gov/fdsys/pkg/FR-2016-10-12/pdf/2016-24495.pdf
4 The Great Gulf IMPROVE data for 2000 was incomplete thus, the baseline was calculated for the period of 2001-2005.

improvement better than the 2028 uniform rate of progress visibility condition for the 20 percent most impaired visibility days, as shown in Figure E-1.

This revision will demonstrate New Hampshire and the MANE-VU region's additional progress, and establish Reasonable Progress Goal plans for improving the 20% most impaired visibility days through the next planning cycle (2018-2028) and for attaining natural background levels by 2064. The Regional Haze Rule also specifies that the 20% clearest days be maintained (or improved) through 2064.

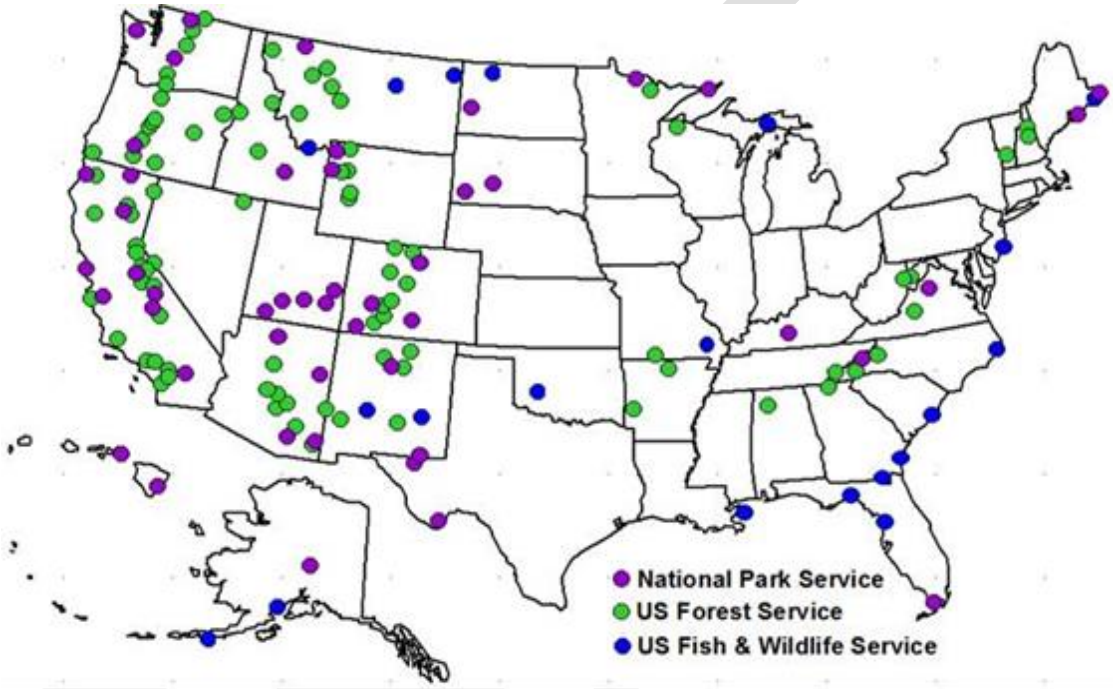
Figure E-1. Visibility Trends at Great Gulf and Presidential Range - Dry River Wilderness Areas



1. THE REGIONAL HAZE ISSUE

In 1999, the EPA issued regulations to improve visibility in 156 national parks and wilderness areas across the United States. The affected areas include many of our best-known natural places, including the Grand Canyon, Yosemite, Yellowstone, Mount Rainier, Shenandoah, the Great Smoky Mountains, Acadia, and the Everglades (Figure 1-1). In New Hampshire, the areas are the Great Gulf Wilderness and the Presidential Range - Dry River Wilderness.

Figure 1-1: Locations of Federally Protected Mandatory Class I Areas



These regulations address visibility impairment in the form of regional haze. Haze is an atmospheric phenomenon that obscures the clarity, color, texture, and form of what we see. It is caused primarily by anthropogenic (manmade) pollutants but can also be caused by a number of natural phenomena, including forest fires, dust storms and sea spray. Some haze-causing pollutants are emitted directly to the atmosphere by anthropogenic emission sources such as electric power plants, factories, automobiles, construction activities, and agricultural burning. Others occur when gases emitted into the air (haze precursors) interact to form new particles that are carried downwind.

Emissions from these activities generally span broad geographic areas and can be transported hundreds or thousands of miles. Consequently, regional haze occurs in every part of the nation. Because of the regional nature of haze, EPA's regulations require the states to consult with one another toward the national goal of improving visibility – specifically, at the 156 parks and wilderness areas designated under the Clean Air Act as mandatory Federal Class I areas.

EPA regional haze regulations found at 40 CFR 51.308 identify the core requirements for addressing the haze phenomenon in each mandatory Federal Class I area located within the State and each Federal

Class I area outside of the State that may be affected by emissions from within the State. These plans must take the form of a SIP revision and are to be updated in 10-year increments, starting July 31, 2018. New Hampshire submitted its Regional Haze Plan on January 29, 2010. It was approved by the EPA on August 22, 2012 [77 FR 50602][5]. EPA amended its requirements for state plans in 2017 [82 FR 3078][6], including extending the deadline at 40 CFR §51.308(f) for comprehensive SIP revisions from July 31, 2018 to July 31, 2021. New Hampshire, along with its regional partners at MANE-VU[7] decided to submit the plan ahead of the revised due date to enable the use of the current 2011-based modeling platform and data analyses.

1.1 Basics of Regional Haze

Small particles and certain gaseous molecules in the atmosphere cause poor visibility by scattering and absorbing light, reducing the amount of visual information about distant objects that reaches an observer. Some light scattering by air molecules and naturally occurring aerosols occurs even under natural conditions. The distribution of particles in the atmosphere depends on meteorological conditions and leads to various forms of visibility impairment. When high concentrations of pollutants are well mixed in the atmosphere, they form a uniform haze. When temperature inversions trap pollutants near the surface, the result can be a sharply demarcated layer of haze.

Visibility impairment can be quantified using three different, but mathematically related measures: light extinction per unit distance (e.g., inverse megameters, or Mm^{-1}); visual range (i.e., how far one can see); and deciviews, a useful metric for measuring increments of visibility change that are just perceptible to the human eye. Each can be estimated from the ambient concentrations of individual particle and gaseous constituents, taking into account their unique light-scattering (or absorbing) properties and making appropriate adjustments for relative humidity. Assuming natural conditions, visibility in the Northeast and Mid-Atlantic is estimated to have a light extinction of about 23 Mm^{-1}, which corresponds to a visual range of about 106 miles or eight dv (the lower the dv, the better the visibility). Under current polluted conditions in the region, average light extinctions ranges from 103 Mm^{-1} in the south to 55 Mm^{-1} in the north - these values correspond to a visual range of 24 to 44 miles or 23 to 17 dv, respectively. Updates to the regional haze rule specify that dominant uncontrollable influences, such as volcanic activity and certain types of fires, can be removed from determination of worst visibility days for satisfaction of progress requirements. As a result, the rule now focuses on a metric referred to as the 20% most impaired visibility days.

The small particles that commonly cause hazy conditions in the East are primarily particles composed of sulfate, nitrate, organic carbon, elemental carbon (soot), and crustal material (e.g., soil dust, sea salt, etc.). Of these constituents, only elemental carbon impairs visibility by absorbing visible light; the others scatter light. Sulfate, nitrate, and organic carbon particles are secondary pollutants that form in the atmosphere from precursor pollutants, primarily SO_2, NO_X, and VOCs, respectively. By contrast, soot and crustal material and some organic carbon particles are released directly to the atmosphere. Particle

5 https://www.federalregister.gov/documents/search?conditions%5Bterm%5D=77+FR+50602

6 https://www.federalregister.gov/documents/2017/01/10/2017-00268/protection-of-visibility-amendments-to-requirements-for-state-plans

7 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.

constituents also differ in their relative effectiveness at reducing visibility. Sulfate and nitrate based particles, for example, contribute disproportionately to haze because of their chemical affinity for water. This property allows them to grow rapidly in the presence of moisture, to the optimal particle size for scattering light (i.e., 0.1 to 1 micrometer).

Monitoring data collected over the last decade show that fine particle[8] concentrations, and hence visibility impairment, are generally highest near industrial and highly populated areas of the Northeast and Mid-Atlantic. Particle concentrations are lower, and visibility conditions are better, at the more northerly Class I sites (such as the Great Gulf and Presidential Range - Dry River Wildernesses in New Hampshire), where current visibility on the 20 percent clearest days[9] (5.2 dv)[10] is close to natural (3.73 dv), unpolluted conditions. Because there are naturally occurring visibility impairing emissions, the 20% most impaired days' metric is applicable to natural conditions. Natural visibility on the 20% most impaired of days at Great Gulf/Presidential-Dry River Wilderness is estimated to be 9.78 dv (compared to 3.73 dv on the best of days). Current visibility on 20% most impaired visibility days is 13.31 dv. About half of the worst visibility days in the New Hampshire Class I areas occur in the summer when meteorological conditions are more conducive to the formation of sulfate from SO_2 and to the oxidation of organic aerosols. The remaining worst visibility days are divided nearly equally among spring, winter, and fall. In contrast to sulfate and organic carbon, the nitrate contribution is typically higher in the winter months. The crustal and elemental carbon fractions do not show a clear pattern of seasonal variation. In addition, winter and summer transport patterns are different, possibly leading to different contributions from upwind pollutant source regions.

1.2 Regulatory Framework

In amendments to the CAA in 1977, Congress added Section 169A (42 U.S.C. 7491), setting forth the following national visibility goal:

> "Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Federal Class I areas which impairment results from manmade air pollution."

The "Class I" designation was initially given to 158 areas, in existence as of August 1977 that met these criteria:

- All national parks greater than 6,000 acres.
- All national wilderness areas and national memorial parks greater than 5,000 acres.
- One international park.

In 1999, the U.S. Environmental Protection Agency announced a major effort to improve air quality in

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8 "Fine particles" refers throughout this study to particles less than or equal to 2.5 micrometers in diameter, consistent with EPA's fine particle NAAQS.

9 "20 percent clearest visibility conditions" are defined throughout this report as the simple average of the lower 20th percentile of a cumulative frequency distribution of available data (expressed in dv).

10 Five-year average, 2013-2017.

these areas. The Regional Haze Rule calls for state and federal agencies to work together to improve visibility in 156[11] designated national parks and wilderness areas (Figure 1-1). The rule requires the states, in coordination with the EPA, the National Park Service, U.S. Fish and Wildlife Service, the U.S. Forest Service, and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment.

1.2.1 The Regional Haze Rule

The federal requirements that states must meet to achieve national visibility goals are contained in Title 40: Protection of Environment, Part 51 – Requirements for Preparation, Adoption, and Submittal of Implementation Plans, Subpart P – Protection of Visibility (40 CFR 51.300-309). Known more simply as the Regional Haze Rule, these regulations were adopted on July 1, 1999, and went into effect on August 30, 1999. The rule seeks to address the combined visibility effects of various pollution sources over a large geographic region. This wide-reaching pollution net means that many states – even those without Federal Class I areas – are required to participate in haze reduction efforts.

Regional haze regulations recognize that visibility impairment is fundamentally a regional phenomenon. Emissions from numerous sources over a broad geographic area commonly create hazy conditions across large portions of the eastern U.S. because of the long-range transport of airborne particles and precursor pollutants in the atmosphere. The key sulfate precursor, SO_2, for example, has an atmospheric lifetime of several days and is known to be subject to transport distances of hundreds of miles. NO_X and some organic carbon species are also subject to long-range transport, as are small particles of soot and crustal material.

1.2.2 Revision to the Regional Haze Rule

States are required to submit periodic plans demonstrating how they have and will continue to make progress toward achieving their visibility improvement goals. The first state plans were due in December 2007 and covered the 2008-2018 planning period. The 2017 revision to the regional haze rule addresses requirements for the second planning period, 2018-2028. The updated rule makes the following changes:

- Adjusts the SIP submittal deadline for the second planning period from July 31, 2018 to July 31, 2021. As noted in section 1, New Hampshire, along with its regional partners in MANE-VU, have elected to submit their comprehensive revision closer to the original timeline to enable the use of the current 2011-based modeling platform and data analyses already underway when the revised rule was released.
- Adjusts interim progress report submission deadlines so that second and subsequent progress reports will be due by January 31, 2025, July 31, 2033, and every 10 years thereafter. This means that one progress report will be required mid-way through each planning period.
- Removes the requirement for interim progress reports to take the form of SIP revisions. States will be required to consult with Federal Land Managers and obtain public comment on their progress reports before submission to the EPA. These progress reports will be reviewed by the EPA, but the EPA will not formally approve or disapprove them.
- Clarifies EPA's long-standing interpretations of the 1999 Regional Haze Rule, including:

[11] In 1980, Bradwell Bay, Florida, and Rainbow Lake, Wisconsin, were excluded for purposes of visibility protection as Federal Class I areas.

- Requirements that reasonable progress goals be set based on the long-term strategy.
- Obligations of states with mandatory Federal Class I areas and other states contributing to impairment at those areas.
- Obligations on states setting reasonable progress goals that provide for a slower rate of progress than that needed to attain natural conditions by 2064.

Another key change in the 2017 revision is addition of the word "anthropogenic" to the definition of most impaired, that is: "Most impaired days means the twenty percent of monitored days in a calendar year with the highest amounts of **anthropogenic** visibility impairment." (emphasis added) (40 CFR 51.301). EPA guidance[12] states that the 20% most impaired days each year at each Class I area based on daily anthropogenic impairment. Previously, states and the EPA tracked visibility progress on the 20% worst visibility days, regardless of origin. Throughout this document, NHDES uses both approaches, referencing the haziest or "worst" days with respect to the first implementation period, and "most impaired," or anthropogenic impairment only, for discussing the baseline and projections for this implementation period plan. Comparisons of the two are also made.

1.2.3 State Implementation Plan

The core requirement for states where a mandatory Federal Class I area is located is the submission of an implementation plan containing the elements found in 40 CFR 51.308(d)(1) through (4). New Hampshire submitted its State Implementation Plan revision to meet these requirements in January 2010. It was approved by the EPA on August 22, 2012 [77 FR 50602].[13] In addition to the core requirements referenced above, the plan also covered the BART components of 40 CFR 51.308(e), and addressed requirements pertaining to regional planning, and state/tribe and Federal Land Manager (FLM) coordination and consultation.

40 CFR 51.308(g) requires NHDES to submit a report to EPA every 5 years that evaluates progress toward the reasonable progress goal for each mandatory Federal Class I area located within the state and each mandatory Federal Class I area located outside the state that may be affected by emissions from within the state. NHDES submitted its first progress report on December 16, 2014 [81 FR 70360].[14]

1.3 New Hampshire's Class I Areas

In New Hampshire, the U.S. Forest Service manages two Class I areas in the White Mountain National Forest - Great Gulf Wilderness and the Presidential Range - Dry River Wilderness.

These Class I areas flank the northern and southern slopes of the nationally renowned Mt. Washington, in the Presidential Range of the White Mountains (Figure 1-2). Each of these areas covers thousands of acres containing high mountain terrain, scenic vistas, and interesting or unique geologic formations and vegetation communities (Figure 1-3). Many species of wildlife are present, including a number of alpine-zone residents. Cool, crystal-clear streams, cascades, and high-elevation ponds are common throughout the two areas, and the region is full of natural woodland. Hardwoods are most abundant on the lower slopes; mixed birches, maples and spruce-fir dominate the mid-slopes; and spruce-fir is most common

[12] Technical Guidance on Tracking Visibility Progress for the Second Implementation Period, EPA -454/R-18-010, December 2018.
[13] https://www.federalregister.gov/documents/2012/08/22/2012-20271/approval-and-promulgation-of-air-quality-implementation-plans-new-hampshire-regional-haze
[14] https://www.federalregister.gov/documents/2016/10/12/2016-24495/air-plan-approval-nh-regional-haze-5-year-report

on the upper mountainsides. The unusual low-elevation tree line in the White Mountains of New Hampshire is caused by the high winds and harsh conditions this area experiences through the year. The result is a fragile, near-Arctic-tundra vegetation at the higher elevations.

Figure 1-2: Mt. Washington from the West[15]

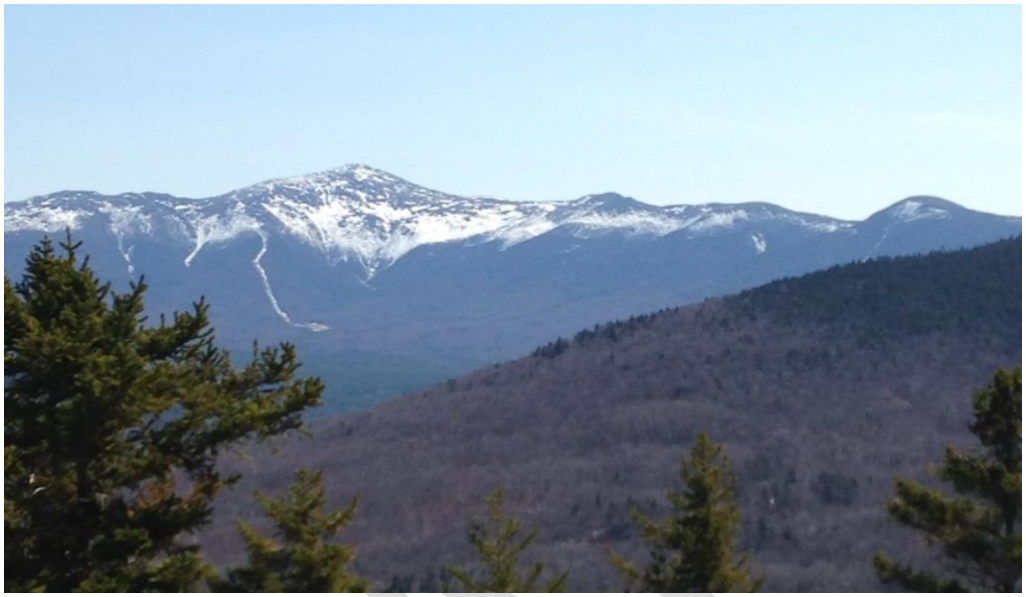
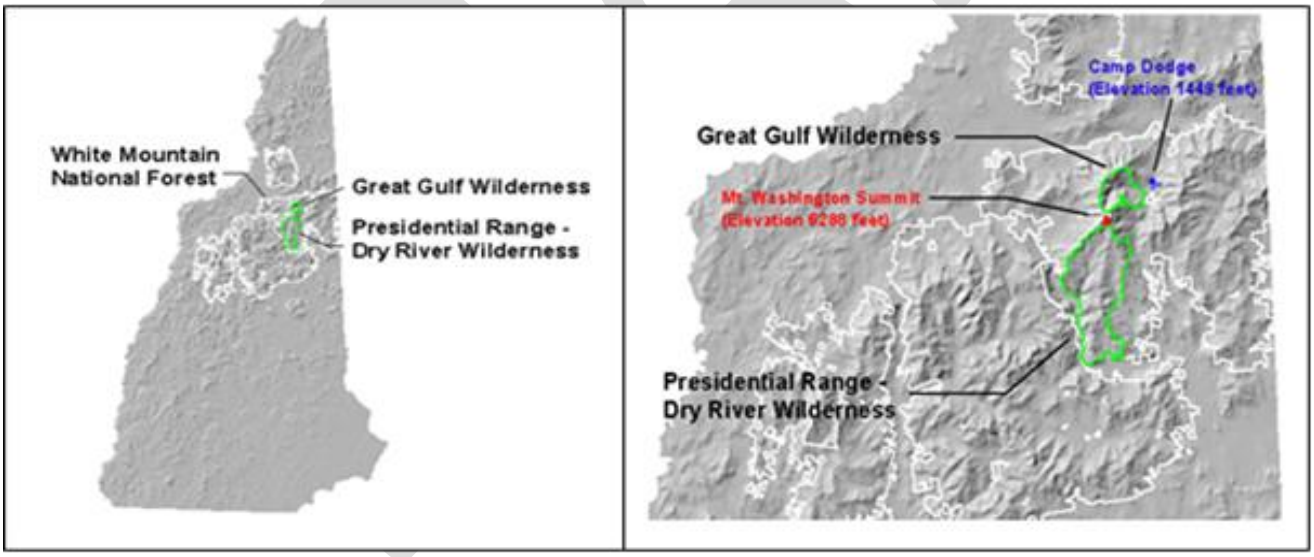


Figure 1-3: Location of New Hampshire's Class I Areas



The two New Hampshire Class I areas are heavily visited by tourists and hikers. Mt. Washington summit, while close but not in the Federal Class I areas, represents a favorite hiking, road and cog railway accessible tourist location to take in the views that reach into four states, plus Canada. Views of Mt. Washington from around the state are an important part of tourism and the way of life in the state.

[15] Photos at Figures 1-2, 1-4 and 1-5 taken by Felice Janelle.

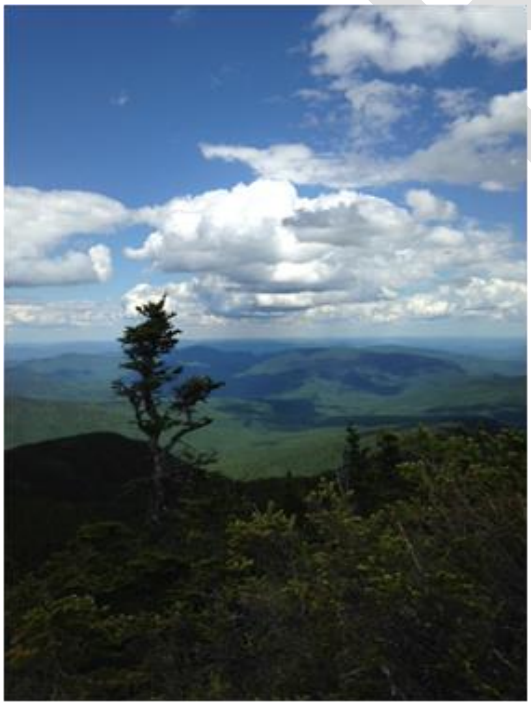
1.3.1 Great Gulf Wilderness

The Great Gulf Wilderness is located in Greens Grant (Coos County) in the White Mountain National Forest of northern New Hampshire (Figure 1-4). Occupying the northeastern slopes of the Presidential Range, Great Gulf covers an area of 5,552 acres and ranges in elevation from 1,680 to 5,807 feet. The area includes many rivulets that drain eastward to the West Fork of the Peabody River. For visitors, the Great Gulf has 21.3 miles of marked trails, which offer some of the best views of the ridges and summits of the Presidential Range.

Figure 1-4: View of Great Gulf Wilderness from the East

1.3.2 Presidential Range – Dry River Wilderness

The Presidential Range - Dry River Wilderness is also located in Greens Grant in the White Mountain National Forest of northern New Hampshire (Figure 1-4); however, at 29,000 acres, it is about five times larger than the Great Gulf Wilderness. Ranging in elevation from 880 to 5,413 feet, the Presidential Range - Dry River Wilderness constitutes a rugged expanse of mountains and valleys lying to the south of Mt. Washington's summit. On its western side, the area flanks other peaks in the Presidential Range, including Mt. Eisenhower and Mt. Monroe. The wilderness area extends across and beyond the central valley of the Dry River to the Saco River, encompassing numerous brooks and smaller, heavily forested mountains (Figure 1-5).



As the name suggests, the Dry River is almost without water by late summer but swells quickly during heavy rains. There are 43 miles of maintained trails in the area. Because of its remote location, this area receives fewer visitors than Great Gulf (about 7,000 annually). Its southern portion has almost no trails, is very steep and rugged, and offers a rare degree of solitude.

Figure 1-5: **Presidential Range-Dry River Wilderness from the North**

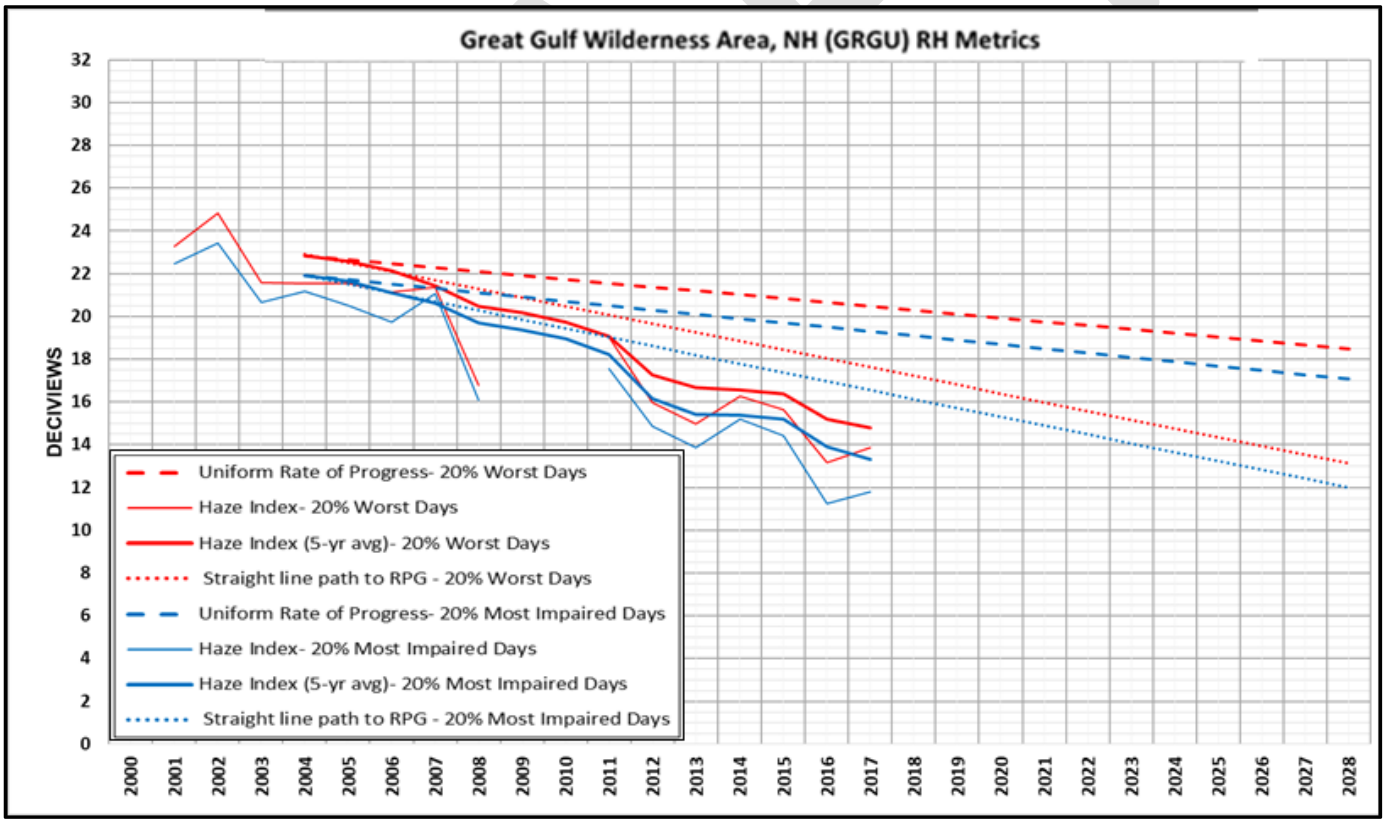
1.4 Monitoring and Recent Visibility Trends

Visibility monitoring at Great Gulf Wilderness and Presidential Range - Dry River Wilderness is accomplished with instruments located at a single site at Camp Dodge. This monitoring station represents both wilderness areas, and for this reason, New Hampshire's wo Federal Class I areas are often referred two as simply the Great Gulf Wilderness or the abbreviation GRGU. Instruments at Camp Dodge measure and

record light scattering, aerosols, and relative humidity. This information is tracked over time to look for trends.

Figure 1-6 depicts recent visibility trends (in annual average dv) at Great Gulf Wilderness and Presidential Range - Dry River Wilderness for the 20% most and least visibility-impaired days for each year from 2000 to 2017. While visibility data was collected during the period of 2008 through 2011, equipment reliability issues prevented collection of sufficient data to develop annual summary statistics, and is thus excluded from this chart. Trends were developed by staff from the Maine Department of Environmental Protection (MEDEP)[16] for both the previously approved calculation method[17] looking at "20% worst" visibility days and EPA proposed calculation method looking at the "20% most impaired" visibility days. The blue markings represent information based on revised calculation methodology and the red markings indicate data based on the previous methodology. Solid lines represent 1-year (thin line) and 5-year averages (bold line) of actual monitoring data. Dashed lines indicate the glideslope between the base period and 2064 goals with points along these lines representing the URP for each year. Dotted lines represent uniform rates towards RPG that include the state's long-term strategy. Actual 5-year monitoring averages (bold blue solid line) need to equal or be below the RPG (red dotted line) in 2028.

Figure 1-6: Regional Haze Metric Trends – Great Gulf Wilderness Area[18]



16 Regional Haze Metric Trends and HYSPLIT Trajectory Analyses, MANE-VU, May 2017: Appendix A.

17 Guidance for Tracking Progress Under the Regional Haze Rule, September 2003, *http://www3.epa.gov/ttnamti1/files/ambient/visible/tracking.pdf*.

18 MANE-VU 2000-17 RH METRICS COMPARISON PLOTS 11-11-2018: https://otcair.org/manevu/Document.asp?fview=Reports.

Visibility trends for the Class I sites in New Hampshire, and out of state Class I sites potentially impacted by New Hampshire, are noted in Table 1-1. This table was presented in New Hampshire's first progress report in 2014. It was updated to the revised metric (depicting impairment by anthropogenic sources only). It is noteworthy that visibility improvement as of the most recent 5-year average (2013-2017) at Great Gulf Wilderness Area is already ahead of the 2028 RPG thanks largely to energy market forces.

Table 1-1: Visibility trends for Class I sites in New Hampshire, or potentially impacted by New Hampshire (Observed Visibility vs. Reasonable Progress Goals, all values in dv)[19]

Federal Class I Area IMPROVE Site	2000-2004 5-Year Average	2013-2017 Annual Average	2028 Uniform Rate of Progress	2028 Baseline / Reasonable Progress Goal[20]
20% Most Impaired Days				
Acadia National Park	22.01	14.89	17.36	13.44 / 13.35
Moosehorn Wilderness Area**	20.66	13.54	16.38	13.20 / 13.12
Great Gulf Wilderness Area***	21.64*	13.31	16.90	12.13 / 12.00
Lye Brook Wilderness Area	23.57	15.30	18.23	13.89 / 13.68
Brigantine Wilderness Area	27.43	19.86	20.74	18.16 / 17.97
20% Clearest Days				
Acadia National Park	8.78	6.52	--	6.33 / 6.33
Moosehorn Wilderness Area	9.16	6.59	--	6.46 / 6.45
Great Gulf Wilderness Area	7.51*	5.20	--	5.11 / 5.06
Lye Brook Wilderness Area	6.37	5.15	--	3.90 / 3.86
Brigantine Wilderness Area	14.33	11.48	--	10.55 / 10.47

* Great Gulf baseline period is 2001-2005 according to EPA 2019 Guidance.
** IMPROVE site also represents Roosevelt Campobello International Park in New Brunswick, Canada.
*** IMPROVE site also represents the Presidential Range-Dry River Wilderness Area

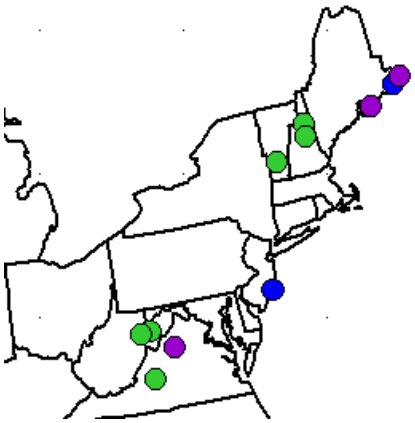
[19] Maine Department of Environmental Protection, Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics), December 18, 2018: Appendix B.

[20] Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update (Appendix V)

2. AREAS CONTRIBUTING TO REGIONAL HAZE

The Regional Haze Rule requires states to determine their contributions to visibility impairment at Federal Class I areas, and to determine the impact of emissions from outside the state on its Federal Class I areas. In coordination with its regional partners, New Hampshire has committed to implementing a long-term strategy to improve visibility at MANE-VU's seven Class I areas and nearby Federal Class I Areas shown on Figure 2-1.

Figure 2-1: MANE-VU and nearby Federal Class I Areas



MANE-VU Class I Areas

Maine: Acadia National Park, Moosehorn Wilderness Area, Roosevelt Campobello International Park (spans the border of Maine and New Brunswick, Canada)

New Hampshire: Great Gulf and Presidential-Dry River Wilderness Areas

Vermont: Lye Brook Wilderness

New Jersey: Brigantine Wilderness Area

Nearby Federal Class I Areas

West Virginia: Dolly Sods and Otter Creek Wilderness

Virginia: James River Face Wilderness Area and Shenandoah National Park

National Park Service **US Forest Service** **US Fish & Wildlife Service**

Source apportionment screening modeling (using emissions to distance ratios and the CALPUFF model) was used to identify major contributors to regional haze at the MANE-VU and nearby Federal Class I areas. These tools were used to help identify the emission sources in the eastern and central United States and to help determine which states with whom NH shall consult.

NHDES, in conjunction with the Vermont Department of Environmental Conservation (VTDEC) used the CALMET, CALPUFF and CALPOST programs to estimate pollutant concentrations and visibility impacts at eleven Class I areas in the northeastern U.S. This work enabled MANE-VU states to estimate and rank the relative impact of the sulfate and nitrate components of regional haze attributable to sulfur dioxide and nitrogen oxide emissions from individual large stationary point sources. Emission units were selected for CALPUFF modeling based on their emission magnitudes and proximity to MANE-VU Class I areas. At a minimum, the five largest EGU units in each eastern state were modeled. Other large emitting units were added, thus some states had many units modeled. ICI units were initially selected based on similar emission magnitude to EGUs being modeled for a state. Smaller ICI units were added in MANE-VU States near Federal Class I areas. Additional detail can be found in Appendix C.[21]

[21] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources, April 4, 2017: Appendix C.

The modeling resulted in the following observations:

1. Emissions of SO_2 and NOx from EGUs are lower in 2015 compared to 2011 at many EGUs, however some show increased emissions.
2. Modeled sulfate, nitrate and visibility impacts for 95th percentile daily emissions produce substantially different results than modeling with annual emissions, especially for units with low operating hours.
3. The application of three different years of meteorology with identical emission rates can provide differing maximum sulfate, nitrate and visibility impacts. In some cases, the difference is substantial.
4. Emission sources located close to Federal Class I areas typically show higher visibility impacts than similarly sized facilities further away. However, visibility degradation appears to be dominated overall by more distant emission sources.
5. Some industrial emissions sources other than EGUs may have significant impacts on visibility at MANE-VU Class I areas. Several of these sources are located in MANE-VU, while a few are located in nearby states.

This screening modeling was not intended to determine need for mandatory regulation on specific emission sources, but rather to identify emission units for further evaluation. The results of the modeling are discussed further in section 2.1.

Additional modeling was conducted by members of the MANE-VU Technical Support Committee (CTDEEP) to estimate sulfate contributions to a receptor using the emissions over distance (Q/d) method.[22] The analysis was done using ARC MAP® software that utilized the empirical formula:

$$I = C_i \left({}^{Q}/_{d} \right)$$

Where the strength of an emission source, Q, is linearly related to the impact, I, that it will have on a receptor located a distance, d, away (the term C_i is a specific adjustment factor for wind direction that was used in this analysis). The MANE-VU Class I areas with IMPROVE monitors – Acadia, Brigantine, Great Gulf, Lye Brook & Moosehorn and several near-by Federal Class I areas with IMPROVE monitors – Dolly Sods, James River Face and Shenandoah – were used as receptors. The results were compared with a similar study published in 2012.[23] The James River Face Wilderness was added in the 2015 analysis because it was considered close enough in proximity to MANE-VU states to be an important receptor to MANE-VU states. The locations of receptors analyzed in the 2015 analysis are shown in Figure 2-2.

A review of recent IMPROVE speciated visibility data shows the relative importance of sulfates compared to other pollutants in regard to light extinction at the IMPROVE sites analyzed (see Figure 2-3). This led to the conclusion that SO_2 was the most accurate and most relevant estimation for determining the impact of states' emissions to the visibility impairment of the MANE-VU Class I areas. Emissions of NOx were considered in the final analysis and factored into Q/d calculations with chemistry

[22] MANE-VU Technical Support Committee, *MANE-VU Updated Q/d*C Contribution Assessment*, April 6, 2016: Appendix D.

[23] NESCAUM, 2012. Contributions to Regional Haze in the Northeast and Mid-Atlantic United States: Preliminary Update through 2007. http://www.nescaum.org/topics/regional-haze/regional-haze-documents

information provided by CALPUFF modeling. Although nitrate generally accounts for a substantially smaller fraction of fine particle mass and related light extinction than sulfate and organic carbon at northeastern Federal Class I areas, it may play a more important role in urban settings and in the wintertime. In addition, NO_X may have an indirect effect on summertime visibility by virtue of its role in the formation of ozone. Furthermore, it is worth examining nitrates emanating from the electric sector in the Midwest where power plants contribute significantly to NO_X emissions.

Figure 2-2: Receptors for the 2015 C_i(Q/d) Analysis

Ohio was determined to be one of the top two contributors for all of the eight Federal Class I areas reviewed. Pennsylvania also continues to be one of the top three contributors for seven of the eight receptors. The majority of the top five contributors were very similar to the previous analysis, however significant reshuffling of the top five is apparent thus indicating the emissions reductions achieved were not equally applied among the neighboring states. Table 2-1 displays the Q/d quantitative contributions to the MANE-VU and neighboring Federal Class I areas between the 2012 analysis (2007 emissions) and the 2015 analysis (2011 data).

Figure 2-3: Speciation at MANE-VU and Neighboring Class I Areas

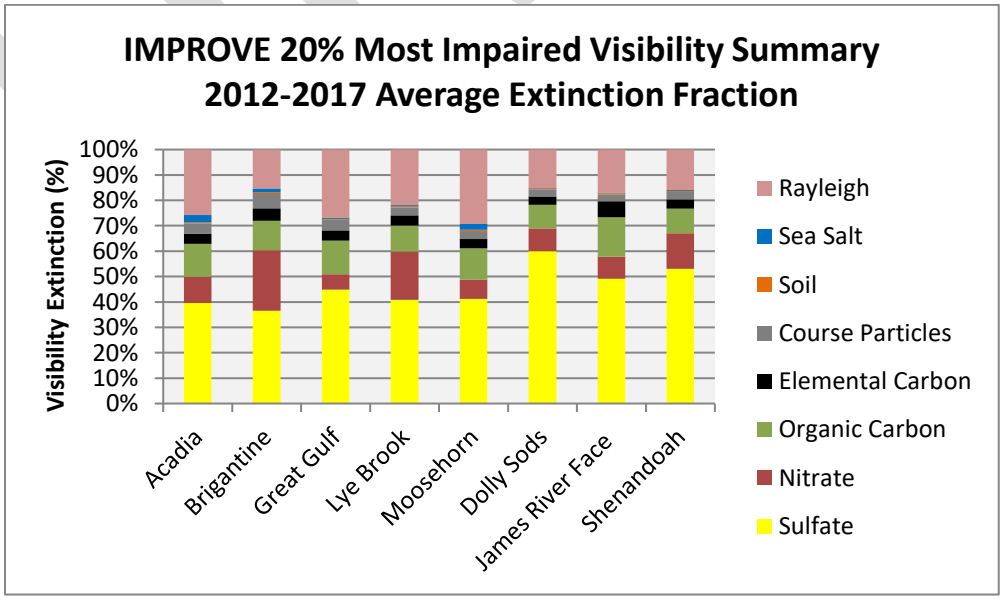


Table 2-1: Top Five Contributing U.S. States for Total State SO_2 Emissions over the Three Analyses (Q/d)[24]

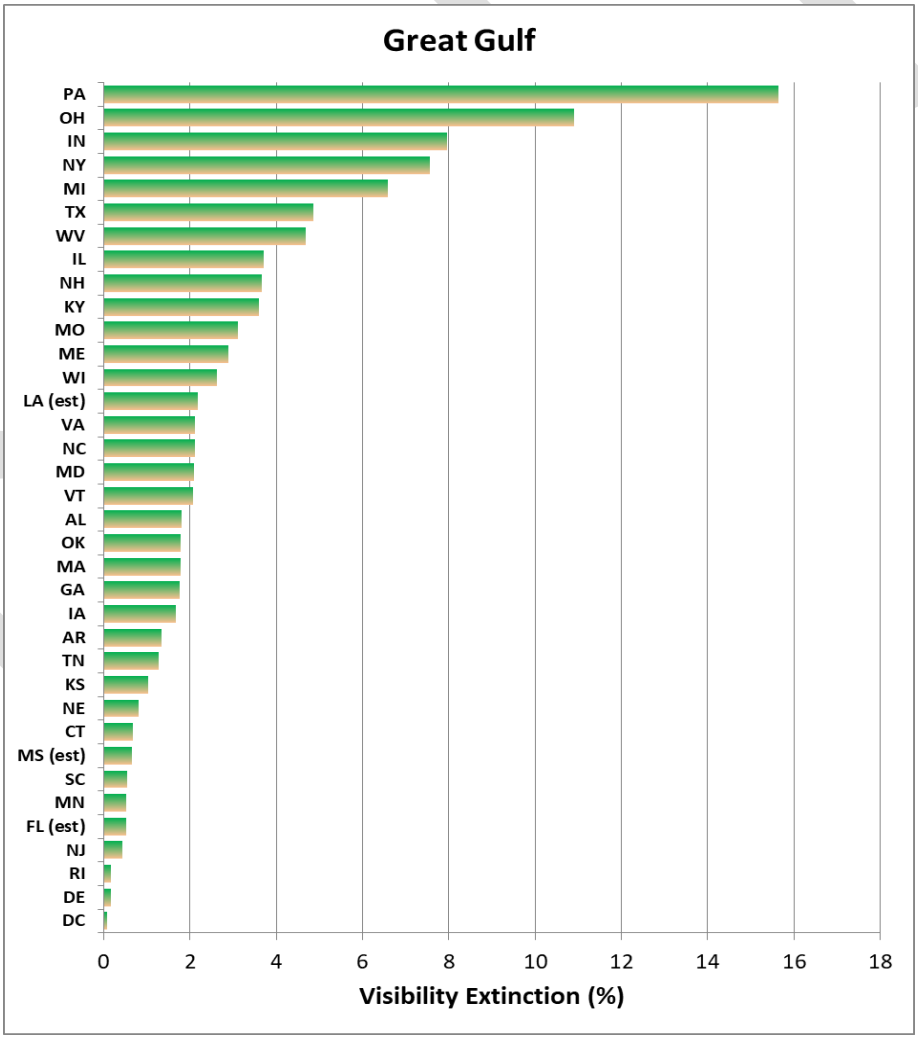
Federal Class I Area (Receptor)	Rank	2012 Analysis (2007* emissions)	2015 Analysis (2011 emissions)
Acadia	1	Pennsylvania	Ohio
	2	Ohio	Pennsylvania
	3	Indiana	Indiana
	4	Michigan	Michigan
	5	Georgia	Illinois
Brigantine	1	Pennsylvania	Pennsylvania
	2	Maryland	Ohio
	3	Ohio	Maryland
	4	Indiana	Indiana
	5	West Virginia	Kentucky
Dolly Sods	1	Pennsylvania	Ohio
	2	Ohio	West Virginia
	3	West Virginia	Pennsylvania
	4	Indiana	Indiana
	5	North Carolina	Kentucky
Great Gulf / Presidential-Dry River	1	Pennsylvania	Ohio
	2	Ohio	Pennsylvania
	3	Indiana	Indiana
	4	Michigan	Michigan
	5	New York	Illinois
James River Face	1	New to analysis	Ohio
	2		Pennsylvania
	3		Indiana
	4		Kentucky
	5		West Virginia
Lye Brook	1	Pennsylvania	Pennsylvania
	2	Ohio	Ohio
	3	New York	Indiana
	4	Indiana	New York
	5	Michigan/West Virginia	Michigan
Moosehorn/ Campobello	1	Pennsylvania	Ohio
	2	Ohio	Indiana
	3	Indiana	Illinois
	4	Michigan	Michigan
	5	Texas/Missouri/Illinois/West Virginia/New York	Texas
Shenandoah	1	Pennsylvania	Ohio
	2	Ohio	Pennsylvania
	3	West Virginia	Indiana
	4	Maryland	West Virginia
	5	Indiana	Virginia

[24] MANE-VU Updated Q/d*C Contribution Assessment: Appendix D.

2.1 States and Sources Contributing to Visibility Impairment in New Hampshire's Class I Areas

Modeling of point source (EGUs and industrial/institutional units) contributions to Federal Class I areas undertaken in 2016 by NHDES and VTDEC[25] was used to estimate the visibility impairment attributable to SO_2 and NOx on the 20% most impaired days that was contributed by other states to New Hampshire's Federal Class I areas. Emissions used for the MANE-VU contribution assessment modeling included EPA's CAMD 2015 daily EGU SO_2 and NOx emissions and the MARAMA 2011 typical daily industrial/institutional SO_2 and NOx emissions. As with other Federal Class I areas in MANE-VU and nearby, emissions from Pennsylvania and Ohio have a large impact in New Hampshire— over 25% (Figure 2-4). The impact of anthropogenic sulfate and nitrate is depicted in Figure 2-5. Individual sources are given in Table 2.2.

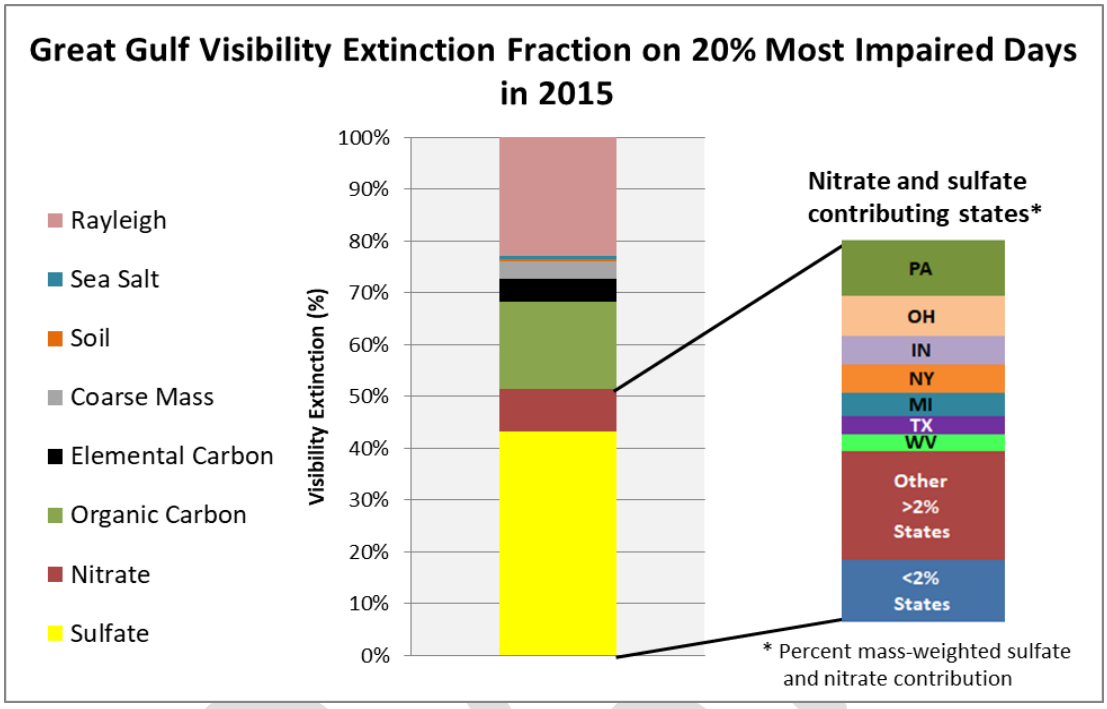
Figure 2-4: Estimated 2011-2015 Percent Mass Weighted Sulfate and Nitrate Contribution for Great Gulf, NH[26]



[25] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources: Appendix C.

[26] Data from "Selection of States for MANE-VU Regional Haze Consultation (2018)" MANE-VU Technical Support Committee, 9/5/2017: Appendix E.

Figure 2-5: Estimated State Contribution to Nitrate and Sulfate Visibility Impairment at New Hampshire's Class I Sites



Previously mentioned metrics analyses included speciation analyses for 2000-2015 and trajectory modeling analyses for the "most impaired" visibility days in 2002, 2011 and 2015 for Federal Class I areas in MANE-VU, and nearby Federal Class I areas in Virginia and West Virginia.[27] For MANE-VU states, 2002 is the base year for the first round of regional haze SIPs, 2011 is the base year for the current round of regional haze SIPs and 2016 is the latest year IMPROVE data was available for this report. Years chosen were the same years used in the MANE-VU Source Contribution Modeling Report using 2015 emissions (i.e., CALPUFF and Q/d).[28]

CALPUFF modeling results used for comparison with the trajectory analyses include states having an impacting EGU or ICI source with at least a 1 Mm^{-1} light extinction impact to a Federal Class I area. For example, New Hampshire had two EGUs at two facilities modeled to have greater than 1 Mm^{-1} light extinction at Acadia using 2015 emissions. Table 2-2 shows the results of this modeling for New Hampshire and other MANE-VU states' emissions sources. **Due to concerns raised during consultation about CALPUFF performance at distances greater than 50 km, MANE-VU agreed to use the model only as a screening tool to identify contributing states and sources that may benefit from more detailed examination.**

[27] MANE-VU Regional Haze Metric Trends and HYSPLIT Trajectory Analyses: Appendix A.

[28] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources: Appendix C, and MANE-VU Updated Q/d*C Contribution Assessment: Appendix D.

Table 2-2: Individual Electrical Generation Unit Sources Contributing to Visibility Impairment at New Hampshire's Class I Areas Based on CALPUFF modeling with 2015 CAMD Emissions[29]

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Great Gulf		
				24-hr Max SO_4 Ion ($\mu g/m^3$)	24-hr Max NO_3 Ion ($\mu g/m^3$)	Est Extinction (Mm^{-1})
OH	Avon Lake Power Plant	2836	12	0.64	0.13	**8.9**
PA	Homer City	3122	1	0.58	0.10	**7.3**
PA	Homer City	3122	2	0.52	0.09	**6.4**
ME	William F Wyman	1507	4	0.16	0.20	**4.1**
OH	Muskingum River	2872	5	0.30	0.01	**3.6**
VA	Yorktown Power Station	3809	3	0.24	0.07	**3.6**
KY	Big Sandy	1353	BSU1, BSU2	0.20	0.05	**2.9**
NH	Merrimack	2364	2	0.04	0.19	**2.9**
WV	Harrison Power Station		1 (25%), 2 (20%)	0.05	0.20	**2.8**
GA	Harllee Branch	709	3&4	0.24	0.02	**2.8**
IN	Rockport	6166	MB1, MB2	0.14	0.11	**2.7**
IN	Wabash River Gen Station	1010	2,3,4,5,6	0.21	0.01	**2.6**
OH	Killen Station	6031	2	0.09	0.13	**2.4**
OH	Gen J M Gavin	8102	1	0.13	0.08	**2.4**
PA	Keystone	3136	1	0.15	0.09	**2.3**
OH	Gen J M Gavin	8102	2	0.12	0.07	**2.2**
PA	Keystone	3136	2	0.15	0.09	**2.2**
NH	Newington	8002	1	0.07	0.13	**2.2**
MI	Trenton Channel	1745	9A	0.16	0.03	**2.1**
OH	W H Zimmer Generating Station	6019	1	0.08	0.11	**2.1**
MI	St. Clair	1743	6	0.17	0.01	**2.0**
PA	Shawville	3131	3,4	0.15	0.04	**1.9**
MI	St. Clair	1743	7	0.14	0.02	**1.8**
MA	Brayton Point	1619	4	0.09	0.06	**1.8**
OH	Muskingum River	2872	1,2,3,4	0.13	0.03	**1.8**
NY	Oswego Harbor Power	2594	6	0.09	0.06	**1.8**
NY	Somerset Operating Company (Kintigh)		1	0.10	0.05	**1.7**
PA	Homer City		3	0.06	0.12	**1.7**
IL	Powerton		51,52,61,62	0.11	0.04	**1.7**
WV	Kammer	3947	1,2,3	0.10	0.04	**1.6**
MI	Belle River		2	0.09	0.06	**1.6**
VA	Yorktown Power Station	3809	1,2	0.11	0.02	**1.5**
MI	Belle River		1	0.08	0.06	**1.5**

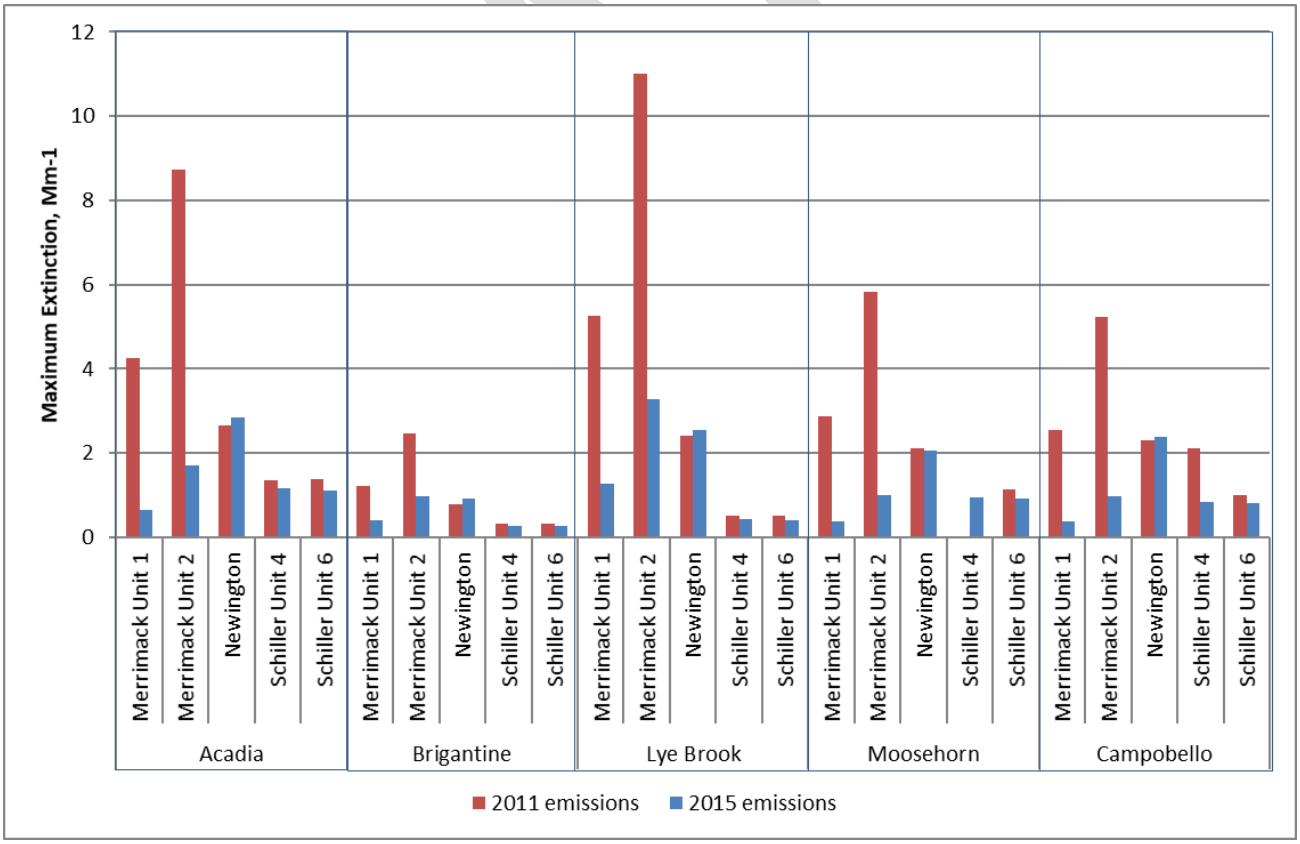
[29] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources: Appendix F.

2016 CALPUFF modeling was also performed in seven phases to include different combinations of emission type (EGU 95th percentile daily or annual, industrial typical daily), emission years (2011 or 2015) and meteorological data (2002, 2011, or 2015). The CALPUFF report provides a table of the top-ten 2011 and 2015 EGU emission sources and the top-five industrial/institutional sources impacting each of the eleven regional Class I areas.

2.2 New Hampshire Emission Sources Potentially Contributing to Visibility Impairment to Federal Class I Areas in Other States

Emissions from New Hampshire-based large emissions sources were assessed with CALPUFF for estimated impacts at all MANE-VU federal Class I areas. The same methodology used by MANE-VU was followed in this work. In summary, emissions and visibility extinctions caused by New Hampshire-based EGUs were lower in 2015 than in 2011 except for Newington Station, which was slightly higher (see Figure 2-6). Emissions at Merrimack Station were down significantly due to installation of a SO_2 scrubber. Since 2015, Merrimack and Newington stations have operated only periodically, and when Newington station has operated, it has primarily used natural gas rather than oil.

Figure 2-6: Maximum Extinction for Emission Years 2011 and 2015 at Using Three Years of Meteorological Data (2002, 2011, 2015) [30]



[30] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources: Appendix F.

Tables 2-3 and 2-4 provide estimated modeled visibility impacts among multiple phases of modeling. Each of these phases represent 2011 95th percentile emissions impacts, but differ in the year of meteorology (2002, 2011, or 2015). For comparison, Table 2-3 also provides modeling results (shown in red text) from another phase of modeling specific to 2015: 95th percentile daily emissions with 2015 meteorology. The maximum values upon which each are ranked are bolded in blue font. For example, Merrimack Station is ranked third out of ten EGUs affecting Lye Brook in Table 2-3 based on the 2011 data/2011 meteorology extinction value of 11.0.

Table 2-3: New Hampshire Visibility Impairing EGU Point Sources (2011 emissions data)

	Facility Info				2011 95th Percentile Extinction Value (Mm^{-1})			2015 95th Percentile Extinction Value (Mm^{-1})	
Federal Class I Area	Rank	Facility	ORIS ID	Unit IDs	Meteorological Year				Distance (mi)
					2002	2011	2015	2015	
Acadia	5	Merrimack	2364	2	8.7	8.3	8.2	1.7	180
Lye Brook	3	Merrimack	2364	2	5.5	**11.0**	2.3	3.3	79
Lye Brook	10	Merrimack	2364	1	2.7	5.3	**1.1**	1.3	79
Moosehorn	7	Merrimack	2364	2	5.5	5.3	**5.8**	1.0	244
Campobello	7	Merrimack	2364	2	**5.2**	5.1	4.6	1.0	254

Table 2-4 follows the same format as Table 2-3, but represents modeling of 2015 emissions for all three meteorology years. Note that only the 2015 meteorology year is based on modeled outputs; extinction values for the 2002 and 2011 meteorology years are estimated using emissions ratios. This table also compares these 2015 results to the maximum 2011 95th percentile emission impacts (shown in red text) among the three years of meteorology. EGUs at Merrimack and Newington are the primary impairing point sources in New Hampshire.

Table 2-4: New Hampshire Visibility Impairing EGU Point Sources (2015 emissions data)

	Facility Info				2015 95th Percentile Extinction Value (Mm^{-1})			2011 95th Percentile Extinction Value (Mm^{-1})	
Federal Class I Area	Rank	Facility	ORIS ID	Unit IDs	Meteorological Year			Maximum Impact for Meteorological Years 2002, 2011, 2015	Distance (mi)
					Est. 2002	Est. 2011	Modeled 2015		
Acadia	10	Newington	8002	1	**2.8**	2.5	2.8	2.7	152
Lye Brook	7	Merrimack	2364	2	1.6	**3.3**	0.7	11.0	79

NHDES also performed CALPUFF screening on several other New Hampshire emission sources. The selection of emission units for modeling were based on the MANE-VU EGU and peaking unit criteria, the MANE-VU industrial, commercial and institutional (ICI) facility criteria, and requests from EPA and the National Park Service through consultation. The units modeled include:

- APC Paper
- Burgess BioPower
- Dartmouth College
- E.P. Newington
- Gorham Paper & Tissue LLC
- Granite Ridge
- Lost Nation
- Merrimack Station Units; 1, 2, CT1, CT2
- Monadnock Paper
- NWPP (Schiller Station SR5)
- Pinetree Tamworth
- Schiller Station Units; 4, 6, CT1
- Wheelabrator Concord
- White Lake

Table 2-5 summarizes the estimated emission impact of all New Hampshire EGUs, CTs and major ICI emission units on MANE-VU Federal Class I areas in the region. This documents the impact of New Hampshire emission sources on nearby Class I areas in Maine and Vermont, as well as the more distant New Jersey. Extinction values presented are the maximum from modeling with three years of meteorology (2002, 2011, and 2015). Large EGU emissions are based on the 95th percentile of 2015 emissions as provided by the CAMD database. Other units' emissions are based on current permitted or highest daily actual emissions from 2016-2018, as indicated. Except for visibility impacts from New Hampshire's large EGUs which are subject to the MANE-VU Ask, all modeled had maximum estimated visibility extinction below 1 Mm^{-1} at all out of state federal Class I areas which was below the MANE-VU screening criteria used for further evaluation. Two peaking combustion turbine units (Lost Nation and White Lake) and one wood powered generating unit (Pinetree Tamworth) had modeled visibility impacts above 1 Mm^{-1} at a New Hampshire Class I area. NHDES subjected each of the peaking combustion turbine units to a 4-factor analysis and is proposing further NOx reductions at Pinetree Tamworth after reviewing the capabilities of existing control equipment.

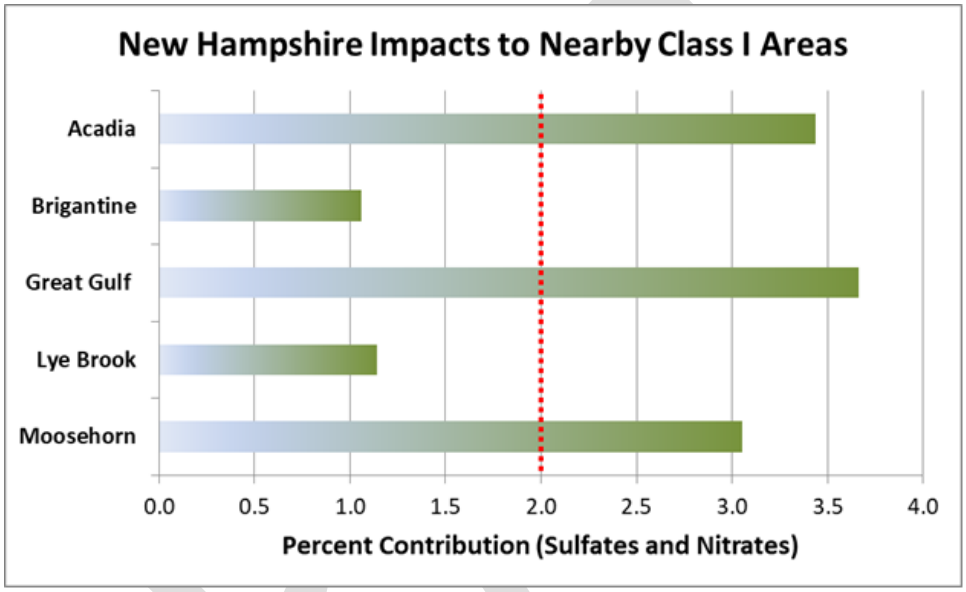
Table 2-5: New Hampshire Visibility Impairing EGU and ICI Point Sources (2015/2011 emissions data)

Facility Information			2015 EGU Emission/2011 Typical ICI Emission Extinction Value (Mm^{-1})					
Facility	**Emissions**	**Unit IDs**	**Acadia**	**Brigantine**	**Great Gulf**	**Lye Brook**	**Moosehorn**	**Presidential**
APC Paper	b	EU01	0.01	0.00	0.01	0.02	0.00	0.01
APC Paper	b	EU02	0.01	0.00	0.01	0.02	0.00	0.01
Burgess BioPower	b	EU01	0.07	0.05	0.83	0.14	0.08	0.68
Dartmouth College	b	EU01	0.08	0.02	0.09	0.25	0.04	0.10
Dartmouth College	b	EU02	0.09	0.03	0.11	0.30	0.05	0.12
Dartmouth College	b	EU03	0.09	0.03	0.11	0.29	0.05	0.12
Dartmouth College	b	EU04	0.08	0.03	0.10	0.28	0.04	0.11
E.P. Newington	b	EU01	0.15	0.04	0.12	0.14	0.08	0.15
E.P. Newington	b	EU02	0.15	0.04	0.12	0.14	0.08	0.15
Gorham Paper & Tissue LLC	c	EU01	0.02	0.01	0.20	0.03	0.02	0.15
Gorham Paper & Tissue LLC	c	EU02	0.02	0.01	0.19	0.03	0.02	0.13
Gorham Paper & Tissue LLC	c	EU09	0.00	0.00	0.02	0.00	0.00	0.01
Granite Ridge	b	EU01	0.03	0.01	0.03	0.06	0.02	0.04
Granite Ridge	b	EU02	0.04	0.01	0.03	0.07	0.03	0.04
Lost Nation	b	LNCT1	0.20	0.08	1.20	0.20	0.17	1.87
Merrimack Station	a	MK1	0.65	0.39	1.16	1.28	0.38	1.27
Merrimack Station	a	MK2	1.69	0.97	2.89	3.28	1.00	3.15
Merrimack Station	b	MKCT1	0.37	0.11	0.30	0.55	0.18	0.42
Merrimack Station	b	MKCT2	0.36	0.11	0.28	0.53	0.17	0.41
Monadnock Paper	d	EU01	0.04	0.02	0.04	0.07	0.03	0.05
Monadnock Paper	d	EU02	0.04	0.02	0.04	0.07	0.03	0.05
Newington Station	a	NT1	2.85	0.93	2.18	2.55	2.06	2.66
Pinetree Tamworth	b	Wood	0.22	0.08	0.66	0.25	0.17	1.05
Schiller Station	a	SR4	1.15	0.28	0.71	0.43	0.95	0.84
Schiller Station (NWPP)	b	SR5	0.28	0.07	0.17	0.11	0.24	0.21
Schiller Station	a	SR6	1.12	0.26	0.67	0.42	0.91	0.79
Schiller Station	b	SRCT	0.50	0.14	0.44	0.42	0.28	0.55
Wheelabrator Concord	b	EU01	0.08	0.04	0.10	0.18	0.04	0.14
Wheelabrator Concord	b	EU02	0.08	0.04	0.10	0.18	0.04	0.14
White Lake	b	WLCT1	0.38	0.10	0.97	0.42	0.28	2.20

a. 2015 95th percentile daily emissions.
b. Current permitted emissions.
c. Highest daily actual emissions from 2016, 2017, 2018.
d. Permitted potential rate with actual fuel use.

Figure 2-7 shows the percent mass-weighted sulfate and nitrate contributions from New Hampshire to Federal Class I areas. If a state was estimated to contribute two percent or more (mass-weighted sulfate and nitrate contributions) at any of the five Federal Class I areas it was considered to be a contributing state, and subject to consultation. New Hampshire's emissions result in high enough impact at Acadia and Moosehorn in Maine to qualify as a contributing state.

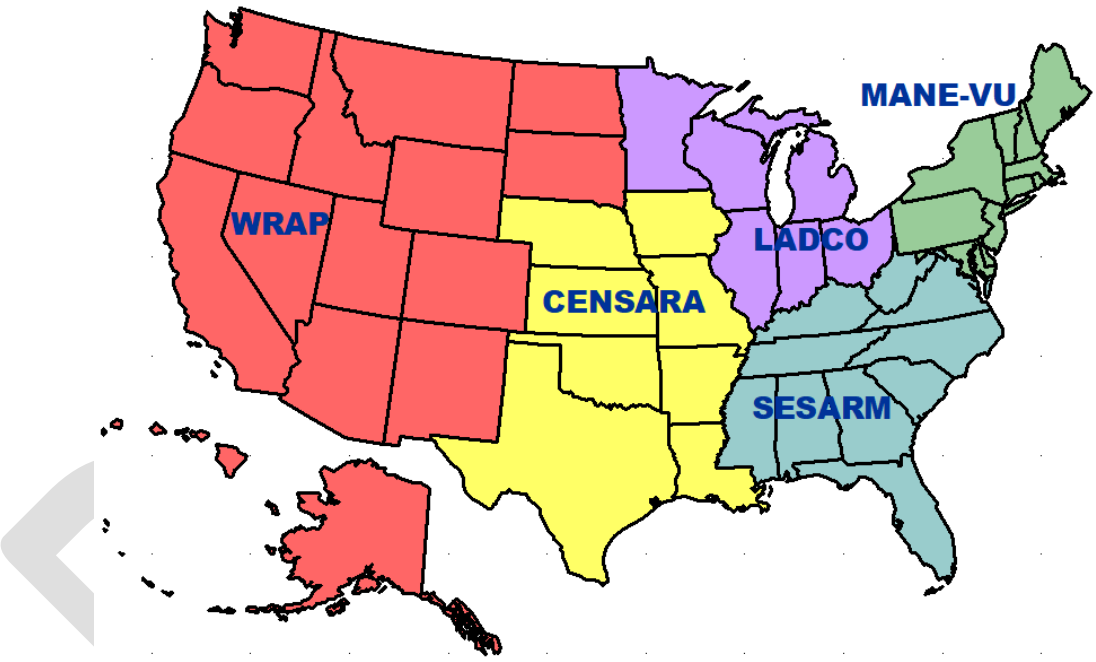
Figure 2-7: Percent Mass-Weighted Sulfate and Nitrate Contribution to Federal Class I areas from New Hampshire



3. REGIONAL PLANNING AND CONSULTATION

In accordance with 40 CFR 51.308(f)(2)(ii) New Hampshire must consult with States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Federal Class I areas. Because the pollutants that lead to regional haze can originate from sources located across broad geographic areas, EPA has encouraged the States and Tribes across the U.S. to address visibility impairment from a regional perspective. In 1999, EPA and affected states/tribes agreed to create five RPOs to facilitate interstate coordination on SIPs addressing regional haze. The RPOs, and states/tribes within each RPO, are required to consult on emission management strategies toward visibility improvement in affected Federal Class I areas. As shown in Figure 3-1, the five RPOs were originally called MANE-VU, VISTAS, MRPO, CenRAP, and WRAP. MRPO, VISTAS and CenRap operations have been absorbed into their parent organizations LADCO, SESARM and CENSARA, respectively. New Hampshire is a member of MANE-VU.

Figure 3-1: Regional Planning Organizations



These RPOs evaluate technical information to better understand how their states and tribes impact national parks and wilderness areas (Federal Class I areas) across the country, pursue the development of regional strategies to reduce emissions of particulate matter and other pollutants leading to regional haze, and help states meet the consultation requirements of the Regional Haze Rule.

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

MANE-VU's work is managed by the OTC and carried out by OTC, MARAMA, and NESCAUM. The states, tribes and federal agencies comprising MANE-VU are listed in Table 3-1. Individuals from the member states, tribes and agencies, along with professional staff from OTC, MARAMA and NESCAUM, make up the various committees and workgroups. MANE-VU also established a policy advisory group (PAG) to provide advice to decision-makers on policy questions. To fulfill the PAG function, state and tribal Air Directors meet on an as-needed basis with EPA and the FLMs.

Table 3-1: MANE-VU Members

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

*Non-voting members
~Also represents the U.S. portion of Roosevelt Campobello International Park

Since its inception on July 24, 2001, MANE-VU has employed an active committee structure to address both technical and non-technical issues related to regional haze. The primary committee is the TSC. While the work of the TSC is instrumental to policies and programs, all policy is reviewed by the MANE-VU Air Directors and decisions are ultimately made by the MANE-VU Board.

The TSC is charged with assessing the nature and magnitude of regional haze within MANE-VU, interpreting the results of technical work, and reporting on such work to the MANE-VU Board. This committee has evolved to function as a valuable resource on all technical projects and issues for MANE-VU. The TSC has established a process to ensure that important regional-haze-related projects are completed in a timely fashion, and members are kept informed of all MANE-VU tasks and duties. In addition to the formal working committees, ad hoc workgroups of the TSC may be used for purposes of evaluating emissions, monitoring and modeling.

The Communications Committee is charged with developing approaches to inform the public about regional haze and making recommendations to the MANE-VU Board to facilitate that goal. This committee oversees the production of MANE-VU's newsletter and outreach tools, for both stakeholders and the public, regarding regional issues affecting MANE-VU's members.

3.2 Regional Consultation and the "Ask"

On May 10, 2006, MANE-VU adopted the Inter-RPO State/Tribal and FLM Consultation Framework[31] whose purpose is to "...delineate, by consensus, the basic consultation requirements for states, tribes, RPOs, and Federal Land Managers required under 40 CFR Part 51, during the regional haze State Implementation Plan development process." The basic principles set forth in the framework are presented in Table 3-2. The MANE-VU states and tribes applied these principles to the regional haze consultation and SIP development process. Issues addressed included regional haze baseline assessments, natural background levels, and development of reasonable progress goals. These are described at length in later sections of this SIP.

[31] MANE-VU, Inter-RPO State/Tribal and FLM Consultation Framework, May 10, 2006: Appendix F.

Table 3-2: MANE-VU Consultation Principles for Regional Haze Planning

1.	All State, Tribal, RPO, and Federal participants are committed to continuing dialogue and information sharing in order to create understanding of the respective concerns and needs of the parties.
2.	Continuous documentation of all communications is necessary to develop a record for inclusion in the SIP submittal to EPA.
3.	States alone have the authority to undertake specific measures under their SIP. This inter-RPO framework is designed solely to facilitate needed communication, coordination and cooperation among jurisdictions but does not establish binding obligation on the part of participating agencies.
4.	There are two areas that require State-to-State and/or State-to-Tribal consultations ("formal" consultations): (i) development of the reasonable progress goal for a Class I area, and (ii) development of long-term strategies. While it is anticipated that the formal consultation will cover the technical components that make up each of these policy decision areas, there may be a need for the RPOs, in coordination with their State and Tribal members, to have informal consultations on these technical considerations.
5.	During both the formal and informal inter-RPO consultations, it is anticipated that the States and Tribes will work collectively to facilitate the consultation process through their respective RPOs, when feasible.
6.	Technical analyses will be transparent, when possible, and will reflect the most up-to-date information and best scientific methods for the decision needed within the resources available.
7.	The State with the Class I area retains the responsibility to establish reasonable progress goals. The RPOs will make reasonable efforts to facilitate the development of a consensus among the State with a Class I area and other States affecting that area. In instances where the State with the Class I area cannot agree with such other States that the goal provides for reasonable progress, actions taken to resolve the disagreement must be included in the State's regional haze implementation plan (or plan revisions) submitted to the EPA Administrator as required under 40 CFR §51.308(d)(1)(iv).
8.	All States whose emissions are reasonably anticipated to contribute to visibility impairment in a Class I area, must provide the FLM agency for that Class I area with an opportunity for consultation, in person, on their regional haze implementation plans. The States/Tribes will pursue the development of a memorandum of understanding to expedite the submission and consideration of the FLMs' comments on the reasonable progress goals and related implementation plans. As required under 40 CFR §51.308(i)(3), the plan or plan revision must include a description of how the State addressed any FLM comments.
9.	States/Tribes will consult with the affected FLMs to protect the air resources of the State/Tribe and Class I areas in accordance with the FLM coordination requirements specified in 40 CFR §51.308(i) and other consultation procedures developed by consensus.
10.	The consultation process is designed to share information, define and document issues, develop a range of options, solicit feedback on options, develop consensus advice if possible, and facilitate informed decisions by the Class I States.
11.	The collaborators, including States, Tribes and affected FLMs, will promptly respond to other RPOs/States'/Tribes' requests for comments.

Through this process, New Hampshire consulted with other states by participating in the MANE-VU intra-RPO, inter-RPO, and EPA/FLM consultations that led to the creation of coordinated strategies, or "Asks" on regional haze. These strategies were consolidated in three "Ask" statements that identify a recommended course of action for: a) states within MANE-VU; b) states outside of MANE-VU; and c) the EPA and FLM for the current regional haze planning period, 2018-2028, described in section 4.2 of this document. All MANE-VU states participated in the MANE-VU Intra-RPO consultations, as did Federal Land Managers represented by the National Park Service, the Forest Service and the Fish and Wildlife Service. A summary of the consultations is found in Appendix G.[32]

[32] MANE-VU Regional Haze Consultation Report, MANE-VU TSC, July 27, 2018: Appendix G.

3.2.1 Selections of States for MANE-VU Inter-RPO Regional Haze Consultation[33]

EPA's guidance document[34] calls for a process for determining what states, sources, or sectors reasonably contribute to visibility impairment. It begins with analyzing monitored emissions data on the 20% most impaired days to determine what pollution is leading to anthropogenic visibility impacts. This is followed by screening for sources or source sectors that lead to a majority of that impact. The results of this analysis lead to identification of which sources or sectors need a four-factor analysis performed and with which states consultation should occur.

As part of this process, MANE-VU concluded, after developing a conceptual model, that the sulfates from SO_2 emissions were still the primary driver behind visibility impairment in the region, though nitrates from NOx emission sources do play a more significant role than they had in the first planning period. Because of this, MANE-VU chose an approach for contribution assessments that focused on sulfates and included nitrates when they could be included in a technically sound fashion.

Next, MANE-VU examined annual inventories of emissions to find sectors that should be considered for further analysis.[35] EGUs emitting SO_2 and NOx and industrial point sources emitting SO_2 were found to be point source sectors with emissions levels that warranted further scrutiny. Mobile sources were also found to be an important sector in terms of NOx emissions.

After this initial work, MANE-VU initiated a screening process using two tools, Q/d and CALPUFF to determine baseline visibility impacts to identify potential sources or source categories that could be subject to four-factor analysis. MANE-VU limited this work to only these two screening analyses to determine which upwind states should be consulted because of reduced financial and staffing resources within the MANE-VU States. Results of this contribution analysis were then compared to air mass trajectories for 20% most impaired days at the MANE-VU Class I areas.

NHDES recognizes the concerns of EPA and the FLMs that CALPUFF is no longer a recommended model for longer distance visibility impacts, but at the time this work was conducted, it was still listed as recommended. This matter was discussed during consultation and the MANE-VU states agreed to use the modeling only as a screening tool to identify emissions sources for further analysis. No direct requests for emission control resulted from CALPUFF modeling in the MANE-VU Ask.

In accordance with EPA guidance, MANE-VU considered only the four statutory factors to determine whether control measures were necessary to achieve reasonable progress. Visibility benefits were not weighed against the four statutory factors to identify appropriate control measures. Rather, for each source or source category that is selected for further analysis during the screening process, MANE-VU would require whatever control measures were determined to be reasonable after considering the four statutory factors alone.

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33 Selection of States for MANE-VU Regional Haze Consultation: Appendix E.

34 See reference 7.

35 Mid-Atlantic Northeast Visibility Union, "RE: Contribution Assessment Preliminary Inventory Analysis": Appendix H.

The four factors are:

1. Costs of compliance.
2. Time necessary for compliance.
3. Energy and non-air quality environmental impacts.
4. Remaining useful life of affected sources.

MANE-VU considered emissions from EGUs and industrial, commercial and institutional boilers (ICI) units predominately, but also included statewide emissions to account for the impact of area and mobile sources. Since impairment from winter nitrates have increased percentage wise in several MANE-VU Class I areas, SO_2 and NOx emissions were both considered. Modeling initially included 2011 emissions because it corresponds to the base year of the modeling platform used to establish reasonable progress goals (RPGs). Emissions in 2015 were either directly considered or estimated so that recent changes in the make-up of more recent emissions inventory would be considered. When these factors were considered, states that contributed 2% or more of the visibility impairment and had an average mass impact of over 1% (0.01 µg/m^3) were considered necessary to consult with as part of the Regional Haze SIP process. This lead to the 14 upwind states in three upwind RPOs in Table 3-3 being considered necessary to consult with. States specifically identified for New Hampshire consultation are listed in blue type. A visual representation for contributing states for Great Gulf is given in Figure 3-2.

Table 3-3: States in each upwind RPO that are considered contributing to a MANE-VU Class I area

MRPO	**Illinois**	**Indiana**	**Michigan**	**Ohio**			
VISTAS	Alabama	Florida	**Kentucky**	**N. Carolina**	Tennessee	**Virginia**	**W. Virginia**
CENRAP	**Louisiana**	**Missouri**	**Texas**				

Figure 3-2: States Contributing to Visibility Impairment at Great Gulf Based on Mass Weighting Analysis

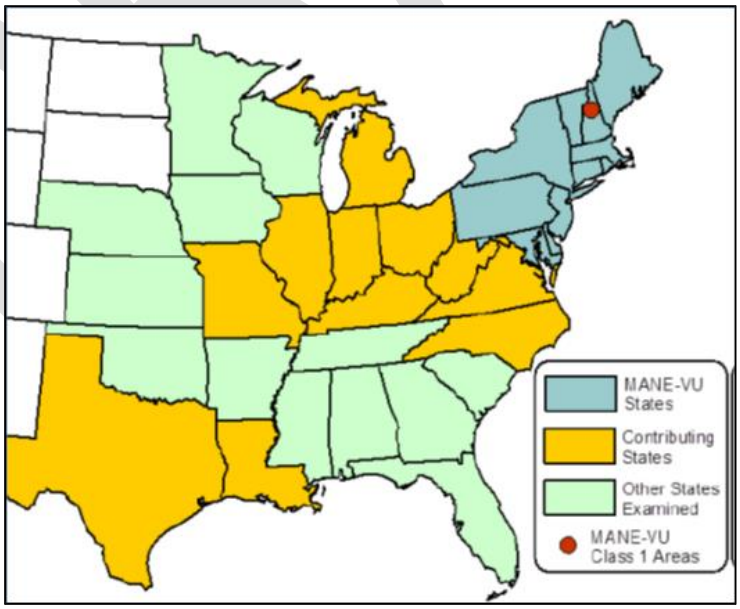
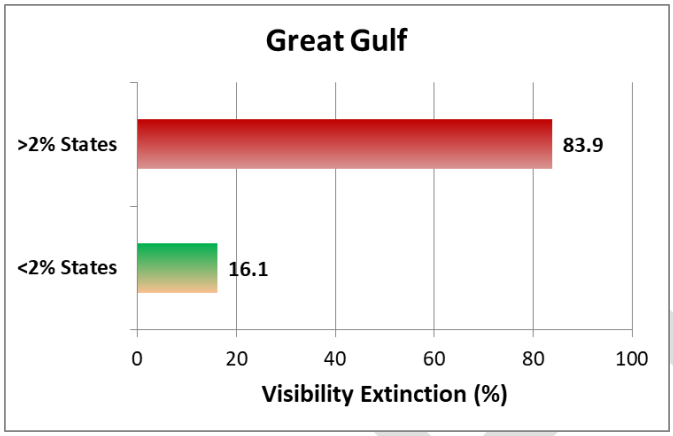


Figure 3-3 shows that these states identified for consultation with New Hampshire represent approximately 84% of the visibility extinction at Great Gulf due to sulfates and nitrates from analyzed state emissions.

Figure 3-3: Estimated Visibility Extinction at Great Gulf Due to Sulfates and Nitrates from Assessed States



Figures 3-4 and 3-5 show the most recent available emission inventories for the MANE-VU states and other states invited for consultation with New Hampshire and MANE-VU. For statewide total emissions, the most recent available year is 2014 and it is 2017 for larger point sources.

Figure 3-4: 2014 NEI Statewide NOx and SO_2 Emissions for States Selected by MANE-VU for Consultation

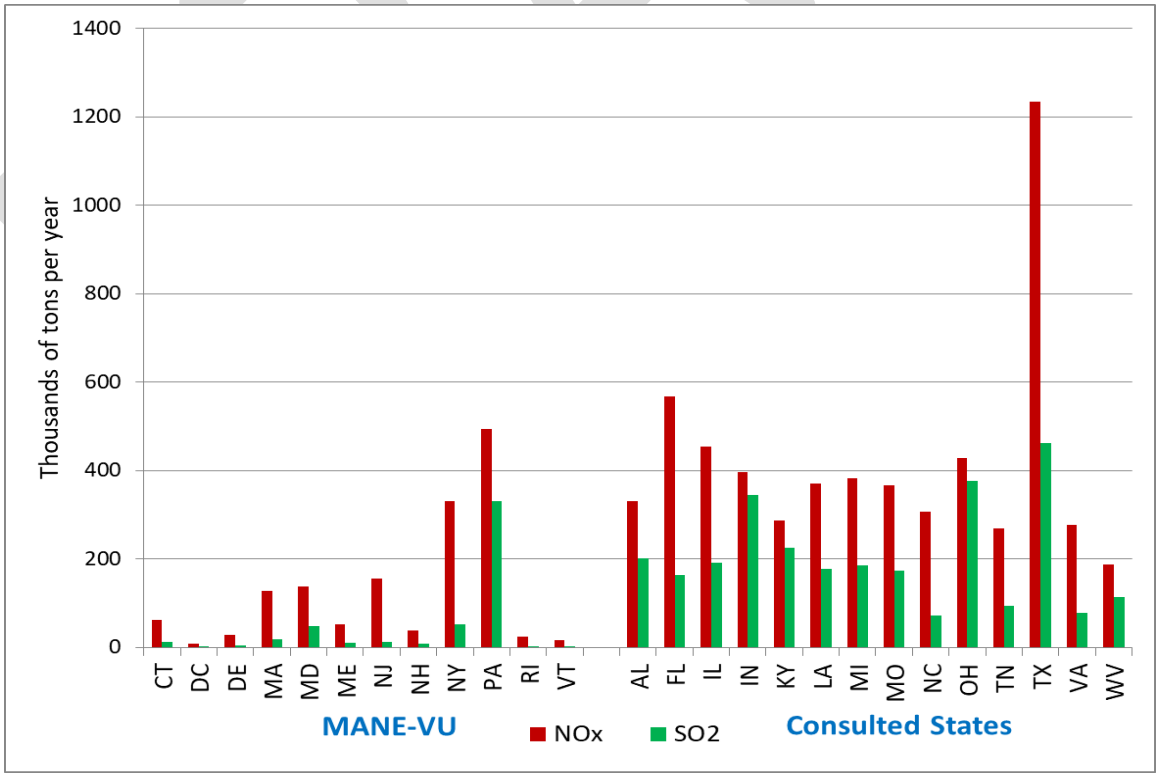
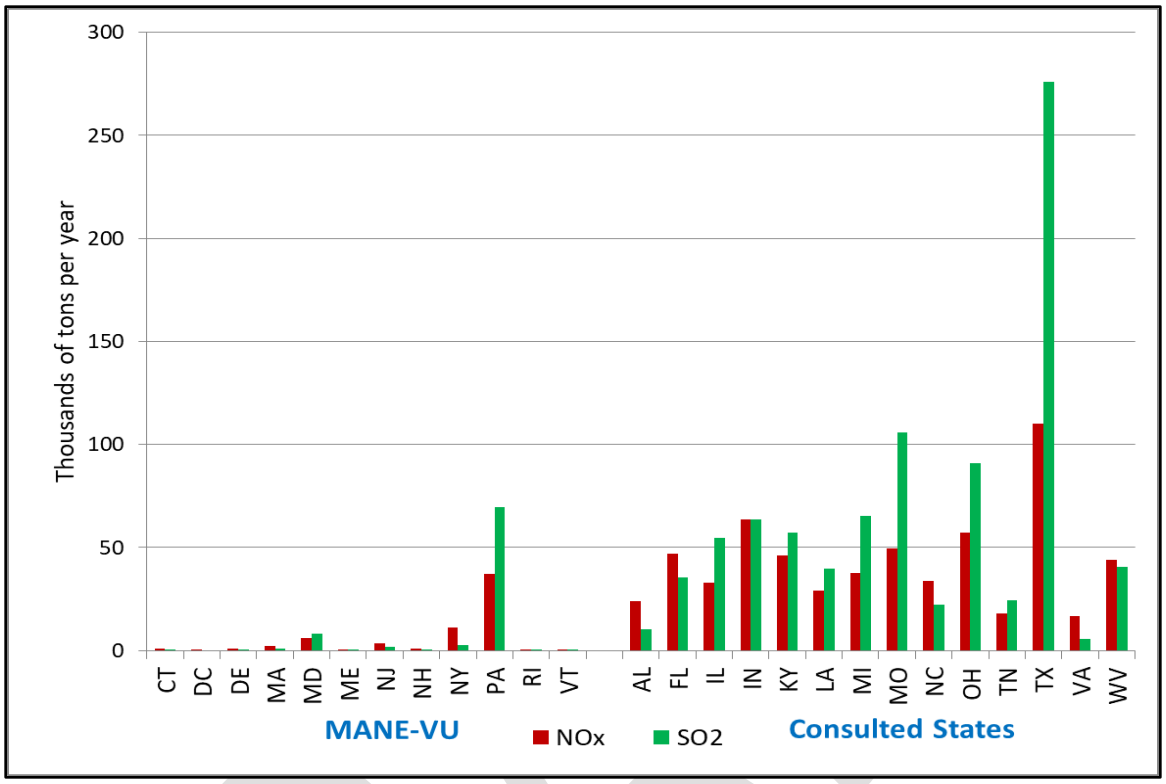


Figure 3-5: 2017 Air Markets Program Division Sources NOx and SO_2 Emissions for States Selected by MANE-VU for Consultation



3.2.2 New Hampshire Specific Consultation

40 CFR 51.308(f)(2)(ii) of the Regional Haze Rule requires the State of New Hampshire to consult with other states/tribes to develop coordinated emission management strategies. This requirement applies both when emissions from a state/tribe are reasonably anticipated to contribute to visibility impairment in Federal Class I areas outside the state/tribe and when emissions from other states/tribes are reasonably anticipated to contribute to visibility impairment at mandatory Federal Class I areas within a state/tribe.

New Hampshire consulted with other states/tribes by participating in the MANE-VU intra-RPO and inter-RPO processes leading to the creation of coordinated strategies on regional haze. This coordinated effort considered the individual and aggregated impacts of states'/tribes' emissions on Federal Class I areas within and outside the states/tribes.

To maintain consistency within MANE-VU, every MANE-VU member was requested to consult with New Hampshire. Several states outside MANE-VU were also requested to join this consultation in response to the findings of MANE-VU's evaluations. All MANE-VU states with Federal Class I areas have similarly requested consultation with New Hampshire on the regional haze issue.

Throughout the consultation process, New Hampshire was guided by the principals contained in a resolution adopted by the MANE-VU Class I states on June 7, 2007 (Table 3-2). In the resolution, the

Class I states agreed to set reasonable progress goals for 2018 that would provide visibility improvement at least as great as that which would be achieved under a uniform rate of progress to reach natural visibility conditions by 2064. The goals would be set by the Class I states at levels reflecting implementation of measures determined to be reasonable after consultation with the contributing states. At the same time, the Class I states recognized that each state should be given the flexibility to choose other measures that achieve the same or greater benefits.

The results of New Hampshire's consultation efforts will ultimately rest with the individual states and the EPA as they develop and implement their own regional haze SIPs. The other MANE-VU states have agreed to incorporate certain control measures into their SIPs, but most of these plans are still under development. For the non-MANE-VU states, New Hampshire has the expectation that the same or equivalent control measures will be included in those states plans. Further, New Hampshire depends on EPA and the FLMs to fulfill the "Ask" requested of them and to ensure the MANE-VU Asks are adequately addressed in the SIP of all contributing states.

4. PERIODIC COMPREHENSIVE REVISION (40 CFR 51.308(f))

The Regional Haze Rule at 40 CFR 51.308(f) outlines the requirements for periodic comprehensive revisions of the implementation plans for regional haze, specifying that each applicable State revise and submit its regional haze implementation plan revision to EPA by July 31, 2021, July 31, 2028 and every ten years thereafter. As explained in Section 1, New Hampshire and its regional partner MANE-VU states accelerated the timeline to an earlier submittal year to enable the use of the current 2011-based modeling platform. EPA has agreed that the 2011-based work would be acceptable for a 2019 submittal, but that a timelier data set may be required for a 2021 submittal.

4.1 Ambient Data Analysis - Calculations of Baseline, Current and Natural Visibility (40 CFR 51.308(f)(1)

40 CFR 51.308(f) of the Regional Haze rules requires states to address regional haze in each mandatory Federal Class I area located within the State. Specifically, the plan must contain:

- Baseline, natural and current visibility conditions for the most impaired and clearest days. These six conditions must be quantified in deciviews.
- Actual progress made on the most impaired and clearest days toward natural visibility conditions (1) since the baseline period and (2) in the previous implementation period. These four calculations must be quantified in deciviews.
- The difference between current and natural visibility conditions for the most impaired and clearest days. These two calculations must be quantified in deciviews.
- The URP for the most impaired days between baseline visibility conditions and natural visibility conditions. The URP must be quantified in deciviews per year.

For the first implementation period, states selected the least and most impaired days as the monitored days with the lowest and highest actual deciview levels regardless of the source of the particulate matter causing the visibility impairment. The EPA, in its Regional Haze Rule revision, stated that focusing on anthropogenic impairment is a more appropriate method for determining most impaired days because it will more effectively track whether states are making progress in controlling anthropogenic sources. This approach is also more consistent with the definition of visibility impairment in 40 CFR 51.301 and with the national goal established in the CAA. While not changing the wording, EPA made clear that going forward, ‘‘most impaired days’’ would refer to those with the greatest anthropogenic visibility impairment. The approach for the 20% of days with the best visibility to representing good visibility conditions for RPG and tracking purposes would remain the same but would instead be referred to as the 20% clearest days rather than the 20% least impaired days.

EPA’s Regional Haze Guidance[36] method to track changes in visibility for the “20% most impaired” days to the baseline (2000-2004) and current (2011-2015) visibility levels shows values for both the updated definition to calculate most impaired days and the method used to calculate 20% worst days in the first Regional Haze report, that included contributions from non-anthropogenic sources. Because the Great Gulf IMPROVE monitor did not have sufficient data collection during 2000 to be considered a complete

[36] EPA, Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program, EPA-454/R-18-010, December 2018.

year, the period of 2001 to 2005 was used to establish the Great Gulf baseline as required under EPA revised guidance. Both methods are the same for the 20% best day trends. Regional haze data from the following databases for 2000-2015 were downloaded from the FED[37] for all Federal Class I areas listed in Section 2.1:

- IMPROVE AEROSOL, RHR II (New Equation)
- IMPROVE Natural Conditions II, Baseline (01-05).

Visibility monitoring at Great Gulf Wilderness and Presidential Range - Dry River Wilderness is accomplished with instruments located at Camp Dodge. This monitoring station, which represents both New Hampshire wilderness areas, measures and records light scattering, aerosols, and relative humidity. The collected data are compiled and sorted to ascertain visibility levels on the 20% clearest and most impaired visibility days. This information is tracked over time to look for trends.

4.1.1 Baseline, Natural and Current Visibility Conditions for the Most Impaired and Clearest Days

According to EPA 2019 updated guidance, the 2001-2005 baseline visibility for the Great Gulf and Presidential Range - Dry River Wilderness Class I areas was 7.51 dv for the 20% clearest visibility days and 21.64 dv for the 20% most impaired visibility days. These are average values based on data collected at the Great Gulf (GRGU1) IMPROVE monitoring site at Camp Dodge. New Hampshire accepts designation of this monitoring site as representative of the Great Gulf and Presidential Range - Dry River Wilderness Areas in accordance with 40 CFR 51.308(d)(2)(i). (The Presidential Range – Dry River Wilderness Area is close enough to the monitoring site to be representative of both.)

Table 4-1 lists the baseline visibility for the 20% clearest and 20% most impaired visibility days for each year of the period 2000-2005, from which the valid five-year average values in Table 1-1 were calculated in accordance with 40 CFR 51.308(d)(2). The deciview visibility values for best days were calculated as detailed in the NESCAUM Baseline and Natural Background document.[38] Most impaired days were calculated using the updated method from the EPA guidance. Twenty percent best and worst visibility days (i.e., including non-anthropogenic contributions) are included in the table for comparison.

Natural background refers to the visibility conditions that existed before human activities affected air quality in the region. Consistent with the stated visibility goals of the Clean Air Act, natural background is identified as the visibility target to be reached by 2064 in each Federal Class I area.

[37] http://views.cira.colostate.edu/fed/

[38] NESCAUM, "Baseline and Natural Visibility Conditions," December 2006: Appendix I.

Table 4-1: Baseline Visibility for the 20 Percent Clearest and 20 Percent Worst Days for the baseline period in New Hampshire Class I Areas

Class I Area(s)	Year	Baseline Visibility (dv)				Note
		20% Best	20% Worst	20% Clearest	20% Most Impaired	
Great Gulf Wilderness and Presidential Range - Dry River Wilderness	2000	*	*	*	*	[39]
	2001	8.26	23.29	8.26	22.47	
	2002	7.77	24.84	7.77	23.43	
	2003	6.94	21.69	6.94	20.65	
	2004	7.68	21.56	7.68	21.16	
	2005	6.90	21.53	6.90	20.51	
	5-yr Average	**7.51**	**22.56**	**7.51**	**21.64**	

Data Source: (Appendix B)

The Great Gulf and Presidential Range - Dry River Wilderness Class I areas have an estimated natural background visibility of 3.73 dv on the 20% clearest days and 9.78 dv on the 20 percent most impaired days. These values were calculated using the EPA guideline[40] and approved alternative method described in NESCAUM's Baseline and Natural Background document.[41]

According to 40 CFR 51.308(f)(iii), the period for calculating the current visibility conditions is the most recent 5-year period for which data are available. The current visibility condition for the most impaired or the clearest days is the average of the respective annual values. This is shown in Table 4-2. Table 4-3 shows the comparison between natural, baseline and current visibility.

Table 4-2: Current Visibility for the 20 Percent Clearest and 20 Percent Most Impaired Days during 2013-2017 in New Hampshire Class I Areas

Federal Class I Area(s)	Year	Current Visibility (dv)	
		20% Clearest	20% Most impaired
Great Gulf Wilderness and Presidential Range - Dry River Wilderness	2013	5.41	13.87
	2014	5.75	15.19
	2015	4.92	14.44
	2016	4.69	11.23
	2017	5.22	11.81
	5-yr Average	**5.20**	**13.31**

Data Source: (Appendix B)

[39] Insufficient number of data points for this year. 5-year average based on nearest complete 5-year period (2001-2005)

[40] Ibid.

[41] NESCAUM, "Baseline and Natural Visibility Conditions," December 2006: Appendix I.

Table 4-3: Comparison of Natural, Baseline, and Current Visibility for the 20 Percent Clearest and 20 Percent Most Impaired Days in New Hampshire Class I Areas

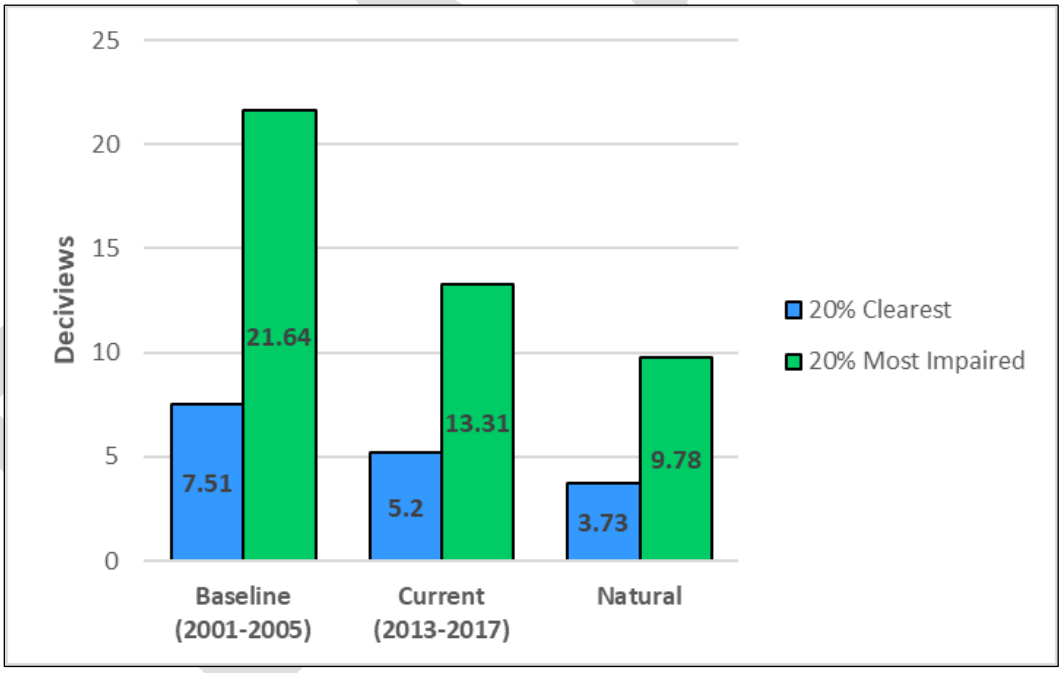
Period	Visibility (dv)	
	20% Clearest	20% Most impaired
Baseline (2001-2005)	7.51	21.64
Current (2013-2017)	5.20	13.31
Natural	3.73	9.78

Data Source: (Appendix B)

4.1.2 Progress to Date for the Most Impaired and Clearest Days

Actual progress made towards the natural visibility condition since the baseline period, and actual progress made during the previous implementation period for both the most impaired and the clearest days represents progress to date. IMPROVE data for 2017 represents the most recent available and thus the period of 2013 to 2017 is the most recent 5-year period available. Current conditions reflect an 8.33 dv improvement from Baseline on the 20% most impaired days and 2.31 dv on the 20% clearest days. This is illustrated in Figure 4-1.

Figure 4-1: Baseline, Current, and Natural Visibility Conditions for the Great Gulf Wilderness/Presidential Range-Dry River Wilderness Areas (dv)



4.1.3 Differences between Current Visibility Condition and Natural Visibility Condition

As of the most recent 5-year period (2013-2017), the current visibility condition in the Great Gulf Wilderness/Presidential Range-Dry River Wilderness exceeds natural visibility condition by 1.47 dv on the 20% clearest days and by 3.53 dv on the 20% most impaired days (Table 4-4).

Table 4-4: Current Visibility (2013-2017) vs. Natural Visibility Conditions (dv)

Federal Class I Area(s)	Year	Current Visibility		Natural Visibility	
		20% Clearest	20% Most Impaired	20% Clearest	20% Most Impaired
Great Gulf Wilderness and Presidential Range - Dry River Wilderness	2013	5.41	13.87	3.73	9.78
	2014	5.75	15.19		
	2015	4.92	14.44		
	2016	4.69	11.23		
	2017	5.22	11.81		
				Difference	
	Average	5.20	13.31	1.47	3.53

Data Source: (Appendix B)

4.1.4 Uniform Rate of Progress

The uniform rate of progress measure defines, in deciviews per year, the rate of visibility improvement that would have to be maintained in order to attain natural visibility conditions by the end of 2064. This measure is called the URP line or glide path between baseline conditions and 2064. In its 2011 Regional Haze Plan for the first planning period to 2018,[42] NHDES calculations showed that rate to be 0.180 dv per year (Table 4-5), and stated that the reasonable progress goals established for the Great Gulf/ Presidential Range-Dry River Wilderness Areas were expected to provide visibility improvements in excess of that rate.[43]

Table 4-5: Uniform Rate of Progress from 2011 SIP (dv)

Federal Class I Area	2000-2004 Baseline Visibility (20% Worst Days)	Natural Visibility (20% Worst Days)	Total Improvement Needed by 2028	Total Improvement Needed by 2064	Uniform Annual Rate of Improvement
Great Gulf Wilderness and Presidential Range - Dry River Wilderness	22.8	12.0	2.5	10.8	0.180

For the second implementation period (2018-2028), the EPA updated its guidance to require five complete years of data to establish the baseline. Since Great Gulf lacked complete data for 2000, a new baseline needed to be established for the period is 2001-2005. After making these changes, the new baseline for 20% most impaired days is 21.64 dv and for 20% clearest days it is 7.51 dv (Table 4-6). The new rate of reasonable progress for the 20% most impaired days is 0.198 dv per year. ***In the last two columns of the table, modeling for 2028 with, and without the MANE-VU Ask measures, is much lower than the 2018 URP.***

[42] New Hampshire Regional Haze SIP Revision, January 14, 2011: https://www.govinfo.gov/content/pkg/FR-2012-08-22/pdf/2012-20271.pdf .

[43] "Baseline and Natural Visibility Conditions, Considerations and Proposed Approach to the Calculation of Baseline and Natural Visibility Conditions at MANE-VU Class I Areas," NESCAUM, December 2006.

Table 4-6: Baseline, Current and Reasonable Progress Goal Haze Index Levels for New Hampshire's Federal Class I Areas

Federal Class I Area	IMPROVE SITE DATA CODE(S)	State	CLEAREST DAYS			MOST IMPAIRED DAYS				
			Baseline (2001-05) (dv)	Current (2013-17) (dv)	RPG (2028) (dv)	Baseline (2001-05) (dv)	Current (2013-17) (dv)	Rate URP[a] 2064 (dv/yr)	URP[b] 2028 (dv)	RPG (2028) (dv)
Great Gulf Wilderness Area	GRGU	NH	7.51	5.20	5.06[c] 5.11[d]	21.64	13.31	0.198	16.90	12.00[c] 12.13[d]
Presidential Range/Dry River Wilderness Area										

[a] *Uniform Rate of Progress, dv improvement per year required to meet 20% most impaired Natural Conditions.*

[b] *URP level if URP is maintained*

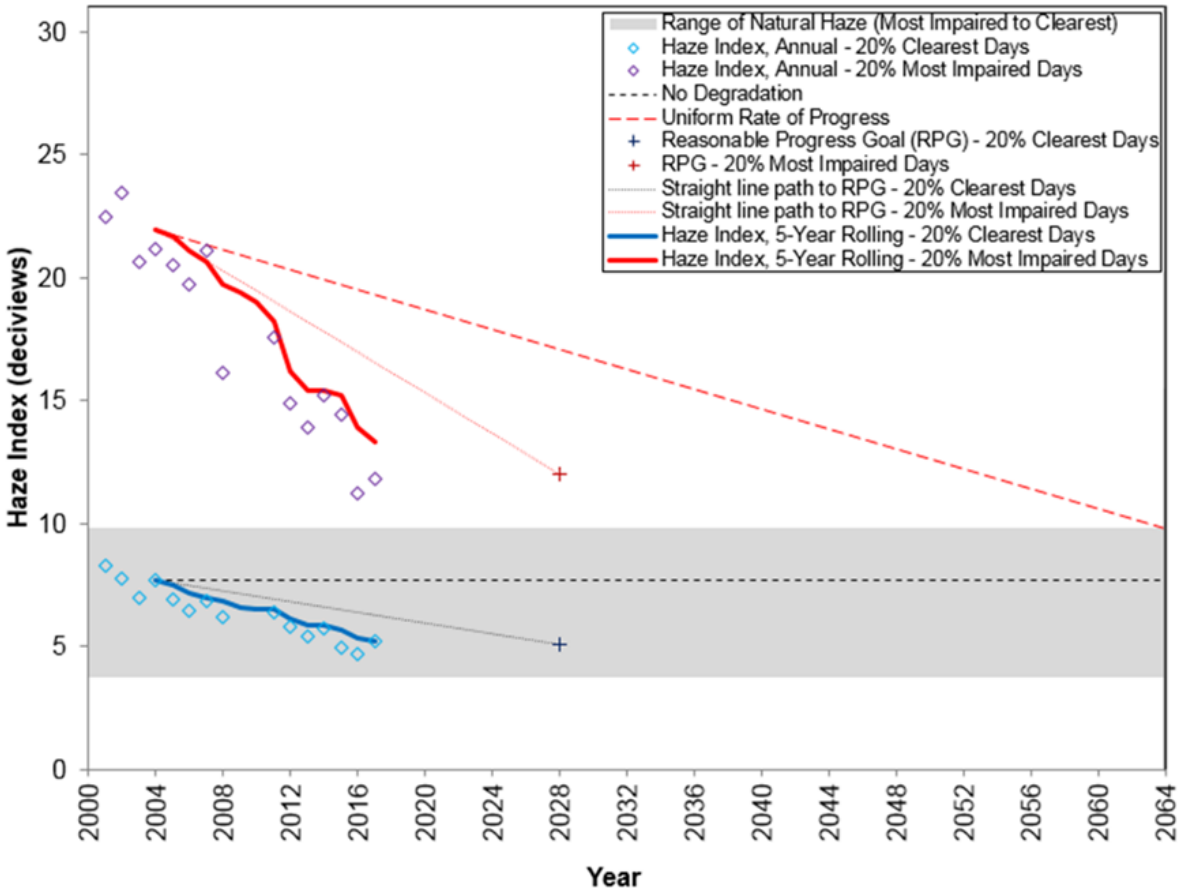
[c] *Modeled with MANE-VU Ask measures*

[d] *Modeled without MANE-VU Ask measures*

Data Source: Appendix B and Appendix V

As shown in in Table 4-6 and in Figure 4-2, the Great Gulf/Presidential-Dry River Wilderness Area is well below the 2018 URP level for the first SIP planning period, and is currently below the 2028 URP level for the second SIP planning period.

Figure 4-2: Visibility Metrics Levels at Great Gulf Wilderness[44]



[44] Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017: Appendix B.

4.2 Long-Term Strategy for Regional Haze (40 CFR 51.308(f)(2))

According to 40 CFR 51.308(f)(2)(i), states must submit a Long-Term Strategy (LTS) that addresses regional haze visibility impairment for each mandatory Federal Class I area within the State and for each Federal Class I area located outside the State that may be affected by emissions from the State. In developing its LTS, states must determine the emission reduction measures that are necessary to make reasonable progress in visibility improvement. This assessment must consider four factors: the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected sources (40 CFR 51.308(f)(2)(i)). This process is described below.

Class I states must have information that will be considered by contributing states so that during the interstate consultation process they can make reasonable asks for controls to be implemented. To achieve these two ends the MANE-VU Four-Factor/Contribution Assessment Workgroup, a subset of the Technical Support Committee, worked to collect the information and summarized it in a memo.[45]

As described in the above referenced memo, these six sectors that had emissions that were reasonably anticipated to contribute to visibility degradation in the MANE-VU region during the first regional haze planning cycle: EGUs, ICI Boilers, Cement Kilns, Heating Oil, Residential Wood Combustion, and Outdoor Wood Boilers.[46]

For the second implementation period, the MANE-VU Technical Support Committee began with analyzing monitored emissions data on the 20% most impaired days to determine what pollution is leading to anthropogenic visibility impacts. This was followed by screening for sources or source sectors that are leading to a majority of that impact. It was determined that the results of this analysis would lead to what source or sectors need a four-factor analysis and which states should be consulted with.

MANE-VU developed a conceptual model that illustrates that sulfates from sulfur dioxide (SO_2) emissions remain the primary driver behind visibility impairment in the region, while nitrates from NOx emissions play a more significant role than they had in the first planning period. MANE-VU chose to assess the contribution to visibility impairment by focusing on sulfates and including nitrates when feasible in a technically sound fashion.

Next, MANE-VU examined annual inventories of emissions to find sectors that should be considered for further analysis.[47] EGUs emitting SO_2 and NOx and industrial point sources emitting SO_2 were found to be point source sectors of high emissions that warranted further scrutiny. Mobile sources were also found to be an important sector in terms of NOx emissions.

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45 Memo from MANE-VU Technical Support Committee to MANE-VU Air Directors, "Re: Four-Factor Data Collection," March 30, 2017: Appendix K.

46 Assessment of Reasonable Progress for Regional Haze in the MANE-VU Class I Areas. http://www.marama.org/visibility/RPG/FinalReport/RPGFinalReport_070907.pdf

47 Mid-Atlantic Northeast Visibility Union, "RE: Contribution Assessment Preliminary Inventory Analysis": Appendix H.

After this initial work, MANE-VU initiated a process of screening states and sectors for contribution using two tools, Q/d and CALPUFF. Results of this contribution analysis were then compared to air mass trajectories for 20% most impaired days at the MANE-VU Class I Areas. The process is described in detail in Appendix E.

4.2.1 Sectors that Reasonably Contribute to Visibility Impairment[48]

A state's LTS must include enforceable emission reduction measures necessary to make reasonable progress. The first long-term strategy covered the 10-15-year period ending in 2018, and subsequent revisions are to be issued every 10 years thereafter. A state's LTS should address all types of manmade emissions contributing to visibility degradation in Federal Class I areas, including those from mobile sources; stationary sources (such as power plants and factories); smaller, so-called "area" sources (such as residential wood stoves and small boilers); and prescribed fires, then determine what reduction measures are needed to make reasonable progress.

EGUs

Following an initial round of CALPUFF modeling using CAMD 2011 reported emissions, information was collated on the 444 EGUs that were determined to warrant further scrutiny based on their 2011 and 2015 emissions of SO_2 and NO_X. Selection criteria are described in Appendix C.[49] Several sources of data were available to rely on for information on the capacity and installed controls on individual units. This included information from NEEDS v5.15[50], ERTAC EGU v2.5L2[51], data collection on NO_X controls conducted by Maryland Department of Environment, and MANE-VU's "167 Stack Retrospective."[52] The individual facility information is in the spreadsheet titled "EGU Data for Four-factor Analyses (Only CALPUFF Units)."[53] A synopsis of the collected information included in the 167 stack analysis is provided in Figure 4-3. A map that shows the locations of the EGUs assessed in the current MANE-VU CALPUFF modeling effort is located in Figure 4-4.

48 Sector level information needed to assess the four factors the following six sectors for EGUs were updated through a contract with SRA and were posted to MARAMA's website for download. Ed Sabo, *2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas*, January 31,2016: Appendix L.

49 "2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources", April 4, 2017: Appendix C.

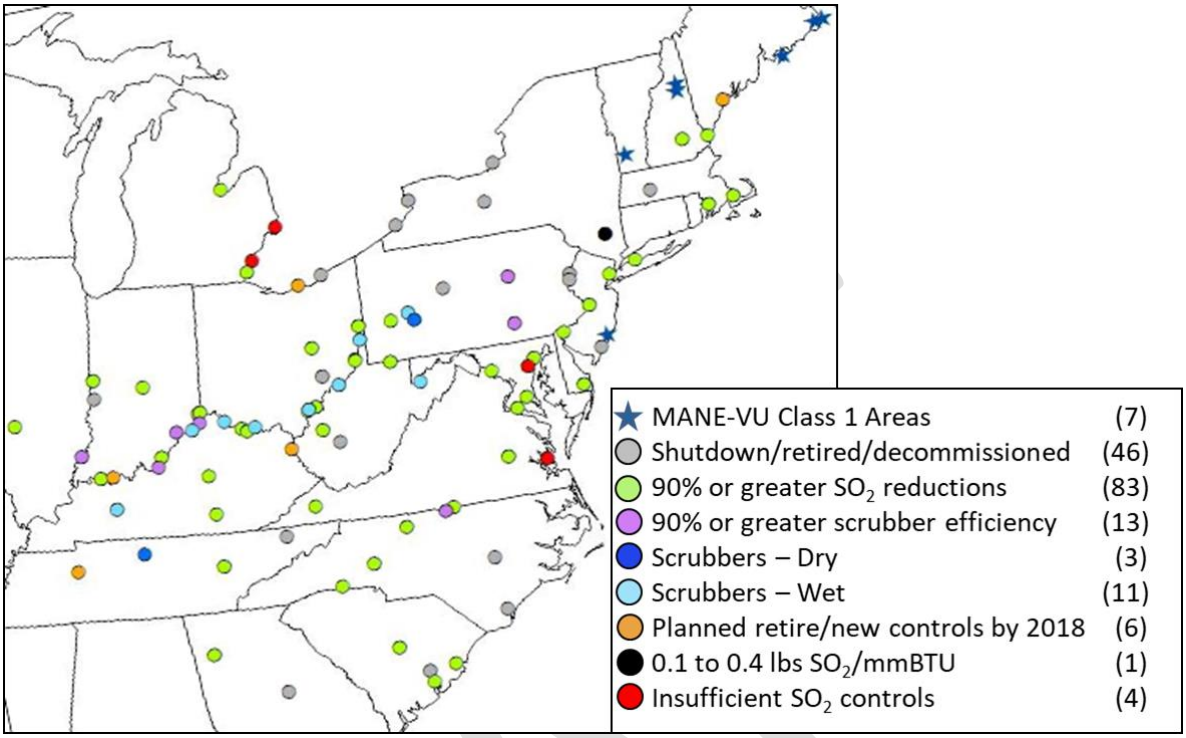
50 EPA, "NEEDS v.5.15 User Guide," August 2015.

51 Documentation of ERTAC EGU CONUS Versions 2.5 and 2.5L2: MARAMA. http://www.marama.org/2013-ertac-egu-forecasting-tool-documentation

52 MANE-VU Technical Support Committee, *Status of the Top 167 Electric Generating Units (EGUs) That Contributed to Visibility Impairment at MANE-VU Class I Areas during the 2008 Regional Haze Planning Period*, July 25, 2016: Appendix M.

53 EGU Data for Four-Factor Analyses (Only CALPUFF Units): https://otcair.org/MANEVU/Upload/Publication/Reports/MANE-VU%20CALPUFF%20Modeling%20Report%20Draft%2004-4-2017.pdf

Figure 4-3: Status of Controls at Top 167 EGUs



ICI Boilers

Information was also collected for ICI facilities with emissions comparable to EGU units modeled for contributing states. Additional units were added based on close proximity to a MANE-VU Federal Class I area, which comprised a top 50 list. Later in the data collection process the number of sources was limited to only sources that cumulatively contributed to roughly 50% of the impairment. The facilities are listed in Table 4-7 with information on 2011 SO_2 emissions and number of Class I sites affected. For New Hampshire, this included Dartmouth College and Gorham Paper & Tissue, LLC. These facilities were then modeled for Class I visibility impacts with CALPUFF based on 2011 estimated typical daily emissions. See Figure 4-4 for location of the facilities.

Cement Kilns

Control factors are in MARAMA's installation of the EMF system but are those that came installed with the system and represent control costs found in EPA's CoST Manual.[54] Concerning data for individual point sources, cement kilns were included in the work to use Q/d to determine the industrial sources with the most impact on Federal Class I areas. As a result, data was collected on individual cement kilns and the cement kilns in the list of the 82 industrial sources and modeled with CALPUFF. Cement kilns were also modeled with estimated 2011 typical daily emissions.

[54] EPA, *Control Strategy Tool (CoST) Development Documentation*, June 9, 2010.

Figure 4-4: EGUs and Industrial Sources for which Data Collection Occurred

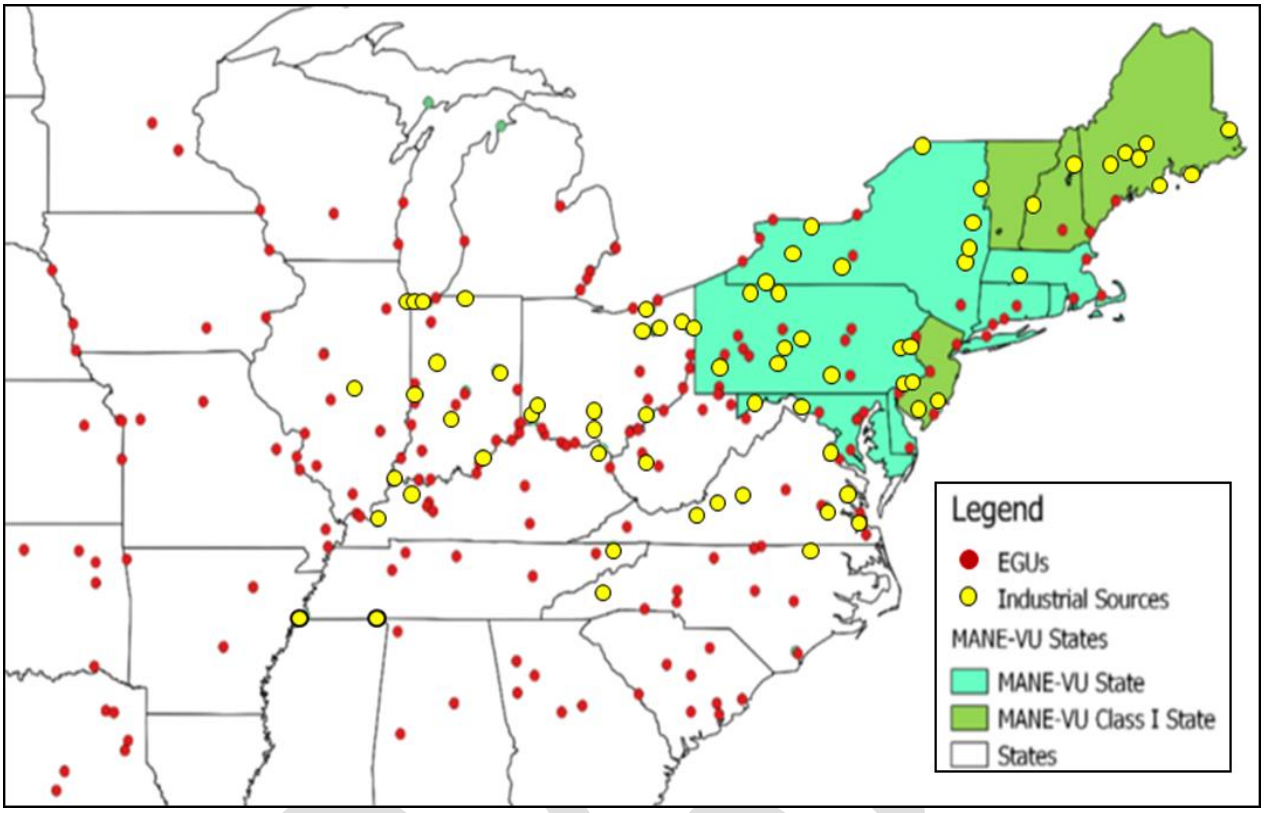


Table 4-7: 82 Industrial Sources Evaluated for Impact at MANE-VU Class I Areas

State	Facility ID	Facility Name	2011 SO_2 (tons)	#Sites Top 50 (a)	#Sites >= 50% (b)
IL	**7793311**	Tate & Lyle Ingredients Americas, LLC	102.90	5	3
IL	**8065311**	Aventine Renewable Energy Inc.	21.51	5	5
IN	**3986511**	Indiana Harbor East	1,332.52	5	0
IN	**4553211**	Indiana University	2,467.99	1	0
IN	**4873211**	Ball State University	1,045.58	4	0
IN	**4885311**	Citizens Thermal	124.94	5	4
IN	**5552011**	University of Notre Dame Du Lac	4,291.94	2	0
IN	**7364611**	Sabic Innovative Plastics Mt. Vernon, LLC	9,570.03	5	4
IN	**7376411**	Tate & Lyle, Lafayette South	908.83	4	0
IN	**7376511**	ArcelorMittal Burns Harbor Inc.	309.55	5	5
IN	**8181811**	Alcoa Inc., Warrick Operations	1,495.20	5	2
IN	**8192011**	US Steel, Gary Works	1,063.30	5	3
IN	**8198511**	ESSROC Cement Corp	1,516.32	1	0
IN	**8223611**	Eli Lilly & Co., Clinton Labs	4,434.03	2	0
KY	**6096411**	E I DuPont, Inc.	2,045.96	1	0
KY	**7352311**	Century Aluminum Sebree, LLC	1,917.99	5	2
KY	**7365311**	Isp Chemicals Inc.	2,207.50	1	0
MA	**7236411**	Solutia, Inc.	19,696.90	2	0
MD	**6117011**	Naval Support Facility, Indian Head	1,728.88	1	0
MD	**7763811**	Luke Paper Company	2,133.08	5	5

State	Facility ID	Facility Name	2011 SO_2 (tons)	#Sites Top 50 (a)	#Sites >= 50% (b)
MD	**8239711**	Sparrows Point, LLC	2,033.07	1	1
ME	**5253911**	Madison Paper	1,444.64	2	0
ME	**5691611**	Huhtamaki Inc., Waterville	1,420.05	1	0
ME	**5692011**	FMC Biopolymer	992.04	2	0
ME	**5974211**	Woodland Pulp, LLC	680.87	2	0
ME	**7764711**	Verso Paper, Androscoggin Mill	1,018.69	2	0
ME	**7945211**	The Jackson Laboratory	1,754.70	1	0
ME	**8200111**	Sappi, Somerset	983.53	2	0
MI	**8126511**	Escanaba Paper Company	297.11	2	0
MI	**8160611**	St. Mary's Cement, Inc. (U.S.)	1,279.00	2	0
MI	**8483611**	US Steel, Great Lake Works	1,046.43	5	5
NC	**7920511**	Blue Ridge Paper Products, Canton Mill	2,043.68	5	5
NC	**8048011**	KapStone Kraft Paper Corporation	1,467.51	1	0
NC	**8122511**	DAK Americas, LLC	2,181.00	1	0
NH	**7199811**	Dartmouth College	308.9	1	0
NH	**7866711**	Gorham Paper & Tissue, LLC	127.02	1	0
NJ	**12804611**	Gerresheimer Moulded Glass	3,007.04	1	0
NJ	**8093211**	Atlantic County Utilities Authority Landfill	907.88	1	0
NY	**7814711**	Morton Salt Division	1,143.29	4	1
NY	**7968211**	Alcoa, Massena Operations (West Plant)	805.13	4	2
NY	**7991711**	International Paper Ticonderoga Mill	1,917.74	4	3
NY	**8090911**	Norlite Corporation	2,887.99	1	0
NY	**8091511**	Kodak Park Division	681.06	5	5
NY	**8105211**	Lafarge Building Materials, Inc.	2,102.47	5	5
NY	**8176611**	Cargill Salt Co – Watkins Glen Plant	1,280.09	3	0
NY	**8325211**	Finch Paper LLC	2,265.36	1	1
OH	**15485811**	Fluor-B&W Portsmouth LLC	102.90	1	0
OH	**7219511**	Youngstown Thermal	21.51	1	0
OH	**7416411**	Cargill, Incorporated - Salt Division (Akron)	1,516.32	4	0
OH	**7997111**	Morton Salt, Inc.	4,434.03	5	5
OH	**8008811**	AK Steel Corporation	2,045.96	4	0
OH	**8063611**	BDM Warren Steel Operations, LLC	1,917.99	5	0
OH	**8130511**	Kraton Polymers U.S. LLC	2,207.50	5	1
OH	**8131111**	P. H. Glatfelter Company - Chillicothe Facility	19,696.90	5	5
OH	**8170411**	City of Akron Steam Generating	1,728.88	5	0
OH	**8252111**	The Medical Center Company	2,133.08	5	2
OH	**9301711**	DTE St. Bernard, LLC	2,033.07	3	0
PA	**3186811**	Penn State University	1,444.64	5	0
PA	**3881611**	Hercules Cement CO LP/Stockertown	1,420.05	5	1
PA	**4966711**	United Refining CO/Warren PLT	992.04	2	0
PA	**6463511**	PPG Ind/Works No 6	680.87	1	0
PA	**6532511**	Amer Ref Group/Bradford	1,018.69	3	0
PA	**6582111**	Intl Waxes Inc./Farmers Valley	1,754.70	5	3
PA	**6582211**	Keystone Portland Cement/East Allen	983.53	3	0
PA	**6652211**	Phila Energy Sol Ref/PES	297.11	1	0
PA	**7409311**	USS Corp/Edgar Thompson Works	1,279.00	4	0
PA	**7872711**	MILL Appleton Papers/Spring Mill	1,046.43	2	0
PA	**7873611**	Sunoco Inc. (R&M)/Marcus Hook Refinery	2,043.68	5	2

State	Facility ID	Facility Name	2011 SO_2 (tons)	#Sites Top 50 (a)	#Sites >= 50% (b)
PA	**8204511**	USS/Clairton Works	1,467.51	4	0
PA	**9248211**	Team Ten/Tyrone Paper Mill	2,181.00	5	1
TN	**3982311**	Eastman Chemical Company	22,024.21	5	5
TN	**4963011**	Packaging Corporation of America	2,400.59	1	0
TN	**5723011**	Cargill Corn Milling	3,007.04	2	0
VA	**4182011**	Smurfit Stone Container Corporation - West Point	907.88	1	0
VA	**4183311**	GP Big Island LLC	1,143.29	1	0
VA	**4938811**	Huntington Ingalls Incorporated -NN Shipbldg Div	805.13	1	0
VA	**5039811**	Roanoke Cement Company	1,917.74	4	1
VA	**5748611**	Radford Army Ammunition Plant	2,887.99	5	1
VA	**5795511**	Philip Morris USA Inc. - Park 500	681.06	1	0
WV	**4878911**	Dupont Washington Works	2,102.47	5	1
WV	**4987611**	Capitol Cement – ESSROC Martinsburg	1,280.09	3	1
WV	**5782411**	Bayer Cropscience	2,265.36	5	1

(a) number of monitored MANE-VU Class I areas for which the facility is in the top 50 contributors
(b) number of monitored MANE-VU Class I areas for which the facility made up 50% of the contribution

Heating Oil, Residential Wood Stoves and Outdoor Wood-fired Boilers

Sector level information needed to assess the four factors for heating oil, residential wood stoves and outdoor wood-fired boilers was updated. As part of the contract information on the cost of controls was updated in MARAMA's EMF system to allow for states to have access to more recent information if they opt to use EMF, and the full list of updated control factors are included as an Appendix to "2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas."[55] Since heating oil, RWS and OWB are area sources, no specific point source data were collected.

4.2.2 Interstate Consultation

New Hampshire consulted with other states as identified in section 3.2.1 in accordance with 40 CFR 51.308(f)(ii) which says the *"State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress."* The consultation process undertaken for the second implementation period is described in detail in Appendix G.

According to the federal Regional Haze rule (40 CFR 51.308 (f)(2)(i) through (iv)), all states must consider, in their Regional Haze SIPs, the emission reduction measures identified by Class I States as being necessary to make reasonable progress in any Class I area. After reviewing the four-factor analysis, MANE-VU Class I member states determined its reasonable measures to begin consultation with all MANE-VU states (Intra-RPO consultation) and then subsequently, other contributing states (Inter-RPO consultation). These measures identified as reasonable by the MANE-VU Class I states reasonable measures were formed into the MANE-VU "Asks" to be discussed during consultation. The "Ask" was divided into three parts, the "Intra-RPO Ask" for Intra-MANE-VU consultation, the Inter-RPO Ask for consultation with non-MANE-VU contributing states, and the Ask specific to FLMs and EPA. These Asks

[55] 2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas: Appendix L.

were adopted by MANE-VU Class I States on August 25, 2017, and are included in Appendices N, O and P.

The MANE-VU Ask focuses on what MANE-VU Class I states identified as reasonable measures to apply over the Northeast region and contributing states. The states focused on SO_2 and NOx emissions (which also form particles) as being the most reasonable measures at this time to apply while Federal Class I areas are already ahead of their uniform rate of progress requirements. Additional measures on other emissions sources and visibility impairing particulate matter emission sources can be assessed individually by states, EPA and the FLMs.

New Hampshire has included in this implementation plan all measures agreed to during state-to-state consultations, and has considered emission reduction measures identified by other states. No disagreements relative to the nature of the request or the ability to complete it were encountered during the consultation process.

4.2.3 The MANE-VU Intra-RPO "Ask"

The "Intra-RPO Ask" is intended for the states and tribes that contribute to MANE-VU's Class I Areas and should be addressed in their regional haze SIP updates. Portions of the Intra-RPO Ask are shown below:

"To address the impact on mandatory Federal Class I areas within the MANE-VU region, the member states developed a coordinated course of action designed to assure reasonable progress toward preventing any future, and remedying any existing, impairment of visibility in mandatory Federal Class I areas and to leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment.[56] The Regional Haze rule provides that establishing an RPG for a Federal Class I area that is on or below the URP glide-path for that area does not remove the four-factor analysis requirement."

"In addressing the emission reduction measures in the Ask, states will need to harmonize any activity on the strategies in the Ask with other federal or state requirements that affect the sources and pollutants covered by the Ask. These federal and state requirements include, but are not limited to:

- The 2010 SO_2 standard,
- RGGI, if applicable,
- MATS, and
- The 2015 ozone standard.

Because of the need for cross-program harmonization and because of the formal public process required by the federal CAA and state rulemaking processes, it is expected that there will be opportunities for stakeholders and the public to comment on how states intend to address the measures in the Ask."

"Therefore, the course of action for pursuing the adoption and implementation of measures necessary to meet the 2028 reasonable progress goal for regional haze include the following 'emission Management' strategies:

1. *Electric Generating Units (EGUs) with a nameplate capacity larger than or equal to 25MW with already installed NOx and/or SO_2 controls - ensure the most effective use of control technologies on a year-round basis to consistently minimize emissions of haze precursors[57], or obtain equivalent alternative emission*

[56] Statements of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028) (MANE-VU Asks): Appendices N, O, and P.

[57] Impact of Wintertime SCR/SNCR Optimization on Visibility Impairing Nitrate Precursor, MANE-VU TSC, November 20, 2017: Appendix Q.

reductions;

2. *Emission sources modeled by MANE-VU that have the potential for 3.0 Mm^{-1} or greater visibility impacts at any MANE-VU Class I area, as identified by MANE-VU contribution analyses … - perform a four-factor analysis for reasonable installation or upgrade to emission controls [see table below];"*

Table 4-8: 22 EGU and Industrial Units Located in the MANE-VU Region with MANE-VU Screening Modeling Exceeding 3.0 Mm^{-1} at a MANE-VU Class I Area

State	Facility Name	Facility/ ORIS ID	Unit IDs	MANE-VU Class 1 Max Extinction (dv)
MA	Brayton Point	1619	4	4.3
MA	Canal Station	1599	1	3.0
MD	Herbert A Wagner	1554	3	3.8
MD	Luke Paper Company	7763811	001-0011-3-0018	6.0
MD	Luke Paper Company	7763811	001-0011-3-0019	5.9
ME	The Jackson Laboratory	7945211	18	9.0
ME	William F Wyman	1507	4	5.6
ME	Woodland Pulp LLC	5974211	0	7.5
NH	Merrimack	2364	2	3.3
NJ	B L England	2378	2,3	5.6
NY	Lafarge Building Materials Inc.	8105211	43101	8.1
NY	Finch Paper LLC	8325211	12	7.6
PA	Homer City	3122	1	9.3
PA	Homer City	3122	2	8.1
PA	Homer City	3122	3	3.3
PA	Montour	3149	1	4.4
PA	Shawville	3131	3,4	3.6
PA	Keystone	3136	1	3.2
PA	Keystone	3136	2	3.1
PA	Montour	3149	2	4.1
PA	Brunner Island	3140	1,2	4
PA	Brunner Island	3140	3	3.8

The MANE-VU states set a visibility-impairment threshold of 3 inverse mega meter (Mm^{-1}) at any MANE-VU Class I area to differentiate the largest sources potentially affecting visibility at any MANE-VU Class I area, including New Hampshire's. Using a lower level of impairment would have resulted in additional sources being identified but having more sources undergo a four-factor analysis may be beyond the resources of a given state to perform in time for submittal of a complete regional haze SIP. By requesting a four-factor analysis of these sources, a planned shutdown, or other factors, may be considered when determining what installation or upgrade of controls would be reasonable. Additional elements of the Intra-RPO Ask include:

"3. Each MANE-VU State that has not yet fully adopted an ultra-low sulfur fuel oil standard as requested by MANE-VU in 2007 - pursue this standard as expeditiously as possible and before 2028, depending on supply availability, where the standards are as follows:

a. distillate oil to 0.0015% sulfur by weight (15 ppm),
b. #4 residual oil within a range of 0.25 to 0.5% sulfur by weight,
c. #6 residual oil within a range of 0.3 to 0.5% sulfur by weight.

4. EGUs and other large point emission sources greater than 250 MMBtu per hour heat input that have switched operations to lower emitting fuels – pursue updating permits, enforceable agreements, and/or rules to lock-in lower emission rates for SO_2, NOx and PM. The permit, enforcement agreement, and/or rule can allow for suspension of the lower emission rate during natural gas curtailment;

5. Where emission rules have not been adopted, control NOx emissions for peaking combustion turbines that have the potential to operate on high electric demand[58] days by:
a. Striving to meet NOx emissions standard of no greater than 25 ppm at 15% O_2 for natural gas and 42 ppm at 15% O_2 for fuel oil but at a minimum meet NOx emissions standard of no greater than 42 ppm at 15% O_2 for natural gas and 96 ppm at 15% O_2 for fuel oil[59], or
b. Performing a four-factor analysis for reasonable installation or upgrade to emission controls, or
c. Obtaining equivalent alternative emission reductions on high electric demand days."

Ask #5 is only directed to the MANE-VU states and is not included in the "Ask" directed to upwind, potentially contributing states. It targets relatively small electric generating units that operate during a small proportion of the year on high electric demand days, but that tend to have higher emission rates per unit of energy produced. Targeting these units is considered reasonable due to MANE-VU analyses that show correlation between high electric demand days and the 20% most impaired days. The values included in the Ask are consistent with values used by MANE-VU states that have already tightened emission requirements of such units. While this reasonable measure was developed to assist in achieving the ozone NAAQS, it also has added benefits to reducing visibility impairing pollutants as well and should be considered a reasonable measure for regional haze reduction as well.

Finally, the Intra-RPO Ask includes:

"6. Each State should consider and report in their SIP measures or programs to: a) decrease energy demand through the use of energy efficiency, and b) increase the use within their state of Combined Heat and Power[60] (CHP) and other clean Distributed Generation technologies including fuel cells, wind, and solar."

4.2.4 The MANE-VU Inter-RPO "Ask"

The following states outside of MANE-VU were identified by MANE-VU as contributing to visibility impairment at MANE-VU Class I areas: Alabama, Florida, Illinois, Indiana, Kentucky, Louisiana, Michigan, Missouri, North Carolina, Ohio, Tennessee, Texas, Virginia and West Virginia. Therefore, these states should address this "Ask" in their regional haze SIP updates in addition to any other Federal Class I area state "Ask". For New Hampshire specific Class I areas (Great Gulf Wilderness and Presidential Range - Dry River Wilderness), these states include Kentucky, Illinois, Indiana, Louisiana, Michigan, Missouri, North Carolina, Ohio, Texas, Virginia and West Virginia. Contributing state methodology is documented in section 3.2.1 and the MANE-VU report, "Selection of States for MANE-VU Regional Haze Consultation (2018)," using actual 2015 emissions for EGUs and 2011 for other emission sources. The selection

58 High Electric Demand Days and Visibility Impairment in MANE-VU, December 20, 2017: Appendix R.
59 This emission level was determined by MANE-VU to be a reasonable threshold based on emission requirements already developed by member states.
60 Benefits of Combined Heat and Power Systems for Reducing Emissions in MANE-VU States, March 9, 2016: Appendix S.

process was described in section 4.2.

The text of the Inter-RPO Ask is as follows:

"In addressing the emission reduction strategies in the Ask, states will need to harmonize any activity on the strategies in the Ask with other federal or state requirements that affect the sources and pollutants covered by the Ask. These federal and state requirements include, but are not limited to:

- The 2010 SO_2 standard,
- RGGI, if applicable,
- MATS, and
- The 2015 ozone standard.

Because of the need for cross-program harmonization and because of the formal public process required by the federal CAA and state rulemaking processes, it is expected that there will be opportunities for stakeholders and the public to comment on how states intend to address the measures in the Ask.

To address the impact on mandatory Federal Class I 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 Federal Class I areas and to leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment.

Therefore, the course of action for pursuing the adoption and implementation of measures necessary to meet the 2028 reasonable progress goal for regional haze include the following 'emission management' strategies:

1. *Electric Generating Units (EGUs) with a nameplate capacity larger than or equal to 25MW with already installed NOx and/or SO_2 controls - ensure the most effective use of control technologies on a year-round basis to consistently minimize emissions of haze precursors, or obtain equivalent alternative emission reductions;*
2. *Emission sources modeled by MANE-VU that have the potential for 3.0 Mm^{-1} or greater visibility impacts at any MANE-VU Class I area, as identified by MANE-VU contribution analyses … – perform a four-factor analysis for reasonable installation or upgrade to emission controls [see table below);"*

Table 4-9: 14 EGU and Industrial Units Located Outside the MANE-VU Region with MANE-VU Screening Modeling Exceeding 3.0Mm^{-1} at a MANE-VU Class I Area

State	Facility Name	Facility/ ORIS ID	Unit IDs	MANE-VU Class 1 Max Extinction (dv)
IN	Rockport	6166	MB1, MB2	3.8
KY	Big Sandy	1353	BSU1, BSU2	3.5
MI	Belle River		2	4.0
MI	Belle River		1	3.7
MI	St. Clair	1743	1,2,3,4,5,6	3.1
OH	Avon Lake Power Plant	2836	12	9.2
OH	Gen J M Gavin	8102	1	3.3
OH	Gen J M Gavin	8102	2	3.1

State	Facility Name	Facility/ ORIS ID	Unit IDs	MANE-VU Class 1 Max Extinction (dv)
OH	Muskingum River	2872	5	7.7
OH	Muskingum River	2872	1,2,3,4	4.4
VA	Yorktown Power Station	3809	3	10.9
VA	Yorktown Power Station	3809	1,2	7.0
WV	Harrison Power Station		1 (25%), 2 (20%)	7.0
WV	Kammer	3947	1,2,3	3.2

"3. States should pursue an ultra-low sulfur fuel oil standard similar to the one adopted by the MANE-VU States in 2007 as expeditiously as possible and before 2028, depending on supply availability, where the standards are as follows:

a. distillate oil to 0.0015% sulfur by weight (15 ppm),
b. #4 residual oil within a range of 0.25 to 0.5% sulfur by weight,
c. #6 residual oil within a range of 0.3 to 0.5% sulfur by weight.

4. EGUs and other large point emission sources greater than 250 MMBtu per hour heat input that have switched operations to lower emitting fuels – pursue updating permits, enforceable agreements, and/or rules to lock-in lower emission rates for SO_2, NOx and PM. The permit, enforcement agreement, and/or rule can allow for suspension of the lower emission rate during natural gas curtailment;

5. Each State should consider and report in their SIP measures or programs to: a) decrease energy demand through the use of energy efficiency, and b) increase the use within their state of Combined Heat and Power (CHP) and other clean Distributed Generation technologies including fuel cells, wind, and solar."

4.2.5 The MANE-VU EPA and FLM "Ask"

The transport range of visibility impairing pollutants has been demonstrated to be extensive and well beyond the MANE-VU region. For example, a wildfire near Fort McMurray, Alberta, in western Canada last year brought visibility impairing fine particulate matter and ozone over 2,000 miles into the region at concentrations that contributed to exceedances of the health standard in some locations. Clearly, states located beyond those that MANE-VU chose to consult for regional haze can play an active role in impairing visibility at the MANE-VU Class I areas. Further, despite the fact that onroad vehicles produce a significant portion of the visibility impairing pollutants that affect our Class I areas, they are beyond our states' ability to regulate. Therefore, the MANE-VU Class I area states need additional help from the Environmental Protection Agency and Federal Land Managers in pursuing important reasonable emission control measures.[61] These include, but are not limited to, the following contained in the EPA/FLM:

"1. Federal Land Managers to consult with MANE-VU Class I area states when scheduling prescribed burns and ensure that these burns do not impact nearby IMPROVE visibility measurements and do not impact potential 20 percent most and least visibility impaired days;

2. EPA to develop measures that will further reduce emissions from heavy-duty onroad vehicles; and

3. EPA to ensure that Class I Area state 'Asks' are addressed in 'contributing' state SIPs prior to approval. In

[61] Benefits of Combined Heat and Power Systems for Reducing Emissions in MANE-VU States, March 9, 2016: Appendix S.

the case of this 'Ask', contributing states are defined as those that the MANE-VU Class I area states requested for consultation."

4.2.6 Technical Basis for the MANU-VU "Ask"

The MANE-VU Technical Support Committee (TSC), in conjunction with the OTC Modeling Committee, performed photochemical modeling in support of MANE-VU's Regional Haze objectives. Details are provided in the modeling Technical Support Document[62], and fulfill the technical basis requirement of 40 CFR 51.308(f)(2)(iii). Modeling to determine the RPGs for the New Hampshire Class I areas included measures documented in the Asks and documented in the Technical Support Document. Modeled RPGs are shown in Figure 4-2.

In addition to modeling 2028 visibility improvement resulting from implementation of the Asks, MANE-VU evaluated health implications with the BenMap model. BenMap is the model used by EPA to evaluate heath changes resulting from proposed changes in rules and revisions to health standards. MANE-VU found that emissions changes resulted in lower $PM_{2.5}$ and ozone concentrations and improved public health and a lower mortality rate in contributing states as well as MANE-VU states with Class I areas.

4.2.7 Additional Factors Considered in Developing the LTS

In accordance with 40 CFR 51.308(f)(2)(iv), New Hampshire considered the following additional factors:

Emission reductions due to ongoing air pollution control programs, including measures to address reasonably attributable visibility impairment.

- The state's largest EGU (Granite Shore Power – Merrimack Station) installed a wet, limestone-based flue gas desulfurization system (FGD) in order to comply with state law RSA 125-O, *Multiple Pollutant Reduction Program*, which required the reduction of mercury emissions by at least 80 percent from New Hampshire's fossil-fuel-fired power plants. The removal of SO_2 at Merrimack Station occurs as a co-benefit of the FGD system primarily used for the control of mercury emissions from Units MK1 and MK2. Operation of the FGD system also fulfills this facility's requirements for Best Available Retrofit Technology (BART) under EPA's Regional Haze Rule (64 FR 35714).[63] BART emission limits are specified in New Hampshire's Code of Administrative Rules Env-A 2300, *Mitigation of Regional Haze*. EPA approved the rule effective November 14, 2016 (81 FR 70361).[64] In 2019, NHDES amended Env-A 2300 to be consistent with changes made to Env-A 1300 for NOx emissions standards for wet bottom utility boilers firing coal as well as stack testing frequency for TSP. The amended rule was submitted to the EPA as a SIP revision on September 12, 2019.

- The low sulfur fuel portion of the 2017 MANE-VU Ask has been fulfilled. New Hampshire has amended the state law RSA 125-C:10-d, *Sulfur Limits of Certain Liquid Fuels*. Beginning on July 1,

62 2011 Based Modeling Platform Support Document, October 2018 Update. https://otcair.org/MANEVU/Upload/Publication/Reports/OTC MANE-VU 2011 Based Modeling Platform Support Document October 2018 - Final.pdf

63 https://www.govinfo.gov/content/pkg/FR-1999-07-01/pdf/99-13941.pdf

64 https://www.govinfo.gov/content/pkg/FR-2016-10-12/pdf/2016-24495.pdf

2018, fuel imported into New Hampshire must meet these reduced sulfur limits – 0.0015% for No. 2 fuel oil, 0.25% for No. 4 fuel oil and 0.5% for Nos. 5 or 6 fuel oil. Beginning on February 1, 2019, non-compliant fuels may not be distributed for sale within the state, except for any fuel remaining in storage. This law will result in further reductions in SO_2 emissions from industrial, area, and non-road sources beyond the 30% reduction seen in the 2008 vs. 2014 National Emissions Inventory data. The law was incorporated into New Hampshire's Code of Administrative Rules Env-A 1600, *Fuel Specifications* and was submitted to the EPA as a SIP revision on May 17, 2019.

- In 2018, NHDES amended the New Hampshire's Code of Administrative Rules Env-A 1300, *NOx RACT* rule with changes that reduce NOx emissions standards for municipal waste combustors, load shaving gas-fired engines and wet bottom utility boilers firing coal. The rule also streamlines the annual performance tune-up on applicable boiler(s) to match federal requirements. The rule was submitted to the EPA as a SIP revision on September 6, 2018.

- New Hampshire's Code of Administrative Rules Env-A 619, *Prevention of Significant Deterioration*, spells out the PSD requirements of New Hampshire's statewide permit system. The PSD permitting process requires modeling analyses to assess the potential air quality impacts, including those to visibility, at Class I areas. PSD permit applicants may conduct such analyses in consultation with NHDES and the relevant FLM. The most recent revisions to the New Hampshire's Code of Administrative Rules Env-A 600, *Statewide Permit System*, including Env-A 619, were readopted with an effective date of September 1, 2012. EPA approved the rule effective September 26, 2015 (80 FR 57722).[65] Minor amendments were submitted October 26, 2016, which were approved by EPA May 25, 2017 (82 FR 24057).[66] PSD is applicable to all major sources (or existing sources making a major modification) located in an area that is in attainment of the National Ambient Air Quality Standards. All areas of New Hampshire are subject to PSD.

- New Hampshire's Code of Administrative Rules Env-A 2100, *Particulate Matter and Visible Emissions Standards*, establishes standards for particulate matter and visible emissions for those stationary sources or devices that are not specifically regulated pursuant to any other state rule or law. EPA approved the rule effective December 7, 2016 (81 FR 78052).[67]

- NHDES has an ongoing outreach and education program that teaches citizens how to minimize the impact of $PM_{2.5}$ emissions from residential wood stoves and outdoor wood boilers.

Measures to mitigate the impacts of construction activities.

The construction industry is already subject to requirements for controlling pollutants that contribute to visibility impairment. For example, federal regulations require the reduction of SO_2 emissions from construction vehicles. At the state level, New Hampshire's Code of Administrative Rules Env-A 1002, *Fugitive Dust*, requires the control of direct emissions of particulate matter

[65] https://www.govinfo.gov/content/pkg/FR-2017-05-25/pdf/2017-09536.pdf
[66] https://www.govinfo.gov/content/pkg/FR-2017-05-25/pdf/2017-09536.pdf
[67] https://www.govinfo.gov/content/pkg/FR-2016-11-07/pdf/2016-26598.pdf

(primarily crustal material) from mining, transportation, storage, use, and removal activities. These requirements apply to such sources as quarries, unpaved roads, cement plants, construction sites, rock-crushing operations, and general earth-moving activities. Controls may include wet suppression, covering, vacuuming, and other approved means. EPA originally approved the rule effective March 19, 2018 (83 FR 6972).[68] NH revised Env-A 1000 in 2019 and expects to submit it to the EPA as a SIP revision in 2019.

Source retirement and replacement schedules.

The most impactful of New Hampshire's sources are the fossil-fuel-fired EGUs. While recent developments in the oil and gas industry have forced rapid changes in the power production sector, and some generating units have experienced sharp reductions in utilization, no retirements or replacements of New Hampshire's EGUs have occurred or been announced since the regional haze SIP was first submitted in 2010.

Basic smoke management practices for prescribed fires.

Prescribed burns may have short-term visibility impacts. Such impacts are addressed by the New Hampshire Prescribed Fire Council in its recommended standards[69] for planning and implementing prescribed burns. The U.S. Forest Service and NHDES are members of the council and assisted in the development of these standards. Chapter 10 of the standards, which covers smoke management and air quality, recommends as follows: "The burn plan will screen for all smoke sensitive features within one and five miles of the planned burn, and identify measures for minimizing negative impacts of smoke to these features." Class I areas are not specifically identified as smoke sensitive features. However, both of New Hampshire's Class I areas are within the White Mountain National Forest (WMNF); thus, the FLM (in this case, the U.S. Forest Service) would be informed of any planned burn in nearby lands. For any prescribed fire within the WMNF, the burn plan would have to meet the FLM's own requirements for protection of Class I areas, which are more stringent than the New Hampshire Prescribed Fire Council's standards.

The anticipated net effect on visibility due to projected changes in point, area, and mobile source emissions.

See section 5.4.

4.3 Reasonable Progress Goals (40 CFR 51.308(f)(3))

40 CFR 51.308 (f)(3) of the Regional Haze Rule requires New Hampshire to establish, for each Federal Class I area within the state, RPG that reflect the visibility conditions in 2028 that are expected to result from the measures outlined in the LTS. In August 2019, the EPA released guidance[70] to be used by states

[68] https://www.federalregister.gov/documents/2018/02/16/2018-03251/air-plan-approval-new-hampshire-rules-for-open-burning-and-incinerators

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

[70] Guidance on Regional Haze State Implementation Plans for the Second Implementation Period, EPA-457/B-19-003, August 2019. https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf

in setting reasonable progress goals. The goals must provide for visibility improvement on the days of greatest visibility impairment, specifically, when anthropogenic emissions impair visibility and away from days when wildfires and natural dust storms are the greatest contributors to visibility impairment and ensure no visibility degradation on the days of least visibility impairment for the duration of the SIP period.

As provided in 40 CFR 51.308 (f)(3)(i):

> *"A state in which a mandatory Class I Federal area is located must establish reasonable progress goals (expressed in deciviews) that reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period as a result of those enforceable emissions limitations, compliance schedules, and other measures required under paragraph (f)(2) of this section that can be fully implemented by the end of the applicable implementation period, as well as the implementation of other requirements of the CAA. The long-term strategy and the reasonable progress goals must provide for an improvement in visibility for the most impaired days since the baseline period and ensure no degradation in visibility for the clearest days since the baseline period."*

Table 4-10 summarizes the existing visibility conditions and the proposed goals as described in this section and seen in Figure 4-2.

Table 4-10: Visibility Goals for the Great Gulf and Presidential Range/Dry River Wilderness Areas

Conditions	Deciviews
Natural Background on 20% most impaired visibility days (Goal in 2064)	9.78
Average Baseline Visibility on the 20% clearest days (2001-2005)	7.51
Average Baseline Visibility on the 20% most impaired days (2001-2005)	21.64
Uniform Rate of Progress for 2018 on the 20% most impaired days*	18.72
Current 20% Most Impaired Days (2013-2017)	13.31
Uniform Rate of Progress for 2028 on the 20% most impaired days*	16.90
Modeled Reasonable Progress Goal (2028)*	12.00[c] / 12.13[d]

* Average annual value

[c] Modeled with the MANE-VU Ask measures (Appendix U)

[d] Modeled without the MANE-VU Ask measures (Appendix U)

The amount of visibility improvement on the 20% most impaired days from baseline (21.64 dv) to 2028 based on uniform rate progress glideslope of 0.198 dv per year is 4.62 dv. The 2028 URP target value is 16.90 dv. MANE-VU predicts 2028 RPG values of 12.00 dv with the MANE-VU Ask and 12.13 dv without.

New Hampshire consulted with states identified as contributing to visibility impairment at New Hampshire's Class I areas and with states that requested consultation with New Hampshire regarding visibility conditions at their Federal Class I areas. In particular, New Hampshire worked closely with the other MANE-VU states to ensure consistency of approach in setting reasonable progress goals. Accordingly, New Hampshire agrees with the reasonable progress goals established by Maine, Vermont, and New Jersey. A description of the consultation process is found in Section 3. Should other Class I area states that have not yet completed their consultation processes request consultation with New Hampshire as well as request that additional emission measures be considered, then NHDES will address the matter in a SIP update, permit or rule as needed and appropriate.

4.4 Additional Monitoring (40 CFR 51.308(f)(4))

As described in earlier sections, visibility monitoring at Great Gulf Wilderness and Presidential Range - Dry River Wilderness is accomplished with instruments located at a single site at Camp Dodge and is funded by EPA and operated by the National Forest Service. This monitoring station, which represents both wilderness areas, measures and records light scattering, aerosols and relative humidity. The collected data are compiled and sorted to ascertain visibility levels on the 20% most impaired and clearest days, and this information is tracked over time to look for trends in visibility. The parameters and instrumentation for this site are listed in Table 4-11 below.

Table 4-11: Visibility Monitoring at Great Gulf and Presidential Range - Dry River Wilderness Areas

Parameter	Instrument
Scattering coefficient	Nephelometer
Aerosol	IMPROVE module A
Aerosol	IMPROVE module B
Aerosol	IMPROVE module C
Aerosol	IMPROVE module D
Meteorology	Relative humidity

The State has not been advised by the Administrator, Regional Administrator, or affected Federal Land Manager that additional monitoring is required pursuant to 40 CFR 51.308(f)(4). Therefore, New Hampshire has no current plans to alter the current strategy as long as this monitoring continues to be federally supported.

4.5 Meeting the "Ask" – New Hampshire

As part of meeting the MANE-VU Ask, New Hampshire compiled lists of emissions sources and energy conserving programs that meet the specifications cited in the Ask. NHDES closely reviewed and adopted a facility's self-performed analysis, if appropriate. Findings and proposed rule changes are discussed in detail below. The MANE-VU Ask as it applies to New Hampshire seeks full implementation by 2028.

1. *Electric Generating Units (EGUs) ≥ 25MW with already installed NOx and/or SO_2 controls - ensure the most effective use of control technologies on a year-round basis or obtain equivalent alternative emission reductions.*

   Twelve EGUs at seven stationary sources in New Hampshire were identified as meeting the criteria of Ask #1. These include:

Table 4-12: New Hampshire Units Subject to MANE-VU Ask #1

Facility	Unit	Capacity (MW)	Existing NOx Controls	Existing SO_2 Controls
Burgess BioPower	EU01	75	SCR	Inherently low sulfur fuels
Essential Power Newington	EU01	525	DLN/SCR*	Inherently low sulfur fuels
	EU02		DLN/SCR	Inherently low sulfur fuels

Facility	Unit	Capacity (MW)	Existing NOx Controls	Existing SO_2 Controls
Granite Ridge Energy	EU01	720	DLN/SCR	Inherently low sulfur fuels
	EU02		DLN/SCR	Inherently low sulfur fuels
Pinetree Power Tamworth	Wood Boiler	25	SCR, SNCR**	Inherently low sulfur fuels
Granite Shore Power (GSP) Merrimack Station	MK1	459	SCR	FGD****
	MK2		SCR	FGD
Granite Shore Power (GSP) Schiller Station	SR4	150	SNCR	DSI
	SR5		SNCR	Limestone Injection
	SR6		SNCR	DSI
Granite Shore Power (GSP) Newington Station	NT1	400	LNB***	N/A

* Dry low-NOx in combustion combined with selective catalytic reduction.
** Installed voluntarily by Pinetree Tamworth and may be operated at their discretion. SNCR = selective non-catalytic reduction
*** LNB = Low NOx Burner
**** FGD = Flue gas desulfurization

- **Burgess BioPower**: Burgess BioPower's operation is covered by PSD/NNSR Permit TP-0054 which limits NOx emissions to 0.060 lbs/MMBtu on a 30-day rolling average, based on the use of SCR technology and SO_2 emissions to 0.012 lbs/MMBtu. The biomass unit at this facility was subject to NNSR for NOx at the time of their initial permitting; hence, the NOx limit was established as the LAER[71] based limit. Burgess BioPower uses clean wood as their fuel during normal operations and ULSD during plant startups. Both fuels are inherently very low in sulfur. The Burgess BioPower facility was also subject to PSD review for SO_2 at the time of its initial permitting in 2010; hence, the SO_2 limit was established as a BACT based limit. A June 2018 review of the EPA RBLC for biomass fired EGUs greater than or equal to 25 MW indicates that low sulfur fuels remains the SO_2 BACT. Sorbent injection was installed for acid gas control but is not used to control SO_2 emissions because the emissions from burning wood are inherently very low (typically around 0.001 lbs SO_2/MMBtu). Low-sulfur fuels, SCR operation and the NOx and SO_2 emission limitations are required by TP-0054 on a year-round basis. Monitoring data at the facility has shown that operation of the sorbent injection is not necessary to comply with the emission limit for SO_2.
- **Essential Power Newington**: Essential Power Newington's operation is covered by Title V Operating Permit TV-0058 which limits NOx and SO_2 emissions to the limitations listed in Table 4-13. The units at this facility were subject to NNSR for NOx at the time of their initial permitting;

[71] A June 2018 review of the EPA RBLC for biomass fired boilers greater than or equal to 250 MMBtu/hr indicates that 0.060 lb/MMBtu remains as LAER for NOx. While two recent determinations for similar facilities in Vermont established emission rates as low as 0.030 lb/MMBtu on a 12-month rolling period, NHDES understands that these rates have yet to be confirmed. The associated short-term limits for these two facilities are 0.060 lb/MMBtu.

hence, these limits were established as LAER [72] based limits. The Newington units use DLN combustion combined with SCR (as well as water injection during limited firing on ULSD). The facility is required by permit to use inherently low sulfur fuels (natural gas and ULSD). The units at this facility were subject to PSD review for SO_2 at the time of their initial permitting; hence, these limits were established BACT-based limits. A June 2018 review of the RBLC for combined cycle turbines greater than 25 MW indicates that low sulfur fuels remain as SO_2 BACT. DLN/SCR operations and the NOx and SO_2 emission limitations are required by TV-0058 on a year-round basis.

Table 4-13: Essential Power Newington Permitted Emissions and Control Technologies

Pollutant	Fuel	Limitation	Technology BACT/LAER	Averaging Time
NOx	Natural Gas	2.5 ppmvd @ 15% O_2	Dry Low NOx Burner with SCR (LAER/BACT)	3 hour block average
NOx	ULSD	9.0 ppmvd @ 15% O_2	Dry Low NOx Burner with Water Injection and SCR (LAER/BACT)	1 hour block average
SO_2	Natural Gas	0.0071 lbs/MMBtu	Low Sulfur Fuels (BACT)	3 hour rolling
SO_2	ULSD	0.0015 lbs/MMBtu	Low Sulfur Fuels (BACT)	3 hour rolling

- **Granite Ridge Energy:** Granite Ridge Energy's operation is covered by Title V Operating Permit TV-0056 which limits NOx and SO_2 emissions to the limitations listed in Table 4-14. The units at this facility were subject to NNSR for NOx at the time of their initial permitting; hence, these limits were established as LAER[71] based limits. The facility uses inherently low sulfur fuel (natural gas). The units at this facility were subject to PSD review for SO_2 at the time of their initial permitting; hence, this limit was established as a BACT-based limit. A June 2018 review of the RBLC for combined cycle turbines greater than 25 MW indicates that low sulfur fuels remain as SO_2 BACT. DLN/SCR operations and the NOx and SO_2 emission limitations are required by TV-0056 on a year-round basis.

Table 4-14: Granite Ridge Energy Permitted Emissions and Control Technologies

Pollutant	Limitation	Technology BACT/LAER	Averaging Time
NOx	2.5 ppmvd @ 15% O_2	Low NOx Burner with SCR (LAER)	3 hour block average
SO_2	0.0023 lbs/MMBtu	Low Sulfur Fuel (BACT)	3 hour rolling

[72] A June 2018 review of the EPA RBLC for combined cycle gas turbines greater than 25 MW indicates that this remains the control technology upon which current BACT/LAER levels are based. A review of the RBLC also revealed that the emissions limits currently applicable to these two facilities remain in line with recent BACT/LAER determination (2.5 vs. 2.0 ppmvd @15% O_2). For this reason, NHDES has determined that the current limits at Essential Power Newington and Granite Ridge Energy represent the "most effective use of control technologies" for NOx.

- **Pinetree Power Tamworth**: Pinetree Power Tamworth's operation is covered by Title V Operating Permit TV-0018 which currently limits NOx emissions to 0.265 lbs/MMBtu over any consecutive 24-hour period. This is a PSD-based limit that was established when the facility was initially permitted in 1987.

  In 2008, Pinetree Power installed overfire air and flue gas recirculation technologies, as well as a SNCR system and a SCR system. Since the controls were installed, Pinetree Power Tamworth has voluntarily chosen to comply with a more stringent NOx limit of 0.075 lb/MMBtu, on a quarterly average for the purpose of generating renewable energy certificates. In response to the MANE-VU Ask, Pinetree Power Tamworth has agreed to take enforceable NOx emission limitations as outlined in Table 4-15 by 2021. Note that these limitations take into account periods of startup, shutdown, and soot blowing - ergo, separate limits are not necessary to address periods when NOx controls are not at their maximum efficiency. NHDES is proposing to include these limits in New Hampshire's Code of Administrative Rules Env-A 2300, *Mitigation of Regional Haze*. The NOx emission limitations, once incorporated into Env-A 2300, will also be included in the facility's Title V Operating Permit at the time of renewal.

  With regard to SO_2, the unit at this facility performed stack testing in 2009, as it was believed that the EPA AP-42 emission factor for biomass combustion was significantly higher than observed in practice. Based on the results of this test (and confirmed by tests at other similar facilities), potential SO_2 emissions are determined to be less than 1 ton per year. Pinetree Power uses clean wood for fuel, which is inherently very low in sulfur. Low-sulfur fuels are required by TV-0018 on a year-round basis.

Table 4-15: Pinetree Power Tamworth Proposed NOx Emission Limitations

Pollutant	Limitation	Technology	Averaging Time
NOx	0.085	Low NOx Burner with SNCR/SCR	24-hr calendar day average
NOx	0.075	Low NOx Burner with SNCR/SCR	30 day rolling average
SO_2	N/A	Inherently low sulfur fuel	At all times

- **GSP Merrimack Station**: Effective August 15, 2018, New Hampshire amended its rule, Env-A 1300, *Nitrogen Oxide (NOx) Reasonably Available Control Technology (RACT)*, lowering the NOx emission limits for utility boilers firing coal and equipped with a SCR system which includes GSP Merrimack Station units MK1 and MK2. Operation of year-round SCR controls for these units is addressed under Env-A 1303.06. FGD controls the emissions of acid gases from MK1 and MK2. Operation of the FGD is required at all times by TP-0189.

- **GSP Schiller Station**: As part of the New Hampshire SIP for the 2008 Ozone standard, NHDES issued a RACT order RO-003 that established a NOx emission limit for SR4 and SR6 of 0.25 lbs NOx/MMBtu per 24-hour calendar day average, a 50% reduction in their current previous emission limit. This NOx emission limit applies to operation of SR4 and SR6 on a year-round basis. GSP provided an analysis that demonstrated that low NOx boilers (LNB) and over-fire air (OFA) were sufficient to maintain an emission limit of 0.25 lbs NOx/MMBtu and that year-round

operation of the SNCR was not technologically nor economically feasible. GSP is required by the RACT order to operate the SNCR if LNB and OFA were not maintaining the emission limit. DSI for acid gas control is performed year-round as part of normal operations of SR4 and SR6 as required under the federal MATS rule, 40 CFR 63, Subpart UUUUU *National Emission Standards for Hazardous Air Pollutants (NESHAP): Coal- and Oil-Fired Electric Utility Steam Generating Units* and included in the facility's Title V Operating Permit TV-0053. SR5 is a wood-fired boiler that is also permitted to fire coal. However, SR5 has only fired coal for collecting performance test data in 2006 during commissioning of the boiler. SR5 is limited by permit to a daily SO_2 limit is 0.12 lbs SO_2/MMBtu when firing coal.

- **GSP Newington Station**: The unit at this facility is an oil- and natural gas-fired EGU designated as NT1. NT1 is equipped with low NOx burners and an overfire air system. The overfire air system is separately optimized to meet a federally enforceable daily NOx limit of 0.35 lbs NOx/MMBtu for oil combustion and 0.25 lbs NOx/MMBtu for oil and gas combustion. NT1 is subject to MATS as an existing EGU under the "limited-use liquid oil-fired EGU" subcategory. NHDES has included in the Title V Operating Permit TV-0054 for GSP Newington Station the requirement to conduct a NOx RACT analysis within six months of switching from the limited use MATS subcategory to continental liquid oil-fired EGU subcategory should they ever do so.

  NHDES has closely reviewed and adopted the four-factor analyses completed by the operator for the above listed GSP facilities (Merrimack, Schiller and Newington Stations). The analyses are provided in Appendix T.

2. *Emission sources modeled by MANE-VU that have the potential for 3.0 Mm^{-1} or greater visibility impacts at any MANE-VU Class I area, as identified by MANE-VU contribution analyses.*

Table 4-16: New Hampshire Units Subject to MANE-VU Ask #2

Facility	Unit
GSP Merrimack Station	MK2

- NOx, SO_2 and TSP emissions from GSP Merrimack Station Unit MK2 are controlled by SCR, FGD and two ESPs. These control devices are required to be operated year-round in order to achieve the following permitted emission limitations:

Table 4-17: GPS Merrimack Station Unit MK2 Permitted Emissions and Control Technologies

Pollutant	Limitation	Technology	Averaging Time
NOx	0.22 lbs/MMBtu	Low NOx Burner with SCR	24 hour calendar day average
SO_2	0.39 lbs/MMBtu	Low NOx Burner with FGD system	7-boiler operating day rolling average (MK1 and MK2 combined)
PM		Electrostatic Precipitators	

NHDES has closely reviewed and adopted the four-factor analyses completed by the operator. The existing FGD was found to be optimal for facility control of SO_2 emissions. In addition, no

upgrade or replacement of the SCR or the ESP was found to be reasonable. Analysis provided in Appendix T.

3. *Adopt an ultra-low sulfur fuel oil standard as requested by MANE-VU in 2007.*
   The low sulfur fuel portion of the 2017 MANE-VU Ask has been fulfilled. New Hampshire has amended the statute RSA 125-C:10-d, Sulfur Limits of Certain Liquid Fuels. Beginning on July 1, 2018, fuel imported into New Hampshire must meet these reduced sulfur limits – 0.0015% for No. 2 fuel oil, 0.25% for No. 4 fuel oil and 0.5 percent for Nos. 5 or 6 fuel oil. Beginning on February 1, 2019, non-compliant fuels may not be distributed for sale within the state, except for any fuel remaining in storage. This law will result in further reductions in SO_2 emissions from industrial, area, and non-road sources beyond the 30% reduction seen in the 2008 vs. 2014 National Emissions Inventory data. NHDES has submitted this rule as a SIP revision that, once approved by EPA, will be federally enforceable. MANE-VU projected this strategy would result in a 28% reduction in non-EGU SO_2 emissions by 2018, relative to on-the-books/on-the-way 2018 projections used in regional haze planning.

4. *EGUs and other large point emission sources greater than 250 MMBTU per hour heat input that have switched operations to lower emitting fuels –lock-in lower emission rates for SO_2, NOx and PM.*
   There are no facilities in New Hampshire that meet the specifications of this provision.

5. *Where emission rules have not been adopted, control NOx emissions for peaking combustion turbines that have the potential to operate on high electric demand days by:*
   a. *Striving to meet NOx emissions standard of no greater than 25 ppm at 15% O_2 for natural gas and 42 ppm at 15% O_2 for fuel oil but at a minimum meet NOx emission standard of no greater than 42 ppm at 15% O_2 for natural gas and 96 ppm at 15% O_2 for fuel oil, or*
   b. *Performing a four-factor analysis for reasonable installation or upgrade to emission controls, or*
   c. *Obtaining equivalent alternative emissions reductions on high electric demand days.*

   This ask is only directed to the MANE-VU states and is not included in the Ask directed to upwind, potentially contributing states. This ask targets relatively small electric generating units that operate during a small proportion of the year on high electric demand days, but that tend to have higher emission rates per unit of energy produced. Targeting these units is considered reasonable due to MANE-VU analyses that show correlation between high electric demand days and the 20% most impaired days.

Table 4-18: New Hampshire Units Subject to MANE-VU Ask #5

Facility	Unit
GSP Lost Nation Station	LNCT1
GSP Merrimack Station	MKCT1
	MKCT2
GSP Schiller Station	SRCT
GSP White Lake Station	WLCT1

NHDES has closely reviewed and adopted the four-factor analyses for reasonable installation or upgrade to NOx emission controls performed by the operator. (Appendices T and U). GSP's five combustion turbines are of the same vintage (installed 1968-1970), have similar unit ratings (290 MMBtu/hr - 319 MMBtu/hr), are operated in the similar manner (operate less 1% of the number of hours in a given year), and have similar NOx emissions (ranging from 0.7 lbs/MMBtu to 0.9 lbs/MMBtu). The analyses indicated that there are no additional NOx controls that GSP could employ on the combustion turbines that are both technically and economically feasible. Alternatively, GSP has pledged to continue employing good combustion practices to optimize their NOX emissions profile.

6. *Each State should consider and report in their SIP measures or programs to: a) decrease energy demand through the use of energy efficiency, and b) increase the use within their state of Combined Heat and Power (CHP) and other clean Distributed Generation technologies including fuel cells, wind, and solar.*

- New Hampshire participates in RGGI, a Northeast and Mid-Atlantic 10-state initiative to reduce greenhouse gas emissions that contribute to global climate change. The initiative creates a market for emissions allowances through a regional cap-and-trade program for greenhouse gas emissions from area power plants. As a co-benefit of this program, emissions of particle producing pollutants are also reduced. New Hampshire emissions allowances are sold at quarterly auctions and the proceeds fund the GHGER Fund. The GHGER Fund is administered by the Public Utilities Commission, which distributes the funds to programs across the state to support energy efficiency, conservation, and demand response programs.
- New Hampshire's RPS statute, RSA 362-F[73], requires each electricity provider to meet customer load by purchasing or acquiring certificates representing generation from renewable energy based on total megawatt-hours supplied. The RPS requirement increases from 4% in 2008 to 25.2% in 2025 and thereafter, based on type of renewable energy. A portion of this renewable portfolio energy generation comes from non-emitting sources such as hydro, solar and wind.

[73] http://www.gencourt.state.nh.us/rsa/html/NHTOC/NHTOC-XXXIV-362-F.htm

5. PROGRESS REPORT (40 CFR 51.308(f)(5)) and Periodic Reports (40 CFR 51.308)(g)

New Hampshire commits to periodically submitting reports to the Administrator evaluating progress towards the reasonable progress goal for each mandatory Class I Federal area located within the State and in each mandatory Class I Federal area located outside the State that may be affected by emissions from within the State. Subsequent progress reports will be submitted January 31, 2025, July 31, 2033, and every 10 years thereafter. Progress reports will be made available for public inspection and comment for at least 30 days prior to submission to EPA and all comments received from the public will be submitted to EPA along with the subsequent progress report, along with an explanation of any changes to the progress report made in response to those comments.

The Regional Haze rule at 40 CFR 51.308(f)(5) states "So the plan revision will serve also as a progress report, the State must address in the plan revision the requirements of paragraphs (g)(1) through (g)(5) of this section." The first progress report was submitted December 1, 2014. The following section serves as a progress report to the first implementation period, i.e., December 2014 – June 2019.

5.1 Status of Approved Measures of State Implementation Plan 40 CFR 51.308(g)(1)

Measures to combat regional haze were developed by the MANE-VU states after much research and analysis that culminated on June 20, 2007 with the adoption of two documents that provide the technical basis for consultation among the interested parties and define the basic strategies for controlling pollutants that cause visibility impairment at Federal Class I areas in the eastern U.S. These documents, "Statement of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress," and "Statement of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Request for a Course of Action by States outside of MANE-VU toward Assuring Reasonable Progress" are known as the MANE-VU "Ask" (not to be confused with the "Asks" for the current planning period, which were described in Section 4).

During the first implementation period, New Hampshire, as a MANE-VU member state, agreed to and adopted the strategies for controlling pollutants that cause visibility impairment outlined in the first planning period Ask. This "Ask" consisted of the following strategies:

- **Timely implementation of BART requirements.** New Hampshire met the terms of this agreement by controlling its two in-state BART-eligible emission sources with timely control strategies as well as pursuing the low-sulfur fuel oil strategy. Both BART-eligible sources also fell on the list of the top 167 contributing EGU emission points for the current planning period.

- **A targeted EGU strategy:** The larger of these facilities (Merrimack Station Unit MK2) was subject to amendments of New Hampshire state statute Chapter 125-O, Multiple Pollutant Reduction Program in 2006 that imposed emission caps on sulfur dioxide and oxides of nitrogen from fossil-fuel-fired EGUs, and required an 80% reduction in mercury emissions from coal burning EGUs. To reduce mercury emissions, Merrimack Station installed a wet, limestone-based FGD that went on line in November 2011. The removal of SO_2 occurs as a co-benefit of the FGD system. In 2016, Merrimack Station's SO_2 emissions were 228 tons, a 99% reduction from 2010 emissions of 33,248 tons. This reduction is greater than the 90 percent specified in the Ask, and offsets the

lesser control level at the other EGU, described below.

The other facility, a smaller, oil-fired unit (GSP Newington Station), must control fuel sulfur levels under BART requirements to reduce SO_2 emissions. The facility's Title V permit specifies the #6 fuel oil used by its utility boiler contain less than 1% sulfur, and the #2 fuel oil used for its two auxiliary boilers contain less than 0.2% sulfur.

- **A low sulfur fuel oil strategy.** New Hampshire in 2016 amended the statute RSA 125-C:10-d, Sulfur Limits of Certain Liquid Fuels. Effective July 1, 2018, fuel imported into New Hampshire must have a reduced sulfur limit – 0.0015 percent for No. 2 fuel oil, 0.25 percent for No. 4 fuel oil and 0.5% for Nos. 5 or 6 fuel oil. Beginning February 1, 2019, no person shall distribute fuel in the state that does not meet these sulfur limits. This law will result in further reductions in SO_2 emissions from industrial, area, mobile and non-road sources beyond the 30% reduction seen in the 2008 vs. 2014 National Emissions Inventory data.

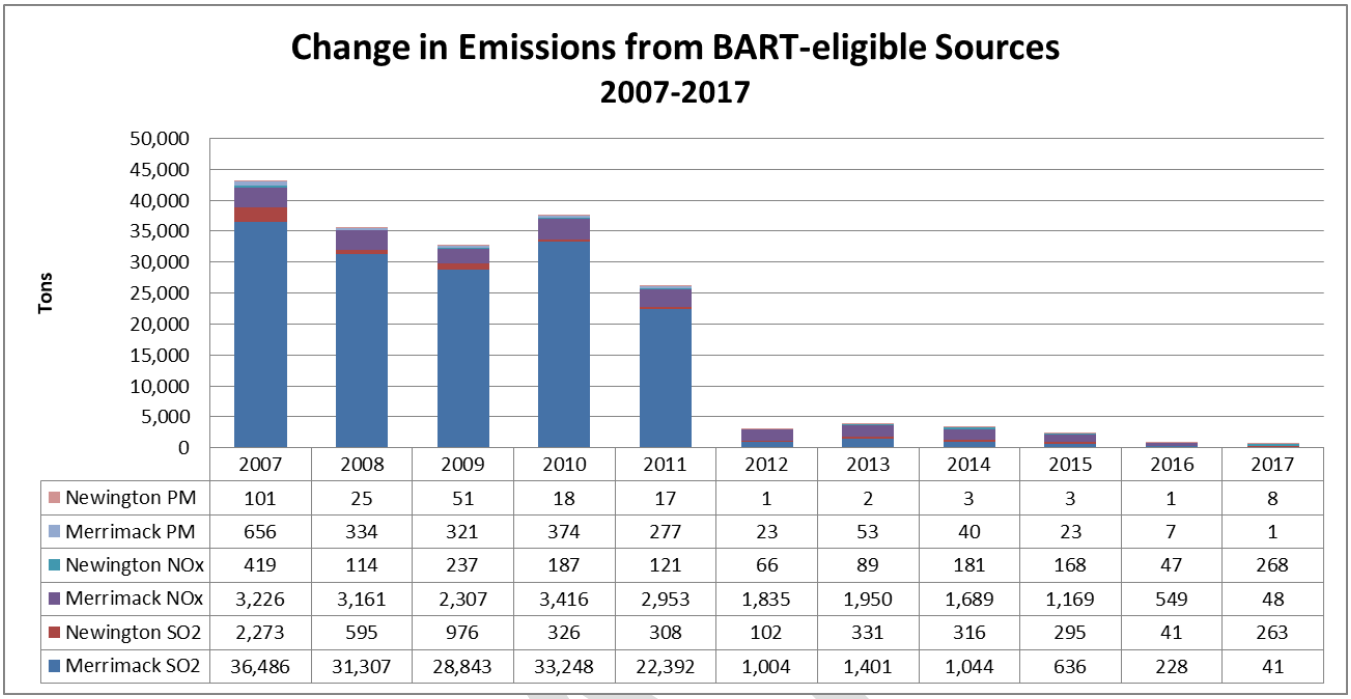
- **Continued evaluation of other control measures.** New Hampshire continues its participation in "Clean Cities," the DOE's program that advances the nation's economic, environmental and energy security by supporting local actions to cut petroleum use in transportation. In addition, New Hampshire amended its CAA Section 129-state plan for municipal waste combustors and decreased the particulate matter emission limit, and strengthened its rules concerning Prevention, Abatement and Control of Open Source Air Pollution. Additionally, NHDES has an ongoing outreach and education program that teaches citizens how to minimize the impact of $PM_{2.5}$ emissions from residential wood stoves[74] and outdoor wood boilers.

5.2 Summary of Emission Reductions Achieved 51.308(g)(2)

Section 51.303(g)(2) calls for summary of the emissions reductions achieved throughout the State through implementation of the measures described in paragraph 5.1 of this section. While the fuel strategy is not fully implemented and the effects of other control measures difficult to quantify, results of other strategies are identifiable. For example, emissions from two EGUs that were subjected to BART and other targeted strategies (Figure 5.1) show reductions in three visibility impairing pollutants (SO_2, NOx and PM).

[74] https://www4.des.state.nh.us/appc/?page_id=149

Figure 5-1: Emissions in SO_2, NOx and PM from two New Hampshire EGUs, 2007-2017 (tpy)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Newington PM	101	25	51	18	17	1	2	3	3	1	8
Merrimack PM	656	334	321	374	277	23	53	40	23	7	1
Newington NOx	419	114	237	187	121	66	89	181	168	47	268
Merrimack NOx	3,226	3,161	2,307	3,416	2,953	1,835	1,950	1,689	1,169	549	48
Newington SO2	2,273	595	976	326	308	102	331	316	295	41	263
Merrimack SO2	36,486	31,307	28,843	33,248	22,392	1,004	1,401	1,044	636	228	41

The summary of statewide emissions of visibility impairing pollutants from all sources and activities for the period from 2002 to 2014 provided in section 5.4, based on the NEI data. For the period 2008 to 2014, one can observe reductions of 25%, 32% and 80% for NOx, PM, and SO_2, respectively, while the EGUs emissions decreased by 43%, 88% and 96% for the same time period, indicating the effect of these sources on the statewide inventory.

5.3 Assessment of Visibility Conditions 51.308(g)(3)

Haze Index and individual constituent light extinction annual results were analyzed for each IMPROVE monitoring site in and adjacent to the MANE-VU region for years between 2000 and 2016. This work was completed by the Maine Department of Environmental Protection on behalf of MANE-VU[75] to determine baseline, current and natural visibility conditions for the 20% most impaired days and the 20 percent clearest days, for each in-state and out-of-state Federal Class I area for states in the MANE-VU region.

Visibility trends analyses used EPA recommended metrics[76] at IMPROVE monitoring sites at federal Class I including New Hampshire's Federal Class I areas. The results of the analysis showed the following:

- There continues to be definite downward trends in overall haze levels at all Federal Class I areas in and adjacent to the MANE-VU region and at IMPROVE Protocol monitoring sites.
- Based on rolling-five year averages demonstrating progress since the 2000-2004 baseline period, all MANE-VU and nearby Federal Class I area visibility conditions are currently better than the 2028 URP visibility condition for the 20% most impaired visibility days and below baseline

[75] Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017: Appendix B.
[76] See reference 7.

conditions for the 20% clearest days. Trends are mainly driven by large reductions in sulfate light extinction, and to a lesser extent, nitrate light extinction.

- Levels of OCM and LAC appear to be approaching natural background levels at most of the MANE-VU Class I areas.
- The percent contribution of nitrate light extinction has been significantly increasing at some of the MANE-VU Class I areas not just due to lower sulfate contributions but due to more winter days and fewer summer days in the mix of 20% most impaired days.

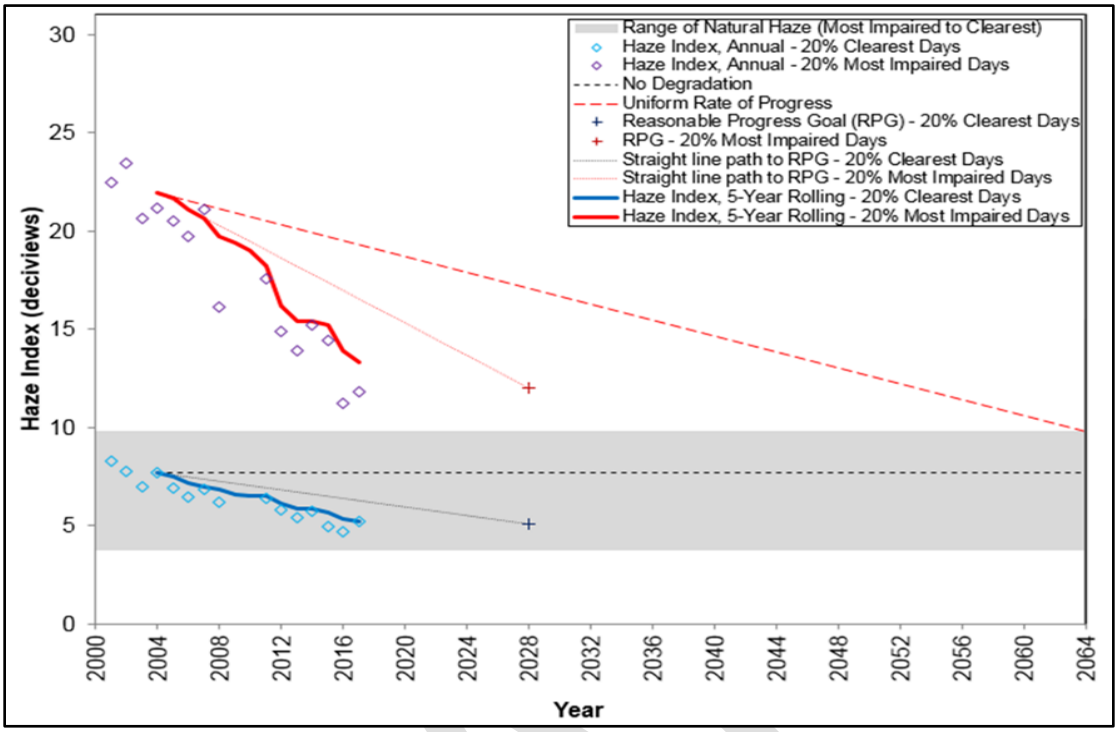
Visibility metrics for Federal Class I areas in and adjacent to MANE-VU are given in Table 5-1. For the Great Gulf Wilderness, these metrics are presented graphically in Figure 5-2. As shown, visibility trends for the 20% most impaired days are well below the uniform rate of progress line as an annual average as well a five-year rolling average.

Table 5-1: Baseline, Current and Reasonable Progress Goal Haze Index Levels for Federal Class I Areas In or Adjacent to the MANE-VU Region

			LEAST IMPAIRED DAYS			MOST IMPAIRED DAYS				
Federal Class I Area	IMPROVE SITE DATA CODE(S)	State	Baseline (2000-04) (dv)	Current (2013-17) (dv)	RPG (2028) (dv)	Baseline (2000-04) (dv)	Current (2013-17) (dv)	URP* 2028 (dv/yr)	URP* 2028 (dv)	RPG (2028) (dv)
Acadia National Park	ACAD	ME	8.78	6.52	6.33[c] 6.33[d]	22.01	14.89	0.194	17.36	13.35[c] 13.44[d]
Moosehorn Wilderness Area Roosevelt Campobello International Park	MOOS	ME NB	9.16	6.59	6.45[c] 6.46[d]	20.66	13.54	0.178	16.38	13.12[c] 13.20[d]
Great Gulf Wilderness Area Presidential Range/Dry River Wilderness Area	GRGU	NH	7.51	5.20	5.06[c] 5.11[d]	21.64	13.31	0.198	16.90	12.00[c] 12.13[d]
Lye Brook Wilderness Area	LYBR_ LYEB	VT	6.37	5.15	3.86[c] 3.90[d]	23.57	15.30	0.222	18.23	13.68[c] 13.89[d]
Brigantine Wilderness Area	BRIG	NJ	14.33	11.48	10.47[c] 10.55[d]	27.43	19.86	0.279	20.74	17.97[c] 18.16[d]
Dolly Sods Wilderness Area† Otter Creek Wilderness Area†	DOSO	WV	12.28	7.29	7.27[c] 7.33[d]	28.29	17.95	0.323	20.54	15.09[c] 15.30[d]
James River Face Area†	JARI	VA	14.21	9.69	9.36[c] 9.45[d]	28.08	18.15	0.315	20.83	15.31[c] 15.48[d]
Shenandoah National Park†	SHEN	VA	10.93	7.14	6.83[c] 7.00[d]	28.32	17.78	0.313	20.80	14.25[c] 14.54[d]

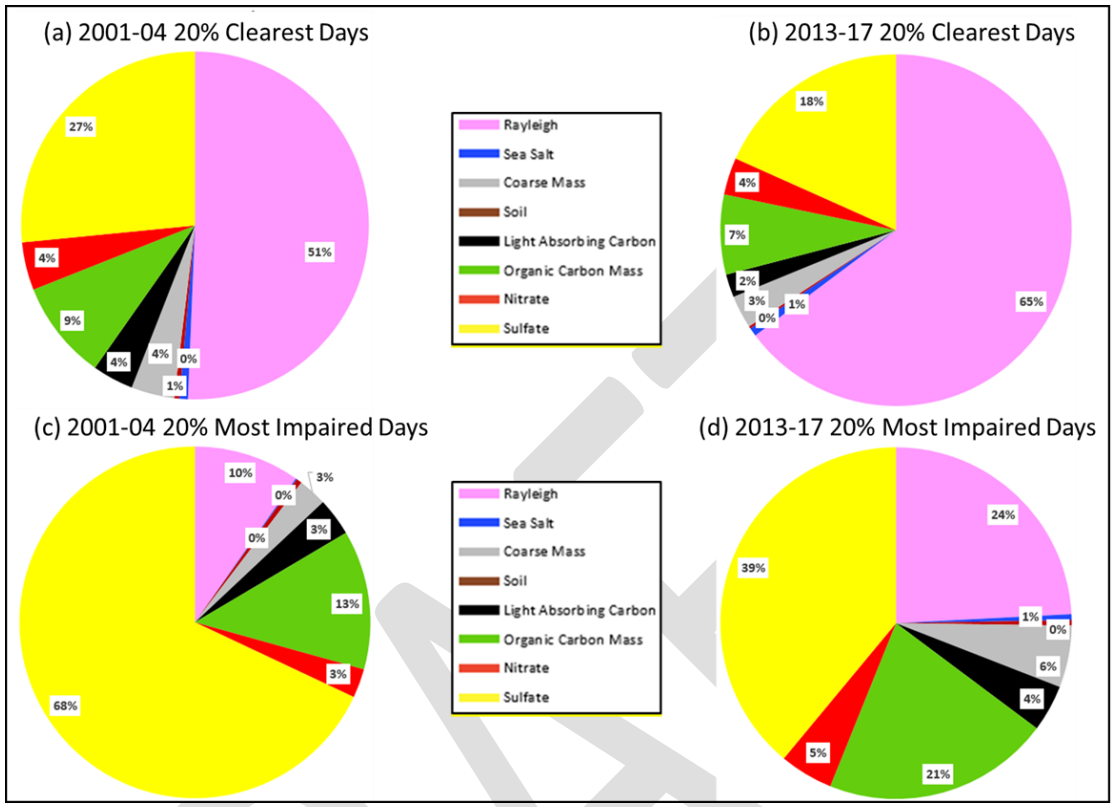
† Federal *Class I area adjacent to the MANE-VU region;*
* *Uniform Rate of Progress;*
[c] *Modeled Reasonable Progress Goal with MANE-VU Ask Measures (MANE-VU 2018a)*
[d] *Modeled Reasonable Progress Goal without MANE-VU Ask Measures (MANE-VU 2018a)*

Figure 5-2: Visibility Metrics Levels at New Hampshire's Federal Class I Areas



Analyses of visibility by species help policy decision makers determine what control strategies to consider for the second regional haze implementation planning period. The plot shown in Figure 5-3 below shows 5-year baseline period vs. 5-year current period species average percent contributions for both 20% clearest and 20% most impaired days. Results clearly show a significant reduction in sulfate contributions to New Hampshire's Federal Class I areas for the 20% most impaired days with varying levels of increases, or no change, for other species. The percent contribution from nitrates has, similar to other Federal Class I areas examined for this report, increased, here from 3% to 5%.

Figure 5-3: Great Gulf/Presidential-Dry RIver Wilderness Areas Species Percent Contribution to Baseline (2001-04) and Current (2013-17) Haze Index Levels



5.4 Analysis of Change in Emissions of Pollutants Contributing to Visibility Impairment 51.308(g)(4)

5.4.1 Introduction

This section is intended to satisfy paragraph 40 CFR 51.308(g)(4) of the Regional Haze Program Requirements. Paragraph 51.308(g)(4) requires:

> "An analysis tracking the change over the period since the period addressed in the most recent plan[77] required under paragraph (f)[78] of this section in emissions of pollutants contributing to visibility impairment[79] from all sources and activities within the State[80]. Emissions changes should be identified by type of source or activity. With respect to all sources and activities, the analysis must extend at least through the most recent year for which the state[81] has submitted emission inventory information to the Administrator[82] in

[77] https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=b06c8bf6554e683d375550ef09b0b0fe&term_occur=23&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[78] https://www.law.cornell.edu/cfr/text/40/51.308#f

[79] …..https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=097517b3459f413f75cec753ee24cbcf&term_occur=24&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[80] …..https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=9176e3156bcde856373399c3213708de&term_occur=198&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[81] …..https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=9176e3156bcde856373399c3213708de&term_occur=197&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[82] https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=55bf4cda446928de237f4bfbd3db8

> compliance with the triennial reporting requirements[83] of subpart A of this part as of a date 6 months preceding the required date of the progress report… The State[84] is not required to backcast previously reported emissions to be consistent with more recent emissions estimation procedures, and may draw attention to actual or possible inconsistencies created by changes in estimation procedures."

To this end, New Hampshire has provided a summary of emissions of visibility impairing pollutants from all sources and activities within the state for the period from 2002 to 2014. 2014 is the most recent year for which New Hampshire has submitted emissions estimates to fulfill the requirements of 40 CFR 51 Subpart A – Air Emissions Reporting Requirements. In this summary, New Hampshire has provided estimates for NOx, PM_{10}, $PM_{2.5}$, SO_2, VOC, and NH_3, all of which have the potential to contribute to regional haze formation. The data were obtained from EPA's NEI.[85] Data categories include point sources, nonpoint sources, nonroad mobile sources, and onroad mobile sources. A brief description of each of these categories is provided below:

- NEI Point sources are discrete facilities that generally report their emissions directly via state and/or Federal permitting and reporting programs. Point sources usually represent larger facilities such as EGUs, factories, and heating plants for large schools and universities. In the tables and charts that follow, point source NOx and SO_2 are further broken down into AMPD sources and non-AMPD sources. The majority of sources that report to one or more of EPA's AMPD programs are EGUs. Therefore, the AMPD point category is a reasonable representation of emissions from EGUs.
- NEI Nonpoint sources are those emissions categories that are too small, widespread, or numerous to be inventoried individually. Therefore, emissions are estimated for these categories using aggregate activity data such as population, employment, and statewide fuel use (after accounting for the fuel used by point sources). There is a wide range of nonpoint categories, but examples include residential fuel combustion and commercial & consumer solvent use. As of 2008, the EPA includes emissions from the mobile source nonroad categories for commercial marine vessels and underway rail emissions in the nonpoint NEI. Prior to 2011, EPA included vehicle refueling at gasoline service stations in the area sector and beginning with 2011 it was included in the onroad sector.
- NEI Nonroad mobile sources represent vehicles and equipment that are not designed to operate on roadways. Examples include aircraft, ships, locomotives, construction equipment, recreational vehicles, and lawn & garden equipment (note, however, that emissions from airports and some large rail yards are inventoried as point sources since these emissions occur at discrete locations). As discussed above, beginning in 2008 the NEI emissions from airports and railroad switchyards are inventoried as point sources and emissions from other railroad activities and commercial marine vessels are inventoried as nonpoint sources.

b0a&term_occur=23&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[83]….https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=1a356b45e7e7c25adc7e65073a84312b&term_occur=3&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[84]….https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=9176e3156bcde856373399c3213708de&term_occur=200&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308

[85] EPA EIS Gateway: https://www.epa.gov/air-emissions-inventories/emissions-inventory-system-eis-gateway.

- NEI On-road mobile sources represent vehicles that operate on roadways, including cars, trucks, buses, and motorcycles. Emissions were calculated with the EPA model (MOVES) in 2007, 2011 and 2017, which was different from the model used for the 2002 inventory (MOBILE6). As of 2011, NEI v2, EPA includes vehicle refueling at gasoline service stations in the onroad sector instead of the area or nonpoint sector.

The summary data were taken from EPA's NEI. Under the AERR, states are required to submit estimates for all emissions categories to EPA on a three-year cycle. The state submittals are combined with EPA's own estimates to form the NEI. Note that 2005 was a limited effort NEI, so that year is not shown. A brief discussion of the trends in emissions, based on the EPA NEI grouping, is provided in the section for each pollutant. Inconsistencies due to changes in estimation procedures and grouping are also pointed out, where applicable.

Paragraph 51.308(g)(4) also states, "With respect to sources that report directly to a centralized emissions data system operated by the Administrator[86], the analysis must extend through the most recent year for which the Administrator[87] has provided a State[88]-level summary of such reported data or an internet-based tool by which the State[89] may obtain such a summary as of a date 6 months preceding the required date of the progress report." Therefore, New Hampshire has also provided a summary of NOx and SO_2 emissions for AMPD sources for the years 2016 and 2017.

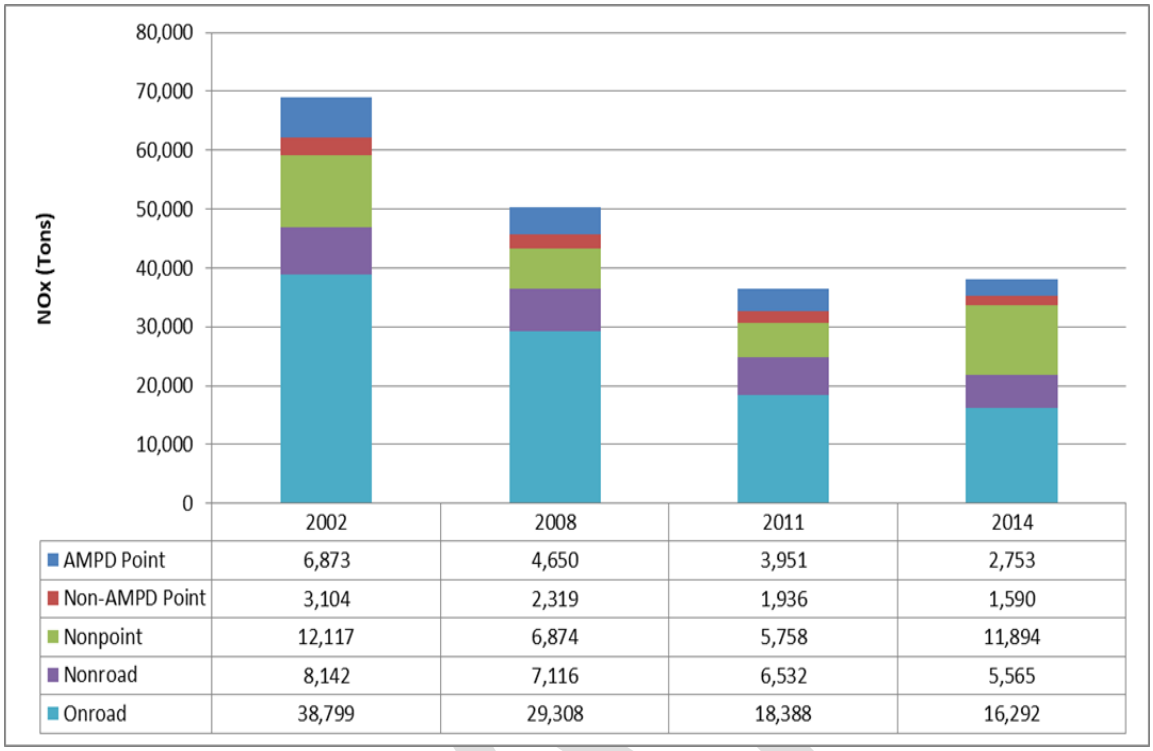
In addition to the New Hampshire-specific data, 2002 – 2014 summaries of emissions from all sectors, as well as summaries of 2016 and 2017 NOx and SO_2 emissions for AMPD sources are provided for all the MANE-VU states, including CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, and VT. Similar summaries are also shown for the states listed in the MANE-VU Inter-RPO Ask[90] as having the potential to contribute to visibility impairment in MANE-VU Class I areas. These states include AL, FL, IL, IN, KY, LA, MI, MO, OH, TN, TX, VA, and WV. This group of states is referred to hereinafter as the "Ask states."

5.4.2 Nitrogen Oxides

Figure 5-4 shows a summary of NOx emissions from all data categories – point, nonpoint, non-road, and on-road – for the period from 2002 to 2014 in New Hampshire.

[86]….https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=55bf4cda446928de237f4bfbd3db8b0a&term_occur=25&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308
[87]….https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=55bf4cda446928de237f4bfbd3db8b0a&term_occur=24&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308
[88]….https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=9176e3156bcde856373399c3213708de&term_occur=201&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308
[89]….https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=9176e3156bcde856373399c3213708de&term_occur=199&term_src=Title:40:Chapter:I:Subchapter:C:Part:51:Subpart:P:51.308
[90] Statement of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress: Appendix O.

Figure 5-4: NOx Emissions in New Hampshire for all Data Categories, 2002 – 2014 (tpy)



	2002	2008	2011	2014
AMPD Point	6,873	4,650	3,951	2,753
Non-AMPD Point	3,104	2,319	1,936	1,590
Nonpoint	12,117	6,874	5,758	11,894
Nonroad	8,142	7,116	6,532	5,565
Onroad	38,799	29,308	18,388	16,292

NOx emissions have shown a steady decline in New Hampshire over the period from 2002 to 2014, particularly in the non-road and on-road mobile sectors. Reductions in non-road emissions are due to a wide range of Federal rules to reduce emissions from non-road vehicles and equipment. A few examples of regulatory programs that have reduced, and/or will continue to reduce, emissions from non-road vehicles and equipment include Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel[91], Control of Emissions from Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters Per Cylinder[92], and Control of Emissions from Nonroad Spark-Ignition Engines and Equipment[93]. On-road mobile emissions reductions are due in part to Federal requirements for on-road vehicles such as the Tier 2 motor vehicle emissions standards[94]. Federal requirements for on-road mobile sources and fuels are being strengthened even further with the Tier 3 requirements[95]. More information on programs to control emissions from mobile sources can be found on EPA's Transportation, Air Pollution, and Climate Change website[96]. For both non-road and on-road mobile sources, NOx emissions are expected to continue to decrease as fleets turn over and older more

91 40 CFR Parts 9, 69, et al. Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel; Final Rule: https://www.gpo.gov/fdsys/pkg/FR-2004-06-29/pdf/04-11293.pdf.

92 40 CFR Parts 9, 85, et al. Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder; Republication; Final Rule: https://www.gpo.gov/fdsys/pkg/FR-2008-06-30/pdf/R8-7999.pdf.

93 40 CFR Parts 9, 60, 80 et al. Control of Emissions From Nonroad Spark-Ignition Engines and Equipment; Final Rule: https://www.gpo.gov/fdsys/pkg/FR-2008-10-08/pdf/E8-21093.pdf.

94 40 CFR Parts 80, 85, and 86 Control of Air Pollution From New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements; Final Rule: https://www.gpo.gov/fdsys/pkg/FR-2000-02-10/pdf/00-19.pdf.

95 40 CFR Parts 79, 80, 85, et al. Control of Air Pollution From Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards; Final Rule: https://www.gpo.gov/fdsys/pkg/FR-2014-04-28/pdf/2014-06954.pdf.

96 EPA Transportation, Air Pollution, and Climate Change: https://www.epa.gov/air-pollution-transportation.

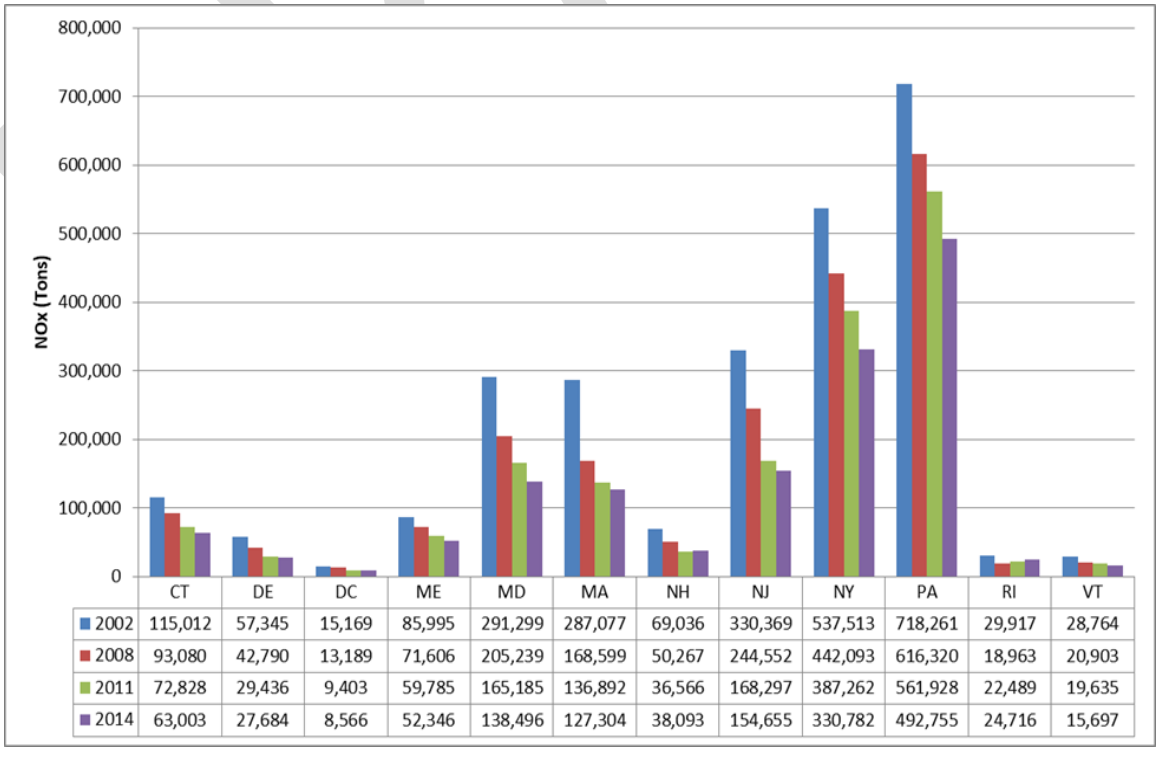
polluting vehicles and equipment are replaced by newer, cleaner ones.

It should be noted that the increase in nonpoint NOx between 2011 and 2014 is artificial. For the 2011 and previous inventories, New Hampshire estimated and reported industrial and commercial distillate oil combustion emissions under a composite SCC for boilers and IC engines using a single emission factor for boilers. However, there has been a recent focus on NOx emissions from IC engines. Therefore, for the 2014 inventory, New Hampshire estimated and reported nonpoint industrial and commercial distillate oil emissions for boilers and IC engines separately using specific emission factors for boilers and IC engines. Since the NOx emission factor for IC engines is significantly higher than that for boilers, it created the artificial increase that can be seen for nonpoint NOx emissions in New Hampshire when comparing 2014 to previous inventories. In addition, because of a revised point source subtraction methodology, the sharp decrease in nonpoint NOx between 2002 and 2008/2011 is also artificial.

Source of NOx emissions in New Hampshire that report to the EPA's AMPD showed a decline in emissions from 2016 to 2017 (1,326 tons in 2016 and 1,070 tons in 2017). These are compared to the AMPD reporting sources in the MANE-VU states in Figure 5-4. AMPD NOx emissions have also declined relative to the 2002 to 2014 data shown in Figure 5-1.

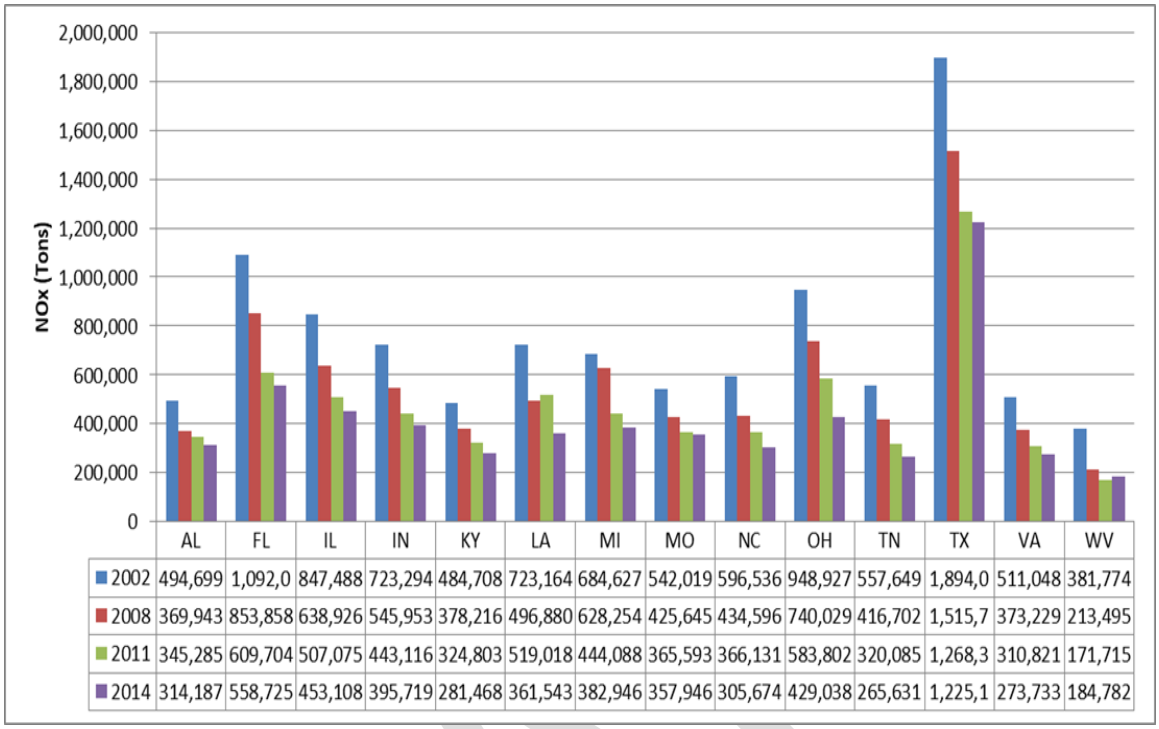
Similar to New Hampshire, Figures 5-5 and 5-6 show a steady decline in NOx emissions from 2002 to 2014 for almost all of the MANE-VU states and the Ask states (average of 42 and 45 percent, respectively). Much of this decline in NOx emissions is due to the Federal control programs for non-road and on-road mobile sources described earlier. Other sources of NOx emissions reductions include individual states' rules for NOx RACT.

Figure 5-5: Total NOx Emissions in the MANE-VU States from all Data Categories, 2002 – 2014 (tpy)



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002	115,012	57,345	15,169	85,995	291,299	287,077	69,036	330,369	537,513	718,261	29,917	28,764
2008	93,080	42,790	13,189	71,606	205,239	168,599	50,267	244,552	442,093	616,320	18,963	20,903
2011	72,828	29,436	9,403	59,785	165,185	136,892	36,566	168,297	387,262	561,928	22,489	19,635
2014	63,003	27,684	8,566	52,346	138,496	127,304	38,093	154,655	330,782	492,755	24,716	15,697

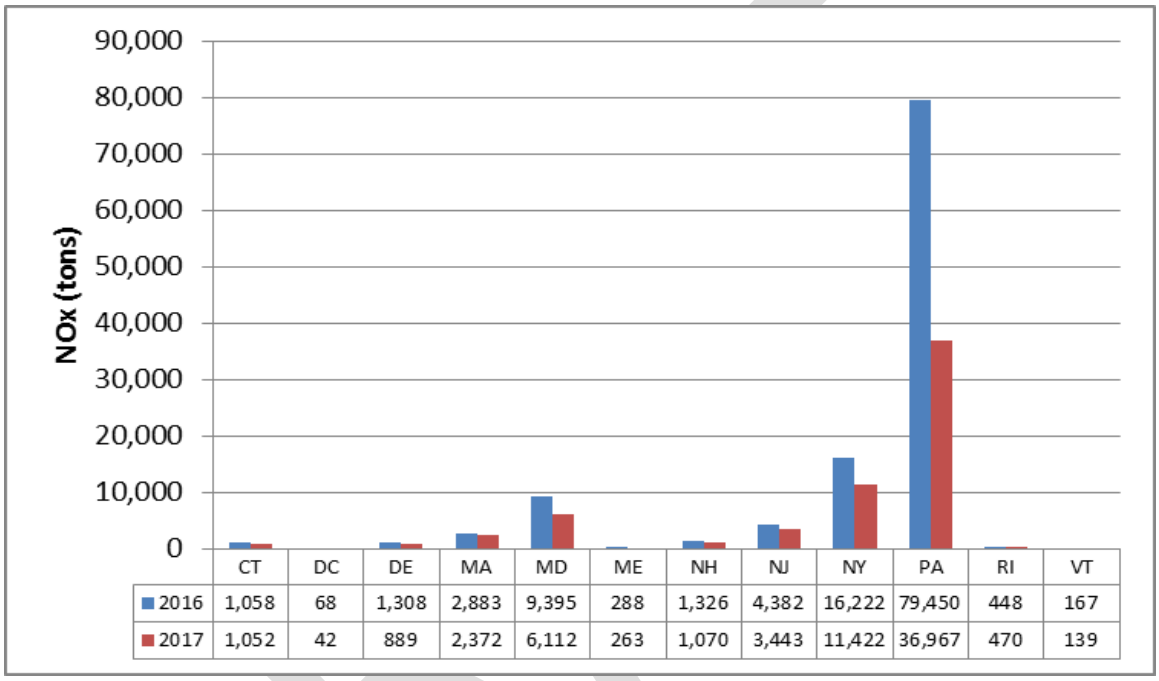
Figure 5-6: Total NOx Emissions in the Ask States from all Data Categories, 2002 – 2014 (tpy)



	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2002	494,699	1,092,0	847,488	723,294	484,708	723,164	684,627	542,019	596,536	948,927	557,649	1,894,0	511,048	381,774
2008	369,943	853,858	638,926	545,953	378,216	496,880	628,254	425,645	434,596	740,029	416,702	1,515,7	373,229	213,495
2011	345,285	609,704	507,075	443,116	324,803	519,018	444,088	365,593	366,131	583,802	320,085	1,268,3	310,821	171,715
2014	314,187	558,725	453,108	395,719	281,468	361,543	382,946	357,946	305,674	429,038	265,631	1,225,1	273,733	184,782

AMPD NOx data for 2016 and 2017 from the MANE-VU states and for the Ask states is shown below in Figures 5-7 and 5-8, and indicates decreases in NOx emissions in both groups of states. For applicable states, some of the reduction in AMPD NOx since 2002 is attributable to the NOx Budget Trading Program[97] under the NOx SIP Call and CAIR[98] (replaced by CSAPR). Other reductions are attributable to source retirements and fuel switching due to the availability of less expensive natural gas in recent years.

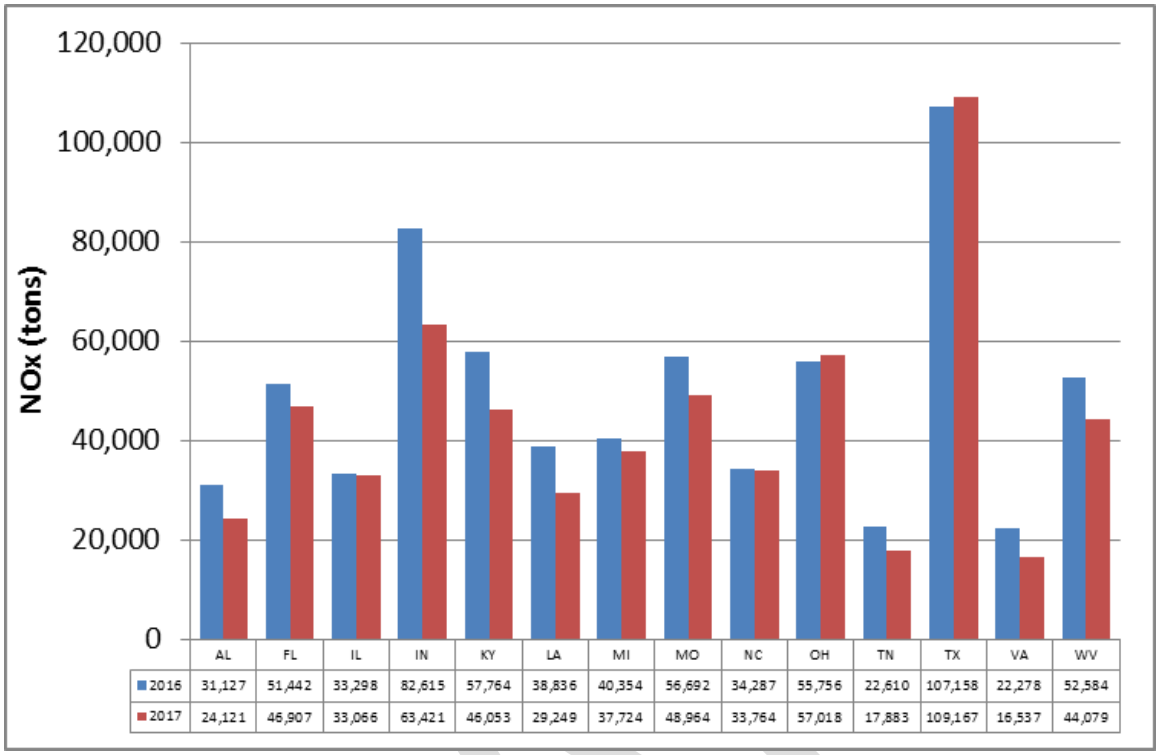
Figure 5-7: MANE-VU State NOx Emissions from Air Markets Program Division Sources, 2016–2017 (tpy)



	CT	DC	DE	MA	MD	ME	NH	NJ	NY	PA	RI	VT
2016	1,058	68	1,308	2,883	9,395	288	1,326	4,382	16,222	79,450	448	167
2017	1,052	42	889	2,372	6,112	263	1,070	3,443	11,422	36,967	470	139

97 EPA NOx Budget Trading Program: https://www.epa.gov/airmarkets/nox-budget-trading-program.
98 EPA Clean Air Interstate Rule: https://archive.epa.gov/airmarkets/programs/cair/web/html/index.html.

Figure 5-8: Ask State NOx Emissions from Air Markets Program Division Sources, 2016–2017 (tpy)

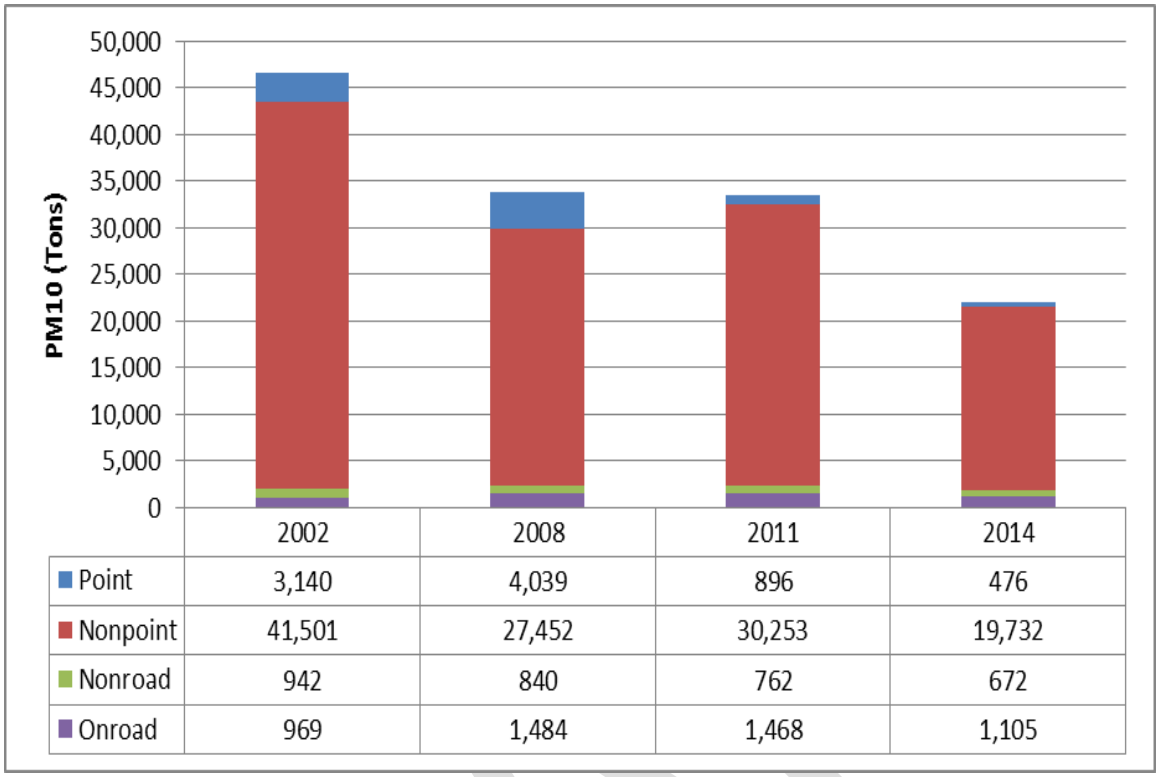


	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2016	31,127	51,442	33,298	82,615	57,764	38,836	40,354	56,692	34,287	55,756	22,610	107,158	22,278	52,584
2017	24,121	46,907	33,066	63,421	46,053	29,249	37,724	48,964	33,764	57,018	17,883	109,167	16,537	44,079

5.4.3 Particulate Matter Less Than 10 Microns

Figure 5-9 shows a summary of PM_{10} emissions from all data categories – point, nonpoint, non-road, and on-road – for the period from 2002 to 2014 in New Hampshire. Generally, PM_{10} emissions have remained constant in New Hampshire, particularly between 2008 and 2014. It should be noted that the sharp decrease in point source PM_{10} emissions between the 2002/2008 inventories and the 2011/2014 inventories is impacted by the fact that a large point source in New Hampshire mistakenly reported its PM_{10} emissions in pounds instead of tons.

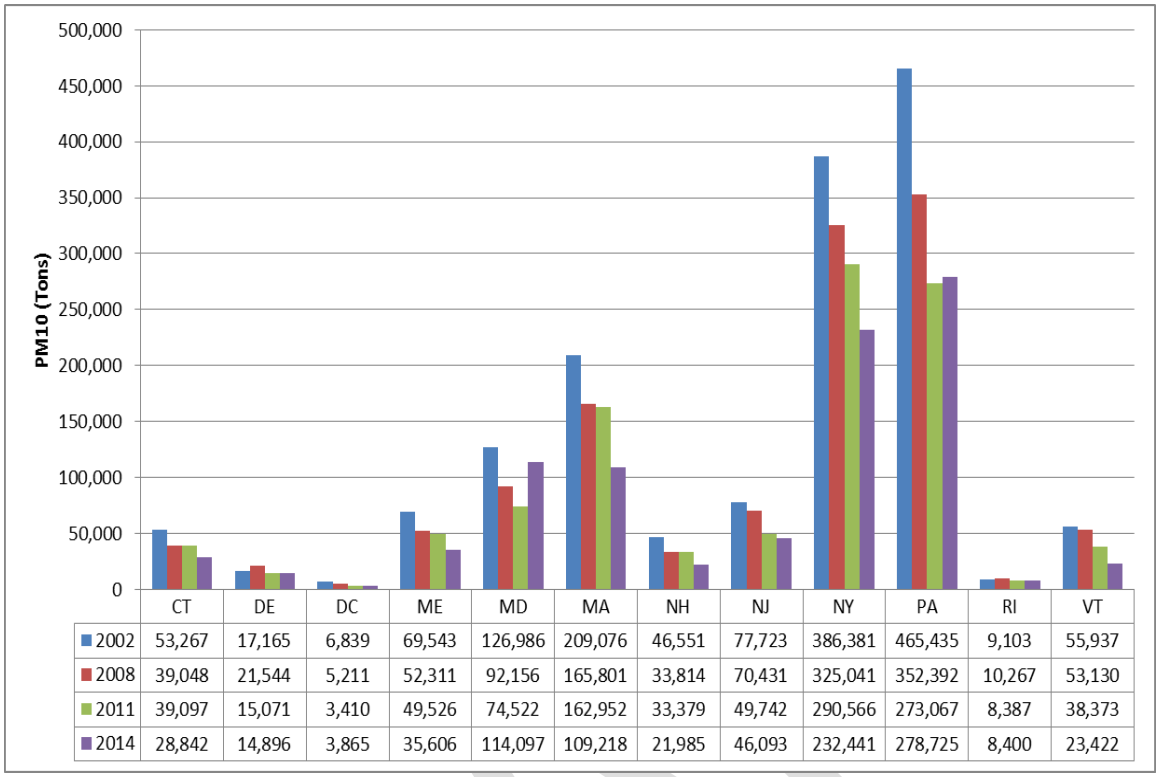
Figure 5-9: PM_{10} Emissions in New Hampshire for all Data Categories, 2002 – 2014 (tpy)



	2002	2008	2011	2014
Point	3,140	4,039	896	476
Nonpoint	41,501	27,452	30,253	19,732
Nonroad	942	840	762	672
Onroad	969	1,484	1,468	1,105

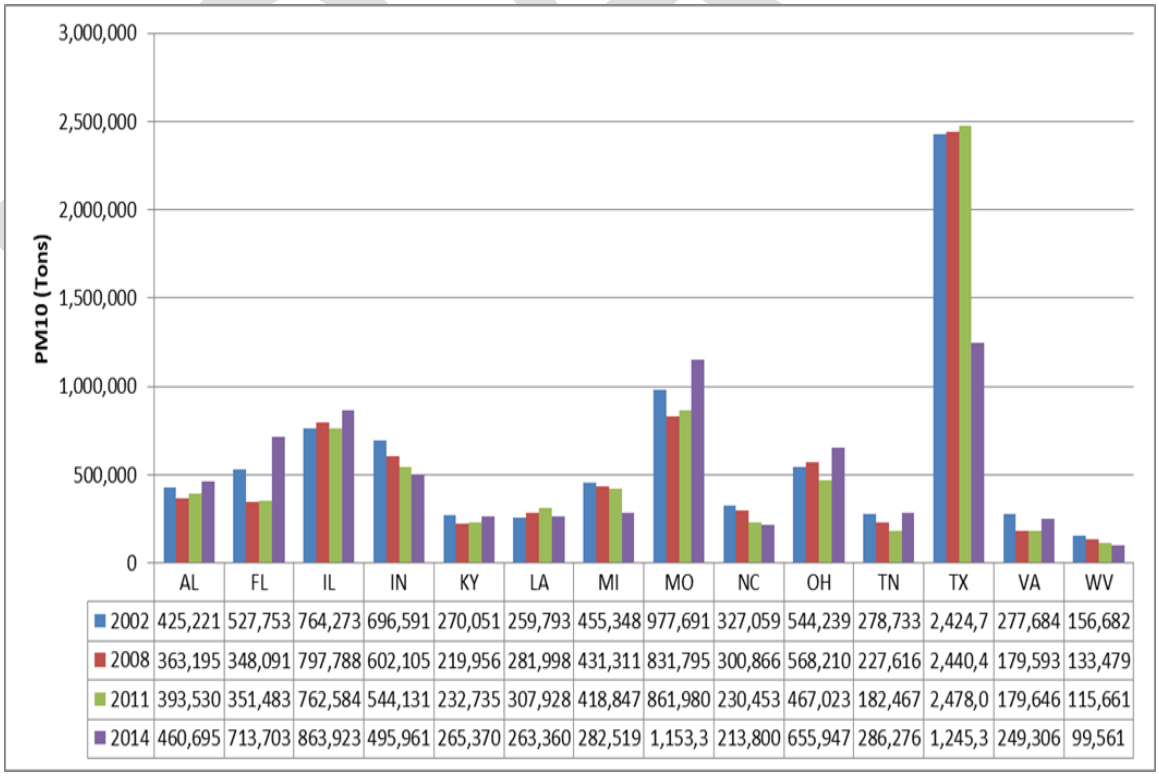
Figure 5-10 shows total PM_{10} emissions from all data categories in the MANE-VU states, Figure 5-11 from the Ask states. PM_{10} emissions in the MANE-VU and Ask states show no particular pattern over the 2002 to 2014 period. Some of the large declines in PM_{10} emissions from 2002 to subsequent years, as well as some of the increases in 2014, could be due to changes in estimation methodologies for categories such as yard waste burning, paved and unpaved road dust, and residential wood combustion.

Figure 5-10: Total PM_{10} Emissions in the MANE-VU States from all Data Categories, 2002 – 2014 (tpy)



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002	53,267	17,165	6,839	69,543	126,986	209,076	46,551	77,723	386,381	465,435	9,103	55,937
2008	39,048	21,544	5,211	52,311	92,156	165,801	33,814	70,431	325,041	352,392	10,267	53,130
2011	39,097	15,071	3,410	49,526	74,522	162,952	33,379	49,742	290,566	273,067	8,387	38,373
2014	28,842	14,896	3,865	35,606	114,097	109,218	21,985	46,093	232,441	278,725	8,400	23,422

Figure 5-11: Total PM_{10} Emissions in the Ask States from all Data Categories, 2002 – 2014 (tpy)

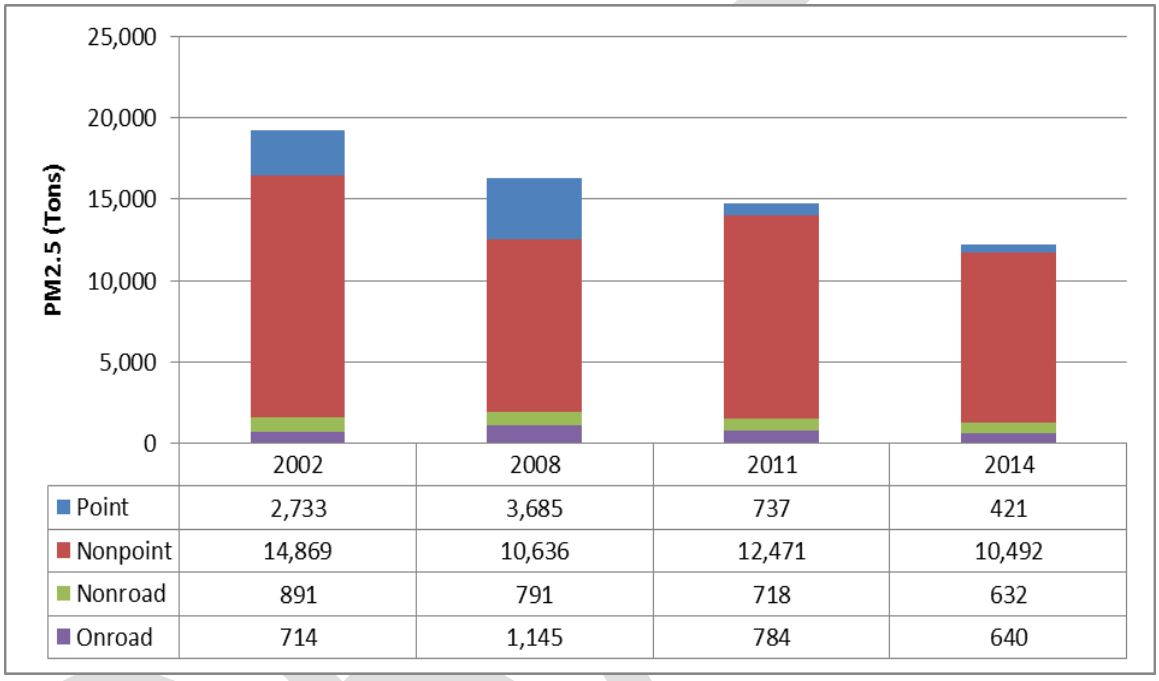


	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2002	425,221	527,753	764,273	696,591	270,051	259,793	455,348	977,691	327,059	544,239	278,733	2,424,7	277,684	156,682
2008	363,195	348,091	797,788	602,105	219,956	281,998	431,311	831,795	300,866	568,210	227,616	2,440,4	179,593	133,479
2011	393,530	351,483	762,584	544,131	232,735	307,928	418,847	861,980	230,453	467,023	182,467	2,478,0	179,646	115,661
2014	460,695	713,703	863,923	495,961	265,370	263,360	282,519	1,153,3	213,800	655,947	286,276	1,245,3	249,306	99,561

5.4.4 Particulate Matter Less Than 2.5 Microns

Figure 5-12 shows a summary of $PM_{2.5}$ emissions from all data categories for the period from 2002 to 2014 in New Hampshire. Similar to PM_{10}, $PM_{2.5}$ emissions have remained constant in New Hampshire, particularly between 2008 and 2014. As with PM_{10}, it should be noted that the sharp decrease in point source $PM_{2.5}$ emissions between the 2002/2008 inventories and the 2011/2014 inventories is artificial. For the 2008 and earlier inventories, a large point source in New Hampshire mistakenly reported its $PM_{2.5}$ emissions in units of pounds rather than tons.

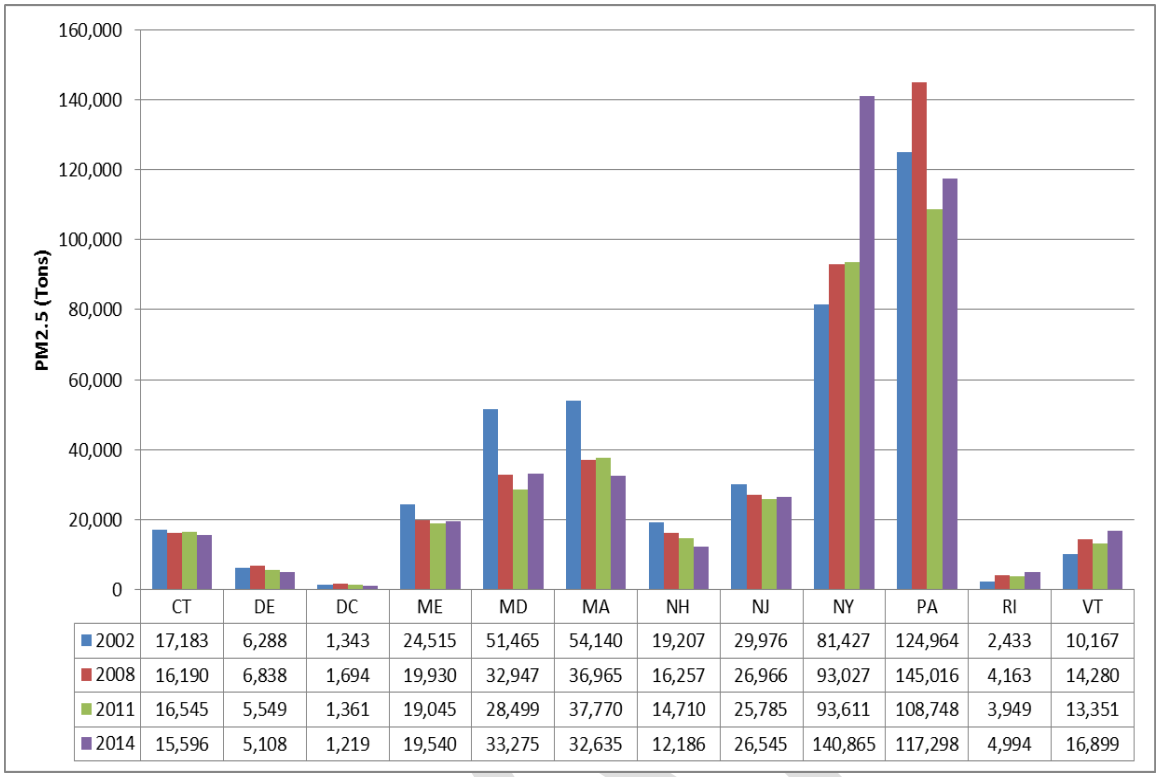
Figure 5-12: $PM_{2.5}$ Emissions in New Hampshire from all Data Categories (tpy)



	2002	2008	2011	2014
Point	2,733	3,685	737	421
Nonpoint	14,869	10,636	12,471	10,492
Nonroad	891	791	718	632
Onroad	714	1,145	784	640

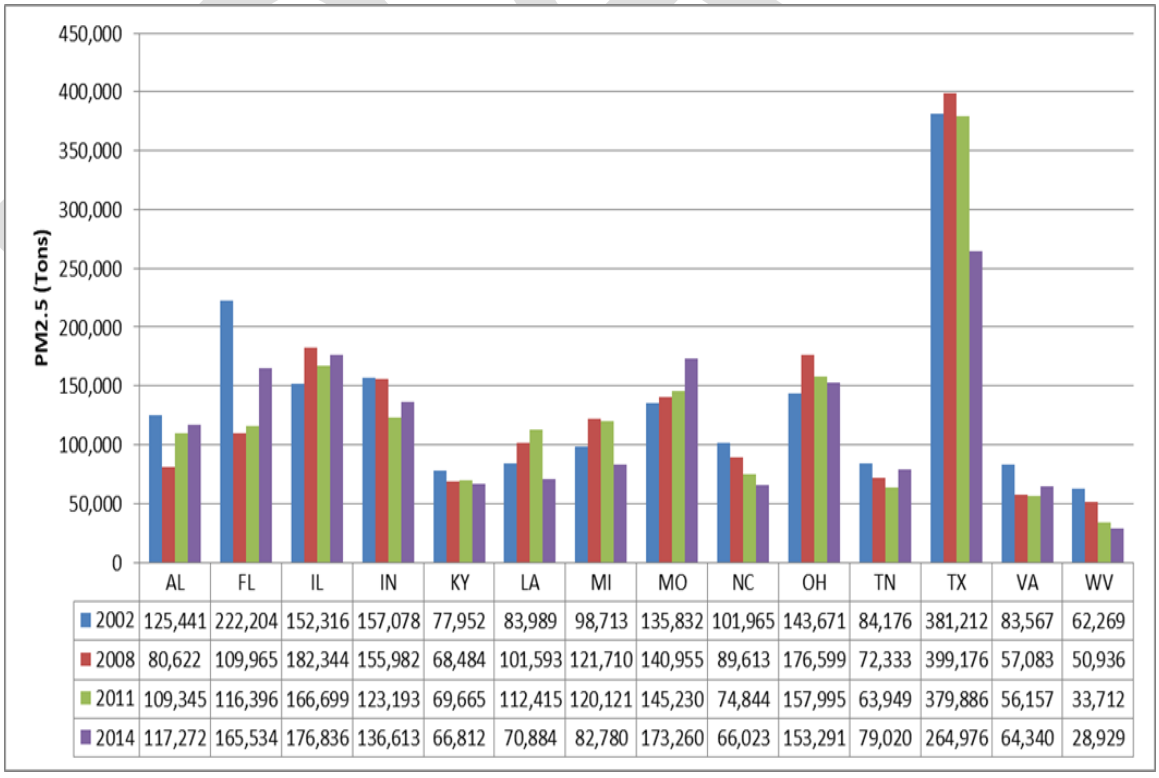
Figures 5-13 and 5-14 below show total $PM_{2.5}$ emissions from all data categories in the MANE-VU and Ask states. These emissions show no particular pattern over the 2002 to 2014 period. In some states, emissions have declined or remained constant; in others, there are increases. As with PM_{10}, some of the large declines in $PM_{2.5}$ emissions from 2002 to subsequent years, as well as some of the increases in 2014, could be due to changes in estimation methodologies for categories such as yard waste burning, paved and unpaved road dust, and residential wood combustion.

Figure 5-13: Total $PM_{2.5}$ Emissions in the MANE-VU States from all Data Categories, 2002 – 2014 (tpy)



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002	17,183	6,288	1,343	24,515	51,465	54,140	19,207	29,976	81,427	124,964	2,433	10,167
2008	16,190	6,838	1,694	19,930	32,947	36,965	16,257	26,966	93,027	145,016	4,163	14,280
2011	16,545	5,549	1,361	19,045	28,499	37,770	14,710	25,785	93,611	108,748	3,949	13,351
2014	15,596	5,108	1,219	19,540	33,275	32,635	12,186	26,545	140,865	117,298	4,994	16,899

Figure 5-14: Total $PM_{2.5}$ Emissions in the Ask States from all Data Categories, 2002 – 2014 (tpy)

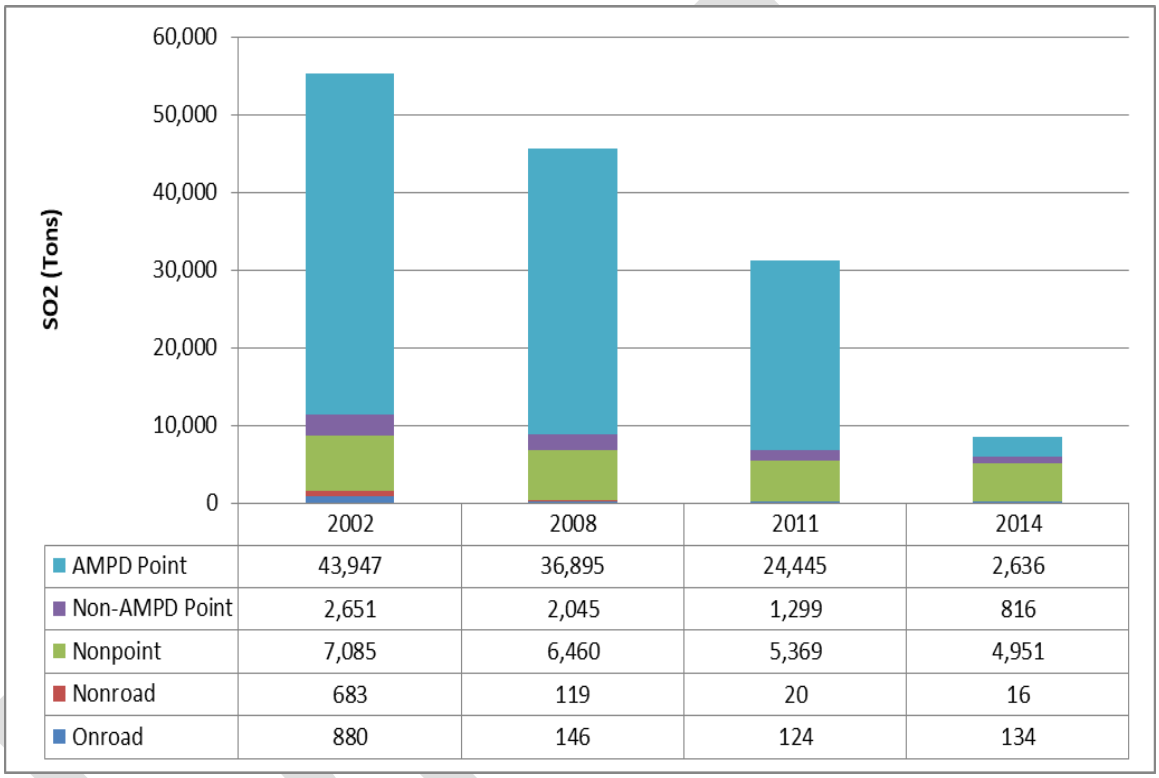


	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2002	125,441	222,204	152,316	157,078	77,952	83,989	98,713	135,832	101,965	143,671	84,176	381,212	83,567	62,269
2008	80,622	109,965	182,344	155,982	68,484	101,593	121,710	140,955	89,613	176,599	72,333	399,176	57,083	50,936
2011	109,345	116,396	166,699	123,193	69,665	112,415	120,121	145,230	74,844	157,995	63,949	379,886	56,157	33,712
2014	117,272	165,534	176,836	136,613	66,812	70,884	82,780	173,260	66,023	153,291	79,020	264,976	64,340	28,929

5.4.5 Sulfur Dioxide

Figure 5-15 shows SO_2 emissions in New Hampshire for all data categories for the period from 2002 to 2014. As shown, there is a marked decrease in AMPD SO_2 emissions for 2014 compared to 2011 and earlier years. This is due to the installation of a scrubber at Granite Shore Power (formerly Eversource Energy) Merrimack Station, a large EGU in New Hampshire. This scrubber became operational at the end of 2011. SO_2 emissions from AMPD sources in New Hampshire also declined in 2016 and 2017 (573 tons in 2016 and 473 tons in 2017). This is a substantial reduction in SO_2 emissions in 2014 as shown in Figure 5-12, even when compared to the sharp decrease in emissions in 2014 from 2011.

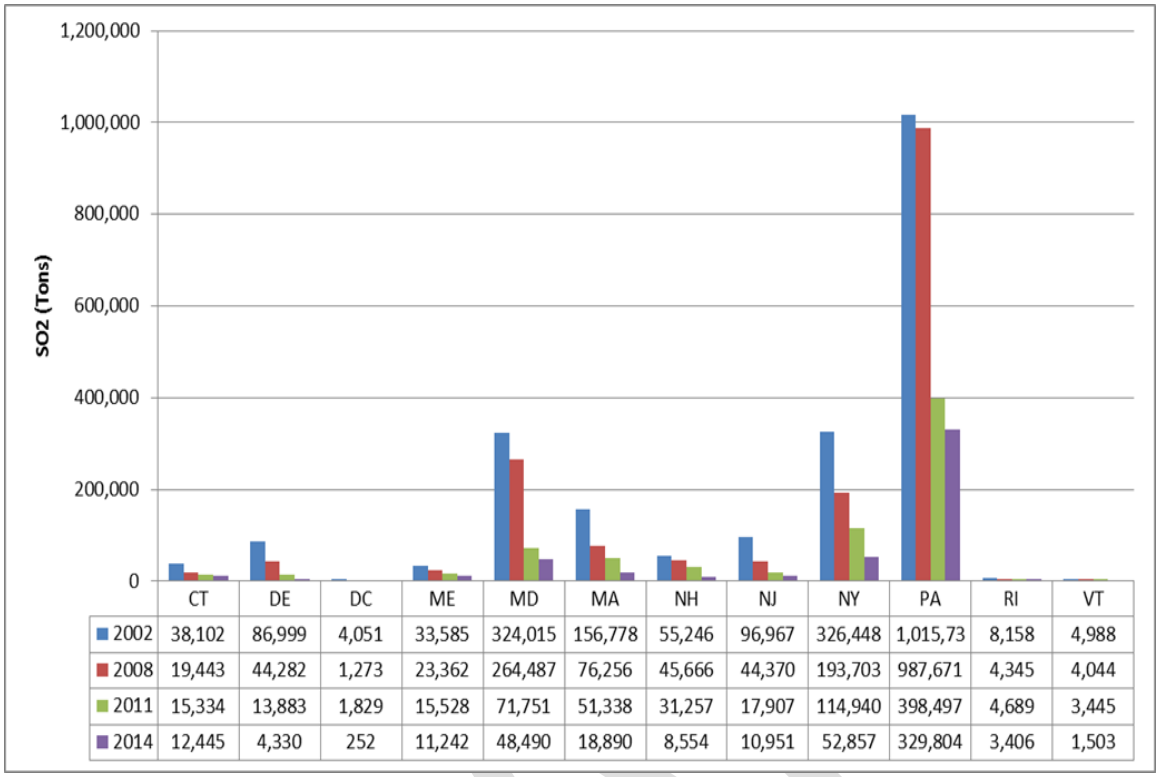
Figure 5-15: SO_2 Emissions in New Hampshire from all Data Categories, 2002 – 2014 (tpy)



	2002	2008	2011	2014
AMPD Point	43,947	36,895	24,445	2,636
Non-AMPD Point	2,651	2,045	1,299	816
Nonpoint	7,085	6,460	5,369	4,951
Nonroad	683	119	20	16
Onroad	880	146	124	134

Figure 5-16 shows total SO_2 emissions from all data categories in the MANE-VU states for 2002 to 2014. A steady decrease in SO_2 emissions can be seen for each MANE-VU state over this period. Some of these decreases are attributable to the low sulfur fuel strategy and the 90% or greater reduction in SO_2 emissions at 167 EGU stacks (both inside and outside of MANE-VU) requested in the MANE-VU "Ask" for states within MANE-VU for the first regional haze planning period. Since some components of the MANE-VU low sulfur fuel strategy have milestones of 2014, 2016 and 2018, and as MANE-VU states continue to adopt rules to implement the strategy, SO_2 emissions reductions are expected to continue well beyond the 2002 to 2014 timeframe shown in Figure 5-13. Other SO_2 emissions decreases are due to source shutdowns and fuel switching due to the availability of less expensive natural gas in recent years.

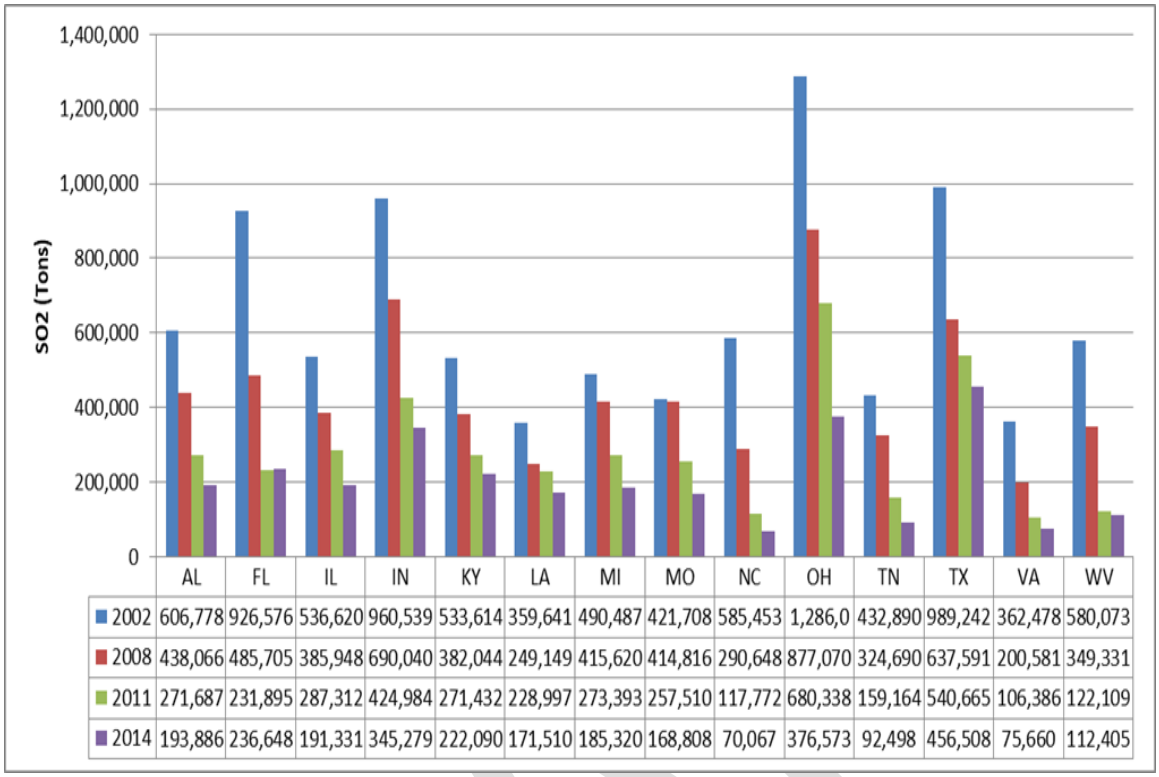
Figure 5-16: Total SO_2 Emissions in the MANE-VU States for all Data Categories, 2002 – 2014 (tpy)



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002	38,102	86,999	4,051	33,585	324,015	156,778	55,246	96,967	326,448	1,015,73	8,158	4,988
2008	19,443	44,282	1,273	23,362	264,487	76,256	45,666	44,370	193,703	987,671	4,345	4,044
2011	15,334	13,883	1,829	15,528	71,751	51,338	31,257	17,907	114,940	398,497	4,689	3,445
2014	12,445	4,330	252	11,242	48,490	18,890	8,554	10,951	52,857	329,804	3,406	1,503

Figure 5-17 shows total SO_2 emissions from all data categories in the Ask states for 2002 to 2014. Similar to the MANE-VU states, decreases in SO_2 can be seen for all the Ask states over this period. Some of these decreases are attributable to the control measures requested in the MANE-VU Ask for states outside of MANE-VU for the first regional haze planning period, including timely implementation of BART requirements and a 90% or greater reduction in SO_2 emissions at 167 stacks inside and outside of MANE-VU.

Figure 5-17: Total SO_2 Emissions in the Ask States for all Data Categories, 2002 – 2014 (tpy)

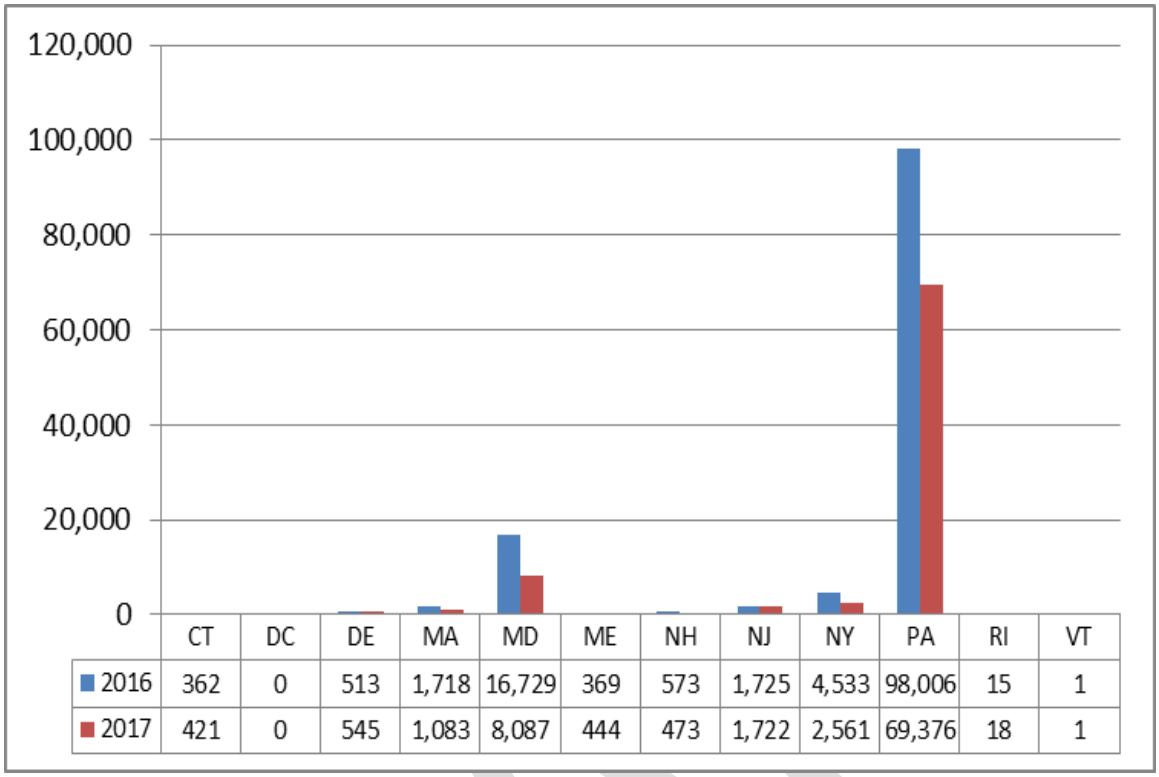


	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2002	606,778	926,576	536,620	960,539	533,614	359,641	490,487	421,708	585,453	1,286,0	432,890	989,242	362,478	580,073
2008	438,066	485,705	385,948	690,040	382,044	249,149	415,620	414,816	290,648	877,070	324,690	637,591	200,581	349,331
2011	271,687	231,895	287,312	424,984	271,432	228,997	273,393	257,510	117,772	680,338	159,164	540,665	106,386	122,109
2014	193,886	236,648	191,331	345,279	222,090	171,510	185,320	168,808	70,067	376,573	92,498	456,508	75,660	112,405

Figure 5-18 and 5-19, respectively, show 2016 and 2017 SO_2 emissions for AMPD sources in the MANE-VU states and in the Ask states. AMPD SO_2 emissions in 2017 are lower than the corresponding 2016 emissions for almost every MANE-VU and Ask state. However, a few MANE-VU and Ask states show slight increases in AMPD SO_2 emissions between 2016 and 2017. Despite the handful of state increases, total AMPD SO_2 emissions for 2017 are well below the corresponding 2016 total for both the MANE-VU states and the Ask states. For applicable states, some of the SO_2 reduction for AMPD sources is attributable to CSAPR[99] (formerly CAIR), which requires NOx and/or SO_2 emissions reductions from EGUs in 27 states in the eastern and central US.

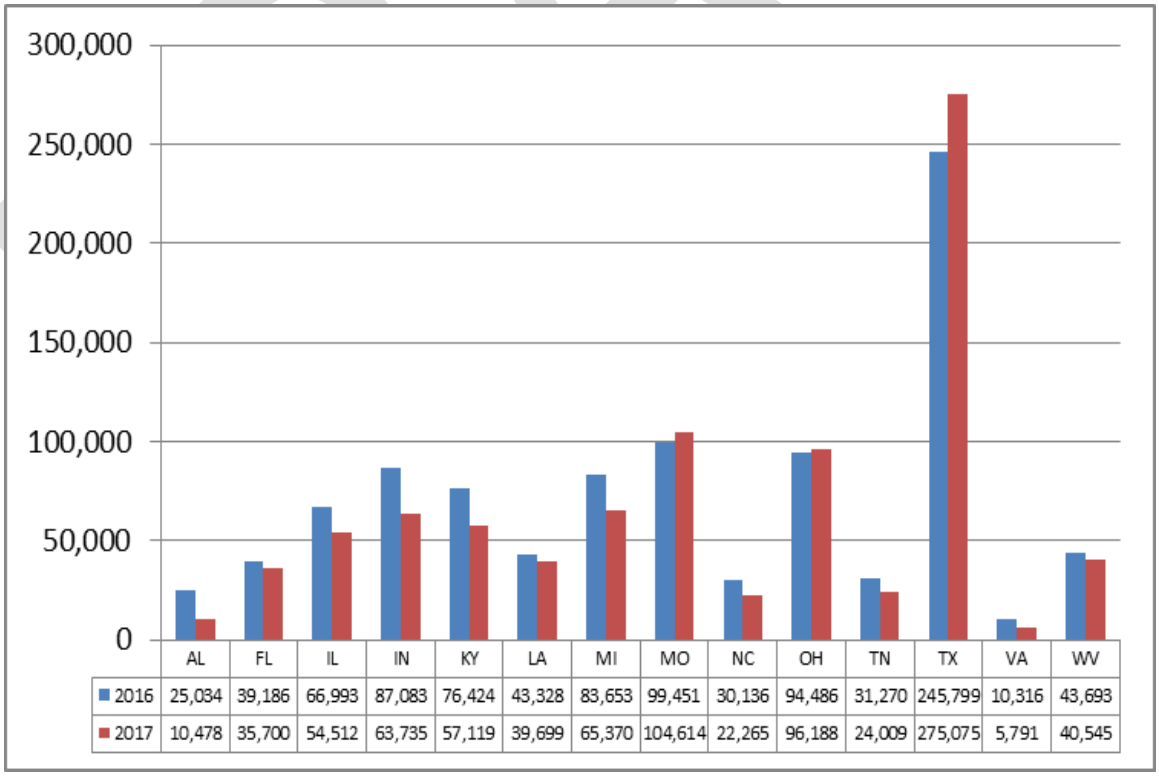
[99] EPA Cross-State Air Pollution Rule: https://www.epa.gov/csapr.

Figure 5-18: MANE-VU State SO_2 Emissions from AMPD Sources, 2016–2017 (tpy)



	CT	DC	DE	MA	MD	ME	NH	NJ	NY	PA	RI	VT
2016	362	0	513	1,718	16,729	369	573	1,725	4,533	98,006	15	1
2017	421	0	545	1,083	8,087	444	473	1,722	2,561	69,376	18	1

Figure 5-19: Ask State SO_2 Emissions from AMPD Sources, 2016–2017 (tpy)

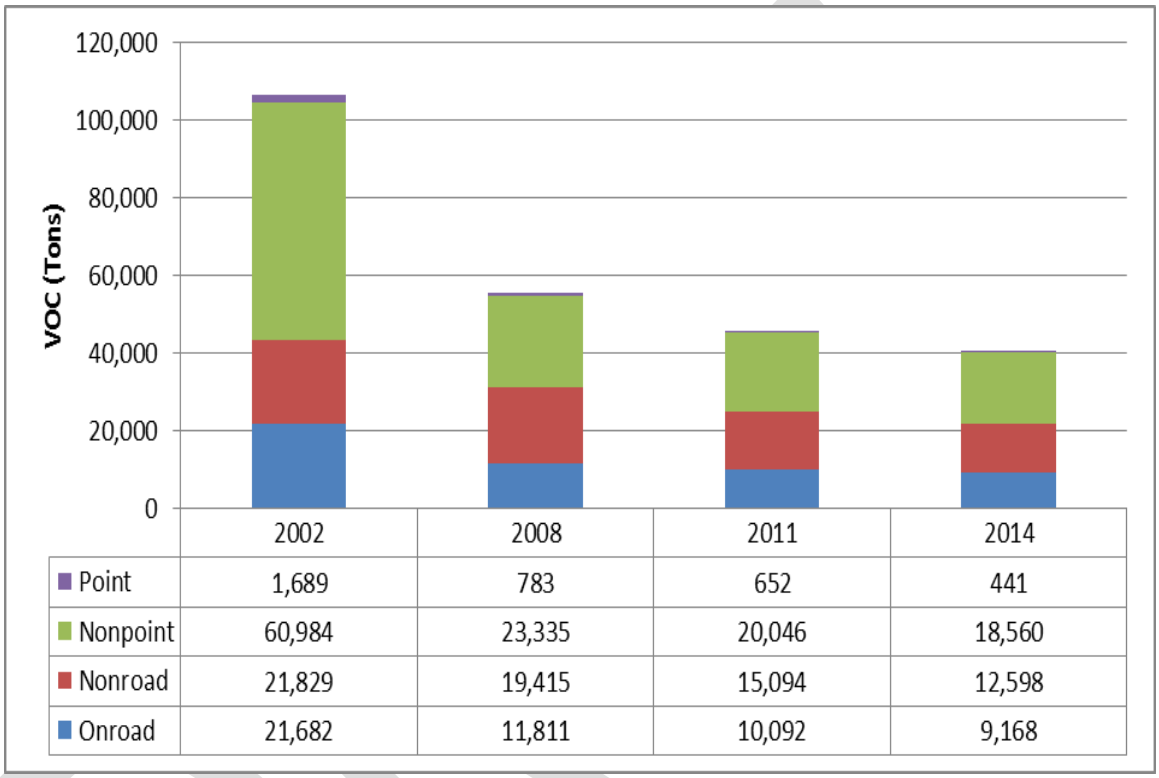


	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2016	25,034	39,186	66,993	87,083	76,424	43,328	83,653	99,451	30,136	94,486	31,270	245,799	10,316	43,693
2017	10,478	35,700	54,512	63,735	57,119	39,699	65,370	104,614	22,265	96,188	24,009	275,075	5,791	40,545

5.4.6 Volatile Organic Compounds

Figure 5-20 shows VOC emissions from all data categories in New Hampshire over the 2002 to 2014 period. In general, VOC emissions have declined during this period. However, the sharp decrease in nonpoint VOC between 2002 and subsequent years is partly due to a revised methodology for residential wood combustion. Therefore, the decrease in nonpoint VOC between 2002 and subsequent years is artificially overstated.

Figure 5-20: VOC Emissions from all Data Categories in New Hampshire, 2002 – 2014 (tpy)



	2002	2008	2011	2014
Point	1,689	783	652	441
Nonpoint	60,984	23,335	20,046	18,560
Nonroad	21,829	19,415	15,094	12,598
Onroad	21,682	11,811	10,092	9,168

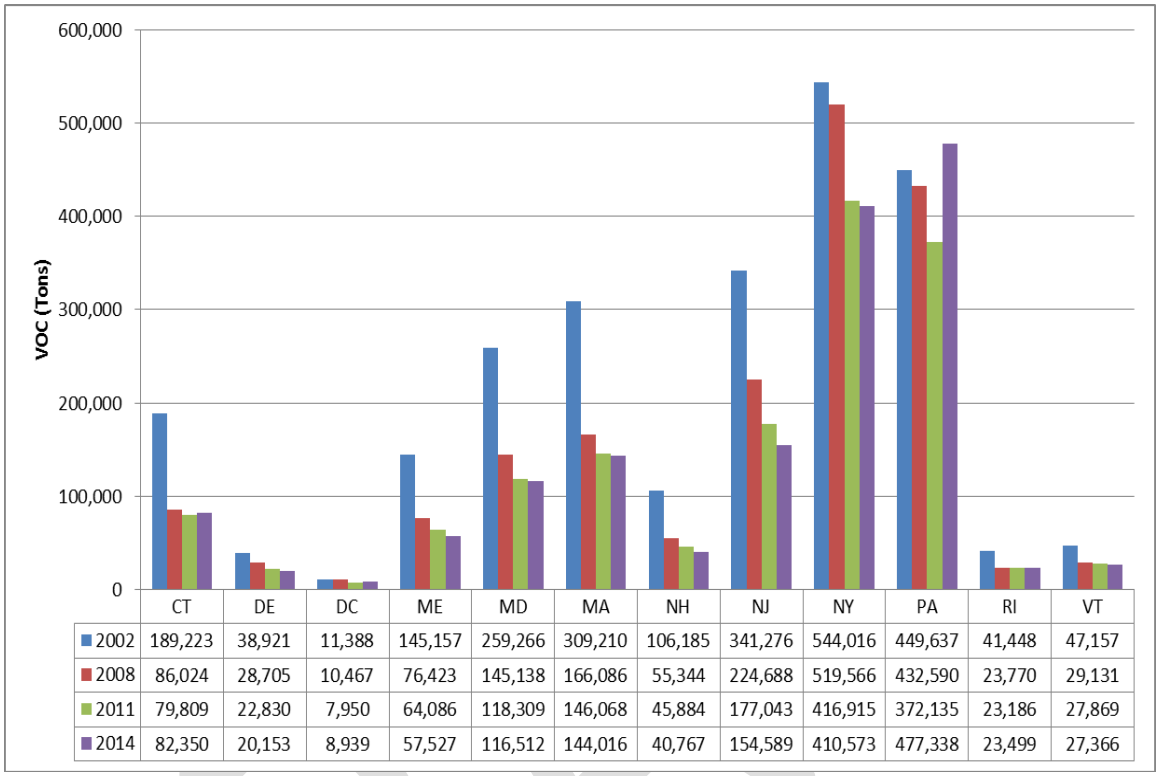
Figure 5-21 shows total VOC emissions from all data categories for the MANE-VU states during the period from 2002 to 2014. Except for CT, PA, and RI, VOC emissions have declined in all MANE-VU states during this period. Similar to New Hampshire, the decrease between 2002 and subsequent years is likely artificially overstated for many states because of changes in estimation methodologies for nonpoint categories such as residential wood combustion and yard waste burning.

Much of the decrease in VOC is attributable to Federal and state rules for evaporative sources of VOC emissions such as portable fuel containers, architectural, industrial, and maintenance coatings, consumer products, and solvent degreasing. Many states rules for these types of categories are based on the OTC Model Rules.[100] Evaporative VOC emissions from these types of sources are expected to continue to decline as more states adopt rules based on the OTC Model Rules. Other decreases are due to states' VOC RACT rules. Evaporative VOC emissions from on-road mobile sources have decreased due to state motor vehicle I&M programs and the permeation of more ORVR equipped vehicles into the

[100] OTC Model Rules: https://otcair.org/document.asp?Fview=modelrules.

fleet. VOC emissions from non-road and on-road mobile sources are expected to continue decrease as older, more polluting vehicles are replaced by newer, cleaner ones.

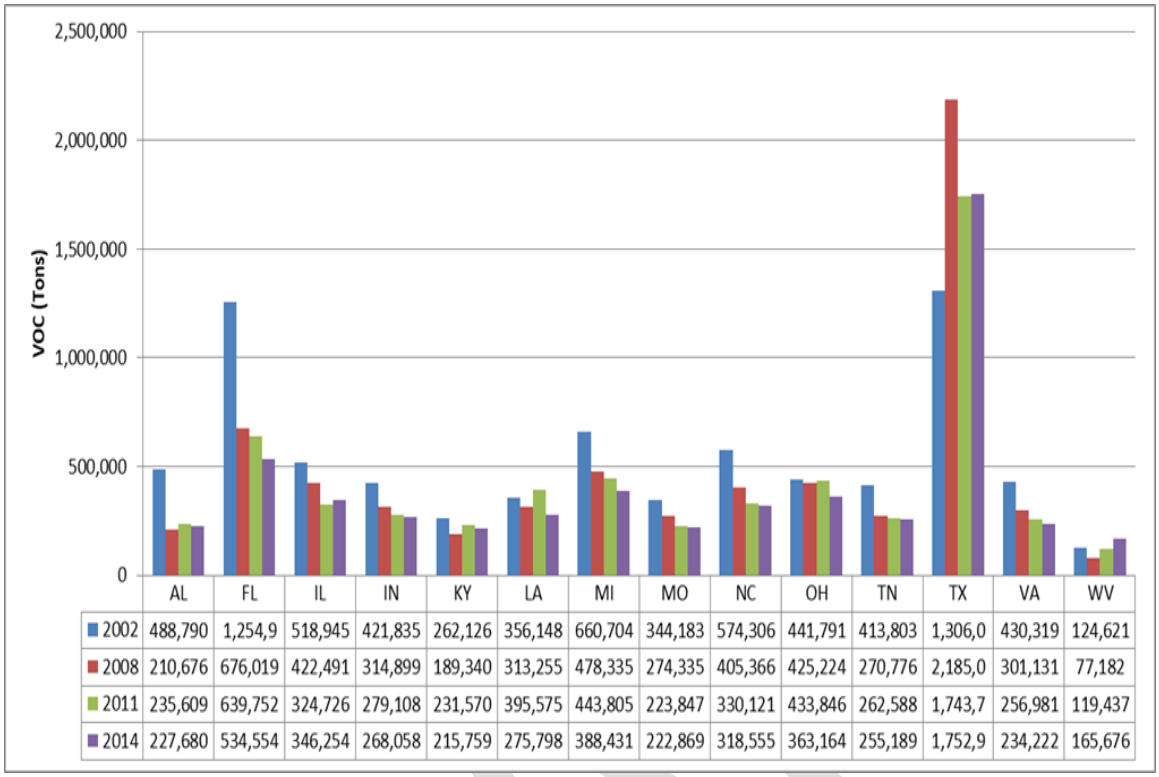
Figure 5-21: Total VOC Emissions from all Data Categories in the MANE-VU States, 2002 – 2014 (tpy)



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002	189,223	38,921	11,388	145,157	259,266	309,210	106,185	341,276	544,016	449,637	41,448	47,157
2008	86,024	28,705	10,467	76,423	145,138	166,086	55,344	224,688	519,566	432,590	23,770	29,131
2011	79,809	22,830	7,950	64,086	118,309	146,068	45,884	177,043	416,915	372,135	23,186	27,869
2014	82,350	20,153	8,939	57,527	116,512	144,016	40,767	154,589	410,573	477,338	23,499	27,366

VOC emissions from all data categories from the Ask states are shown in Figure 5-22. In general, VOC emissions have declined in the Ask states, although some states show little change, or even increases, in total VOC emissions from 2002 to 2014. Some of these increases, or the sharp decreases evident in AL and FL between 2002 and subsequent years, could be artificial due to methodology changes. Despite the increases in some individual states, overall total VOC emissions in the Ask states have declined from 2002 to 2014.

Figure 5-22: Total VOC Emissions from all Data Categories in the Ask States, 2002 – 2014 (tpy)



	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2002	488,790	1,254,9	518,945	421,835	262,126	356,148	660,704	344,183	574,306	441,791	413,803	1,306,0	430,319	124,621
2008	210,676	676,019	422,491	314,899	189,340	313,255	478,335	274,335	405,366	425,224	270,776	2,185,0	301,131	77,182
2011	235,609	639,752	324,726	279,108	231,570	395,575	443,805	223,847	330,121	433,846	262,588	1,743,7	256,981	119,437
2014	227,680	534,554	346,254	268,058	215,759	275,798	388,431	222,869	318,555	363,164	255,189	1,752,9	234,222	165,676

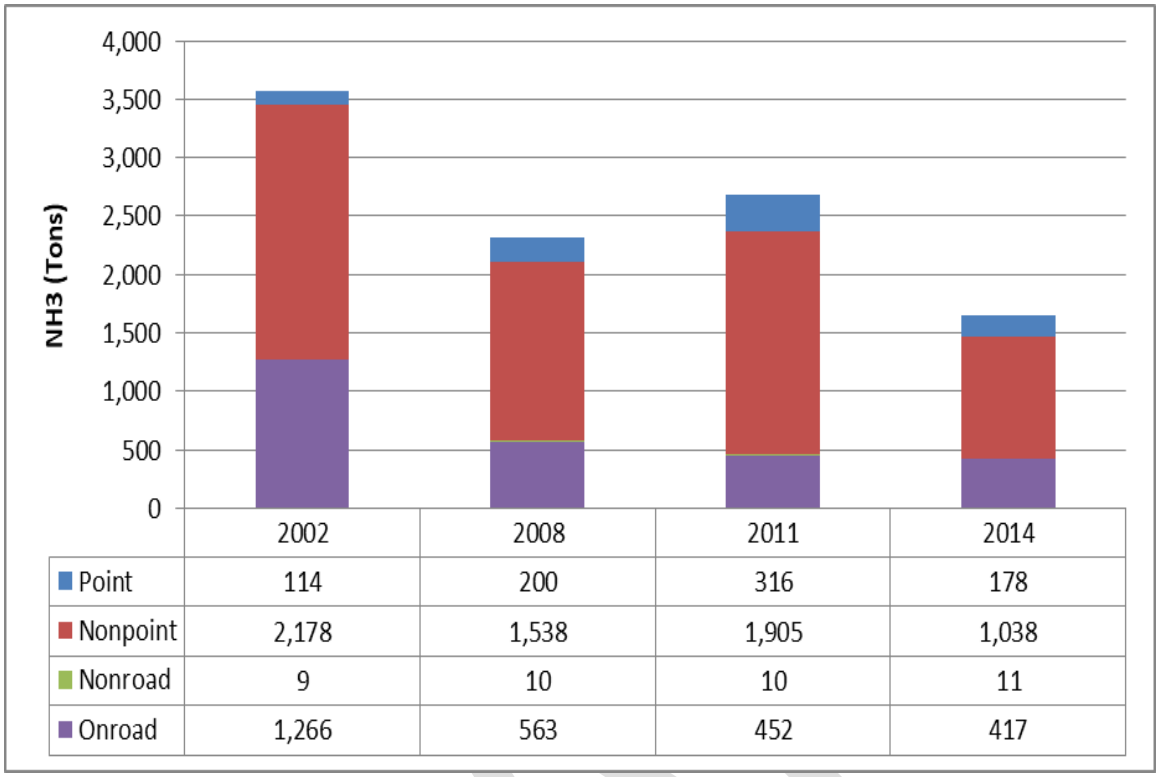
5.4.7 Ammonia

Figure 5-23 shows ammonia emissions for all data categories in New Hampshire. Although some year to year variability can be seen, there is still a general downward trend in ammonia emissions for New Hampshire. This is particularly true when comparing 2014 with earlier years.

Figure 5-24 shows total ammonia emissions for all data categories combined for the MANE-VU states. Similar to New Hampshire, some year-to-year variability can be seen. However, for all MANE-VU states except NJ, ammonia emissions for 2014 are lower than they were for earlier years.

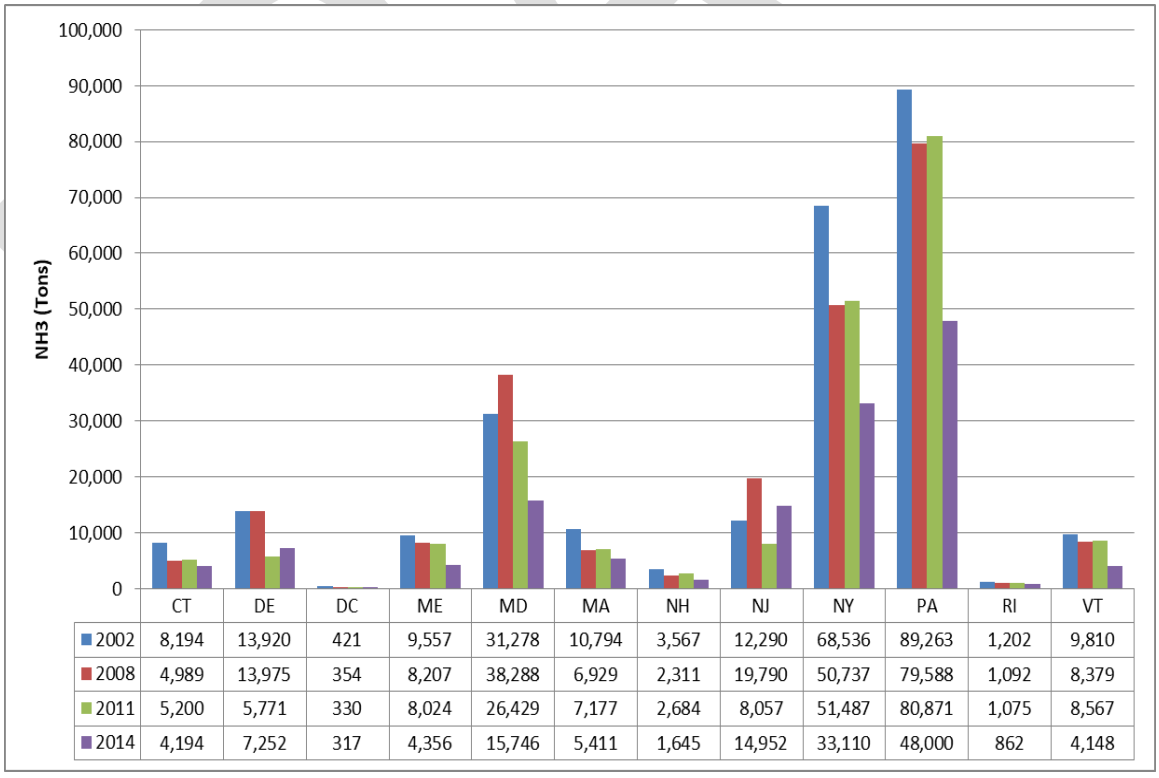
Total ammonia emissions for all data categories for the Ask states are shown in Figure 5-25. Again, some year-to-year variability in ammonia emissions can be seen. In most of the Ask states, 2014 emissions are lower than they were for previous years. For every Ask state, 2014 emissions are lower than they were for at least one of the earlier years.

Figure 5-23: NH_3 Emissions in New Hampshire from all Data Categories, 2002 - 2014 (tpy)



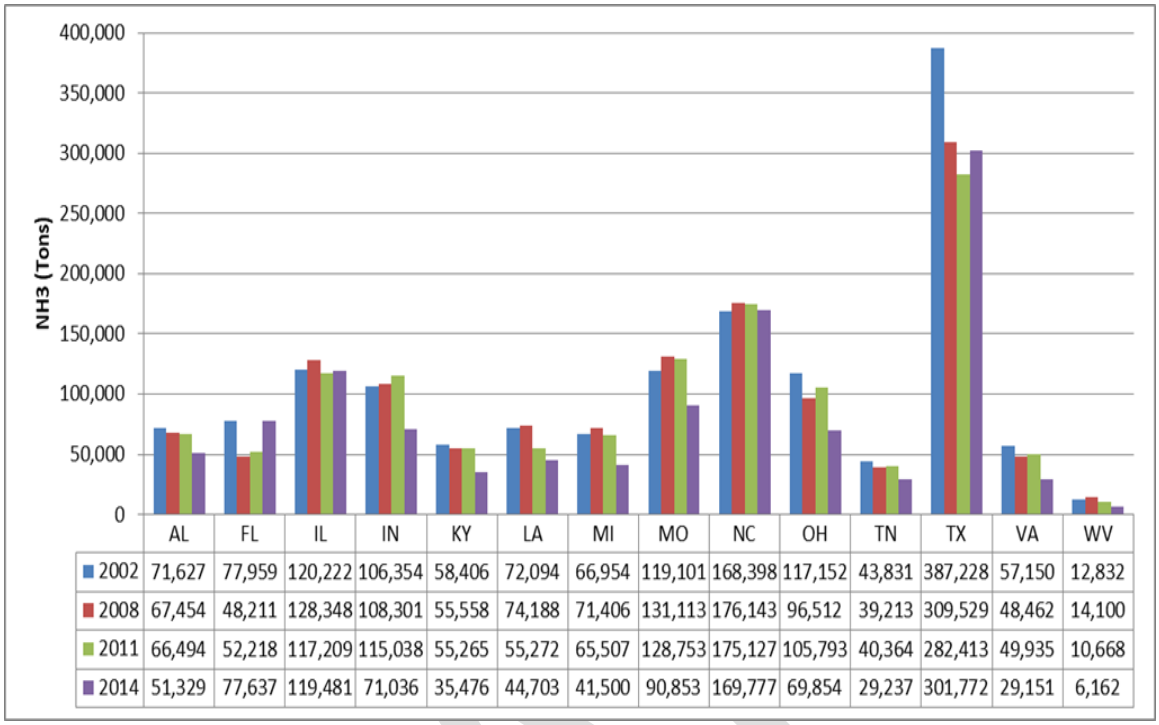
	2002	2008	2011	2014
Point	114	200	316	178
Nonpoint	2,178	1,538	1,905	1,038
Nonroad	9	10	10	11
Onroad	1,266	563	452	417

Figure 5-24: Total NH_3 Emissions in the MANE-VU States from all Data Categories, 2002 - 2014 (tpy)



	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT
2002	8,194	13,920	421	9,557	31,278	10,794	3,567	12,290	68,536	89,263	1,202	9,810
2008	4,989	13,975	354	8,207	38,288	6,929	2,311	19,790	50,737	79,588	1,092	8,379
2011	5,200	5,771	330	8,024	26,429	7,177	2,684	8,057	51,487	80,871	1,075	8,567
2014	4,194	7,252	317	4,356	15,746	5,411	1,645	14,952	33,110	48,000	862	4,148

Figure 5-25: Total NH_3 Emissions in the Ask States from all Data Categories, 2002 - 2014 (tons)



	AL	FL	IL	IN	KY	LA	MI	MO	NC	OH	TN	TX	VA	WV
2002	71,627	77,959	120,222	106,354	58,406	72,094	66,954	119,101	168,398	117,152	43,831	387,228	57,150	12,832
2008	67,454	48,211	128,348	108,301	55,558	74,188	71,406	131,113	176,143	96,512	39,213	309,529	48,462	14,100
2011	66,494	52,218	117,209	115,038	55,265	55,272	65,507	128,753	175,127	105,793	40,364	282,413	49,935	10,668
2014	51,329	77,637	119,481	71,036	35,476	44,703	41,500	90,853	169,777	69,854	29,237	301,772	29,151	6,162

5.5 Assessment of Anthropogenic Sources that Have Impeded Progress 51.308(g)(5)

Paragraph 51.308(g)(5) requires an assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred since the period addressed in the most recent plan required under paragraph (f) of this section including whether or not these changes in anthropogenic emissions were anticipated in that most recent plan and whether they have limited or impeded progress in reducing pollutant emissions and improving visibility. Further, paragraph 51.308(f)(5) states the following: So that the plan revision will also serve as a progress report, the State must address in the plan revision the requirements of paragraphs (g)(1) through (5) of this section. However, the period to be addressed for these elements shall be the period since the most recent progress report. New Hampshire's most recent progress report was drafted in August 2014[101] and covered the period from baseline through 2013.

Paragraph 51.308(g) does not specifically define what would constitute a significant change in emissions that would limit or impede progress in reducing pollutant emissions or improving visibility. There are no new sources or existing sources in New Hampshire that have significantly increased emissions of haze-causing pollutants. Further, in New Hampshire and upwind states, there has been a shift to cleaner generation of electricity using natural gas in place of dirtier fuels such as coal or oil. This trend is driven by economics and the availability of less expensive natural gas supplies rather than by any regulatory mechanism. It is not known if this economic situation will continue into the future, therefore MANE-VU states are pursuing Item 4 of the current Intra-RPO Ask (i.e. the enforceable “locking-in” of the emission rates associated with the burning of cleaner fuels, see sections 4.2.3. and 4.5.).

[101] NHDES Regional Haze Progress Report: https://www.des.nh.gov/organization/divisions/air/do/sip/documents/rh-progress-report.pdf.

6. MONITORING STRATEGY (40 CFR 51.308(f)(6))

In their periodic comprehensive revisions, states must identify their strategy for measuring, characterizing, and reporting regional haze visibility impairment that is representative of the Federal Class I areas within their states. Compliance with this requirement may be met through participation in the IMPROVE network. The IMPROVE program provides scientific documentation of the visual air quality of America's Federal wilderness areas and national parks.

The IMPROVE program consists of monitoring sites operated and maintained through a formal cooperative relationship between the EPA, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management and U.S. Forest Service. Several other organizations have joined the program since its inception in the mid-1980s. These are State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (which have since merged under the name NACAA), WSARC, MARAMA, and NESCAUM.

New Hampshire's monitoring strategy relies on participation in the IMPROVE network and FED. NHDES evaluates the monitoring network periodically and makes appropriate adjustments to it as necessary. However, New Hampshire's commitment to following this strategy and providing continuing assessments of progress toward national visibility goals at mandatory Federal Class I areas will remain contingent on sufficient federal funding in support of monitoring program requirements and associated databases. In the event that existing funding sources are eliminated or curtailed, New Hampshire will consult with the FLMs on the most practicable course of action. Other implementation plan requirements related to the monitoring strategy are addressed in the following sections.

6.1 Additional Requirements Related to Monitoring

- **40 CFR 51.308(f)(6)(i)** *The establishment of any additional monitoring sites or equipment to assess whether reasonable progress goals are being achieved.*

  At this time, the existing monitors are sufficient to make this assessment. New Hampshire's commitment to maintain the current level of monitoring, and to expand monitoring or analysis should such action become necessary, will remain contingent on federal funding assistance.

- **40 CFR 51.308(f)(6)(ii)** *Procedures by which monitoring data and other information are used in determining contributions to regional haze visibility impairments to Class I Federal areas both within and outside of the State.*

  In order to determine which states should be consulted an analysis must be conducted to define what states, sources, or sectors reasonably contribute to visibility impairment. EPA's guidance document calls for a process for determining which sources or source sectors should be considered. The procedures that NHDES used to make this determination were described earlier in Section 3.2.1.

- **40 CFR 51.308(f)(6)(iv)** *Provide for the reporting of all visibility monitoring data to the Administrator at least annually for Class I Federal areas within the state.*

The Federal Land Manager submits the data, and the data are posted on the FED website.

- **40 CFR 51.308(f)(6)(v)** *Provide a statewide inventory of emissions of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in mandatory Class I areas within New Hampshire.*

  In Section 5.4, NHDES has provided statewide emissions estimates of NOx, SO_2, $PM_{2.5}$, VOCs, and NH_3 for most recent year for which data are available (2014 for all categories and 2017 for those facilities that report to EPA's AMPD) NHDES commits to update its statewide emissions inventory periodically.

- **40 CFR 51.308(f)(6)(vi)** *requires that SIPs provide other elements, including reporting, recordkeeping, and other measures necessary to assess and report on visibility.*

  While NHDES believes the current IMPROVE network is sufficient to adequately measure and report progress toward the regional haze goals set for New Hampshire's and other Federal Class I areas, NHDES in the past has found additional monitoring information to be useful in assessing patterns of regional visibility and fine particle pollution. Examples of these data sources include:
  - The NESCAUM RAIN network, which provides continuous, speciated information on rural aerosol characteristics and visibility parameters.
  - The EPA CASTNET program, which has provided complementary rural fine particle speciation data at non-Class I sites.
  - The EPA Speciation Trends Network (STN), which provides speciated, urban fine particle data to help develop a comprehensive picture of local and regional sources.
  - State-operated rural and urban speciation sites using IMPROVE or STN methods (the latter program comprising 54 monitoring stations located mainly in or near larger metropolitan areas).
  - The Supersites program, which has undertaken special studies to expand knowledge of the processes that control fine particle formation and transport in the region.

Assuming that these resources will continue to be available and that fiscal reality allows, New Hampshire will continue using these and other data sources for the purposes of understanding visibility impairment and documenting progress toward national visibility goals for Federal Class I areas under the Regional Haze Rule. New Hampshire's IMPROVE monitoring site representing Great Gulf and the Presidential Range / Dry River Wilderness Areas is located in Green's Grant is pictured below in Figure 6-1.

Figure 6-1: Camp Dodge IMPROVE Monitoring Station, AQS ID 33-007-4002

7. PUBLIC COMMENT PERIOD

New Hampshire is offering this State Implementation Plan for a 60-day public comment period and will hold a public hearing on this plan should one be requested. New Hampshire will document the public participation process, including formal comments submitted to the State of New Hampshire by the Federal Land Manager, the EPA or any member of the public. Responses to comments will be included as an Appendix to this SIP and any appropriate or necessary changes to the SIP will be made based upon acceptable and meaningful public comments.

8. CONCLUSION

This SIP update represents the culmination of years' worth of technical work performed in partnership with member states, tribes, EPA and the federal land managers (FLMs). This current SIP update is being filed according to the original SIP update timeline of 2018, rather than 2021, because much of the technical work investment has already been made and funding is not expected to be available to redo it with data that are more recent. Concerns were raised during consultation about using more up to date data, but this leads into a cycle where no data will ever represent the most recent possible because emission inventories take years to calculate and finalize before they can be used. Using a 2011 NEI based modeling platform for a 2018 SIP submittal represents the same time delay as a 2014 NEI platform for a 2021 SIP submittal.

It is important to note that many of the concerns about using the latest emissions inventory can be put into a perspective that it is not a critical factor during this SIP update. Currently, Federal Class I areas in the MANE-VU region are monitoring visibility improvement in excess of the rate of progress requirements for 2018 and most are also already monitoring benefits in excess of the 2028 rate of progress requirements. Therefore, the emissions inventories used for photochemical modeling are not likely to determine that additional measures will be required to meet rate of progress goals. Instead, the primary direction of this SIP update is to consider another provision of the regional haze rule, the determination of other measures that can improve visibility that can be reasonably implemented during this 10-year planning cycle. Photochemical modeling based on the 2011 NEI was not used to determine how reasonable those measures are, but rather to demonstrate the benefit that may occur if those additional measures are implemented. If an emission source has updated its operations and reduced emissions, then that would be considered during the requested analysis prior to SIP inclusion.

It is noteworthy that the additional measures included in the MANE-VU Ask (and this SIP update) were selected because they were already analyzed and implemented by at least one-member state. Thus, in application, they were found to be reasonable. After further examination by the MANE-VU technical support committee, MANE-VU states agreed that the measures are reasonable to pursue at this time to benefit visibility at MANE-VU Class I areas. The measures are expected to benefit Federal Class I areas outside the MANE-VU region as well.

Because New Hampshire finds the measures included in this SIP to be reasonable to pursue at this time, they are included in this SIP update along with appropriate technical analysis, rulemaking and public review. As result, New Hampshire expects visibility at its two Federal Class I areas, and nearby Federal Class I areas that New Hampshire emissions might affect, to continue to improve over the next 10 years. Further, because most visibility impairing pollutants are small particles, further reducing their concentrations is expected to produce incremental public health benefits.