Maine
Regional Haze Plan
Periodic Comprehensive Revision

FLM REVIEW DRAFT 3/1/21

DEPARTMENT OF ENVIRONMENTAL PROTECTION • STATE OF MAINE •

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Periodic Comprehensive Revision

DRAFT

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FOREWORD

This document fulfills the requirement at 40 C.F.R. §51.308(f) to complete a periodic comprehensive revision of the state implementation plan for regional haze.

1. THE REGIONAL HAZE ISSUE

In 1999, the Environmental Protection Agency (EPA) issued regulations to improve visibility in 156 national parks and wilderness areas across the United States, designating federally protected mandatory Class I areas. 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 Maine, the associated areas are Acadia National Park, Roosevelt Campobello International Park, and Moosehorn Wilderness Area.

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 visual clarity, color, texture, and form. It is caused primarily by anthropogenic (man-made) pollutants but can also be caused by many 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 (CAA) as mandatory Class I Federal Areas.

EPA regional haze regulations found at 40 C.F.R. 51.308 identify the core requirements for addressing the haze phenomenon in each mandatory Federal Class I Area located within a state and each Federal Class I Area outside of a state which may be affected by emissions from within that state. These plans must take the form of a State Implementation Plan (SIP) revision and are to be updated in ten-year increments, starting July 31, 2018. Maine submitted its Regional Haze Plan on December 9, 2010. It was approved by the EPA on April 24, 2012 [77 FR 24385]. In 2017, EPA amended its requirements for state plans, including extending the deadline at 40 C.F.R. §51.308(f) for comprehensive SIP revisions from July 31, 2018, to July 31, 2021 [82 FR 3078].

1.1 Basics of Regional Haze

Small particles and certain gaseous molecules in the atmosphere cause poor visibility by scattering and absorbing light, limiting the distance an observer can see and obscuring color and clarity. 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 (dv), a 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 particles and gaseous constituents, considering their unique light-scattering or absorbing properties and making appropriate adjustments for relative humidity. Updates to the Regional Haze Rule (found at 40 C.F.R. § 51.300-309, discussed in greater detail below) 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 along with the existing metric for the 20% clearest (best) visibility days. Assuming natural conditions, visibility in the Northeast and Mid-Atlantic states for the 20% clearest days is estimated to have total light extinction of 15.55 Mm^{-1}, which corresponds to a visual range of about 156 miles or 4.3 dv (the lower the dv, the better the visibility); and for the 20% most impaired days is estimated to have total light extinction of about 29 Mm^{-1} which corresponds to a visual range of about 84 miles or 10.7 dv. Under current (2015-19) conditions in the region, average total light extinction for the 20% most impaired days ranges from 59 Mm^{-1} in the south to 40 Mm^{-1} in the north; these values correspond to a visual range of 41 to 61 miles or 17.8 to 13.9 dv, respectively.

The small particles that commonly cause hazy conditions in the Northeast and Mid-Atlantic states are primarily composed of sulfates, nitrates, 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. Sulfates, nitrates, and organic carbon are secondary pollutants that form in the atmosphere from precursor pollutants, primarily sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and volatile organic compounds (VOC), respectively. By contrast, soot and crustal material and some organic carbon particles are released directly to the atmosphere. Particle constituents also differ in their relative effectiveness at reducing visibility. Sulfates and nitrates, 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[1] concentrations, and hence visibility impairment, are generally highest near industrial and highly populated areas of the Northeast and Mid-Atlantic states. Particle concentrations are lower, and visibility conditions are better, at the more northerly Class I Areas (such as Acadia National Park, Roosevelt Campobello International Park, and Moosehorn Wilderness Area), where visibility on the 20% clearest days[2] is close to natural conditions[3] (6.36 dv for Acadia National Park compared to 4.66 dv under natural conditions; and 6.48 dv for the Moosehorn Wilderness Area compared to 5.02 dv under natural conditions). Because there are naturally occurring visibility-impairing air contaminants, impaired visibility can also occur under natural conditions. Natural visibility on the 20% most impaired days at Acadia National Park is estimated to be 10.39 dv (compared to 4.66 dv on the 20% clearest days) and at the Moosehorn Wilderness Area is estimated to be 9.98 dv (compared with 5.02 dv on the 20% clearest days). Current visibility on 20% most impaired visibility days is 14.24 dv at Acadia National Park and 12.99 dv at the Moosehorn Wilderness Area.[4] The nitrates 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 causing different contributions from upwind pollutant source regions.

1.2 Regulatory Framework

In the 1977 amendments to the CAA, 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 Class I Federal 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.

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[1] "Fine particles" refers throughout this report to particles less than or equal to 2.5 micrometers in diameter, consistent with US EPA's $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS).

[2] "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 deciviews).

[3] Five-year average, 2015-2019

[4] Current visibility on the 20% clearest visibility days is 6.36 dv at Acadia National Park and 6.48 dv at the Moosehorn Wilderness Area

1.2.1 The Regional Haze Rule

In 1999, the EPA announced a major effort to improve air quality in these areas, through the Regional Haze Rule. The Regional Haze Rule calls for state and federal agencies to work together to improve visibility in 156 designated national parks and wilderness areas (Figure 1-1)[5]. The rule requires the states, in coordination with the EPA, the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), the U.S. Forest Service (FS), and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment.

Title 40: *Protection of Environment*, Part 51 – Requirements for Preparation, Adoption, and Submittal of Implementation Plans, Subpart P – Protection of Visibility (40 C.F.R. 51.300-309) contains the federal requirements states must meet to achieve national visibility goals. 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 addresses the combined visibility effects of various pollution sources over a large geographic region. This wide-reaching pollution goal means that many states – even those without 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. as a result 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 may therefore be transported 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 towards achieving their visibility improvement goals. The first SIP was 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:

- Adjusting the SIP submittal deadline for the second planning period from July 31, 2018, to July 31, 2021.

- Adjusting 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.

- Removing the requirement for interim progress reports to take the form of SIP revisions. States will be required to consult with Federal Land Managers and provide opportunity for public comment on their progress reports before submission to the EPA. These progress reports will be

[5] In 1980, Bradwell Bay, Florida, and Rainbow Lake, Wisconsin, were excluded for purposes of visibility protection as federal Class I Areas.

reviewed by the EPA, but the EPA will not formally approve or disapprove them.

- Finalizing clarifications to reflect the EPA's long-standing interpretations of the 1999 Regional Haze Rule, including the following:
    - Requirements that reasonable progress goals be set based on the long-term strategy.
    - Obligations of states with mandatory 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" (40 C.F.R. 51.301), as follows: "Most impaired days means the twenty percent of monitored days in a calendar year with the highest amounts of **anthropogenic** visibility impairment." [emphasis added]. EPA draft guidance[6] states that the 20% most impaired days must be based on anthropogenic impairment for the second and future implementation periods. The guidance also states, "States may choose to include the first-implementation period approach that uses the haziest days as the most impaired days in addition to the new approach, but not instead of the new approach." Throughout this document, Maine 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 containing a mandatory Class I Area is the submission of an implementation plan containing the elements found in 40 C.F.R. 51.308(d)(1) through (4). Maine submitted its State Implementation Plan revision to meet these requirements in December 2010, and it was approved by the EPA on April 24, 2012 [77 FR 24385]. In addition to the core elements referenced above, the plan also covered the best available retrofit technology (BART) components of 40 C.F.R. 50.308(e), and addressed requirements pertaining to regional planning and state/tribe and Federal Land Manager (FLM) coordination and consultation.

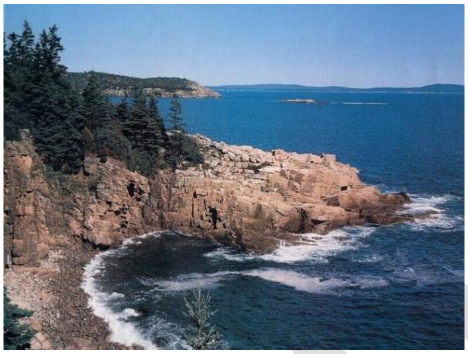
Federal regulation 40 C.F.R. 51.308(g) requires Maine to submit a report to EPA every five years that evaluates progress toward the reasonable progress goal (RPG) for each mandatory Class I Area located within the state and each mandatory Class I Area located outside the state that may be affected by emissions from within the state. Maine submitted its first progress report on February 23, 2016 [82 FR 33471].

[6] https://www.epa.gov/sites/production/files/2016-07/documents/draft_regional_haze_guidance_july_2016.pdf

1.3 Maine's Class I Areas

Moosehorn Wilderness Area

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



Acadia National Park

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

Roosevelt Campobello International Park

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

1.4 Monitoring and Recent Visibility Trends

Visibility monitoring at Roosevelt Campobello International Park and Moosehorn Wilderness Area is accomplished with instruments located at a single site in the Moosehorn Wilderness Area. This monitoring station measures and records light scattering, aerosols, and relative humidity. Visibility monitoring instruments are also located at Acadia National Park. This information is tracked over time to show trends.

Figures 1-2 and 1-3 depict visibility trends (in annual average deciviews) from 2000 to 2018 using the initial SIP planning period metrics (see Appendix B) at Maine's Class I Areas. Results show that visibility conditions for the 20% worst visibility days are well below the 2018 modeled reasonable progress goal (RPG) for the initial SIP at all Class I Areas in Maine, and there has been no degradation of visibility during the 20% clearest (best) visibility days.

Figure 1-2: Regional Haze Metric Trends – Acadia National Park

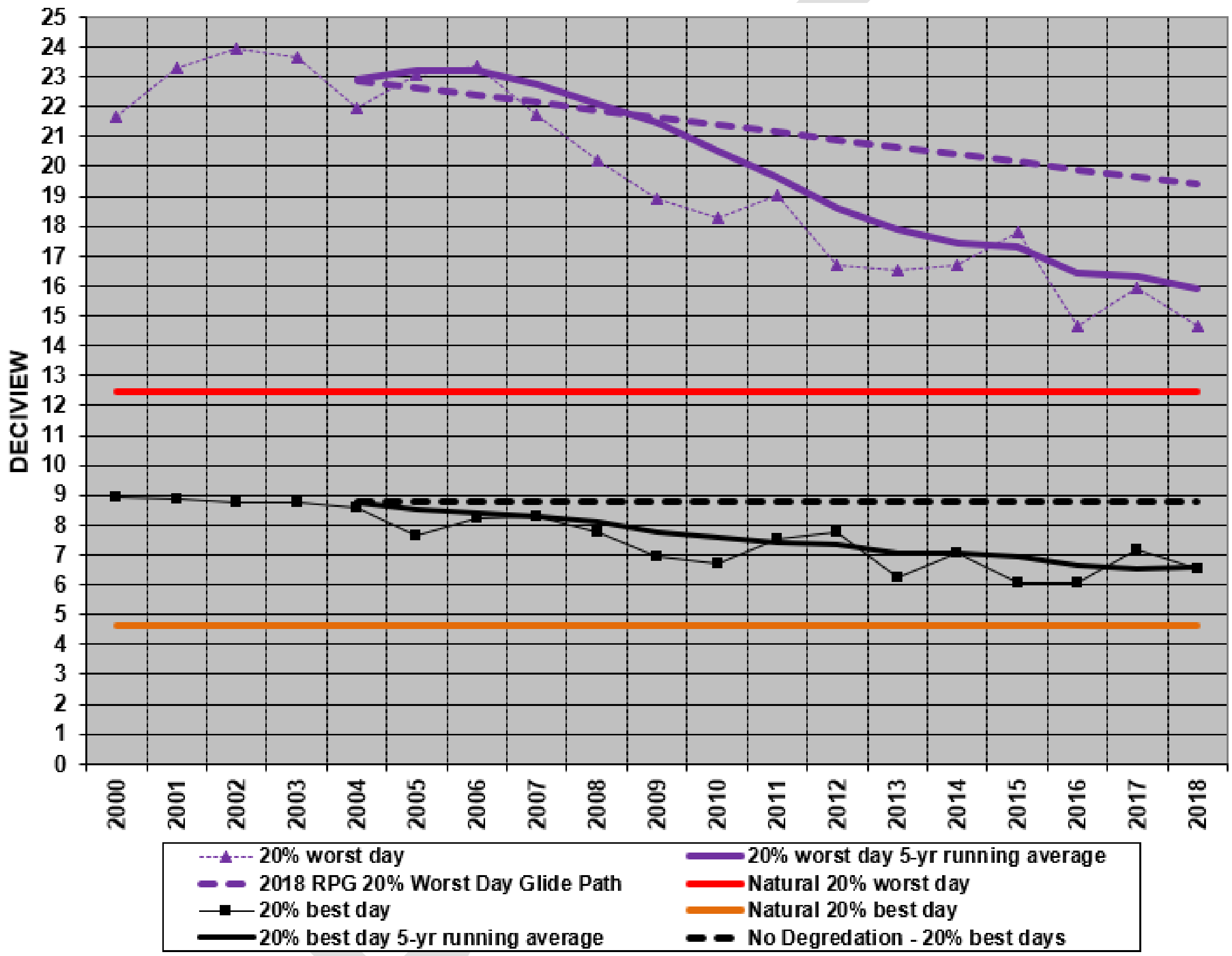
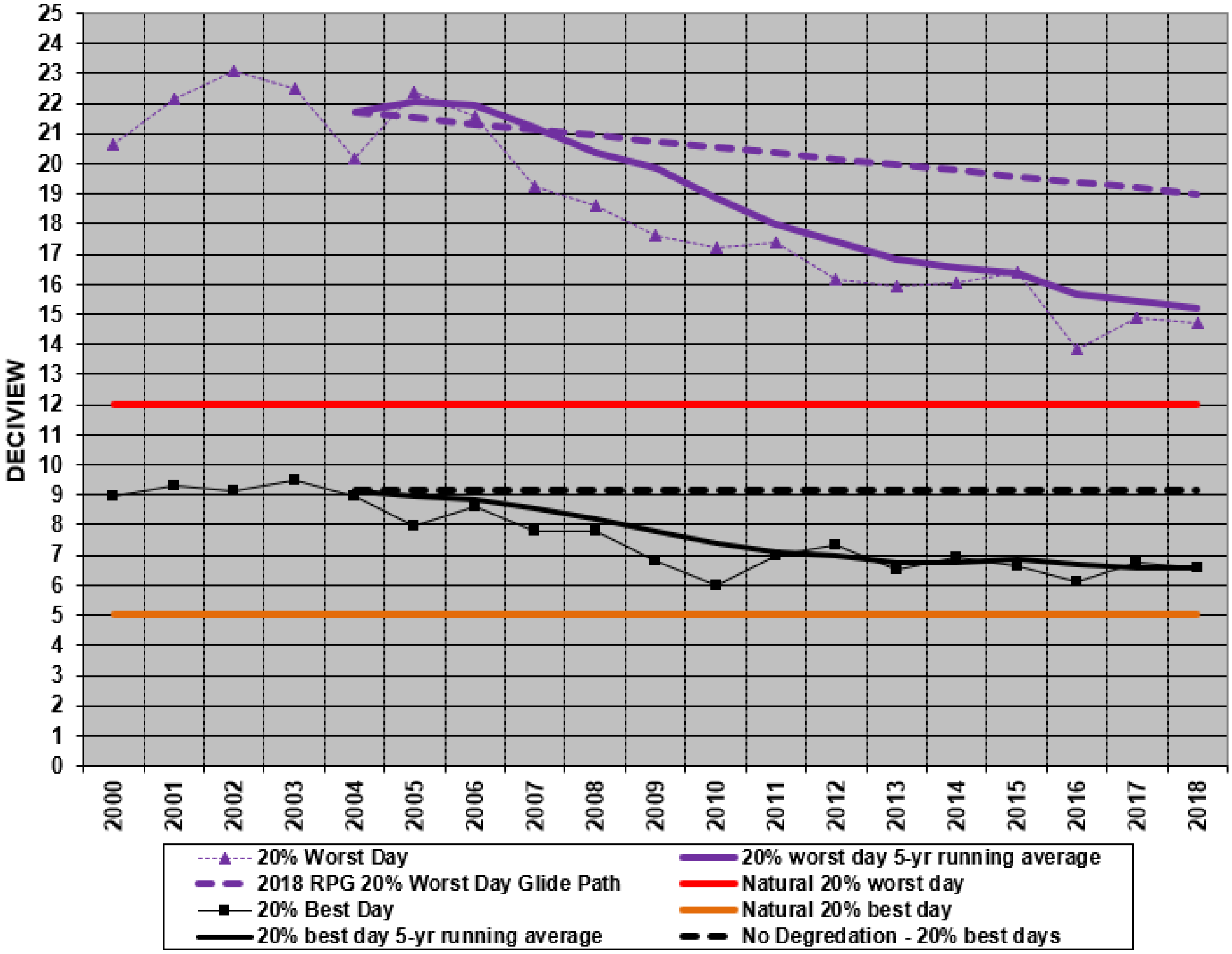


Figure 1-3: Regional Haze Metrics Trends – Moosehorn Wilderness Area



Visibility trends for Class I Areas in Maine, and out of state Class I Areas potentially impacted by Maine, are also noted in Table 1-1, updated to revised metric (most impaired versus worst) from Maine's first progress report in 2016.

Table 1-1: Visibility trends for Class I Areas in and nearby the MANE_VU region

(Observed Visibility vs. Reasonable Progress Goals, all values in deciviews)[7]

Class I Area IMPROVE* Site	**2000-2004 5-Year Average**	**2015-2019 5-Year Average**	**2019 Annual Average**	**2028 Reasonable Progress Goal**
20% Most Impaired Days				
Acadia National Park	22.01	14.24	13.85	13.35
Moosehorn Wilderness Area**	20.65	12.99	12.49	13.12
Great Gulf Wilderness Area***	21.88	12.33	11.47	12.00
Lye Brook Wilderness Area	23.57	14.06	13.28	13.68

[7] MANE-VU, "Mid-Atlantic/Northeast U.S. Visibility Data 2004-2019 (2nd RH SIP Metrics), January 21, 2021 (Appendix C).

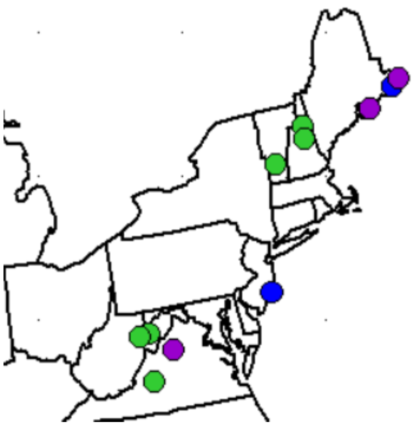
Class I Area IMPROVE* Site	2000-2004 5-Year Average	2015-2019 5-Year Average	2019 Annual Average	2028 Reasonable Progress Goal
Brigantine Wilderness Area	27.43	18.53	17.19	17.97
Shenandoah National Park	28.32	16.38	15.16	14.25
James River Face Wilderness Area	28.08	17.28	16.11	15.31
Dolly Sods Wilderness Area ****	28.29	17.03	16.34	15.09
20% Clearest Days				
Acadia National Park	8.78	6.36	5.95	6.33
Moosehorn Wilderness Area	9.16	6.48	6.31	6.45
Great Gulf Wilderness Area	7.65	4.70	4.30	5.06
Lye Brook Wilderness Area	6.37	4.88	4.25	3.86
Brigantine Wilderness Area	14.33	10.81	9.44	10.47
Shenandoah National Park	10.96	6.54	6.44	6.83
James River Face Wilderness Area	14.21	8.99	8.41	9.36
Dolly Sods Wilderness Area	12.28	6.18	6.04	7.27

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

2. AREAS CONTRIBUTING TO REGIONAL HAZE

The Regional Haze Rule requires states to determine their contributions to visibility impairment at Class I Areas and the impact of emissions from outside the state on its Class I Areas. In coordination with its regional partners, Maine 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 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 modeling was used to identify major contributors to regional haze at these areas and focused on electric generating units (EGUs) and large industrial and institutional sources of SO_2 and NO_X in eastern and central United States.[8] The modeling resulted in the following observations:

1. Emissions of SO_2 and NO_X from many EGUs are lower in 2015 compared to 2011; 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 meteorological data 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 Class I Areas typically show higher visibility impacts than similarly sized facilities further away, but 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 states' Class I Areas. Several of these sources are located in MANE-VU states, while a

[8] New Hampshire Department of Environmental Services (NHDES) and Vermont Department of Environmental Conservation (VTDEC), "2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources," April 4, 2017. (Appendix D)

few are located in nearby states.

This 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 (Connecticut Department of Energy and Environmental Protection (CTDEEP)) to estimate sulfate contributions to a receptor using the emissions (tons/year) over distance (km) (Q/d) method.[9] The analysis was done using ARC MAP® software which utilized the empirical formula:

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

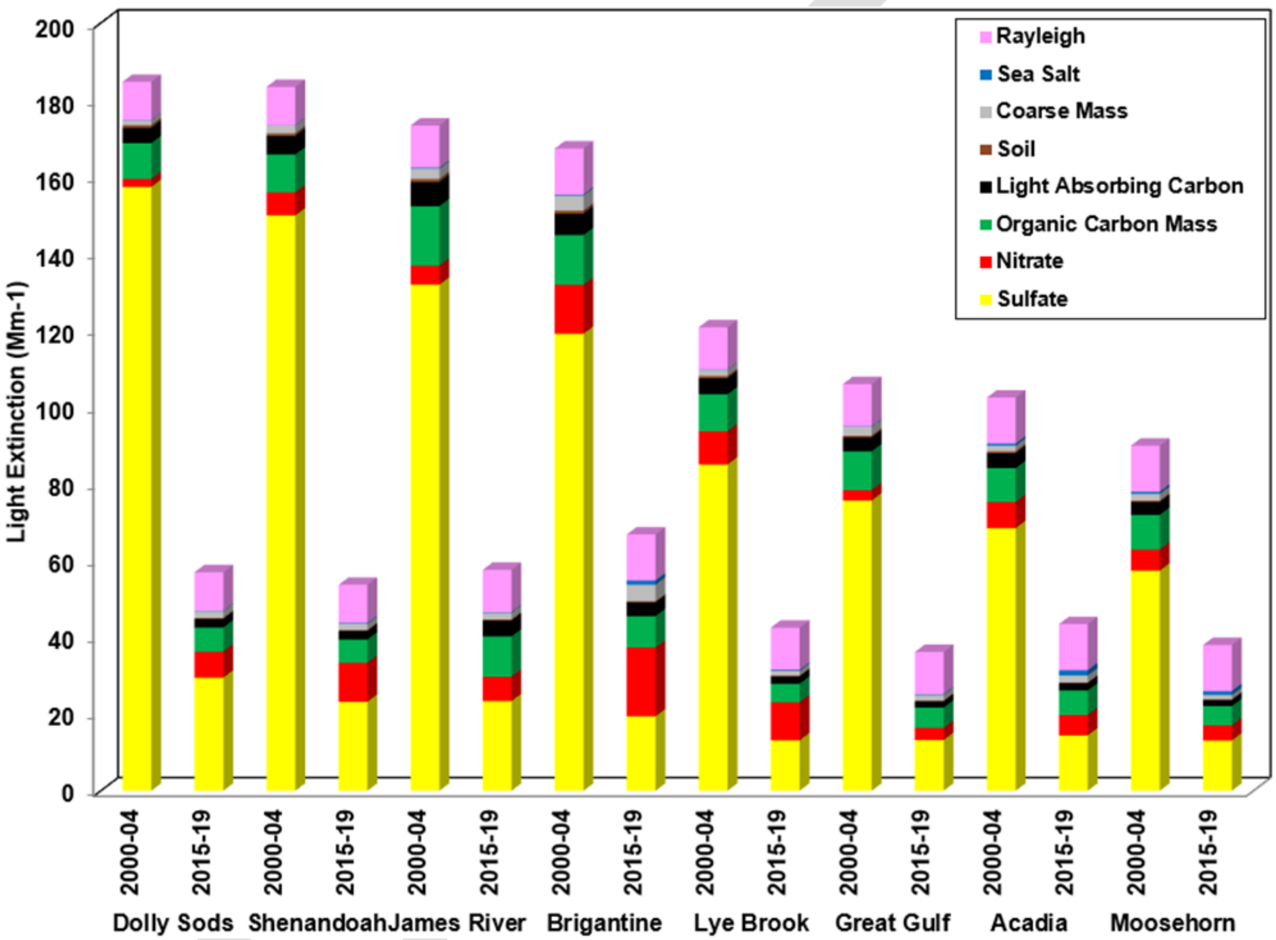
where emissions from an emission source, Q, is linearly related to the impact, I, that it will have on a receptor located a distance, d, away. The MANE-VU Class I Areas with Interagency Monitoring of Protected Visual Environments (IMPROVE) monitors (Acadia, Brigantine, Great Gulf, Lye Brook, and Moosehorn) and several near-by 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.[10] The James River Face Wilderness was added in the 2015 analysis because it was considered close enough in proximity to MANE-VU states to potentially be an important receptor to MANE-VU states. The locations of receptors analyzed in the 2015 analysis are shown in Figure 2-2.

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

[9] MANE-VU Technical Support Committee, *MANE-VU Updated Q/d*C Contribution Assessment*, April 6, 2016. (Appendix E)
[10] NESCAUM, 2012. *Contributions to Regional Haze in the Northeast and Mid-Atlantic United States: Preliminary Update through 2007*. (Appendix F) http://www.nescaum.org/topics/regional-haze/regional-haze-documents

The assessment showed the relative importance of sulfates compared to other pollutants in regard to light extinction at the IMPROVE sites analyzed (see Figure 2-3), which led to the conclusion that SO_2 levels were the most accurate and most relevant indicator for determining the impact of states' emissions to the visibility impairment in the MANE-VU Class I Areas. Emissions of NO_X were considered in the final analysis and factored into Q/d calculations with chemistry information provided by CALPUFF[11] modeling.

Figure 2-3: Baseline and Current 20% Most Impaired Visibility Days Speciation at MANE-VU and Neighboring Class I Areas



For all of the analyses historical and current, Ohio was determined to be one of the top two contributors for all eight 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, indicating that emissions

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[11] CALPUFF is an advanced, integrated Lagrangian puff modeling system for the simulation of atmospheric pollution dispersion.

reductions achieved were not equally achieved among the neighboring states. Table 2-1 below displays the Q/d quantitative contributions to the MANE-VU states' and neighboring states' Class I Areas between the 2012 analysis (2007 emissions data) and the 2015 analysis (2011 emissions data).

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

Modeling of point source (EGUs and industrial/institutional units) contributions to Class I Areas undertaken in 2016 by NHDES and VTDEC[12] was used to estimate the visibility impairment attributable to SO_2 and NO_X on the 20% most impaired days contributed by other states to Maine's Class I Areas. Emissions used for the MANE-VU contribution assessment modeling included EPA's Clean Air Markets Division (CAMD) 2015 daily EGU SO_2 and NO_X emissions and the Mid-Atlantic Regional Air Management Association (MARAMA) 2011 typical daily industrial/institutional SO_2 and NO_X emissions. As with Class I Areas in other MANE-VU and nearby states, emissions from Pennsylvania and Ohio have a large impact on the Class I Areas in Maine. Figures 2-4 and 2-5 depict states' collective impact on Maine's Class I Areas. The individual sources with the largest impacts to visibility in Maine's Class I Areas are listed in Tables 2-2 through 2-5.

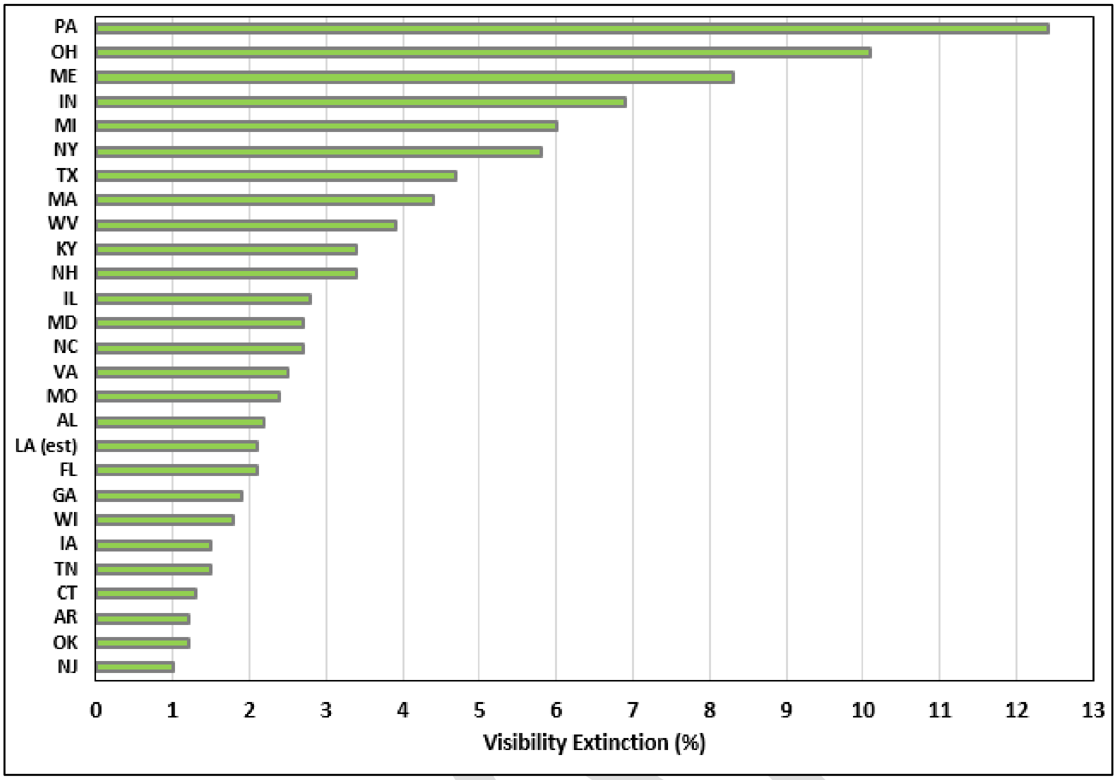
Table 2-1: Top Five Contributing U.S. States for Total State SO_2 Emissions over the Three Analyses (Q/d)[13]

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	1	Pennsylvania	Ohio
	2	Ohio	Pennsylvania
	3	Indiana	Indiana
	4	Michigan	Michigan
	5	New York	Illinois

[12] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources Appendix D
[13] Appendix E

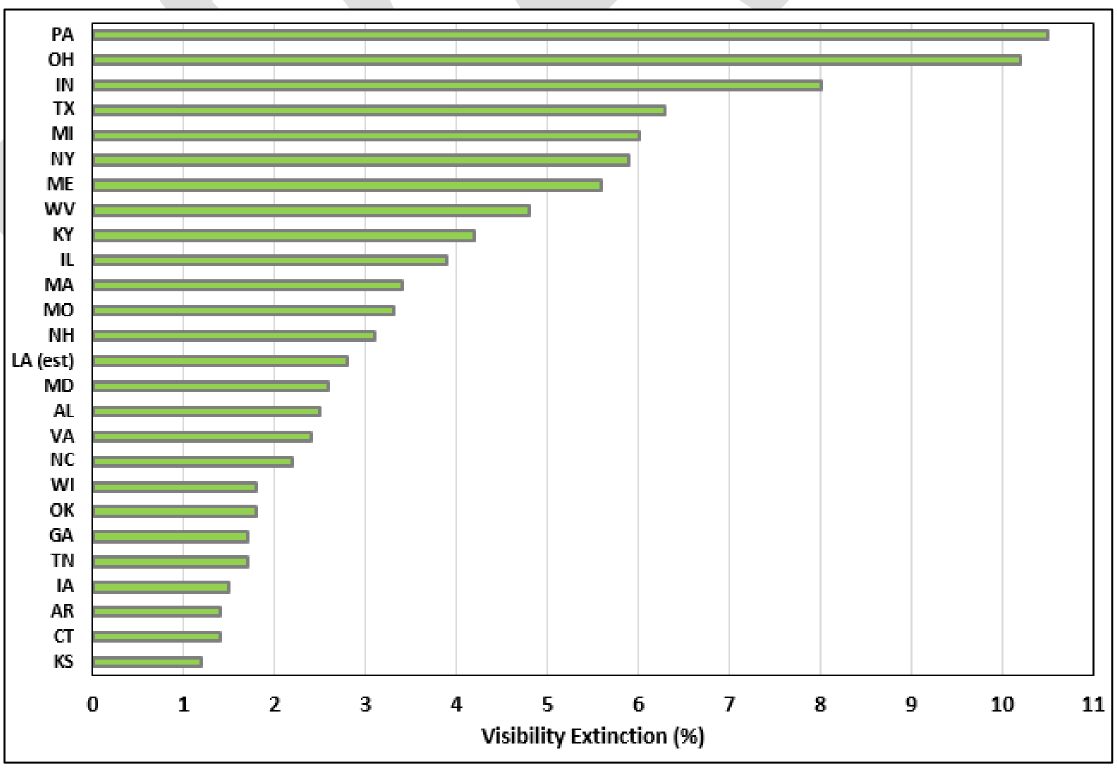
Class I Area (Receptor)	**Rank**	**2012 Analysis (2007* emissions)**	**2015 Analysis (2011 emissions)**
James River Face	1	New to analysis	Ohio
	2		Pennsylvania
	3		Indiana
	4		Kentucky
	5		West Virginia
Lye Brook	1	Pennsylvania	Pennsylvania
	2	Ohio	Ohio
	3	New York	Indiana
	4	Indiana	New York
	5	Michigan/West Virginia	Michigan
Moosehorn	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

Figure 2-4: 2011-2015 Percent Mass Weighted Sulfate and Nitrate Contribution for Acadia NP, ME



Note: Only states at or above 1% contribution are shown.

Figure 2-5: 2011-2015 Percent Mass Weighted Sulfate and Nitrate Contribution for Moosehorn, ME



Note: Only states at or above 1% contribution are shown.

Figure 2-6: States Contributing to Nitrate and Sulfate Visibility Impairment at Maine's Class I Areas

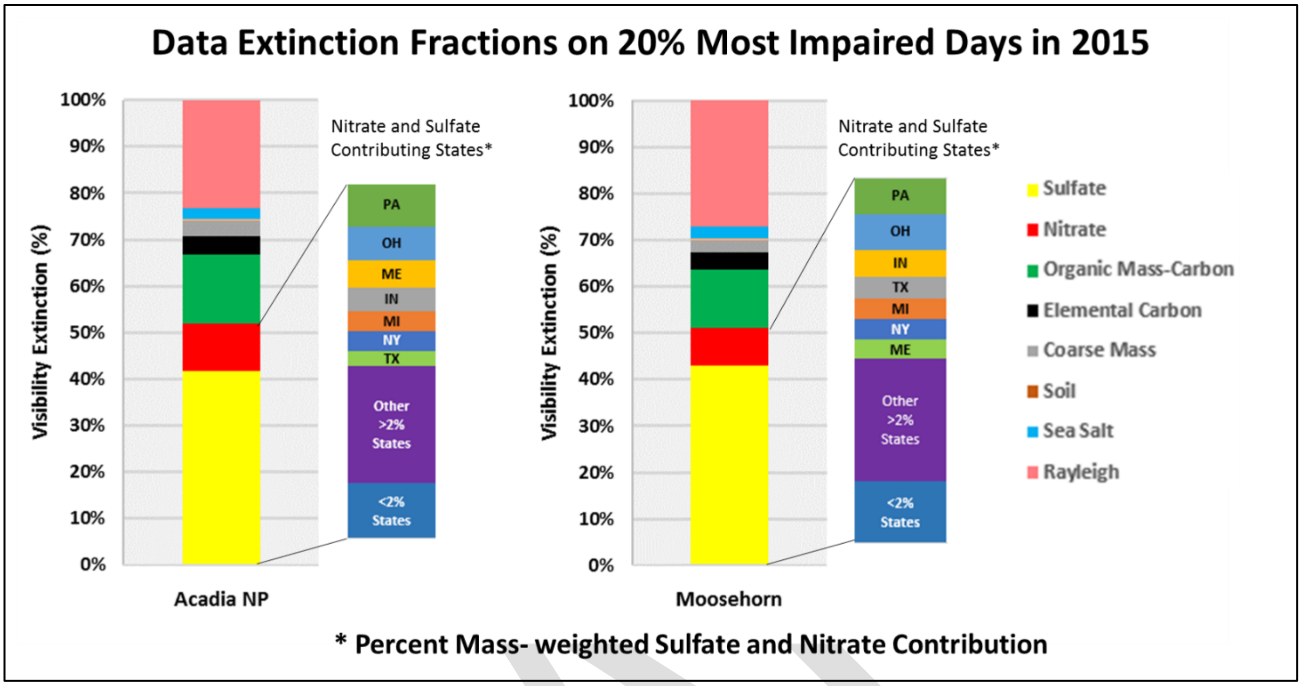


Table 2-2: Individual Electrical Generation Unit Sources Contributing to Visibility Impairment at the Acadia National Park Class I Area Based on CALPUFF modeling with 2015 CAMD Emissions

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Acadia National Park: 24-hr Max SO_4 Ion ($\mu g/m^3$)	24-hr Max NO_3 Ion ($\mu g/m^3$)	Est Extinction (Mm^{-1})
PA	Homer City	3122	1	0.65	0.07	9.3
OH	Avon Lake Power Plant	2836	12	0.61	0.08	9.1
PA	Homer City	3122	2	0.58	0.06	8.1
ME	William F Wyman	1507	4	0.29	0.15	5.6
OH	Muskingum River	2872	5	0.36	0.01	4.6
VA	Yorktown Power Station	3809	3	0.3	0.04	4.4
MA	Brayton Point	1619	4	0.27	0.08	4.3
PA	Shawville	3131	3,4	0.24	0.03	3.3
MA	Canal Station	1599	1	0.19	0.04	3
NH	Newington	8002	1	0.13	0.14	2.9
PA	Keystone	3136	1	0.17	0.07	2.8
IN	Rockport	6166	MB1, MB2	0.17	0.07	2.7
PA	Keystone	3136	2	0.16	0.07	2.7
VA	Yorktown Power Station	3809	1,2	0.18	0.02	2.5
KY	Big Sandy	1353	BSU1, BSU2	0.18	0.03	2.4

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Acadia National Park 24-hr Max SO_4 Ion ($\mu g/m^3$)	24-hr Max NO_3 Ion ($\mu g/m^3$)	Est Extinction (Mm^{-1})
MA	Canal Station	1599	2	0.12	0.08	2.4
OH	Muskingum River	2872	1,2,3,4	0.17	0.01	2.3
GA	Harllee Branch	709	3&4	0.15	0.02	2.1
MI	Trenton Channel	1745	9A	0.15	0.02	2.1
PA	Brunner Island	3140	1,2	0.09	0.07	2.1
MI	St. Clair	1743	6	0.15	0.01	2
WV	Kammer	3947	1,2,3	0.14	0.02	1.9
IN	Michigan City Generating Station	997	12	0.14	0.01	1.9
IN	Tanners Creek	988	U4	0.13	0.01	1.9
PA	Brunner Island	3140	3	0.07	0.07	1.9
OH	Gen J M Gavin	8102	1	0.11	0.03	1.8
MI	Belle River	6034	2	0.09	0.05	1.8
MI	St. Clair	1743	7	0.12	0.02	1.8
OH	W H Zimmer Generating Station	6019	1	0.1	0.05	1.8
WV	Harrison Power Station	3944	1 (25%), 2 (20%)	0.05	0.1	1.7
NH	Merrimack	2364	2	0.05	0.14	1.7
OH	Gen J M Gavin	8102	2	0.11	0.03	1.7
MI	Belle River	6034	1	0.08	0.05	1.7
KY	Mill Creek	1364	1,2,3	0.1	0.03	1.6
IN	Wabash River Gen Station	1010	2,3,4,5,6	0.12	0.01	1.6
PA	Montour	3149	1	0.08	0.06	1.6
PA	Homer City	3122	3	0.08	0.08	1.5
MI	St. Clair	1743	1,2,3,4,5,6	0.07	0.05	1.5
NY	Somerset Operating Company (Kintigh)	6082	1	0.1	0.04	1.5
PA	Montour	3149	2	0.06	0.06	1.5
TN	Johnsonville	3406	1 thru 10	0.11	0	1.4
OH	Killen Station	6031	2	0.06	0.05	1.2
OH	Muskingum River	2876	1,2,3,4,5	0.06	0.04	1.2
MD	C P Crane	1552	2	0.05	0.04	1.2
IL	Powerton	879	51,52,61,62	0.06	0.03	1.2
MD	Herbert A Wagner	1554	3	0.09	0	1.2
MI	J H Campbell	1710	3 (50%)	0.09	0.01	1.2
NH	Schiller	2367	4	0.06	0.03	1.2
NH	Schiller	2367	6	0.06	0.03	1.1
KY	Ghent	1356	3,4…(2,3)	0.06	0.02	1.1
NY	Oswego Harbor Power	2594	6	0.06	0.02	1.1
WV	Kanawha River	3936	1,2	0.07	0.02	1
MI	J H Campbell	1710	A,B,1,2	0.08	0.01	1

Table 2-3: Individual Electrical Generation Unit Sources Contributing to Visibility Impairment at the Moosehorn Wilderness Area Class I Area Based on CALPUFF modeling with 2015 CAMD Emissions

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Moosehorn Wilderness Area		
				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	0.53	0.06	6.8
PA	Homer City	3122	1	0.41	0.07	5.6
ME	William F Wyman	1507	4	0.3	0.13	5.1
PA	Homer City	3122	2	0.36	0.07	4.9
VA	Yorktown Power Station	3809	3	0.32	0.04	4.4
MA	Brayton Point	1619	4	0.23	0.07	3.6
OH	Muskingum River	2872	5	0.27	0.01	3.2
MA	Canal Station	1599	1	0.18	0.05	2.8
IN	Rockport	6166	MB1, MB2	0.17	0.06	2.8
MA	Canal Station	1599	2	0.13	0.09	2.8
PA	Shawville	3131	3,4	0.21	0.02	2.7
VA	Yorktown Power Station	3809	1,2	0.16	0.02	2.3
MI	Trenton Channel	1745	9A	0.16	0.02	2.2
NH	Newington	8002	1	0.12	0.1	2.1
IN	Wabash River Gen Station	1010	2,3,4,5,6	0.15	0.02	2.1
KY	Big Sandy	1353	BSU1, BSU2	0.15	0.02	2
GA	Harllee Branch	709	3&4	0.14	0.02	1.9
PA	Brunner Island	3140	1,2	0.09	0.07	1.9
PA	Keystone	3136	1	0.12	0.07	1.8
OH	W H Zimmer Generating Station	6019	1	0.09	0.06	1.8
PA	Keystone	3136	2	0.11	0.07	1.8
MI	Belle River	6034	2	0.09	0.05	1.7
WV	Harrison Power Station	3944	1 (25%), 2 (20%)	0.04	0.1	1.7
PA	Brunner Island	3140	3	0.07	0.08	1.6
OH	Muskingum River	2872	1,2,3,4	0.13	0.02	1.6
MI	St. Clair	1743	6	0.13	0.01	1.6
MI	St. Clair	1743	7	0.11	0.02	1.6
MI	Belle River	6034	1	0.08	0.05	1.6
IN	Tanners Creek	988	U4	0.12	0.01	1.6
OH	Gen J M Gavin	8102	1	0.1	0.04	1.5
IL	Powerton	879	51,52,61 ,62	0.09	0.03	1.4
OH	Gen J M Gavin	8102	2	0.1	0.03	1.4
MI	St. Clair	1743	1,2,3,4, 5,6	0.07	0.05	1.3
PA	Montour	3149	1	0.08	0.06	1.3

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Moosehorn Wilderness Area		
				24-hr Max SO_4 Ion (µg/m^3)	24-hr Max NO_3 Ion (µg/m^3)	Est Extinction (Mm^{-1})
TN	Johnsonville	3406	1 thru 10	0.11	0	1.3
IN	Michigan City Generating Station	997	12	0.1	0.01	1.3
PA	Montour	3149	2	0.07	0.06	1.3
WV	Kammer	3947	1,2,3	0.1	0.02	1.2
MD	Herbert A Wagner	1554	3	0.1	0	1.2
KY	Mill Creek	1364	1,2,3	0.08	0.02	1.2
OH	Killen Station	6031	2	0.06	0.05	1.2
NY	Somerset Operating Company (Kintigh)	6082	1	0.08	0.02	1.1
MI	J H Campbell	1710	3 (50%)	0.09	0.01	1
PA	Homer City	3122	3	0.05	0.06	1
CT	Bridgeport Harbor Station	568	BHB3	0.04	0.04	1

Table 2-4: Individual Electrical Generation Unit Sources Contributing to Visibility Impairment at the Roosevelt Campobello International Park Class I Area Based on CALPUFF modeling with 2015 CAMD Emissions

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Roosevelt Campobello International Park		
				24-hr Max SO_4 Ion (µg/m^3)	24-hr Max NO_3 Ion (µg/m^3)	Est Extinction (Mm^{-1})
OH	Avon Lake Power Plant	2836	12	0.46	0.04	5.9
PA	Homer City	3122	1	0.38	0.06	5.1
VA	Yorktown Power Station	3809	3	0.33	0.04	4.5
PA	Homer City	3122	2	0.34	0.05	4.5
ME	William F Wyman	1507	4	0.25	0.11	4.2
MA	Brayton Point	1619	4	0.24	0.07	3.7
OH	Muskingum River	2872	5	0.28	0.01	3.3
MA	Canal Station	1599	1	0.2	0.04	2.9
PA	Shawville	3131	3,4	0.21	0.02	2.7
IN	Rockport	6166	MB1, MB2	0.18	0.05	2.7
NH	Newington	8002	1	0.13	0.09	2.4
MA	Canal Station	1599	2	0.14	0.06	2.4
VA	Yorktown Power Station	3809	1,2	0.17	0.02	2.3
MI	Trenton Channel	1745	9A	0.14	0.02	1.9
KY	Big Sandy	1353	BSU1, BSU2	0.15	0.02	1.9
IN	Wabash River Gen Station	1010	2,3,4,5,6	0.13	0.01	1.8
GA	Harlee Branch	709	3&4	0.12	0.02	1.7
OH	W H Zimmer Generating Station	6019	1	0.09	0.06	1.7
PA	Keystone	3136	1	0.11	0.06	1.7

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Roosevelt Campobello International Park		
				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	Muskingum River	2872	1,2,3,4	0.13	0.02	1.7
PA	Brunner Island	3140	1,2	0.09	0.05	1.7
PA	Keystone	3136	2	0.1	0.06	1.6
PA	Brunner Island	3140	3	0.07	0.07	1.6
OH	Gen J M Gavin	8102	1	0.11	0.04	1.5
MI	Belle River	6034	2	0.09	0.04	1.5
WV	Harrison Power Station	3944	1 (25%), 2 (20%)	0.03	0.09	1.5
IN	Tanners Creek	988	U4	0.11	0.01	1.5
PA	Montour	3149	1	0.08	0.05	1.4
OH	Gen J M Gavin	8102	2	0.1	0.04	1.4
MI	Belle River	6034	1	0.08	0.04	1.4
MI	St. Clair	1743	6	0.11	0.01	1.4
MI	St. Clair	1743	7	0.1	0.02	1.4
TN	Johnsonville	3406	1-10	0.12	0	1.3
PA	Montour	3149	2	0.07	0.05	1.3
KY	Mill Creek	1364	1,2,3	0.08	0.02	1.3
IL	Powerton	879	51,52, 61,62	0.07	0.03	1.2
MI	St. Clair	1743	1,2,3,4, 5,6	0.06	0.04	1.2
IN	Michigan City Generating Station	997	12	0.1	0.01	1.2
WV	Kammer	3947	1,2,3	0.1	0.02	1.2
MD	Herbert A Wagner	1554	3	0.09	0	1.1
NY	Somerset Operating Company (Kintigh)	6082	1	0.08	0.02	1.1
OH	Killen Station	6031	2	0.05	0.06	1.1

Table 2-5: Individual Industrial, Commercial, and Institutional (ICI) Sources Contributing to Visibility Impairment at the Maine's Class I Areas Based on CALPUFF modeling with MARAMA 2011 Emissions

State	Facility Name	Facility/ ORIS ID	Unit	Contributions		
				24-hr Max SO_4 Ion ($\mu g/m^3$)	24-hr Max NO_3 Ion ($\mu g/m^3$)	Est Extinction (Mm^{-1})
Acadia National Park						
ME	The Jackson Laboratory	7945211	12	0.03	0.64	9.0
ME	SAPPI - Somerset	8200111	1	0.04	0.18	2.9
MD	Luke Paper Company	7763811	001-0011-3-0018	0.18	0.03	2.5
MD	Luke Paper Company	7763811	001-0011-3-0019	0.18	0.03	2.5
ME	Woodland Pulp LLC	5974211	9	0.02	0.16	2.4
NY	Lafarge Building Materials Inc	8105211	43101	0.07	0.06	1.7
ME	FMC Biopolymer	5692011	3, 4	0.08	0.05	1.7
OH	P. H. Glatfelter Company - Chillicothe Facility (671010028)	8131111	147671	0.09	0.00	1.2
Moosehorn Wilderness Area						
ME	Woodland Pulp LLC	5974211	9	0.15	0.46	7.5
MD	Luke Paper Company	7763811	001-0011-3-0018	0.15	0.03	2.2
MD	Luke Paper Company	7763811	001-0011-3-0019	0.15	0.03	2.2
ME	SAPPI - Somerset	8200111	1	0.04	0.13	2.1
NY	Lafarge Building Materials Inc	8105211	43101	0.06	0.04	1.3
OH	P. H. Glatfelter Company - Chillicothe Facility (671010028)	8131111	147671	0.09	0.00	1.1
Roosevelt Campobello International Park						
ME	Woodland Pulp LLC	5974211	9	0.03	0.19	2.7
MD	Luke Paper Company	7763811	001-0011-3-0018	0.15	0.03	2.0
MD	Luke Paper Company	7763811	001-0011-3-0019	0.15	0.03	1.9
ME	SAPPI - Somerset	8200111	1	0.04	0.11	1.8
NY	Lafarge Building Materials Inc	8105211	43101	0.06	0.05	1.3
OH	P. H. Glatfelter Company - Chillicothe Facility (671010028)	8131111	147671	0.09	0.00	1.1

2.2 Class I Areas Affected by Maine Sources

A MANE-VU metrics analyses included speciation analyses for 2000-2015 and trajectory modeling analyses for the "most impaired" visibility days in 2002, 2011, and 2015 for Class I Areas in MANE-VU states and nearby Class I Areas in Virginia and West Virginia.[14] 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 2019 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).[15]

CALPUFF modeling results used for comparison with the trajectory analyses include states having an impacting EGU source or industrial/commercial/institutional (ICI) source with at least a 1 Mm^{-1} light extinction impact to a Class I Area. Table 2-6 shows the results of this modeling for Maine and other states' sources. For example, Maine had one EGU and two ICI sources modeled to have greater than 1 Mm^{-1} light extinction at Great Gulf Wilderness using 2015 emissions. Table 2-4 shows MANE-VU states' contributions to Class I sites in Virginia and West Virginia. No EGU or ICI sources in Maine were identified as impacting Class I sites in Virginia or West Virginia.

Table 2-6: Contribution of States to MANE-VU Class I Areas

Class I Area	Acadia	Moosehorn	Roosevelt Campobello	Great Gulf	Presidential Range	Lye Brook	Brigantine
MANE-VU STATES							
Connecticut	---	1 EGU	---	---	---	---	1 EGU
Maine	**1 EGU 4 ICIs**	**1 EGU 2 ICIs**	**1 EGU 2 ICIs**	**1 EGU 2 ICIs**	**1 EGU 2 ICIs**	**1 EGU 1 ICI**	**1 EGU**
Maryland	2 EGUs 2 ICIs	1 EGU 2 ICIs	1 EGU 2 ICIs	2 ICIs	2 ICIs	1 EGU 2 ICIs	7 EGUs 3 ICIs
Massachusetts	3 EGUs	3 EGUs	3 EGUs	1 EGU	2 EGUs	3 EGUs	3 EGUs
New Hampshire	4 EGUs	1 EGU	1 EGU	3 EGUs	3 EGUs	3 EGUs	---
New Jersey	---	---	---	---	---	---	1 EGU 2 ICIs
New York	2 EGUs 1 ICI	1 EGU 1 ICI	1 EGU 1 ICI	2 EGUs 2 ICIs	2 EGUs 2 ICIs	3 EGUs 5 ICIs	2 EGUs 1 ICI
Pennsylvania	10 EGUs	10 EGUs	9 EGUs	11 EGUs	11 EGUs	12 EGUs	12 EGUs 3 ICIs
OTHER STATES							
Alabama	---	---	---	---	---	---	1 EGU
Georgia	1 EGU	1 EGU	1 EGU	1 EGU	1 EGU	1 EGU	2 EGUs
Illinois	1 EGU	1 EGU	1 EGU	1 EGU	1 UGU	---	1 EGU
Indiana	4 EGUs	4 EGUs	4 EGUs	5 EGUs	6 EGUs	4 EGUs	6 EGUs
Kentucky	3 EGUs	2 EGUs	2 EGUs	2 EGUs	1 EGU	3 EGUs	3 EGUs
Michigan	8 EGUs	7 EGUs	6 EGUs	8 EGUs	8 EGUs	8 EGUs	8 EGUs

[14] Regional Haze Metric Trends and HYSPLIT Trajectory Analyses, MANE-VU TSC, May 2017 (Appendix A)
[15] See Appendix D

Class I Area	Acadia	Moosehorn	Roosevelt Campobello	Great Gulf	Presidential Range	Lye Brook	Brigantine
Missouri	---	---	---	---	---	1 EGU	---
North Carolina							2 EGUs
Ohio	8 EGUs 1 ICI	7 EGUs 1 ICI	7 EGUs 1 ICI	9 EGUs I ICI	9 EGUs 1 ICI	9 EGUs I ICI	9 EGUs 1 ICI
Tennessee	1 EGU	1 EGU	1 EGU	---	---	---	1 EGU 1 ICI
Texas	---	---	---	---	---	2 EGUs	2 EGUs
Virginia	2 EGUs	2 EGUs	2 EGUs	2 EGUs	2 EGUs	2 EGUs	2 EGUs
West Virginia	3 EGUs	2 EGUs	2 EGUs	4 EGUs	4 EGUs	4 EGUs	5 EGUs

Table 2-7: Contribution of MANE-VU States to Nearby Class I Areas

Class I Area	Shenandoah	Dolly Sods	Otter Creek	James River
Maine	**---**	**---**	**---**	**---**
Maryland	7 EGUs 4 ICIs	6 EGUs 3 ICIs	6 EGUs 3 ICIs	5 EGUs 2 ICIs
New Jersey	1 EGU	1 EGU	---	---
New York	1 EGU	1 EGU	2 EGUs	---
Pennsylvania	11 EGUs 1 ICI	11 EGUs 1 ICI	11 EGUs 1 ICI	11 EGUs

2016 CALPUFF modeling was performed in a total of 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 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.

Table 2-7a provides maximum impacts from Maine EGU sources to other states' Class I Areas 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, this table also provides modeling results (shown in red text) from another phase of modeling specific to 2015 95th percentile daily emissions with 2015 meteorology. Table 2-7b provides 2011 emissions impacts from industrial/institutional sources.

Table 2-7a: Maine's Maximum Visibility-Impairing EGU Point Sources (2011 emissions data)

	Facility Info				**Extinction Value (Mm^{-1})**				
Class I Area	**Rank**	**Facility**	**ORIS ID**	**Unit IDs**	**2002 Met 2011 95^{th}**	**2011 Met 2011 95^{th}**	**2015 Met 2011 95^{th}**	**2015 Met 2015 95^{th}**	**Distance (mi)**
Great Gulf	38	William F Wyman	1507	4	1.3	**1.9**	1.2	4.1	66
Presidential Range	35				1.8	**2.0**	1.6	4.2	65
Lye Brook	40				0.4	**2.3**	0.8	4.6	151
Brigantine	162				0.5	0.4	**0.8**	1.6	370
Dolly Sods	260				0.1	0.1	**0.4**	0.9	576
Otter Creek	265				0.1	0.1	**0.4**	0.8	590
James River	248				0.1	0.1	**0.4**	0.9	646
Shenandoah	260				0.1	0.4	**0.4**	0.9	582

Table 2-7b: Maine's Maximum Visibility-Impairing ICI Point Sources (2011 emissions data)

	Facility info				**Extinction Value (Mm^{-1})**			
Class I Area	**Rank**	**Facility**	**ORIS ID**	**Unit IDs**	**2002 Met 2011 95^{th}**	**2011 Met 2011 95^{th}**	**2015 Met 2011 95^{th}**	**Distance (mi)**
Great Gulf	3	Sappi - Somerset	8200111	1	0.4	**2.2**	0.6	84
Presidential Range	3				0.4	**2.6**	0.7	90
Lye Brook	8				0.4	**1.4**	0.8	201
Brigantine	48				0.1	0.2	**0.3**	438
Dolly Sods	75				0.0	0.0	**0.2**	633
Otter Creek	81				0.0	0.0	**0.2**	647
James River	79				0.0	0.0	**0.2**	707
Shenandoah	90				0.0	0.1	**0.2**	643

Table 2-8 is based on modeling with 2015 emissions for all 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 95^{th} percentile emission impacts (shown in red text) among the three years of meteorology.

Table 2-8: Maine's Maximum Visibility-Impairing EGU Point Sources (2015 emissions data)

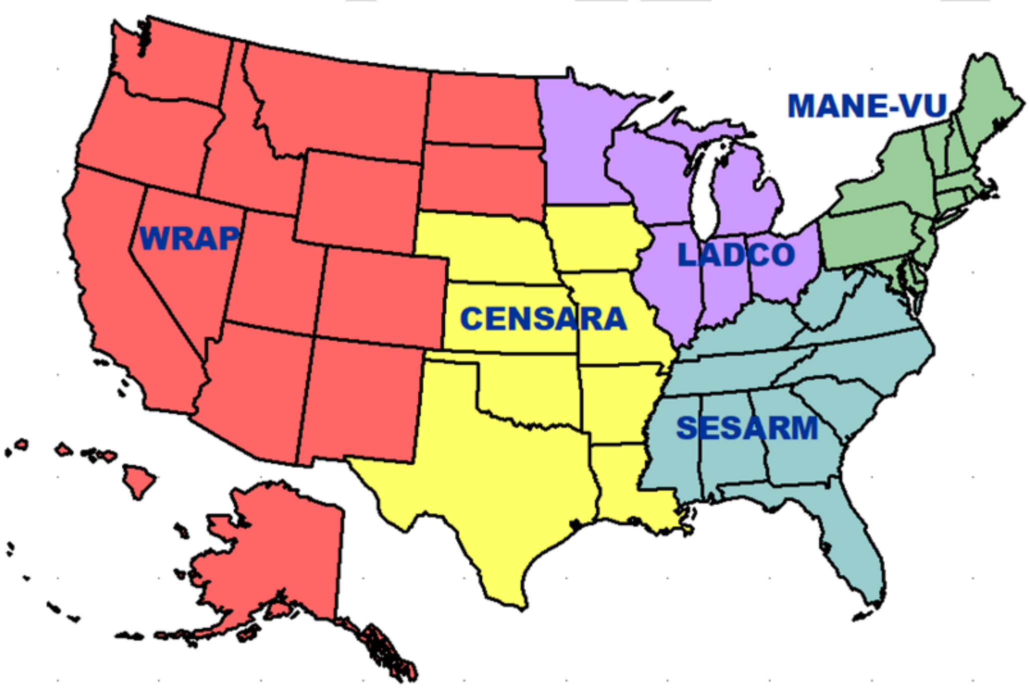
	Facility Info				Extinction Value (Mm^{-1})				
	Rank	**Facility**	**ORIS ID**	**Unit IDs**	**Est.2002 Met 2015 95th**	**Est. 2011 Met 2015 95th**	**Modeled 2015 Met 2015 95th**	**Maximum 2002,11,15 Met 2011 95th**	**Distance (mi)**
Great Gulf	4	William F Wyman	1507	4	2.9	**4.1**	2.7	1.9	66
Presidential Range	4				3.9	**4.2**	3.3	2.0	65
Lye Brook	6				0.8	**4.6**	1.7	2.3	151
Brigantine	48				0.9	0.8	**1.6**	0.8	370
Dolly Sods	85				0.1	0.3	**0.9**	0.4	576
Otter Creek	90				0.1	0.3	**0.8**	0.4	590
James River	76				0.2	0.3	**0.9**	0.4	646
Shenandoah	84				0.3	0.8	**0.9**	0.4	582

The maximum values upon which each are ranked are bolded in blue font. For example, William F Wyman is ranked thirty-eighth out of all EGUs affecting Great Gulf in Table 2-7a based on the 2011 data/2011 meteorology extinction value of 1.9 Mm^{-1}. The William F Wyman EGU and Sappi-Somerset ICI are the primary impairing point sources in Maine.

3. REGIONAL PLANNING AND CONSULTATION

In accordance with 40 C.F.R. 51.308(f)(2)(ii) Maine must consult with states that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Area. 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 Regional Planning Organizations (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 Class I Areas. The five RPOs were originally called MANE-VU (Mid-Atlantic/Northeast Visibility Union), VISTAS (Visibility Improvement State and Tribal Association of the Southeast), MRPO (Midwest Regional Planning Organization), CenRAP (Central Regional Air Planning Association), and WRAP (Western Regional Air Partnership). As shown in Figure 3-1, MRPO, VISTAS, and CenRap operations have been absorbed into their parent organizations LADCO (Lake Michigan Air Directors Consortium), SESARM (Southeastern Air Pollution Control Agencies), and CENSARA (Central States Air Resource Agencies), respectively. Maine is a member of MANE-VU.

Figure 3-1: Regional Planning Organizations[16]



These RPOs evaluate technical information to better understand how their states and tribes impact 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.

[16] Source: https://www.epa.gov/visibility/visibility-regional-planning-organizations

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

MANE-VU's work is managed by the Ozone Transport Commission (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 member

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 Technical Support Committee (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, workgroups of the TSC may be implemented 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, both for 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 [17]

[17] MANE-VU, Inter-RPO State/Tribal and FLM Consultation Framework, May 10, 2006. (Appendix G)

whose purpose is to "...delineate, by consensus, the basic consultation requirements for states, tribes, RPOs, and Federal Land Managers (FLMs) required under 40 C.F.R. Part 51, during the regional haze State Implementation Plan (SIP) 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.

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 which require state-to-state and/or state-to-tribal consultations ("formal" consultations): (i) development of the RPG 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 C.F.R. §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 C.F.R. §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 C.F.R. §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, Maine consulted with other states by participating in the MANE-VU intra-RPO, inter-RPO, and EPA/FLM consultations which 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 FLMs 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.

3.2.1 Selections of States for MANE-VU Inter-RPO Regional Haze Consultation[18]

EPA's non-binding August 2019 guidance document[19] 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 the 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 NO_X emissions do play a more significant role than they had in the first planning period.[20] 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.[21] EGUs emitting SO_2 and NO_X 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 because of NO_X emissions.

After this initial work, MANE-VU initiated a process of screening states and sectors for contribution using two tools, Q/d and CALPUFF.[22] This Q/d and CALPUFF modeling was described earlier in Section 2. Results of this contribution analysis were then compared to air mass trajectories for the 20% most impaired days at the MANE-VU Class I Areas. 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.

MANE-VU considered emissions from EGUs and ICI units predominately, but also included state-wide 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 NO_X emissions were both considered. Emissions in 2015 were either directly considered or estimated so that recent changes in the make-up of the emissions inventory were taken into account. When these factors were considered, states that contributed 2% or more of the visibility impairment and had an average mass impact of over 1%

[18] Mid-Atlantic Northeast Visibility Union Technical Support Committee, "Selection of States for MANE-VU Regional Haze Consultation (2018), September 5, 2017. (Appendix H)
[19] US EPA, "Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," August 2019
[20] Downs et al., *The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description*. (Appendix I)
[21] Mid-Atlantic Northeast Visibility Union, "RE: Contribution Assessment Preliminary Inventory Analysis." (Appendix J)
[22] Appendix D and Appendix E

(0.21 to 0.38 µg/m^3) were consulted with as part of the Regional Haze SIP process. The analysis led to the identification of 14 upwind states in 3 upwind RPOs (Table 3-3) for MANE-VU inter-RPO consultation. States specifically identified for Maine consultation are listed in blue type in Table 3-3. A visual representation for contributing states for Acadia National Park and the Moosehorn Wilderness Area is given in Figures 3-2 and 3-3, respectively.

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

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

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 Maine and MANE-VU. For state-wide total emissions, the most recent available year is 2017, and 2019 for larger point sources.

Figure 3-2: States Contributing to Visibility Impairment at Acadia National Park Class I Area Based on Mass Weighting Analysis

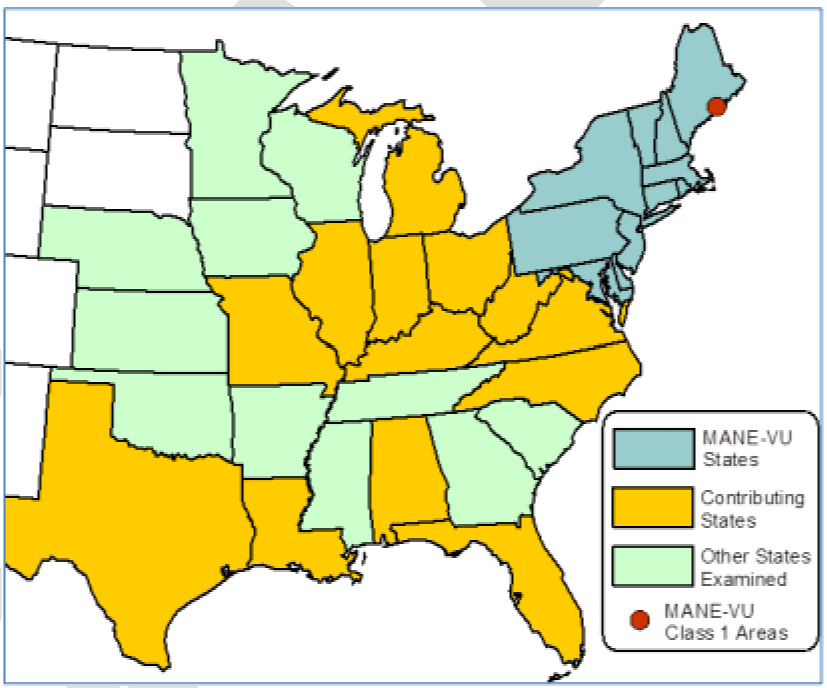


Figure 3-3: States Contributing to Visibility Impairment at the Moosehorn Wilderness Class I Area Based on Mass Weighting Analysis

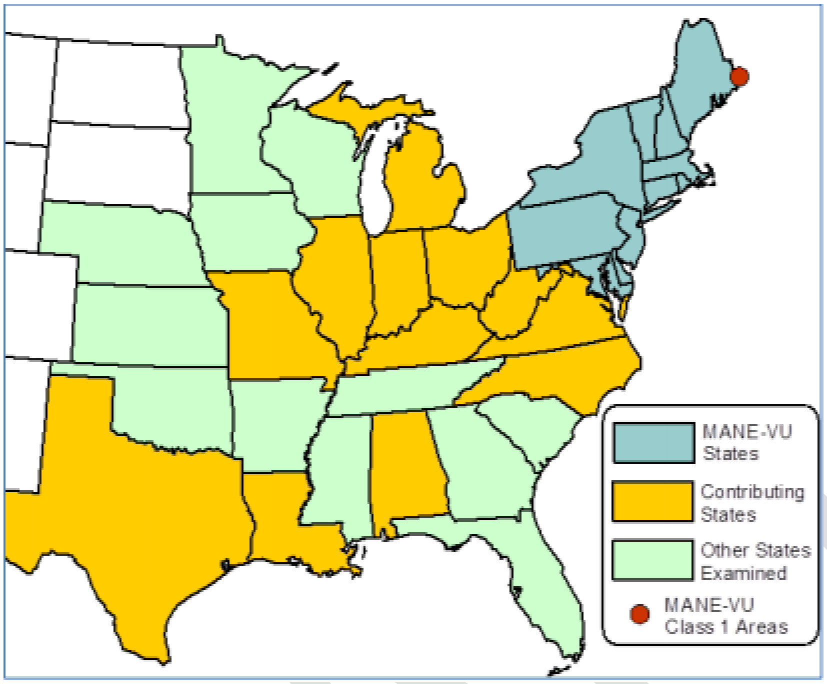


Figure 3-4: 2017 NEI Statewide NO_X and SO_2 Emissions for States Selected by MANE-VU for Consultation

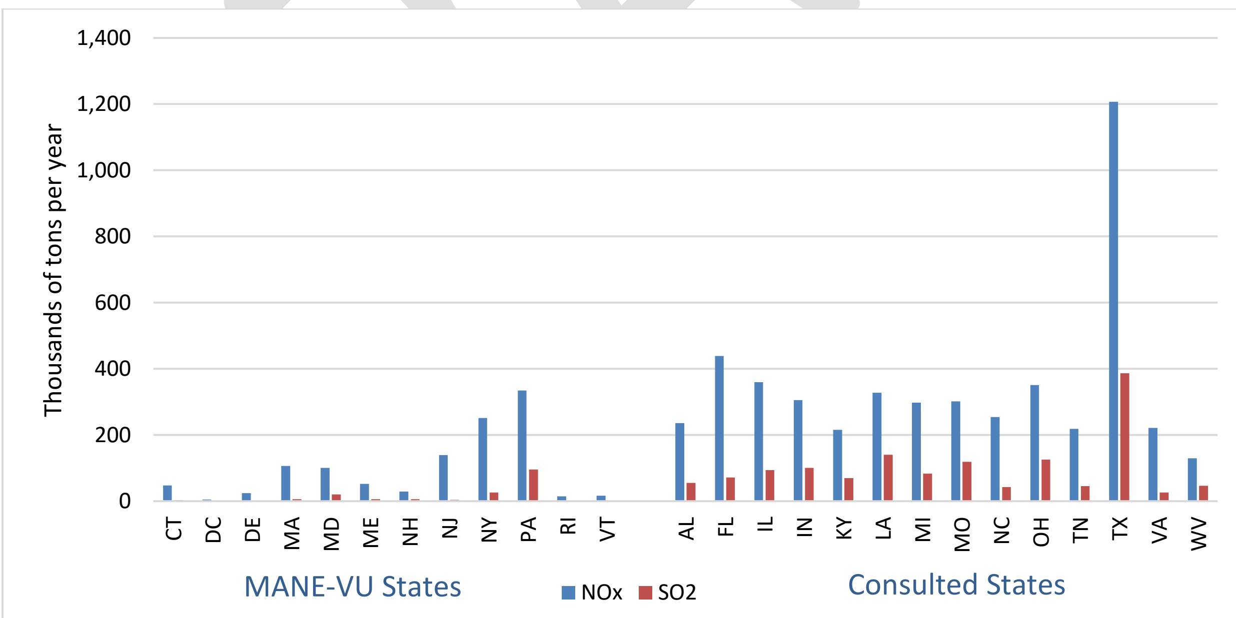
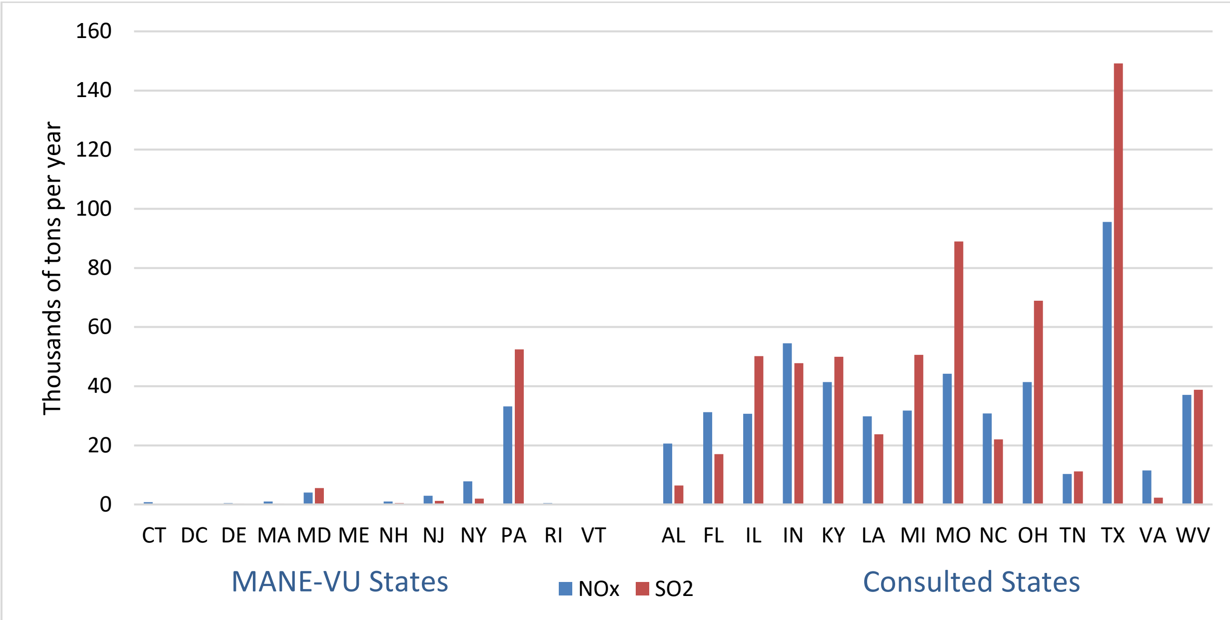


Figure 3-5: 2019 Air Markets Program Division Sources NO_X and SO_2 Emissions for States Selected by MANE-VU for Consultation



3.2.2 Maine Specific Consultation

Section 40 C.F.R. 51.308(d)(3)(i) of the Regional Haze Rule requires Maine 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 Class I Areas outside the state/tribe and when emissions from other states/tribes are reasonably anticipated to contribute to visibility impairment at mandatory Class I Areas within a state/tribe.

Maine 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 Class I Areas within and outside the states/tribes. To maintain consistency within MANE-VU, every MANE-VU member was requested to consult with Maine. 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 Class I Areas have similarly requested consultation with Maine on the regional haze issue.

Throughout the consultation process, Maine was guided by the principles 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 background 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 outcomes of Maine's consultation efforts will ultimately rest with individual states 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 states outside of MANE-VU, Maine expects that the same or equivalent control measures will be included in those states' plans. Further, Maine 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 SIPs of all contributing states.

4. PERIODIC COMPREHENSIVE REVISION (40 C.F.R. 51.308(f))

The Regional Haze Rule at 40 C.F.R. 51.308(f) outlines the requirements for periodic comprehensive revisions of the implementation plans for regional haze, specifying that each affected state revise and submit its regional haze implementation plan revision to EPA by July 31, 2021, July 31, 2028, and every ten years thereafter.

Ambient Data Analysis - Calculations of Baseline, Current, and Natural Visibility [40 C.F.R. 51.308(f)(1)]
Section 40 C.F.R. 51.308(f)(1) of the Regional Haze Rule requires states to address regional haze in each mandatory Class I Area located within the state and in each mandatory Class I Area located outside the state that may be affected by emissions from within the state. Specifically, the plan must contain the following:

- 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 Uniform Rate of Progress (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 C.F.R. 51.301. While not changing the wording, EPA made it clear that going forward, ‘‘most impaired days’’ would refer to those with the greatest anthropogenic visibility impairment. The approach for using the top 20 percent of days with the best visibility to represent good visibility conditions for RPG and tracking purposes would remain the same but would instead be referred to as the “20 percent clearest” days rather than the “20 percent least impaired” days.

EPA’s draft Regional Haze Guidance[23] method to track changes in visibility for the “20% most impaired” days to the baseline (2000-2004) and current (2015-2019) visibility levels shows values for both the proposed “new equation” to calculate most impaired days and the method used to calculate 20% worst days in the first Regional Haze report. The methods are the same for the 20% clearest day trends. Regional haze data from the following databases for 2000-2019 were downloaded December 19, 2020 from the Federal Land Manager Environmental Database (FED) (http://views.cira.colostate.edu/fed/) for all Class I Areas listed in Section 2.1:

[23] See Appendix W

- IMPROVE AEROSOL, RHR II (New Equation)
- IMPROVE RHR3 (Impairment)

The collected data were compiled and sorted to ascertain visibility levels on the 20 percent clearest and 20 percent most impaired visibility days for each year

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

The 2000-2004 baseline visibility for the Moosehorn Wilderness and Roosevelt Campobello International Park Class I Areas was 9.16 deciviews for the 20 percent clearest visibility days and 20.65 deciviews for the 20 percent most impaired visibility days. These are average values based on data collected at the Moosehorn (MOOS1) IMPROVE monitoring site. Maine accepts designation of this monitoring site as representative of the Moosehorn Wilderness and Roosevelt Campobello International Park Class I Areas in accordance with 40 C.F.R. 51.308(d)(2)(i). The two wilderness areas are close enough together that a single monitor suffices. The 2000-2004 baseline visibility for the Acadia National Park Class I Area was 8.78 deciviews for the 20 percent clearest visibility days and 22.01 deciviews for the 20 percent most impaired visibility days.

Table 4-1 lists the baseline visibility for the 20 percent clearest and 20 percent most impaired visibility days for each year of the period 2000-2004, from which the valid five-year average values in Table 1-1 were calculated in accordance with 40 C.F.R. 51.308(d)(2). Baseline visibility conditions were calculated using the updated method from the EPA guidance.[24] Twenty percent worst visibility days are included in the table for comparison.

Table 4-1: Baseline Visibility for the 20 Percent Clearest and 20 Percent Most Impaired Days for the Baseline Period in Maine Class I Areas

Class I Area(s)	Year	Baseline Visibility (deciviews)		
		20% Clearest	20% Most Impaired	20% Worst*
Acadia National Park	2000	8.90	20.75	21.64
	2001	8.87	22.37	23.28
	2002	8.77	22.91	23.91
	2003	8.77	22.70	23.65
	2004	8.56	21.34	21.98
	Average	**8.78**	**22.01**	**22.89**
Moosehorn Wilderness and Roosevelt Campobello International Park	2000	8.94	19.48	20.63
	2001	9.31	21.30	22.14
	2002	9.12	22.12	23.07
	2003	9.48	20.96	22.50
	2004	8.93	19.40	20.20
	Average	**9.16**	**20.65**	**21.71**

*20% Worst Days metrics listed for comparison purposes only

24 See Appendix W

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 CAA, natural background is identified as the visibility target to be reached by 2064 in each Class I Area.

The Moosehorn Wilderness and Roosevelt Campobello International Park Class I Areas have an estimated natural background visibility of 5.02 deciviews on the 20 percent clearest days and 9.98 deciviews on the 20 percent most impaired days. The Acadia National Park Class I Area has an estimated natural background visibility of 4.66 deciviews on the 20 percent clearest days and 10.39 deciviews on the 20 percent most impaired days. The clearest 20 percent visibility value was calculated using the latest available IMPROVE Natural Haze Levels II calculations (see Appendix W). The 20% most impaired values are the latest available (see Appendix Y) produced by EPA using the revised method described in its December 2018 guidance.[25]

According to 40 C.F.R. 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 2015-2019 in Maine Class I Areas

Class I Area(s)	**Year**	**Current Visibility (Deciviews)**		
		20% Clearest	**20% Most Impaired**	**20% Worst***
Acadia National Park	2015	6.05	16.07	17.79
	2016	6.08	13.72	14.63
	2017	7.18	13.97	15.93
	2018	6.53	13.58	14.64
	2019	5.95	13.85	14.96
	Average	**6.36**	**14.24**	**15.59**
Moosehorn Wilderness and Roosevelt Campobello International Park	2015	6.64	14.53	16.37
	2016	6.09	12.56	13.86
	2017	6.77	12.13	14.89
	2018	6.57	13.23	14.73
	2019	6.31	12.49	13.79
	Average	**6.48**	**12.99**	**14.73**

*20% Worst Days metrics listed for comparison purposes only

[25] see Appendix W

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

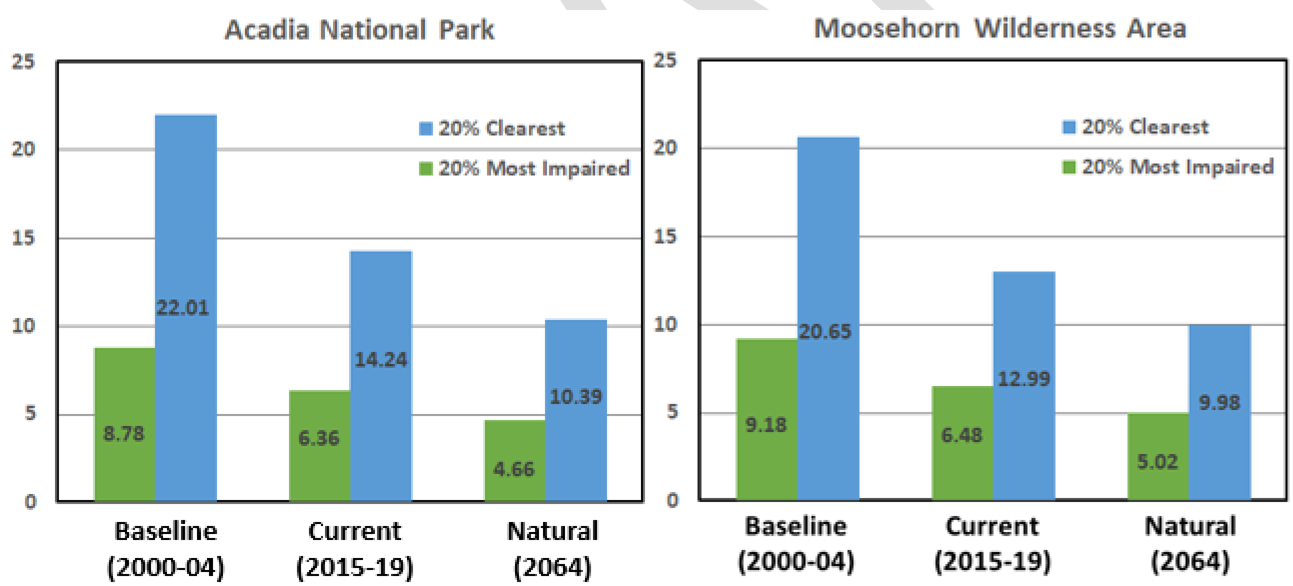
Period	Visibility (deciviews)		
	20% Clearest	20% Most impaired	20% Worst*
Acadia National Park			
Natural	4.66	10.39	12.43
Baseline (2000-2004)	8.78	22.01	22.89
Current (2015-2019)	6.36	14.24	15.59
Moosehorn Wilderness and Roosevelt Campobello International Park			
Natural	5.02	9.97	12.01
Baseline (2000-2004)	9.16	20.65	21.71
Current (2015-2019)	6.48	12.99	14.73

*20% Worst Days metrics listed for comparison purposes only

4.1.1 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. This is illustrated in Figure 4-1.

Figure 4-1: Baseline, Current, and Natural Visibility Conditions for Maine's Class I Areas (deciviews)



4.1.2 Differences Between Current Visibility Condition and Natural Visibility Condition

As of 2019, the current visibility condition in the Acadia National Park Class I Area exceeds natural visibility conditions by 1.70 deciviews on the 20% clearest days and by 3.85 deciviews on the 20% most impaired days (Table 4-4). The current visibility condition in the Moosehorn Wilderness/Roosevelt Campobello International Park Class I Areas exceeds natural visibility condition by 1.46 deciviews on the 20% clearest days and by 3.01 deciviews on the 20% most impaired days.

Table 4-4: Current Visibility (2015-2019) vs. Natural Visibility Condition (deciviews)

Class I Area(s)	Year	Current Visibility		Natural Visibility	
		20% Clearest	20% Most Impaired	20% Clearest	20% Most Impaired
Acadia National Park	2015	6.05	16.07	4.66	10.39
	2016	6.08	13.72		
	2017	7.18	13.97		
	2018	6.53	13.58		
	2019	5.95	13.85	Difference	
	Average	6.36	14.24	1.70	3.85
Moosehorn Wilderness and Roosevelt Campobello International Park	2015	6.64	14.53	5.02	9.98
	2016	6.09	12.56		
	2017	6.77	12.13		
	2018	6.57	13.23		
	2019	6.31	12.49	Difference	
	Average	6.48	12.99	1.46	3.01

4.1.3 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 to attain natural visibility conditions by the end of 2064. This measure is called the uniform rate of progress (URP) line or glide path between baseline conditions and 2064.

Table 4-5: Uniform Rate of Progress (deciviews)

Class I Area	2000-2004 Baseline Visibility (20% Most Impaired)	Natural Visibility (20% Most Impaired Days)	Total Improvement Needed by 2028	Total Improvement Needed by 2064	Uniform Rate of Progress
Acadia National Park	22.01	10.39	4.65	11.62	0.19
Moosehorn Wilderness and Roosevelt Campobello International Park	20.65	9.98	4.27	10.67	0.18

The URP is calculated, and the URP line is drawn for the most impaired visibility days only. As shown in Figures 4-2 and 4-3, trends show that current conditions for the 20% most impaired visibility days in Maine's Class I Areas are well below the 2018 URP level for the first SIP planning period and below the 2028 URP level for the second SIP planning period.

Figure 4-2: Regional Haze Trends in Acadia National Park

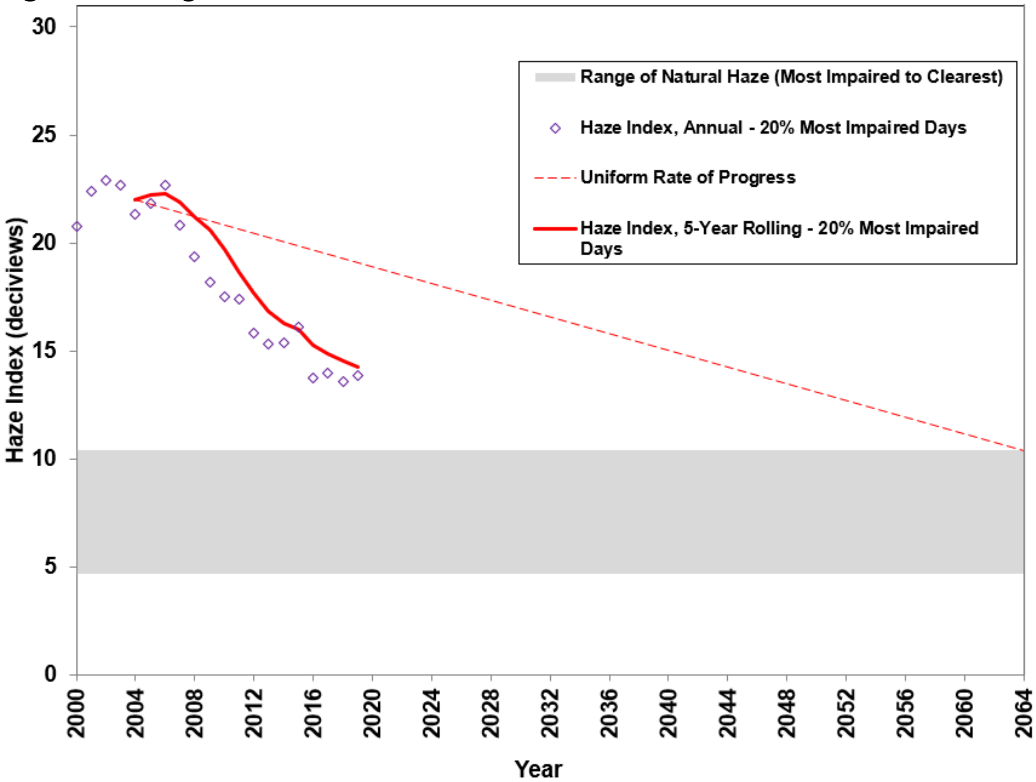
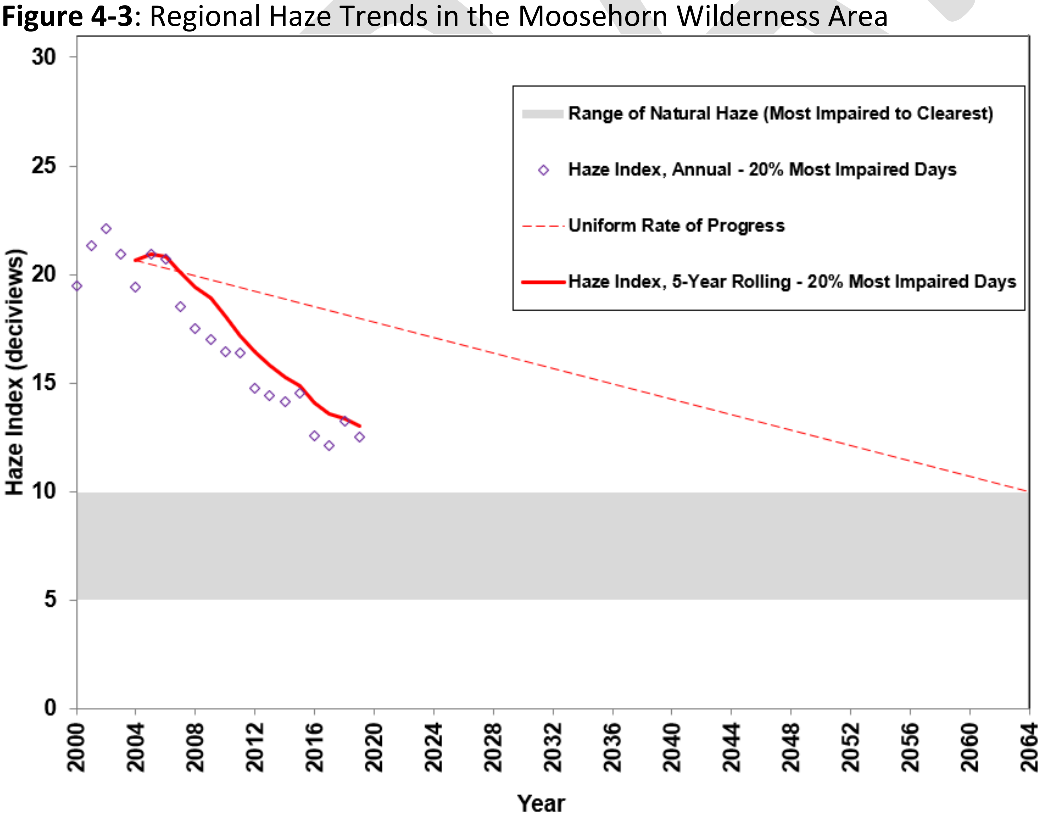


Figure 4-3: Regional Haze Trends in the Moosehorn Wilderness Area



Data from: December 19, 2020 download from the FED website (see Appendix C)

4.2 Long Term Strategy to Address Regional Haze (40 C.F.R. 51.308(f)(2))

According to 40 C.F.R. 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, each state must determine the emission reduction measures 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, collected the information and summarized it in a memo.

This memo identified six source sectors with emissions 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.

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 responsible for the majority of that impact. It was determined that the results of this analysis would identify which sources or sectors should undergo a four-factor analysis and the states with which to consult.

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

Next, MANE-VU examined annual inventories of emissions to identify sectors to be considered for further analysis. EGUs emitting SO_2 and NO_X and industrial point sources emitting SO_2 were identified as point source sectors of high emissions that warranted further scrutiny. Mobile sources were also found to be an important sector in terms of NO_X emissions.

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 H.

4.2.1 Sectors that Reasonably Contribute to Visibility Impairment[26]

A state's long-term strategy (LTS) must include enforceable emission reduction measures necessary to make reasonable progress. The first long-term strategy covers the 10- to 15-year period ending in 2018, and subsequent revisions are to be issued every 10 years thereafter.

A state's LTS must assess all sources of manmade emissions contributing to visibility degradation in Federal Class I areas and determine what reduction measures are needed to make reasonable progress. Sources of emissions contributing to visibility degradation in Federal Class I areas include mobile sources, stationary sources such as power plants and factories, smaller "area" sources such as residential wood stoves and small boilers, and prescribed fires.

EGUs

Following an initial round of CALPUFF modeling using CAMD 2011 reported emissions, information was collated on 444 EGUs determined to warrant further scrutiny based on their 2011 and 2015 emissions of SO_2 and NO_X. Selection criteria are described in Appendix D.[27] 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, ERTAC EGU v2.5L2[28], data collection on NO_X controls conducted by Maryland Department of Environment, and MANE-VU's "167 Stack Retrospective."[29] The individual facility information is in the spreadsheet titled "EGU Data for Four-factor Analyses (Only CALPUFF Units)."[30] A synopsis of the collected information included in the 167 stack analysis is provided in Figure 4-4. Please note that although one Maine EGU is represented in Figure 4-4 as "Planned retire/new controls by 2018," that facility functions in an availability capacity, such that the level of operations in recent years has been a small percentage of actual capacity. A map that shows the locations of the EGUs assessed in the current MANE-VU CALPUFF modeling effort is located in Figure 4-5.

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[26] Sector-level information needed to assess the four factors for EGUs was updated through a contract with SRA and was 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 N)

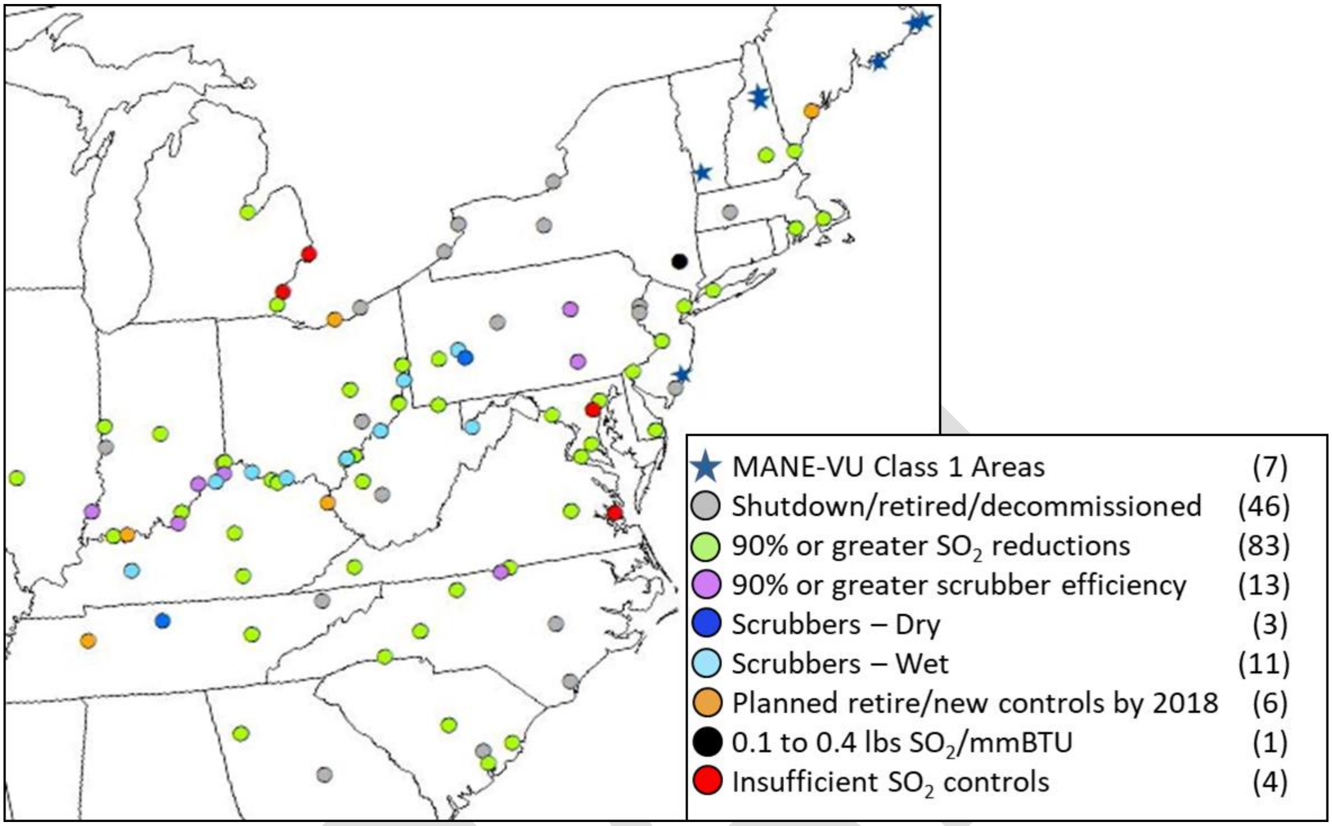
[27] MANE-VU, (April 2017). *2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources*. Appendix D.

[28] ERTAC, (December 2016). *Documentation of ERTAC EGU CONUS Versions 2.5 and 2.5L2*. Available at: https://marama.org/technical-center/ertac-egu-projection-tool/#15815836206519160

[29] MANE-VU, (July 2016). *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*. Appendix Q.

[30] MANE-VU, (April 2017). *2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources*. Appendix D.

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



ICI Boilers

Information was also collected for facilities with ICI boilers that had emissions comparable to EGU units modeled for contributing states. Additional units were added based on proximity to a MANE-VU Federal Class I area, resulting in a list of 50 boilers. 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 4-6 with information on 2011 SO_2 and NO_X emissions and number of Class I sites affected. For Maine, this included Madison Paper, Huhtamaki Inc., FMC Biopolymer, Woodland Pulp LLC, Verso Paper-Androscoggin Mill, The Jackson Laboratory, and Sappi-Somerset. These facilities were then modeled for Class I visibility impacts with CALPUFF based on 2011 estimated typical daily emissions. See Figure 4-5 for location of the facilities.

Cement Kilns

The control factors used for cement kilns were the default factors provided in MARAMA's installation of the Emissions Modeling Framework (EMF) system and represent control costs found in EPA's CoST Manual.[31] Concerning data for individual point sources, cement kilns were included in the Q/d analysis to determine the industrial sources with the most impact on Federal Class I areas. As a result, data was

[31] EPA, (February 2016). *Control Strategy Tool (CoST) Development Documentation*. Available at: https://www.epa.gov/sites/production/files/2020-07/documents/cost_developmentdoc_02-23-2016.pdf

collected on individual cement kilns and the cement kilns in the list of the 82 industrial sources modeled with CALPUFF. Cement kilns were also modeled with estimated 2011 typical daily emissions. [32]

Table 4-6: 82 Industrial Sources Evaluated for Impact at MANE-VU Class I Areas

State	Facility ID	Facility Name	2011 SO_2 (tons)	2011 NO_x (tons)	#Sites Top 50[a]	#Sites >= 50%[b]
IL	**7793311**	Tate & Lyle Ingredients Americas, LLC	3,992.3	374.8	5	3
IL	**8065311**	Aventine Renewable Energy Inc.	12,200.6	1,518.9	5	5
IN	**3986511**	Indiana Harbor East	2,873.8	4,812.7	5	0
IN	**4553211**	Indiana University	1,443.9	325.5	1	0
IN	**4873211**	Ball State University	2,046.0	251.0	4	0
IN	**4885311**	Citizens Thermal	4,348.8	1,422.6	5	4
IN	**5552011**	University of Notre Dame Du Lac	1,643.9	579.3	2	0
IN	**7364611**	Sabic Innovative Plastics Mt. Vernon, LLC	4,915.6	1,798.9	5	4
IN	**7376411**	Tate & Lyle, Lafayette South	2,296.5	491.3	4	0
IN	**7376511**	ArcelorMittal Burns Harbor Inc.	13,842.8	8,289.3	5	5
IN	**8181811**	Alcoa Inc., Warrick Operations	3,897.8	331.6	5	2
IN	**8192011**	US Steel, Gary Works	4,201.8	4,313.5	5	3
IN	**8198511**	ESSROC Cement Corp	1,544.6	1,152.5	1	0
IN	**8223611**	Eli Lilly & Co., Clinton Labs	1,775.1	592.5	2	0
KY	**6096411**	E I DuPont, Inc.	1,519.1	3.9	1	0
KY	**7352311**	Century Aluminum Sebree, LLC	4,193.4	74.9	5	2
KY	**7365311**	Isp Chemicals Inc.	1,976.0	288.2	1	0
MA	**7236411**	Solutia, Inc.	629.7	332.0	2	0
MD	**6117011**	Naval Support Facility, Indian Head	510.0	130.0	1	0
MD	**7763811**	Luke Paper Company	22,659.8	3,607.0	5	5
MD	**8239711**	Sparrows Point, LLC	870.6	1,165.6	1	1
ME	**5253911**	Madison Paper	755.3	179.6	2	0
ME	**5691611**	Huhtamaki Inc., Waterville	202.1	33.8	1	0
ME	**5692011**	FMC Biopolymer	558.7	171.9	2	0
ME	**5974211**	Woodland Pulp LLC	489.7	1,096.9	2	0
ME	**7764711**	Verso Paper, Androscoggin Mill	449.6	928.8	2	0
ME	**7945211**	The Jackson Laboratory	19.7	12.9	1	0
ME	**8200111**	Sappi, Somerset	766.3	2,061.4	2	0
MI	**8126511**	Escanaba Paper Company	2,196.2	2,553.3	2	0
MI	**8160611**	St. Mary's Cement, Inc. (U.S.)	1,942.3	1,996.1	2	0
MI	**8483611**	US Steel, Great Lake Works	5,603.9	2,141.6	5	5
NC	**7920511**	Blue Ridge Paper Products, Canton Mill	8,511.9	3,955.5	5	5
NC	**8048011**	KapStone Kraft Paper Corporation	880.8	1,412.9	1	0
NC	**8122511**	DAK Americas, LLC	2,028.3	1,112.6	1	0
NH	**7199811**	Dartmouth College	308.9	113.2	1	0
NH	**7866711**	Gorham Paper & Tissue, LLC	127.0	42.8	1	0
NJ	**12804611**	Gerresheimer Moulded Glass	102.9	252.3	1	0
NJ	**8093211**	Atlantic County Utilities Authority Landfill	21.5	10.9	1	0
NY	**7814711**	Morton Salt Division	1,332.5	212.5	4	1

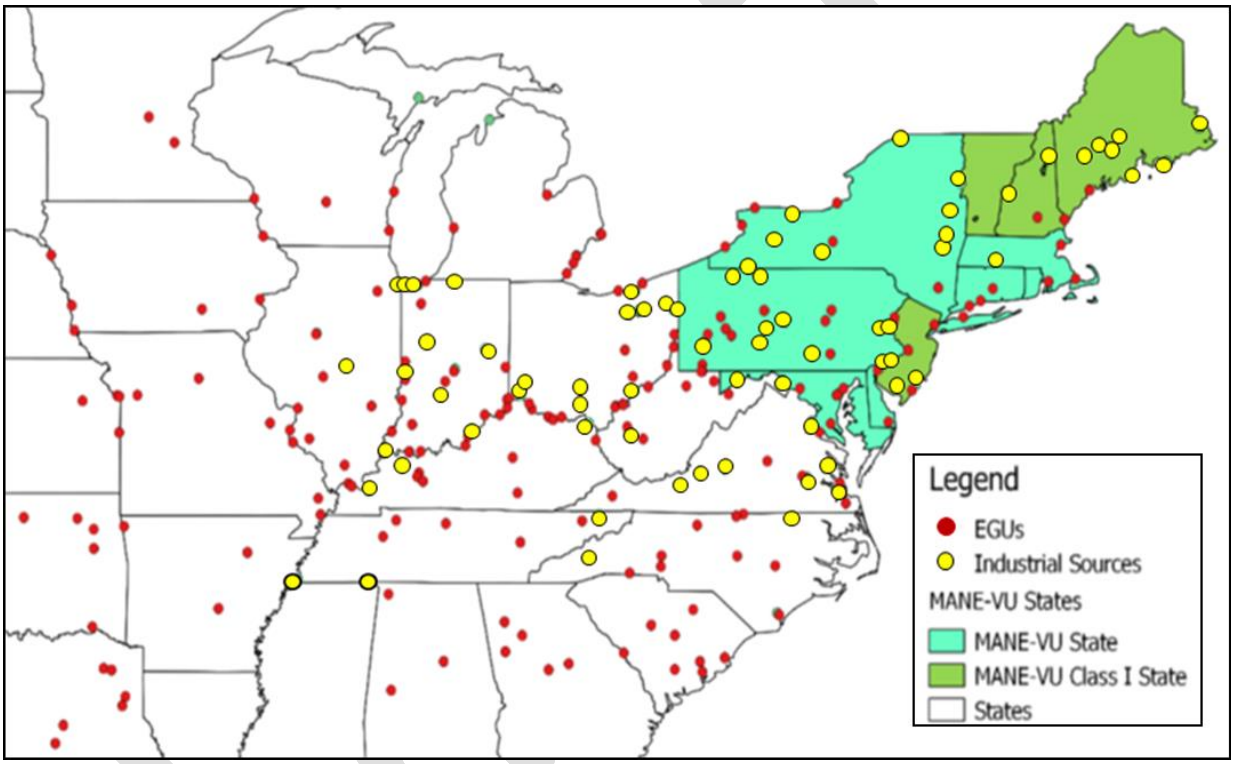
[32] Maine's one facility operating a cement kiln, Dragon Products Company, LLC, licensed a kiln modernization project that requires the application of Best Available Control Technology (BACT). BACT requirements are at least as stringent as RACT requirements, so no consideration of additional controls for this unit is required.

State	Facility ID	Facility Name	2011 SO_2 (tons)	2011 NO_X (tons)	#Sites Top 50[a]	#Sites >= 50%[b]
NY	**7968211**	Alcoa, Massena Operations (West Plant)	2,468.0	196.1	4	2
NY	**7991711**	International Paper Ticonderoga Mill	1,045.6	698.9	4	3
NY	**8090911**	Norlite Corporation	124.9	80.7	1	0
NY	**8091511**	Kodak Park Division	4,291.9	2,592.8	5	5
NY	**8105211**	Lafarge Building Materials, Inc.	9,570.0	4,926.5	5	5
NY	**8176611**	Cargill Salt Co – Watkins Glen Plant	908.8	184.9	3	0
NY	**8325211**	Finch Paper LLC	309.6	1,828.7	1	1
OH	**15485811**	Fluor-B&W Portsmouth LLC	1,495.2	175.9	1	0
OH	**7219511**	Youngstown Thermal	1,063.3	122.5	1	0
OH	**7416411**	Cargill, Incorporated - Salt Division (Akron)	1,516.3	140.1	4	0
OH	**7997111**	Morton Salt, Inc.	4,434.0	194.7	5	5
OH	**8008811**	AK Steel Corporation	2,046.0	2,276.2	4	0
OH	**8063611**	BDM Warren Steel Operations, LLC	1,918.0	238.2	5	0
OH	**8130511**	Kraton Polymers U.S. LLC	2,207.5	560.4	5	1
OH	**8131111**	P. H. Glatfelter Company - Chillicothe Facility	19,696.9	2,093.3	5	5
OH	**8170411**	City of Akron Steam Generating	1,728.9	253.7	5	0
OH	**8252111**	The Medical Center Company	2,133.1	204.1	5	2
OH	**9301711**	DTE St. Bernard, LLC	2,033.1	737.4	3	0
PA	**3186811**	Penn State Univ	1,444.6	243.0	5	0
PA	**3881611**	Hercules Cement CO LP/Stockertown	1,420.0	988.8	5	1
PA	**4966711**	United Refining CO/Warren PLT	992.0	370.5	2	0
PA	**6463511**	PPG Ind/Works No 6	680.9	4,592.7	1	0
PA	**6532511**	Amer Ref Group/Bradford	1,018.7	295.8	3	0
PA	**6582111**	Intl Waxes Inc/Farmers Valley	1,754.7	433.8	5	3
PA	**6582211**	Keystone Portland Cement/East Allen	983.5	828.3	3	0
PA	**6652211**	Phila Energy Sol Ref/PES	297.1	1,315.1	1	0
PA	**7409311**	USS Corp/Edgar Thompson Works	1,279.0	275.1	4	0
PA	**7872711**	MILL Appleton Papers/Spring Mill	1,046.4	394.4	2	0
PA	**7873611**	Sunoco Inc (R&M)/Marcus Hook Refinery	2,043.7	1,490.4	5	2
PA	**8204511**	USS/Clairton Works	1,467.5	3,074.9	4	0
PA	**9248211**	Team Ten/Tyrone Paper Mill	2,181.0	285.6	5	1
TN	**3982311**	Eastman Chemical Company	22,024.2	9,113.4	5	5
TN	**4963011**	Packaging Corporation of America	2,400.6	1,534.0	1	0
TN	**5723011**	Cargill Corn Milling	3,007.0	566.8	2	0
VA	**4182011**	Smurfit Stone Container Corporation - West Point	907.9	1,906.4	1	0
VA	**4183311**	GP Big Island LLC	1,143.3	481.2	1	0
VA	**4938811**	Huntington Ingalls Incorporated -NN Shipbldg Div	805.1	301.0	1	0
VA	**5039811**	Roanoke Cement Company	1,917.7	1,652.1	4	1
VA	**5748611**	Radford Army Ammunition Plant	2,888.0	1,274.0	5	1
VA	**5795511**	Philip Morris Usa Inc - Park 500	681.1	438.2	1	0
WV	**4878911**	Dupont Washington Works	2,102.5	1,089.5	5	1
WV	**4987611**	Capitol Cement – ESSROC Martinsburg	1,280.1	1,495.5	3	1
WV	**5782411**	Bayer Cropscience	2,265.4	1,826.5	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 (RWS), and outdoor wood-fired boilers (OWB) was updated. As part of the contract to update MARAMA's EMS system, information on the cost of controls was updated to allow states to have access to more recent information if they opt to use EMF for this purpose. The full list of updated control factors is included as an Appendix to "2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas."[33] Since heating oil, RWS, and OWB are area sources, no specific point source data was collected.

Figure 4-5: EGUs and Industrial Sources for which Data Collection Occurred



4.2.2 The MANE-VU Intra-RPO Ask[34]

According to the federal Regional Haze Rule (40 C.F.R. 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. These emission reduction measures are referred to as "Asks." If any state cannot agree with or complete a Class I state's Ask, the state must describe the actions taken to resolve the disagreement in their Regional Haze SIP. This Ask is intended to benefit the states and tribes of MANE-VU and should be addressed in their regional haze SIP updates.

To address the impact on mandatory Class I Areas within the MANE-VU region, the member states

33 See Appendix N.
34 See Appendix R-1.

developed a coordinated course of action designed to assure reasonable progress toward remedying any existing impairment and preventing any future impairment of visibility in mandatory Class I Areas, and to leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment. Per the Regional Haze Rule, being on or below the uniform rate of progress for a given Class I Area is not a factor in deciding if a state needs to undertake reasonable measures.

Therefore, the course of action for pursuing the adoption and implementation of measures necessary to meet the 2028 RPG for regional haze includes the following emission management strategies:

1. EGUs with a nameplate capacity larger than or equal to 25MW with already-installed NO_X 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 (list below): Perform a four-factor analysis for reasonable installation or upgrade to emission controls (see table below).

Table 4-7: MANE-VU Sources with the Potential for 3.0 Mm^{-1} or Greater Visibility Impacts at Any MANE-VU Class I Area

State	Facility Name	Facility/ ORIS ID	Unit IDs	MANE-VU Class 1 Max Extinction (deciviews)
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	7945211	10.2
ME	William F Wyman	1507	4	5.6
ME	Woodland Pulp LLC	5974211	9	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	5.9
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

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, with the following limits:
   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, and
   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, NO_X, 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 NO_X emissions for peaking combustion turbines that have the potential to operate on high electric demand days[35] by complying with the following:
   a. Strive to meet NO_X 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 a NO_X 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; or
   b. Perform a four-factor analysis for reasonable installation or upgrade to emission controls; or
   c. Obtain equivalent alternative emission reductions on high electric demand days.

6. Each state should consider and report in their SIP measures or programs ways 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.

4.2.3 The MANE-VU Inter-RPO Ask[36]

The following states outside of MANE-VU, which were identified by MANE-VU as contributing to visibility impairment at MANE-VU Class I Areas, should address this Ask in their regional haze SIP updates in addition to any other Class I Area State Ask: Alabama, Florida, Illinois, Indiana, Kentucky, Louisiana, Michigan, Missouri, North Carolina, Ohio, Tennessee, Texas, Virginia, and West Virginia. Contributing state methodology is documented in the MANE-VU report "Selection of States for MANE-VU Regional Haze Consultation (2018)" using actual 2015 emissions for EGUs and 2011 data for other emission sources.

In addressing the emission reduction strategies in the Ask, any activity by states on the strategies in the Ask will need to be harmonized 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 following:

- The 2010 SO_2 standard;

[35] See Appendix P
[36] See Appendix R-2.

- The Regional Greenhouse Gas Initiative (RGGI), if applicable;
- The Mercury and Air Toxics Standards (MATS); and
- The 2015 ozone standard.

Because of the need for cross-program harmonization and because of the formal public process required by the CAA and state rulemaking processes, there will be opportunities for stakeholders and members of the public to comment on states' plans to address the measures in the Ask.

To address the impact on mandatory Class I Areas within the MANE-VU region, Mid-Atlantic and Northeast states will pursue a coordinated course of action designed to assure reasonable progress toward remedying any existing impairment and preventing any future impairment of visibility in mandatory Class I Areas, and to leverage multi-pollutant benefits that such measures may provide for the protection of public health and the environment. Per the Regional Haze Rule, being on or below the uniform rate of progress for a given Class I Area is not a factor in deciding if a state needs to undertake reasonable measures. Therefore, the course of action for pursuing the adoption and implementation of measures necessary to meet the 2028 RPG for regional haze includes the following emission management strategies:

1. EGUs with a nameplate capacity larger than or equal to 25MW with already installed NO_X 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 (see attached listing): Perform a four-factor analysis for reasonable installation or upgrade to emission controls (see table below).

Table 4-8: Emission Sources Modeled by MANE-VU with the potential for 3.0 Mm^{-1} or Greater Visibility Impacts at Any MANE-VU Class I Area

State	Facility Name	Facility/ ORIS ID	Unit IDs	MANE-VU Class 1 Max Extinction (deciviews)
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
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, with limits 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, NO_X, 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 ways to a) decrease energy demand through improved energy efficiency, and b) increase the use within their state of CHP and other clean distributed generation technologies including fuel cells, wind, and solar.

4.2.4 The MANE-VU EPA and FLM Ask[37]

The transport range of visibility-impairing pollutants has been demonstrated to be extensive and well beyond the MANE-VU region. For example, a wildfire in 2016 near Fort McMurray, Alberta in western Canada generated visibility-impairing fine particulate matter and ozone that traveled over 2,000 miles and into the MANE-VU 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 MANE-VU Class I Areas. Further, even though onroad vehicles produce a significant portion of 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 EPA and FLMs in pursuing important reasonable emission control measures. This includes, but is not limited to, the following:

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

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

3. EPA should ensure that the Asks of Class I Area states are addressed in contributing states' SIPs prior to approval. In the case of this Ask, contributing states are defined as those the MANE-VU Class I Area states identified for consultation.

[37] See Appendix R-3.

4.2.5 Technical Basis for the MANE-VU Ask

The MANE-VU Technical Support Committee, in conjunction with the OTC Modeling Committee, performed photochemical modeling in support of MANE-VU's Regional Haze objectives and to fulfill the technical basis requirement of 40 C.F.R. 51.308(f)(2)(iii). Modeling to determine the RPGs for the MANE-VU and nearby Class I areas included measures documented in the Asks and documented in the modeling Technical Support Document (see Appendix V). Table 4-9 below shows the 2011 monitored, 2028 RPG (with MANE-VU Ask) and 2028 base case (without MANE-VU Ask) modeling results for the 20% clearest and 20% most impaired days.

Table 4-9: 2011 monitored, 2028 base case, and 2028 control case modeled visibility impairment (deciviews) for 20% clearest and 20% most impaired days at Class I areas in MANE-VU and nearby states

		2011 Monitored		2020 Base Projection		2028 Control (RPG) Projection	
Class I Area	**State**	**Clearest 20%**	**Most Impaired 20%**	**Clearest 20%**	**Most Impaired 20%**	**Clearest 20%**	**Most Impaired 20%**
MANE-VU CLASS I AREAS							
Acadia NP	**ME**	**16.84**	**7.02**	**13.44**	**6.33**	**13.35**	**6.33**
Moosehorn	**ME**	**15.80**	**6.71**	**13.20**	**6.46**	**13.12**	**6.45**
Roosevelt Campobello IP	**ME/NB**						
Great Gulf	**NH**	**15.43**	**5.87**	**12.13**	**5.11**	**12.00**	**5.06**
Presidential Range/Dry River	**NH**	**15.43**	**5.87**	**12.13**	**5.11**	**12.00**	**5.06**
Lye Brook	**VT**	**18.06**	**4.89**	**13.89**	**3.9**	**13.68**	**3.86**
Brigantine	**NJ**	**22.26**	**12.25**	**18.16**	**10.55**	**17.97**	**10.47**
NEARBY CLASS I AREAS							
Shenandoah NP	**VA**	**20.72**	**8.6**	**14.54**	**7.00**	**14.25**	**6.83**
James River	**VA**	**21.37**	**11.79**	**15.48**	**9.45**	**15.31**	**9.36**
Dolly Sods	**WV**	**21.59**	**9.03**	**15.30**	**7.33**	**15.09**	**7.27**
Otter Creek	**WV**						

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 not only resulted in lower $PM_{2.5}$ and ozone concentrations but also improved public health and a lower mortality rate in contributing states as well as MANE-VU states with Class I areas.

4.3 Reasonable Progress Goals (40 C.F.R. 51.308(f)(3))

The Regional Haze Rule at 40 C.F.R. 51.308 (f)(3) requires Maine to establish, for each Class I Area within the state, reasonable progress goals toward achieving natural visibility conditions. On June 1, 2007, the EPA released final guidance[38] to be used by states in setting reasonable progress goals. The goals must provide for visibility improvement on the days of greatest visibility impairment and ensure no visibility

[38] https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/20070601_wehrum_reasonable_progress_goals_reghaze.pdf

degradation on the days of least visibility impairment for the duration of the SIP period. As provided in 40 C.F.R. 51.308 (f)(3)(i):

> A state in which a mandatory Class I 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.

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

4.4 Additional Monitoring (40 C.F.R. 51.308(f)(4))

As described in earlier sections, visibility monitoring at Roosevelt Campobello International Park and Moosehorn Wilderness Area is accomplished with instruments located at a single site at Moosehorn Wilderness Area. Visibility monitoring is also conducted in Acadia National Park. These monitoring stations measure and record light scattering, aerosols, and relative humidity. The collected data are compiled and sorted to ascertain visibility levels on the 20 percent most and least visibility-impaired days, and this information is tracked over time to show trends in visibility. The parameters and instrumentation for both sites are listed in Table 4-10 below.

Table 4-10: Visibility Monitoring at Maine Class I 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

Maine has not been advised by the Administrator, Regional Administrator, or affected Federal Land Manager that additional monitoring is needed; therefore, Maine has no plans to alter the current strategy.

4.5 Meeting the Ask – Maine

1. EGUs ≥ 25MW with already installed NO_X and/or SO_2 controls: Ensure the most effective use of control technologies on a year-round basis or obtain equivalent alternative emission reductions.

   There are no Maine facilities affected by this Ask. Maine facilities within this sector with already installed NO_X and/or SO_2 controls are currently required to operate those controls to meet stringent emission limits year-round as part of Best Available Control Technology (BACT) or Best Practical Treatment (BPT) requirements of each facility's air emission license. This is equivalent to "the most effective use of technologies" as described in this Ask, so no further response is required.

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.

Table 4-11: Emission Sources with the Potential for 3.0 Mm^{-1} or Greater Visibility Impacts at Any MANE-VU Class I Area

Facility	ID	Units
William F Wyman	ORIS ID 1507	Boiler No. 4
Jackson Laboratory	7945211	Boiler #12
Woodland Pulp LLC	5974211	#9 Power Boiler

A four-factor analysis was performed for Boiler No. 4 at FPL Energy Wyman Station (Yarmouth, Maine; identified in Table 4-11 and elsewhere in this document as "William F Wyman"); for Boiler #12 at The Jackson Laboratory (Bar Harbor, Maine); and for the #9 Power Boiler at Woodland Pulp LLC (Baileyville, Maine). Each of these analyses concluded that installation or upgrade to emission controls at the facility is not justified. Emission and control standards established in each facility's air emission license meeting BACT or BPT, as applicable, are sufficiently stringent in meeting regional haze goals. Additional information is provided in Appendix U.

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, with the following standards:
   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, and
   c. #6 residual oil within a range of 0.3 to 0.5% sulfur by weight.

   This Ask does not apply to Maine, since this state has already fully adopted an ultra-low sulfur fuel standard at least as stringent as this Ask. In accordance with state statute 38 M.R.S. § 603-A. Low sulfur fuel, beginning July 1, 2018, any liquid fossil fuel imported, distributed, or offered for sale in Maine must meet sulfur content limits of 0.0015% by weight for any distillate fuel and 0.5% by weight for any residual fuel oil. This law results 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.

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, NO_X, and PM. The permit, enforcement agreement, and/or rule can allow for suspension of the lower emission rate during natural gas curtailment.

   EGUs and other large point emission sources in Maine which switch operations to other fuels, including lower emitting fuels, are required to amend their air emission license to include the other fuels and the corresponding licensed emission rates for the new fuels. Therefore, there is no action necessary for Maine facilities to fulfill this Ask.

5. Where emission rules have not been adopted, control NO_X emissions for peaking combustion turbines that have the potential to operate on high electric demand days by complying with the following:
   a. Striving to meet NO_X 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 NO_X 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; 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.

   Maine's combustion turbines that have the potential to operate on high electric demand days are listed in the table below.

Table 4-12: Maine's Combustion Turbines

Facility	NO_X Controls	Licensed NO_X Limit
Pixelle Androscoggin LLC, Jay (3)	• Dry low NO_X burners • SCR (firing gas) • Water injection (firing oil)	4.5 ppm @ 15% O_2
Rumford Power, Rumford (1)	SCR/ammonia injection	3.5 ppm @ 15% O_2
Casco Bay Energy Company, LLC, Veazie (2)	• Dry low NO_X burners • SCR/ammonia injection	3.5 ppm @ 15% O_2
Westbrook Energy Center, LLC, Westbrook (2)	• Dry low NO_X burners • SCR/ammonia injection	2.5 ppm @ 15% O_2
Bucksport Generation, Bucksport (1)	• Dry low NO_X burners • Water injection (firing oil)	9 ppm @ 15% O_2 (natural gas) 42 ppm @ 15% O_2 (distillate fuel)

Maine's combustion turbines – Pixelle Androscoggin LLC in Jay (3); Rumford Power in Rumford (1); Casco Bay Energy in Veazie (2); Westbrook Energy Center, LLC in Westbrook (2); and Bucksport Generation in Bucksport (1) – are subject to license limits which meet or surpass the emission limits in the Ask. Therefore, there is no action necessary for Maine facilities to fulfill this Ask.

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 CHP and other clean distributed generation technologies including fuel cells, wind, and solar.

   Maine participates in the Regional Greenhouse Gas Initiative (RGGI), a collaborative initiative of 11 Northeast and Mid-Atlantic states to reduce greenhouse gas emissions. The initiative creates a market for emissions allowances through a regional cap-and-trade program for CO_2 emissions from power plants. As with all RGGI participating states, Maine's CO_2 emissions allowances are sold at quarterly auctions. The proceeds in Maine are deposited in a fund administered by Efficiency Maine Trust, an independent administrator for programs to improve the energy efficiency and reduce greenhouse gas emissions in Maine. These funds are used as financial incentives toward the purchase of high-efficiency equipment or to make changes to operations that help customers reduce electricity consumption, increase energy efficiency, lower residential heating energy demand, or lower energy costs; and for investment in measures that reduce greenhouse gas emissions.

   Maine's Renewable Portfolio Standard (RPS) statute, 35-A M.R.S. §3210 requires 30% of Maine's retail electricity sales be satisfied by existing renewable electricity generation (Class II) and 10% of retail electricity sales in 2017 and beyond be satisfied by new renewable resources (Class I).

   Maine continues to support the development and increased use within the state of CHP and other clean distributed generation technologies including fuel cells, wind, and solar power generation sources.

5. PROGRESS REPORT (40 C.F.R. 51.308(f)(5))

The Regional Haze Rule at 40 C.F.R. 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." This is addressed below.

5.1 Status of Approved Measures of State Implementation Plan: 40 C.F.R. 51.308(g)(1)

Section 51.303(g)(1) requires a description of the status of implementation of all measures included in the SIP for achieving reasonable progress goals for mandatory Class I Areas both within and outside the state.

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 which define the basic strategies for controlling pollutants that cause visibility impairment at 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, as described in Section 4).

During the first implementation period, Maine, 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. That Ask consisted of the following strategies:

1. **Timely implementation of BART requirements.** Best Available Retrofit Technology (BART) requirements apply to certain industrial sources which began operating before the federal Prevention of Significant Deterioration (PSD) rules were adopted in 1977 to protect visibility in Class I Areas. Maine met the terms of this agreement by addressing its 10 BART-eligible emission sources. Of the 10, three sources with *actual* emissions of visibility-impairing pollutants at less than the BART applicability threshold of 250 tons per year "capped out" of BART, i.e., accepted federally enforceable permit limits on those specific units to permanently limit emissions of applicable pollutants to less than 250 tons per year. Two of the three facilities have since ceased operations, and the third facility has permanently removed the capped unit from service. BART requirements were included in the air emission licenses for the other seven facilities with timely control strategies for emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_X), and particulate matter less than 10 microns in diameter (PM_{10}), as applicable. Since that initial implementation of BART requirements, two of the seven affected sources have been permanently shut down.

   Maine has also implemented the low-sulfur fuel oil strategy.

2. **A targeted EGU strategy.** Maine adopted *NO_X Control Program*, 06-096 C.M.R. ch. 145 (Ch. 145) on July 22, 2001, which prescribes year-round control requirements for large stationary sources of NO_X beginning May 2, 2003. The regulation applies to any owner or operator of a fossil fuel-fired electric

generating unit (EGU) or resource recovery unit or fossil fuel-fired indirect heat exchanger or primary boiler with a heat input greater than 250 million British Thermal Units (MMBtu) per hour located in counties that have not received a waiver of NO_X control requirements pursuant to section 182(f) of the 1990 Clean Air Act Amendments. There is no county in Maine which currently has a NO_X waiver pursuant to section 182(f); therefore, this rule applies statewide to emission units in the identified categories. The rule promulgated interim emissions standards for the period from June 15, 2003, through December 30, 2004. Since January 1, 2005, the following NO_X emission standards are applicable:

Emissions Unit Category	Max. Heat Input Capacity	Standard	Averaging Period
EGU, firing fossil fuel	< 750 MMBtu/hr	0.22 lb/MMBtu	90-day rolling average basis
	≥ 750 MMBtu/hr	0.15 lb/MMBtu	
Indirect Heat Exchangers, firing fossil fuel	> 250 MMBtu/hr	0.20 lb/MMBtu	90-day rolling average basis
Primary Boilers, firing fossil fuel	> 250 MMBtu/hr	0.20 lb/MMBtu	90-day rolling average basis
Resource Recovery Units	> 250 MMBtu/hr	0.20 lb/MMBtu	90-day rolling average basis

This rule allows for emissions averaging for a facility with more than one affected source with a maximum heat input capacity of 750 MMBtu/hr or greater. The rule also provides for alternative emission limitations based on the actual performance of the source's control technology. In such a case, the affected facility has the burden of proof in making a demonstration that achieving the specified emission limitation of this rule is technically infeasible with the NO_X control technology installed pursuant to Section 3(A) of this rule. This rule also specifies applicable monitoring and reporting requirements.

Minor sources or units that can be limited to the minor source threshold as defined in *Definitions Regulation*, 06-096 C.M.R. ch. 100, are exempt from the requirements of this rule.

Many emission units potentially subject to requirements of this rule, including Maine's electric generation facilities operating natural gas-fired combustion turbines, have undergone Best Available Control Technology (BACT) analyses or other regulatory evaluations with corresponding constraints more recently than the effective date of this rule. As a result, they are subject to emissions limitations at least as stringent as those identified in this rule.

Oil-fired EGUs at the FPL Energy Wyman Station in Yarmouth remain constrained by this rule. Because this facility functions in an availability capacity, the level of operations in recent years has been a small percentage of actual capacity. The Part 70 license for this facility, A-388-70-G-R (May 14, 2020), addresses criteria for compliance with Ch. 145.

3. **A low sulfur fuel oil strategy.** Maine amended the statute 38 M.R.S. §603-A. Low sulfur fuel. Effective July 1, 2018,[39] the sulfur limit is 0.0015% by weight for all distillate fuels and 0.5% by weight for all residual fuel oils. This statute results in further reductions in SO_2 emissions from industrial,

[39] Ibid.

area, mobile, and non-road sources beyond the more than 75% reduction seen in the 2008 vs. 2017 National Emissions Inventory data (see Table 5-17).

Continued evaluation of other control measures. Maine continues its participation in “Clean Cities,” the U.S. Department of Energy's (DOE's) program that advances the nation's economic, environmental, and energy security by supporting local actions to cut petroleum use in transportation.

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

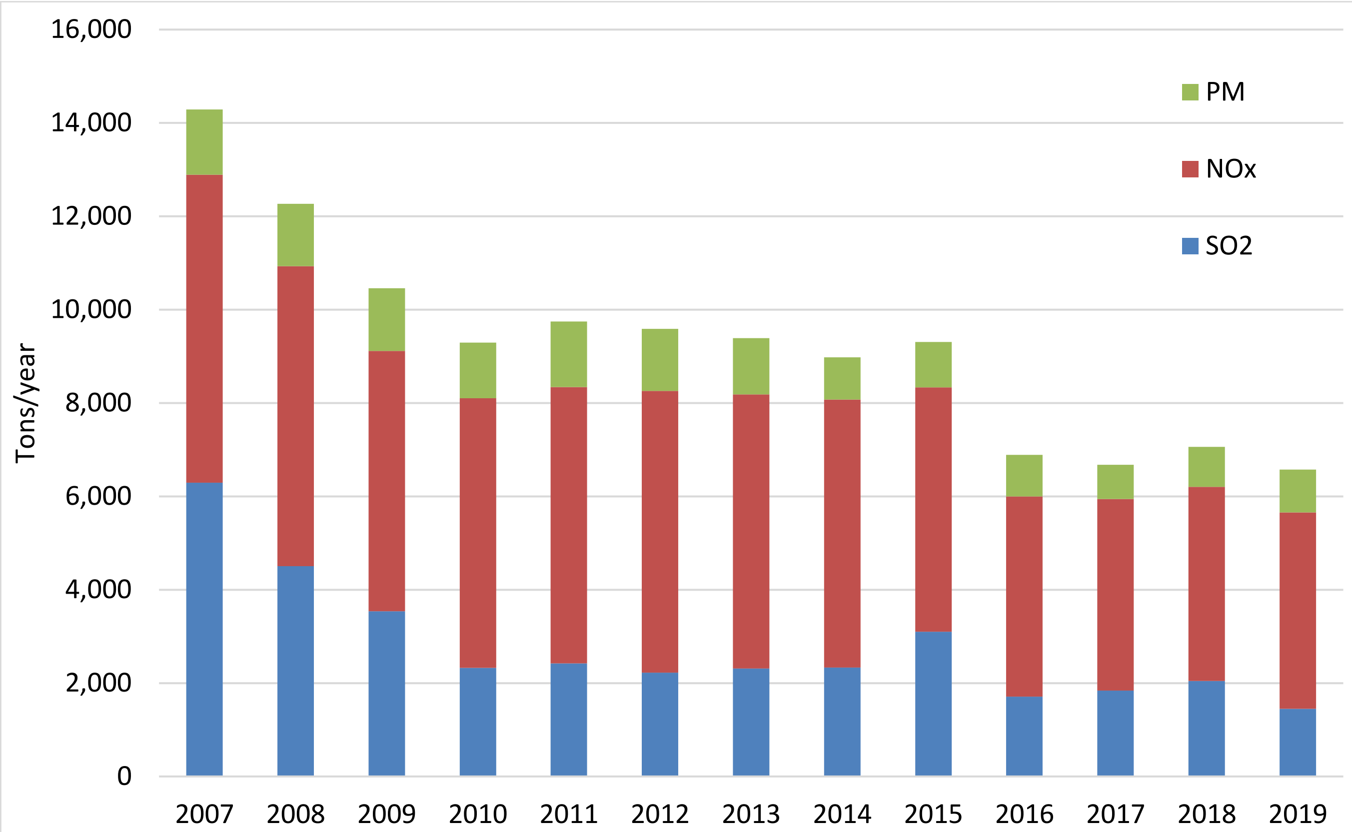
Section 51.303(g)(2) calls for summary of the emissions reductions achieved throughout the state through implementation of the measures described in paragraph 5.1 of this section.

While the fuel strategy was only recently fully implemented and the effects of other control measures difficult to quantify, results of other strategies are identifiable. For example, there are documented reductions in emissions of three visibility-impairing pollutants (SO_2, NO_X, and PM) from Maine’s BART-eligible sources due to implementation of the BART requirements and other targeted strategies, as shown in Table 5-1 and Figure 5-1.

Table 5-1. SO_2, NO_X, and PM Emissions from Maine BART Sources, 2007-2019

Facility/Pollutant	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Woodland Pulp, LLC													
SO_2	893	705	294	281	490	511	334	227	215	175	223	177	262
NO_X	1071	1065	895	997	1097	1064	921	912	933	961	986	984	1016
PM	435	359	245	293	406	288	282	253	340	406	241	236	275
Dragon Products Company, Inc.													
SO_2	41	58	32	20	16	23	25	18	15	34	16	16	17
NO_X	874	1480	421	796	836	950	938	1105	613	410	449	354	331
PM	28	14	7	26	27	30	30	30	32	37	39	36	31
FPL Energy Wyman, LLC													
SO_2	1841	1143	998	863	524	480	943	908	1816	430	510	692	103
NO_X	290	206	221	186	113	123	200	225	429	98	121	164	32
PM	18	12	11	11	11	15	13	8	11	5	5	5	3
Lincoln Paper and Tissue, LLC													
SO_2	91	104	109	80	87	43	42	9	26	0	0	0	0
NO_X	357	394	393	326	372	345	364	121	103	0	0	0	0
PM	148	145	143	146	142	95	90	3	7	0	0	0	0
OTM Holdings, LLC													
SO_2	94	5	98	110	86	81	42	23	36	0	0	0	104
NO_X	304	12	575	619	513	547	560	302	307	0	0	0	41
PM	51	1	104	14	20	68	96	55	62	0	0	0	6
SAPPI, Somerset													
SO_2	1474	1647	731	614	766	892	767	982	809	935	886	955	825
NO_X	2369	2231	1987	1934	2061	1927	1885	1989	1813	1857	1873	1910	1815
PM	240	453	388	389	473	467	339	257	268	221	275	368	344
Verso Androscoggin													
SO_2	1858	841	1279	357	450	195	158	163	183	134	206	202	136
NO_X	1337	1043	1081	918	929	1077	1008	1091	1037	964	675	751	971
PM	475	346	446	314	325	367	353	297	253	222	170	209	263

Figure 5-1: SO_2, NO_X, and PM Emissions Trends from Maine BART Sources, 2007-2019



The summary of statewide emissions of visibility-impairing pollutants from all sources and activities for the period from 2002 to 2014 is provided in section 5.4, based on the National Emissions Inventory (NEI) data. For the period 2008 to 2017, a decrease of 30% for NO_X, an increase of 15% for PM (due to increases in nonpoint sector PM resulting from method changes), and a 75% decrease for SO_2 are documented, while the EGUs emissions decreased by 36%, 45%, and 59% for NO_X, PM, and SO_X respectively for the same 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 2019. This work was completed by the Maine Department of Environmental Protection on behalf of MANE-VU[40] to determine baseline, current, and natural visibility conditions for the 20 percent most impaired days and the 20percent clearest days for each in-state and out-of-state Class I Area for states in the MANE-VU region.

Visibility trends analyses used US EPA-recommended metrics[41] at IMPROVE monitoring sites at Class I Areas including Maine's Acadia National Park and Moosehorn Wilderness Area. The results of the

[40] See Appendix C.
[41] See Appendix W.

analysis showed the following:

- There continue to be definite downward trends in overall haze levels at all 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 Class I Area visibility conditions are currently better than the 2028 URP visibility condition for the 20 percent most impaired visibility days and below baseline conditions for the 20 percent clearest days. Trends are mainly driven by large reductions in sulfate light extinction, and to a lesser extent, nitrate light extinction.
- Levels of organic carbon mass (OCM) and light absorbing carbon (LAC) appear to be approaching natural background levels at most of the MANE-VU Class I Areas.
- 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 percent most impaired days.

Table 5-2: Baseline, Current and Reasonable Progress Goal Haze Index Levels for Class I Areas In or Adjacent to the Mane-VU Region

<table>
<tr><th rowspan="2">Class I Area</th><th rowspan="2">State</th><th colspan="3">20% Clearest Days</th><th colspan="5">20% Most Impaired Days</th></tr>
<tr><th>Baseline (2000-04) (dv)</th><th>Current (2015-19) (dv)</th><th>RPG^ (2028) (dv)</th><th>Baseline (2000-04) (dv)</th><th>Current (2015-19) (dv)</th><th>URP* (2019) (dv)</th><th>URP* (2028) (dv)</th><th>RPG^ (2028) (dv)</th></tr>
<tr><td colspan="10">MANE-VU CLASS I AREAS</td></tr>
<tr><td>Acadia National Park</td><td>ME</td><td>8.78</td><td>6.36</td><td>6.33</td><td>22.01</td><td>14.24</td><td>19.11</td><td>17.36</td><td>13.35</td></tr>
<tr><td>Moosehorn Wilderness</td><td>ME</td><td rowspan="2">9.16</td><td rowspan="2">6.48</td><td rowspan="2">6.45</td><td rowspan="2">20.65</td><td rowspan="2">12.99</td><td rowspan="2">17.98</td><td rowspan="2">16.38</td><td rowspan="2">13.12</td></tr>
<tr><td>Roosevelt Campobello International Park</td><td>NB</td></tr>
<tr><td>Great Gulf Wilderness</td><td rowspan="2">NH</td><td rowspan="2">7.65</td><td rowspan="2">4.70</td><td rowspan="2">5.06</td><td rowspan="2">21.88</td><td rowspan="2">12.33</td><td rowspan="2">18.85</td><td rowspan="2">17.04</td><td rowspan="2">12.00</td></tr>
<tr><td>Presidential Range /Dry River Wilderness</td></tr>
<tr><td>Lye Brook Wilderness</td><td>VY</td><td>6.37</td><td>4.88</td><td>3.86</td><td>23.57</td><td>14.06</td><td>20.24</td><td>18.24</td><td>13.68</td></tr>
<tr><td>Brigantine Wilderness</td><td>NJ</td><td>14.33</td><td>10.81</td><td>10.47</td><td>27.43</td><td>18.53</td><td>23.24</td><td>20.73</td><td>17.97</td></tr>
<tr><td colspan="10">CLASS I AREAS ADJACENT TO THE MANE-VU REGION</td></tr>
<tr><td>Dolly Sods Wilderness</td><td rowspan="2">WV</td><td rowspan="2">12.28</td><td rowspan="2">6.18</td><td rowspan="2">7.27</td><td rowspan="2">28.29</td><td rowspan="2">17.03</td><td rowspan="2">23.45</td><td rowspan="2">20.54</td><td rowspan="2">15.09</td></tr>
<tr><td>Otter Creek Wilderness</td></tr>
<tr><td>James River Face</td><td>VA</td><td>14.21</td><td>8.99</td><td>9.36</td><td>28.08</td><td>17.28</td><td>23.43</td><td>20.64</td><td>15.31</td></tr>
<tr><td>Shenandoah National Park</td><td>VA</td><td>10.96</td><td>6.54</td><td>6.83</td><td>28.32</td><td>16.38</td><td>23.62</td><td>20.80</td><td>14.25</td></tr>
</table>

* Uniform Rate of Progress

^ Modeled Reasonable Progress Goal (see Appendix V)

Visibility metrics for MANE-VU and nearby Class I Areas are shown below in Figures 5-2 through 5-9. As shown, visibility trends for the 20% most impaired days are well below the uniform rate of progress line and quickly approaching 2028 Reasonable Progress Goals as an annual average as well a five-year rolling average. Visibility trends for the 20% clearest days are also well below the no degradation line at all MANE-VU and nearby Class I Areas.

Figure 5-2: Visibility Metrics Levels at Acadia National Park

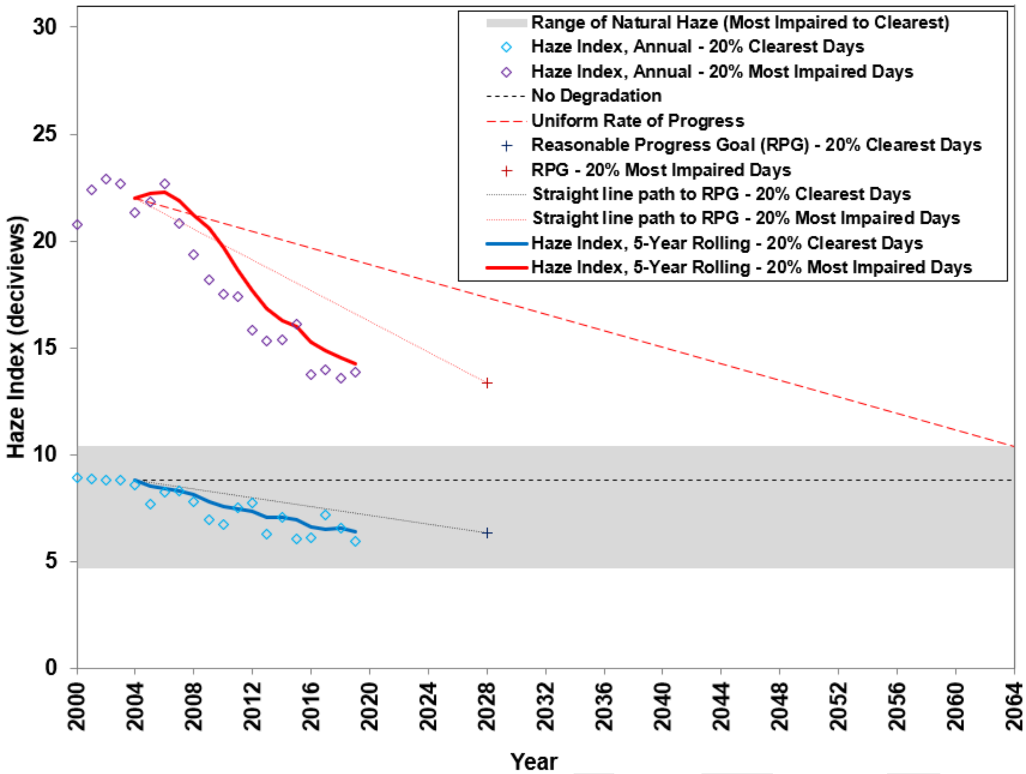


Figure 5-3: Visibility Metrics Levels at Moosehorn Wilderness Area

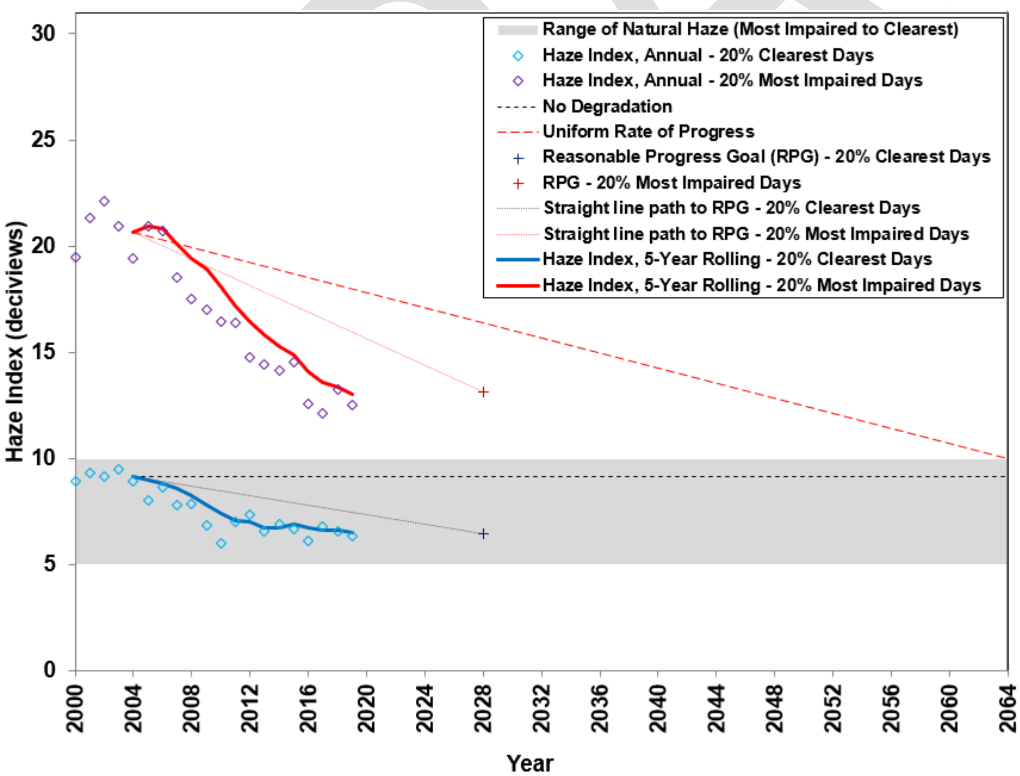


Figure 5-4: Visibility Metrics Levels at Great Gulf Wilderness Area

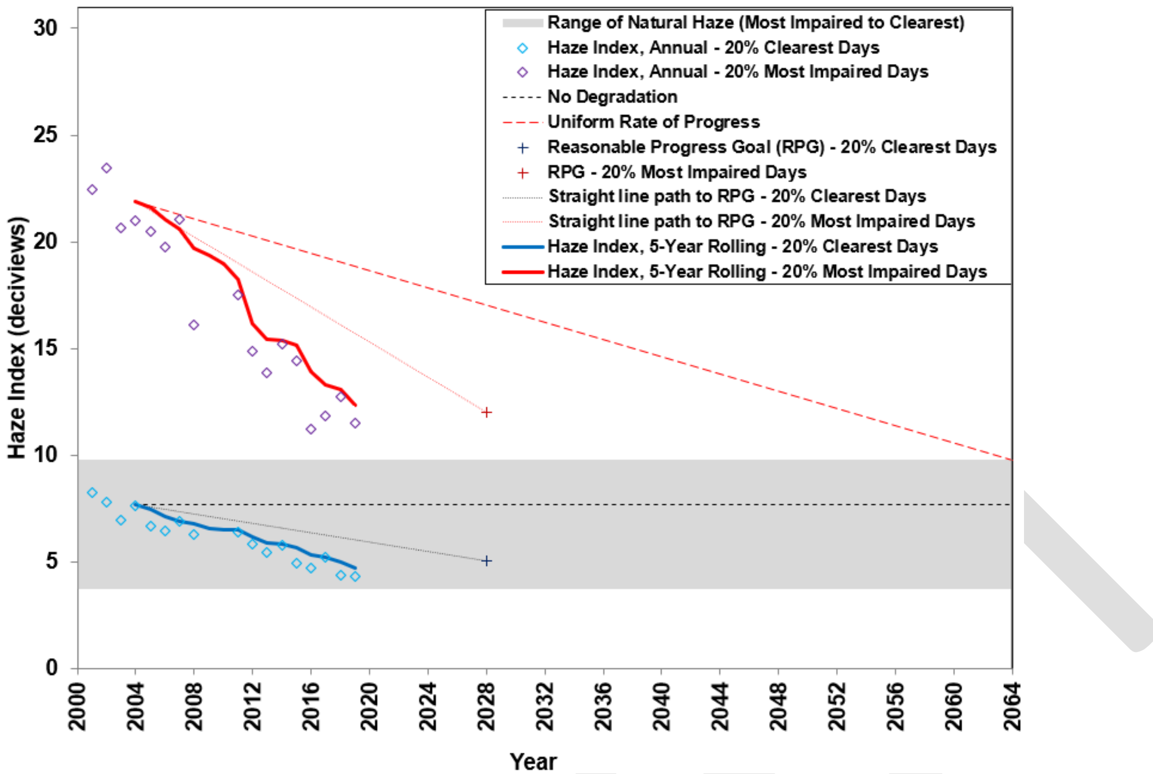


Figure 5-5: Visibility Metrics Levels at Lye Brook Wilderness Area

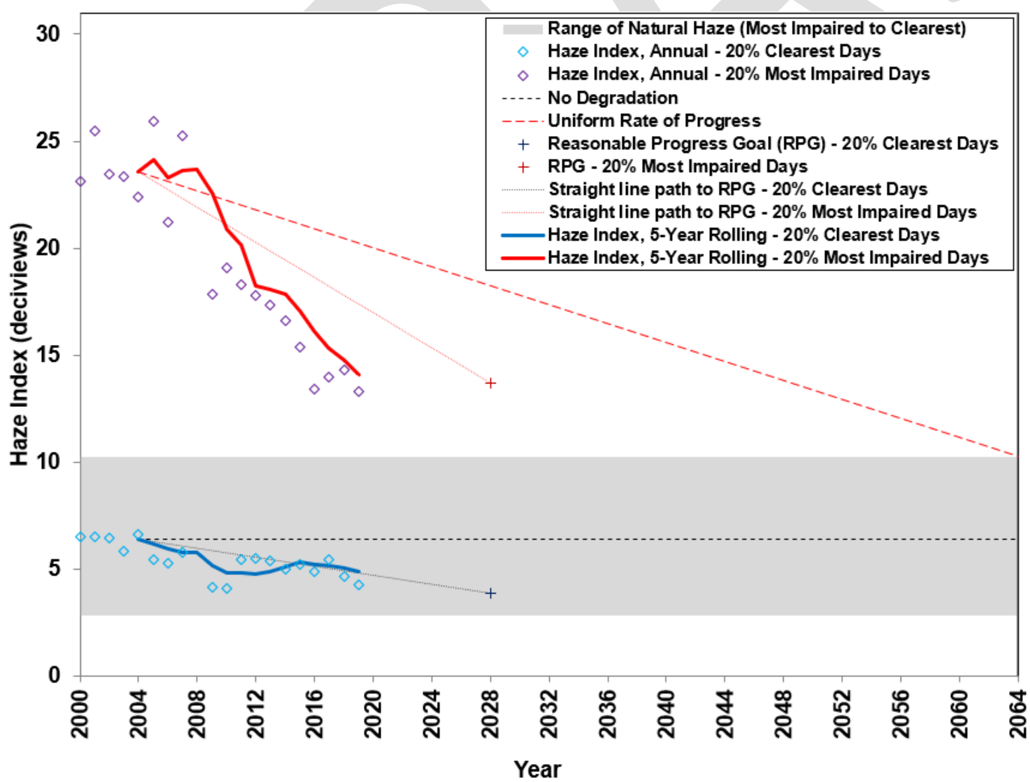


Figure 5-6: Visibility Metrics Levels at Brigantine Wilderness Area

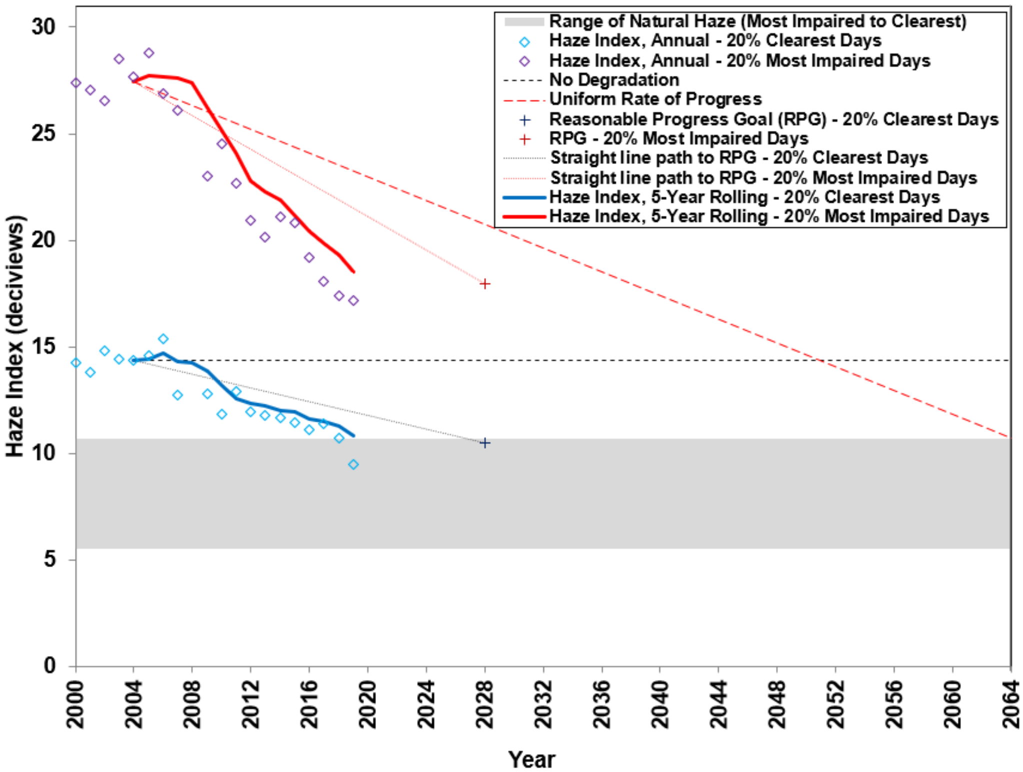


Figure 5-7: Visibility Metrics Levels at Shenandoah National Park

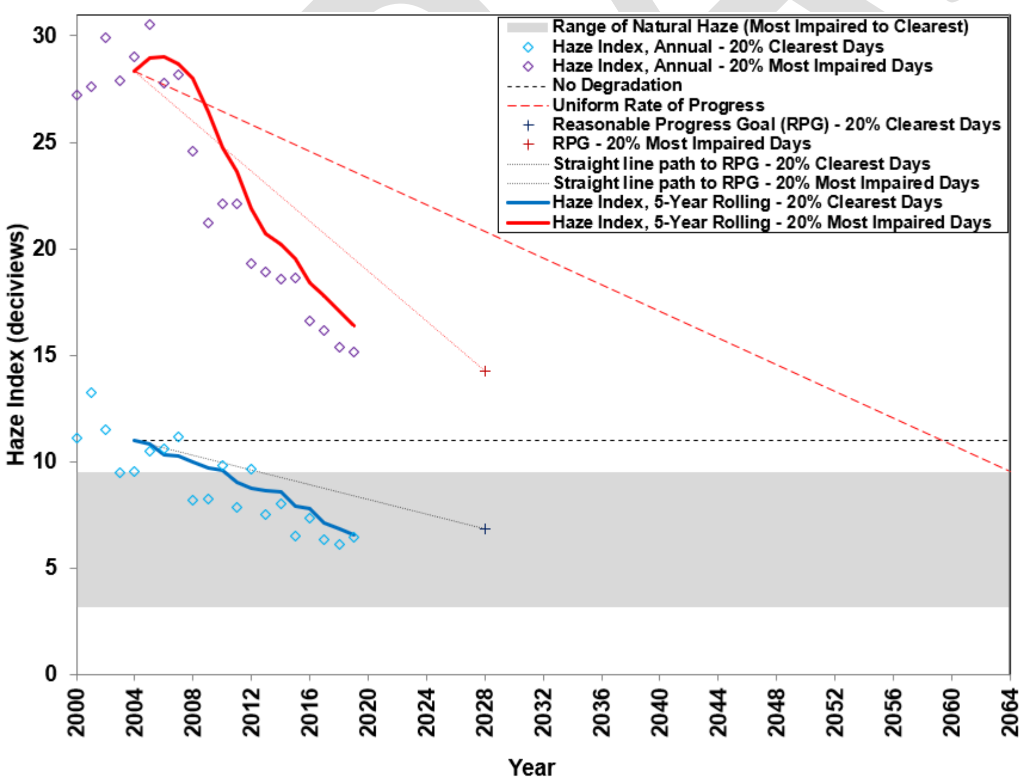


Figure 5-8: Visibility Metrics Levels at James River Face Wilderness Area

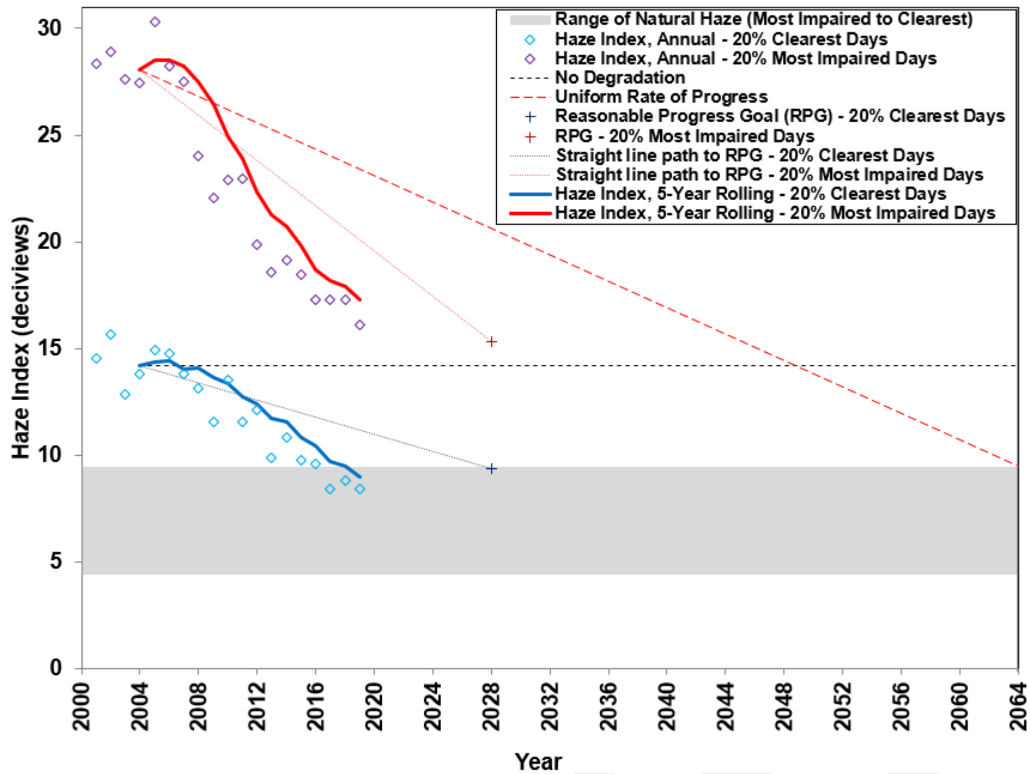
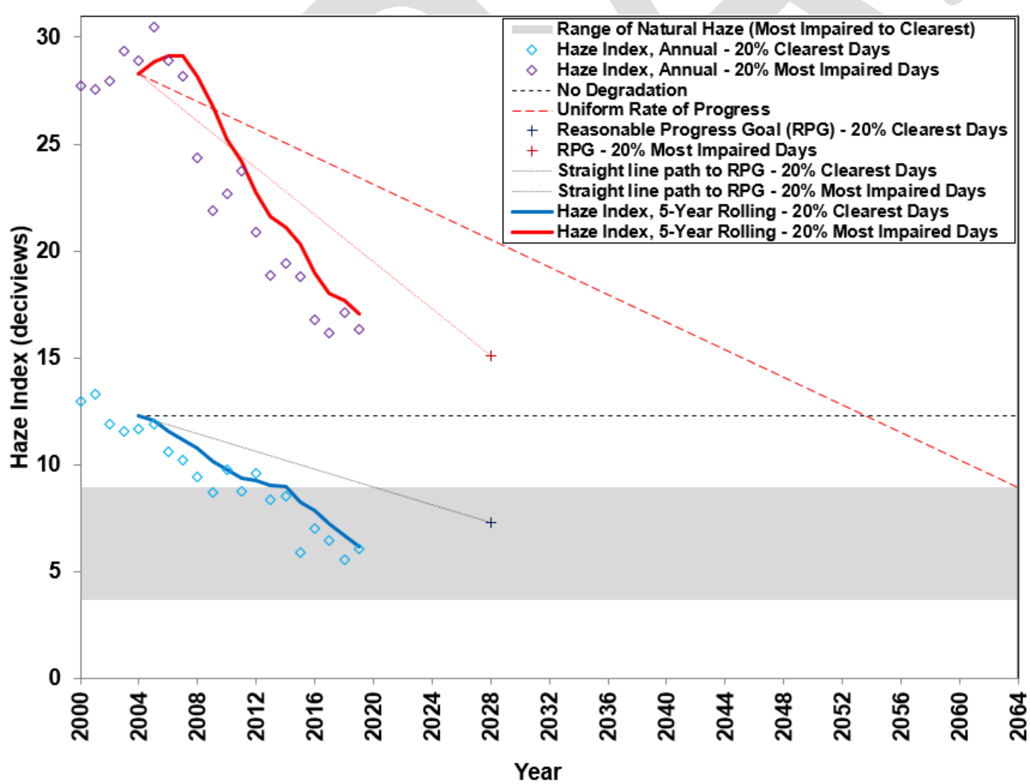


Figure 5-9: Visibility Metrics Levels at Dolly Sods Wilderness Area



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 percent clearest and 20 percent most impaired days. Results clearly show a significant reduction in sulfate contributions to Maine's Class I Areas for the 20 percent most impaired days with varying levels of increases, or no change, for other species. The percent contribution from combined nitrates and organic carbon mass has, similar to other Class I Areas examined for this report, increased, here from 7% to 11%.

Figure 5-10: Acadia National Park Class I Area Species Percent Contribution to Baseline (2000-04) and Current (2015-19) Haze Index Levels

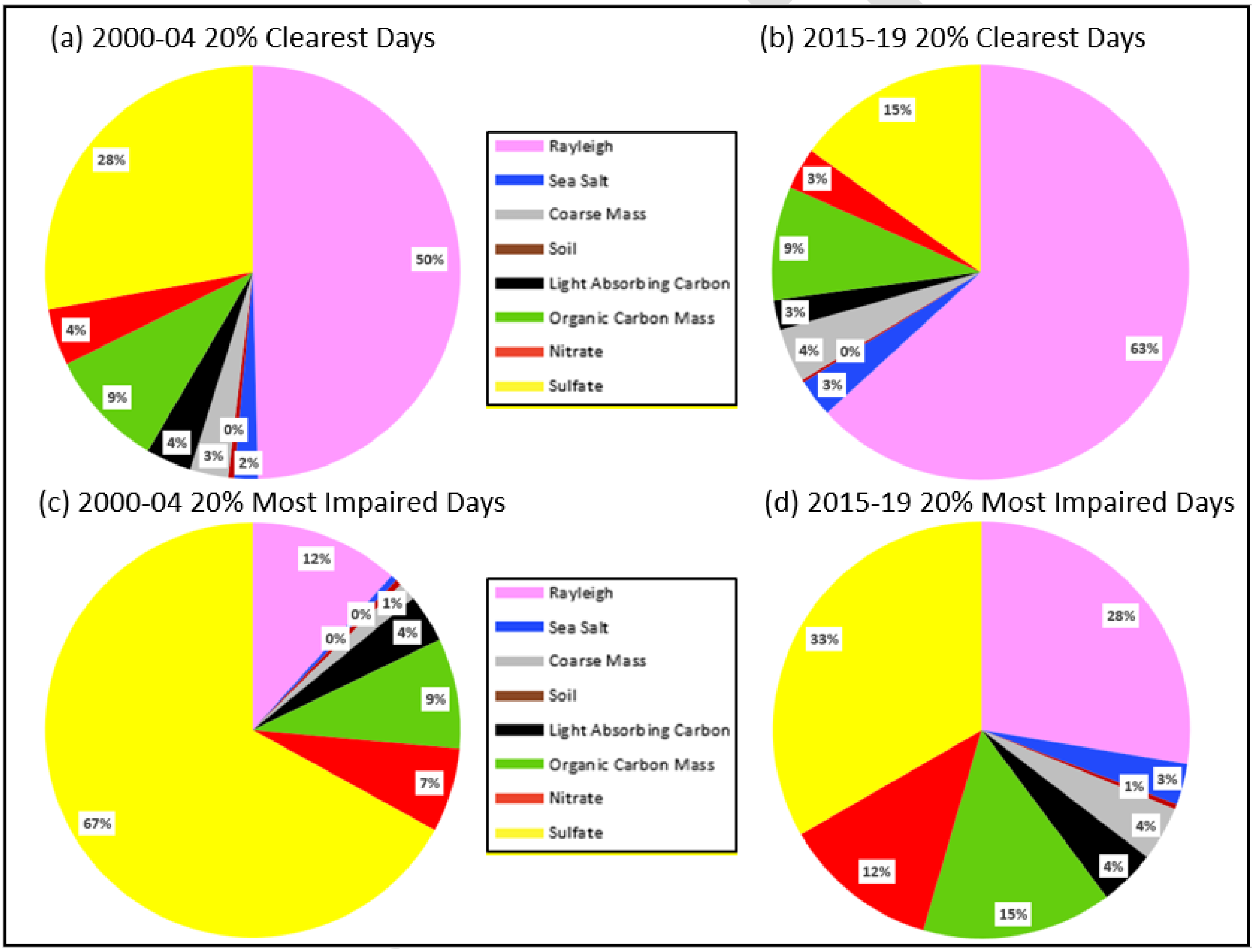
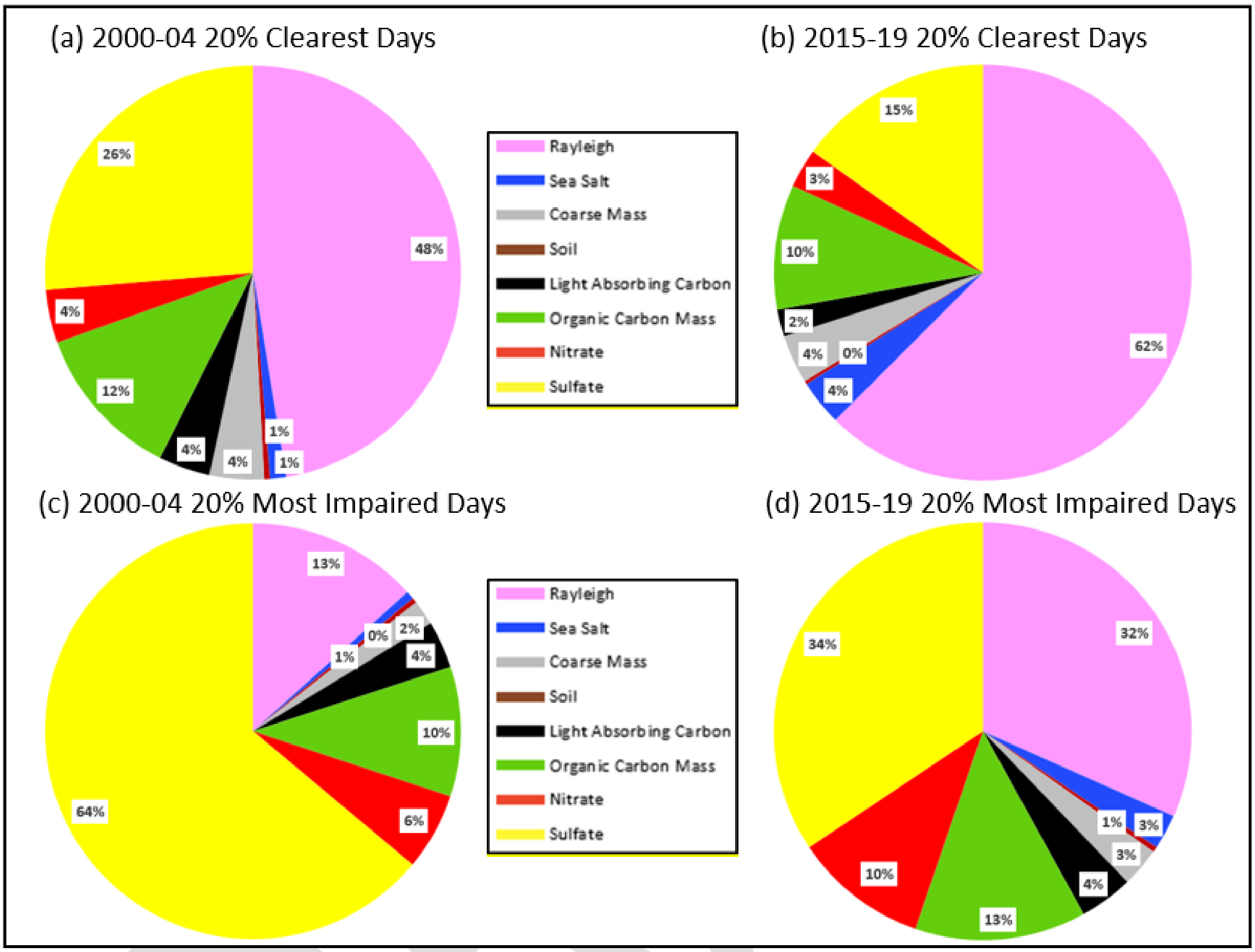


Figure 5-11: Moosehorn Wilderness Class I Area Species Percent Contribution to Baseline (2000-04) and Current (2014-18) Haze Index Levels



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

5.4.1 Introduction

Maine is required by 40 C.F.R. Section 51.308(d)(3)(iv) to identify all anthropogenic sources of visibility impairment considered by the state in developing its long-term strategy. This process begins with the identification of key pollutants and source categories that contribute to visibility impairment at the Class I Area(s) affected by emissions from the state.

Maine is also required by 40 C.F.R. Section 51.308 (g)(4) to analyze trends in emissions of visibility-impairing pollutants. In addition, Section 51.308(d)(4)(v) of EPA's Regional Haze Rule requires a statewide emissions inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I Area. This section explores the characteristics, origin, and quantity of visibility-impairing pollutants emitted in Maine and the Eastern/Mid-Atlantic United States.

Maine has summarized emissions of visibility-impairing pollutants from all sources and activities within the state for the period from 2002 to 2017. The most recent year for which Maine has submitted emission estimates to fulfill the requirements of 40 C.F.R. 51 Subpart A (also known as the Air Emissions Reporting Requirements, or AERR) is 2020. In this summary, Maine has provided estimates for nitrogen oxides (NO_X), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), volatile organic compounds (VOC), and ammonia (NH_3), all of which have the potential to contribute to regional haze formation. The data were obtained from EPA's National Emissions Inventory (NEI).[42] NEI data categories include point sources, nonpoint sources, nonroad mobile sources, and onroad mobile sources and are described below.

- NEI Point sources are stationary facilities that generally report their emissions directly via state and/or federal permitting and reporting programs. Point sources represent larger facilities such as electric generating units (EGUs), manufacturing facilities, and heating units for large schools and universities. As of 2008, mobile source nonroad emissions from airports and railroad switch yards are inventoried as point sources in the NEI. In the tables and charts included in this section, point sources of NO_X and SO_2 are further broken down into EPA Air Markets Program Data (AMPD) sources and non-AMPD sources. Most sources that report to EPA's AMPD are EGUs. Therefore, the AMPD point category is a reasonable representation of emissions from EGUs.

- NEI Nonpoint sources include stationary area sources and some mobile sources. Area sources are those emissions categories that are too small, widespread, or numerous to be inventoried individually. Therefore, emissions are estimated for these categories using activity data such as population, employment, and fuel use. There is a wide range of area source categories, but examples include residential fuel combustion, consumer product use, paints, and any stationary source emissions not included in the point source sector. 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 source sector, and beginning in 2011, it was included in the onroad sector. While biogenic emissions are included in EPA's NEI, biogenic emissions are not included in this report.

- NEI Nonroad mobile sources represent vehicles and equipment that are not designed to operate on roadways. Examples include aircraft, ships, railroad locomotives, construction equipment, recreational boats and vehicles, and lawn and garden equipment. As discussed above, beginning in 2008, the NEI emissions from airports and railroad switch yards are inventoried as point sources, and emissions from other railroad activities and commercial marine vessels are inventoried as nonpoint sources.

- NEI Onroad mobile sources represent vehicles that operate on roadways, including cars, trucks, buses, and motorcycles. Emissions were calculated with a new EPA model (MOVES) in 2007, 2011, and 2017, which was different than the model used for the 2002 inventory (MOBILE6). As

[42] https://www.epa.gov/air-emissions-inventories/emissions-inventory-system-eis-gateway

of 2011 NEI v2, EPA includes vehicle refueling at gasoline service stations in the onroad sector instead of the area or nonpoint source sector.

Under the AERR, states are required to submit estimated emissions or model inputs for all emissions categories to EPA on a three-year cycle or accept EPA's estimates. 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, the analysis must extend through the most recent year for which the Administrator has provided a state-level summary of such reported data or an internet-based tool by which the state may obtain such a summary as of a date 6 months preceding the required date of the progress report." For example, point source NO_X and SO_2 emissions from mostly EGUs are reported to EPA's web-based application, AMPD. Maine has provided a summary of NO_X and SO_2 emissions for AMPD sources for the years 2016 through 2019.

In addition to the Maine-specific data, 2002 – 2017 summaries of emissions from all sectors, as well as summaries of NO_X and SO_2 emissions for AMPD sources are provided for all the MANE-VU states, including Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Similar summaries are also shown for the states listed in the MANE-VU Inter-RPO Ask[43] as having the potential to contribute to visibility impairment in MANE-VU Class I Areas. These states include Alabama, Florida, Illinois, Indiana, Kentucky, Louisiana, Michigan, Missouri, North Carolina, Ohio, Tennessee, Texas, Virginia, and West Virginia. This group of states is referred to hereinafter as the "Non-MANE-VU Ask states."

5.4.2 Nitrogen Oxides (NO_X)

Table 5-3 shows a summary of NO_X emissions from all NEI data categories – point, nonpoint, non-road, and onroad for the period from 2002 to 2017 in Maine. This summary is also shown graphically in Figure 5-12. Table 5-4 shows additional data years for Maine's point sources that report to EPA's AMPD.

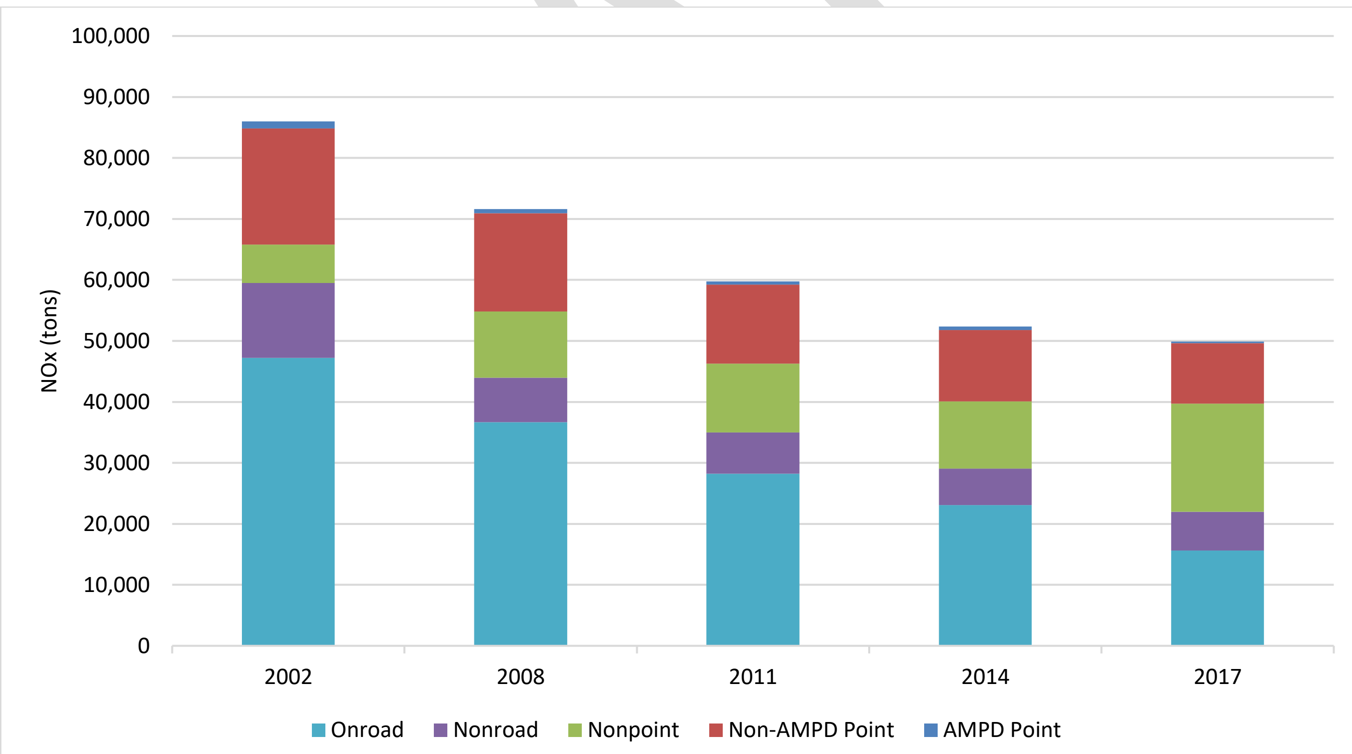
[43] See Appendix R-2

Table 5-3: NO_X Emissions in Maine for all NEI Data Categories, 2002–2017 (tons/yr)

Category	2002	2008	2011	2014	2017	Change 2002 - 2017	Percent Change 2002 - 2017
AMPD Point	1,154	680	575	539	263	-891	-77%
Non-AMPD Point	19,059	16,081	12,963	11,729	9,931	-9,128	-48%
Nonpoint	6,259	10,864	11,281	11,007	17,699	11,440	183%
Nonroad	12,296	7,316	6,759	5,977	6,352	-5,944	-48%
Onroad	47,227	36,666	28,207	23,094	15,646	-31,581	-67%
Total	**85,995**	**71,606**	**59,785**	**52,346**	**49,890**	**-36,105**	**-42%**

Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008 but excludes it after 2008.
The increase in NO_X emissions between 2014 and 2017 NEI years is the result of methodology changes affecting two fuel combustion sectors (Commercial/Institutional – Oil and Industrial Boilers, ICEs-Biomass).
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Figure 5-12: NO_X Emissions in Maine for all Data Categories, 2002–2017 (tons/yr)



Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008 but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Table 5-4: NO_X Emissions from EPA AMPD Sources in Maine, 2016–2019 (tons/yr)

2016	2017	2018	2019
288	263	327	138

Apart from the nonpoint sector, NO_X emissions have shown a steady decline in Maine over the period from 2002 to 2017. Reductions in nonroad emissions are due to new engine standards for nonroad vehicles and equipment as a result of a wide range of federal rules to reduce emissions from nonroad vehicles and equipment. A few examples of regulatory programs that have reduced and/or will continue to reduce emissions from nonroad vehicles and equipment include Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel,[44] Control of Emissions from Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters Per Cylinder,[45] and Control of Emissions from Nonroad Spark-Ignition Engines and Equipment.[46] Onroad mobile emission reductions are due to the National and State Low Emission Vehicle Programs, and the federal requirements for onroad vehicles such as the Tier 2 motor vehicle emissions standards.[47] Federal requirements for onroad mobile sources and fuels are being strengthened even further with the Tier 3 requirements.[48] More information on programs to control emissions from mobile sources can be found on EPA's Transportation, Air Pollution, and Climate Change website.[49] For both nonroad and onroad mobile sources, NO_X emissions are expected to continue to decrease as fleets turn over and older, more-polluting vehicles and equipment are replaced by newer, cleaner ones.

The nonpoint NO_X methodology changes between 2011 and 2014 should be noted. For the 2011 and previous inventories, Maine estimated and reported industrial and commercial distillate oil combustion emissions under a composite source classification code (SCC) for boilers and internal combustion (IC) engines using a single emission factor for boilers. However, there has been a recent focus on NO_X emissions from IC engines. Therefore, for the 2014 inventory, Maine 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. The NO_X emission factor for IC engines is significantly higher than that for boilers. Also, because of a revised point source subtraction methodology, the sharp decrease in nonpoint NO_X between 2002 and 2008/2011 is also artificial.

Tables 5-5 and 5-6 and Figures 5-13 and 5-14 show a steady decline in NO_X emissions from 2002 to 2017 for almost all the MANE-VU states and the Non-MANE-VU Ask states. Much of this decline is due to the federal control programs for non-road and on-road mobile sources described earlier. Other sources of NO_X emissions reductions include individual states' rules for Reasonably Available Control Technology for NO_X (NO_X RACT).

Sources of NO_X emissions in Maine that report to the EPA's AMPD showed a decline in emissions from

[44] https://www.gpo.gov/fdsys/pkg/FR-2004-06-29/pdf/04-11293.pdf
[45] https://www.gpo.gov/fdsys/pkg/FR-2008-06-30/pdf/R8-7999.pdf
[46] https://www.gpo.gov/fdsys/pkg/FR-2008-10-08/pdf/E8-21093.pdf
[47] 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)
[48] Tier 3 Motor Vehicle Emission and Fuel Standards, Final Rule (https://www.gpo.gov/fdsys/pkg/FR-2014-04-28/pdf/2014-06954.pdf)
[49] https://www.epa.gov/air-pollution-transportation

2016 to 2019, with an increase between 2017 and 2018. These are compared to the AMPD reporting sources in the MANE-VU states in Figure 5-15. AMPD NO_X emissions have also declined relative to the 2002 to 2017 data shown in Figure 5-12.

Table 5-5: Total NO_X Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	NO_X Change (2002 – 2017)	Percent NO_X Change (2002 – 2017)
CT	115,012	93,080	72,828	63,003	46,575	-68,437	-60%
DE	57,345	42,790	29,436	27,684	22,882	-34,463	-60%
DC	15,169	13,189	9,403	8,566	4,780	-10,389	-68%
ME	85,995	71,606	59,785	52,346	49,890	-36,105	-42%
MD	291,299	205,239	165,185	138,496	96,310	-194,989	-67%
MA	287,077	168,599	136,892	127,304	105,860	-181,217	-63%
NH	69,036	66,595	47,947	49,880	28,533	-40,503	-59%
NJ	330,369	244,552	168,297	154,655	136,961	-193,408	-59%
NY	537,513	442,093	387,262	330,782	240,411	-297,102	-55%
PA	718,261	616,320	561,928	492,755	321,900	-396,361	-55%
RI	29,917	18,963	22,489	24,716	14,865	-15,052	-50%
VT	28,764	20,903	19,635	15,697	15,311	-13,453	-47%
Total	**2,565,756**	**2,003,930**	**1,681,086**	**1,485,883**	**1,084,279**	**-1,481,477**	**-58%**

Figure 5-13: Total NO_X Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017

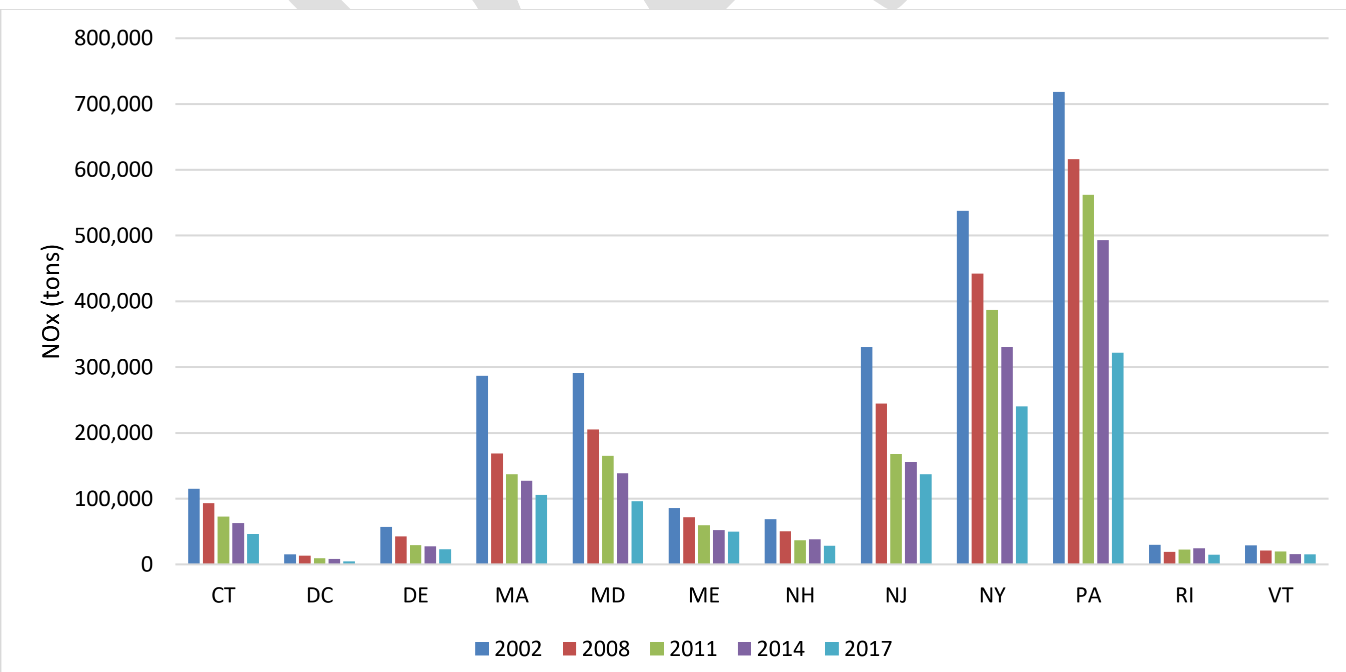


Table 5-6: Total NO_X Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	NO_X Change (2002 – 2017)	Percent NO_X Change (2002 – 2017)
AL	494,699	369,943	345,285	314,187	213,135	-281,564	-57%
FL	1,092,044	853,858	609,704	558,725	406,291	-685,753	-63%
IL	847,488	638,926	507,075	453,108	317,164	-530,324	-63%
IN	723,294	545,953	443,116	395,719	280,409	-442,885	-61%
KY	484,708	378,216	324,803	281,468	196,104	-288,604	-60%
LA	723,164	496,880	519,018	361,543	306,028	-417,136	-58%
MI	684,627	628,254	444,088	382,946	279,503	-405,124	-59%
MO	542,019	425,645	365,593	357,946	259,367	-282,652	-52%
NC	596,536	434,596	366,131	305,674	231,534	-365,002	-61%
OH	948,927	740,029	583,802	429,038	328,246	-620,681	-65%
TN	557,649	416,702	320,085	265,631	199,380	-358,269	-64%
TX	1,894,041	1,515,796	1,268,310	1,225,152	1,017,177	-876,864	-46%
VA	511,048	373,229	310,821	273,733	209,669	-301,379	-59%
WV	381,774	213,495	171,715	184,782	126,645	-255,129	-67%
Total	**10,482,018**	**8,031,522**	**6,579,546**	**5,789,652**	**4,370,653**	**-6,111,365**	**-58%**

Figure 5-14: Total NO_X Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2017 (tons/yr)

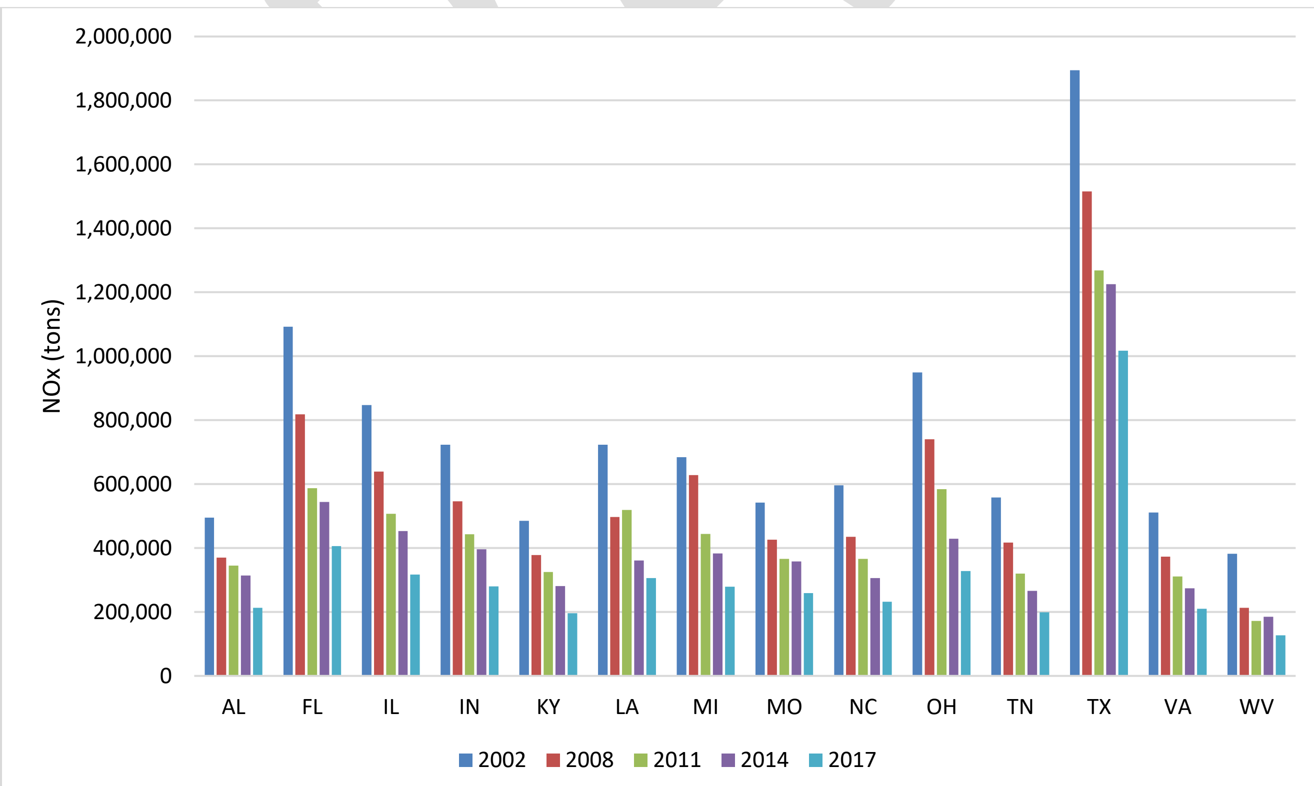


Table 5-7 and Figure 5-15 show AMPD NO_X data trends for the MANE-VU states from 2002 to 2019, and Table 5-8 and Figure 9-16 show AMPD NO_X data trends for the Non-MANE-VU Ask states from 2002 to 2019. Tables 5-7 and 5-8 show significant decreases in NO_X emissions for the AMPD sources between 2002 and 2019 for all states in MANE-VU as well as all the Non-MANE-VU Ask states. For applicable states, some of the reduction in AMPD NO_X since 2002 is attributable to the NO_X Budget Trading Program under the NO_X SIP Call and the Clean Air Interstate Rule. The Clean Air Interstate Rule, or CAIR, was replaced by the Cross-State Air Pollution Rule (CSAPR) in 2015. Other reductions are attributable to source retirements and fuel switching due to the availability of less expensive natural gas in recent years.

Table 5-7: NO_X Emissions from AMPD Sources in the MANE-VU States, 2002–2019 (tons/yr)

State	2002	2008	2011	2014	2016	2017	2018	2019	NO_X Change 2002-2019	Percent NO_X Change 2002-2019
CT	6,329	4,133	1,667	1,955	1,058	1,052	1,492	801	-5,528	-87%
DC	798	291	320	108	68	67	96	76	-722	-90%
DE	11,363	11,545	3,748	1,791	1,308	889	948	496	-10867	-96%
MA	32,940	10,002	5,111	4,108	2,883	2,372	1,646	1,007	-31,933	-97%
MD	76,519	40,327	22,536	15,053	9,405	6,127	8,431	4,019	-72,500	-95%
ME	1,154	680	575	539	288	263	327	138	-1,016	-88%
NH	6,873	4,650	3,951	2,753	1,326	1,070	1,695	1,018	-5,855	-85%
NJ	36,163	15,147	7,040	7,096	4,382	3,443	3,408	2,949	-33,214	-92%
NY	85,917	47,556	31,062	22,214	16,222	11,253	11,702	7,844	-78,073	-91%
PA	218,268	187,771	149,620	125,612	79,450	37,148	34,928	33,132	-185,136	-85%
RI	640	462	630	518	448	470	513	453	-187	-29%
VT	230	296	117	161	167	139	142	133	-97	-42%
Total	**477,195**	**322,858**	**226,377**	**181,908**	**117,014**	**64,292**	**65,326**	**52,066**	**-425,129**	**-89%**

Figure 5-15: NO_X Emissions from AMPD Sources in the MANE-VU States, 2002–2019

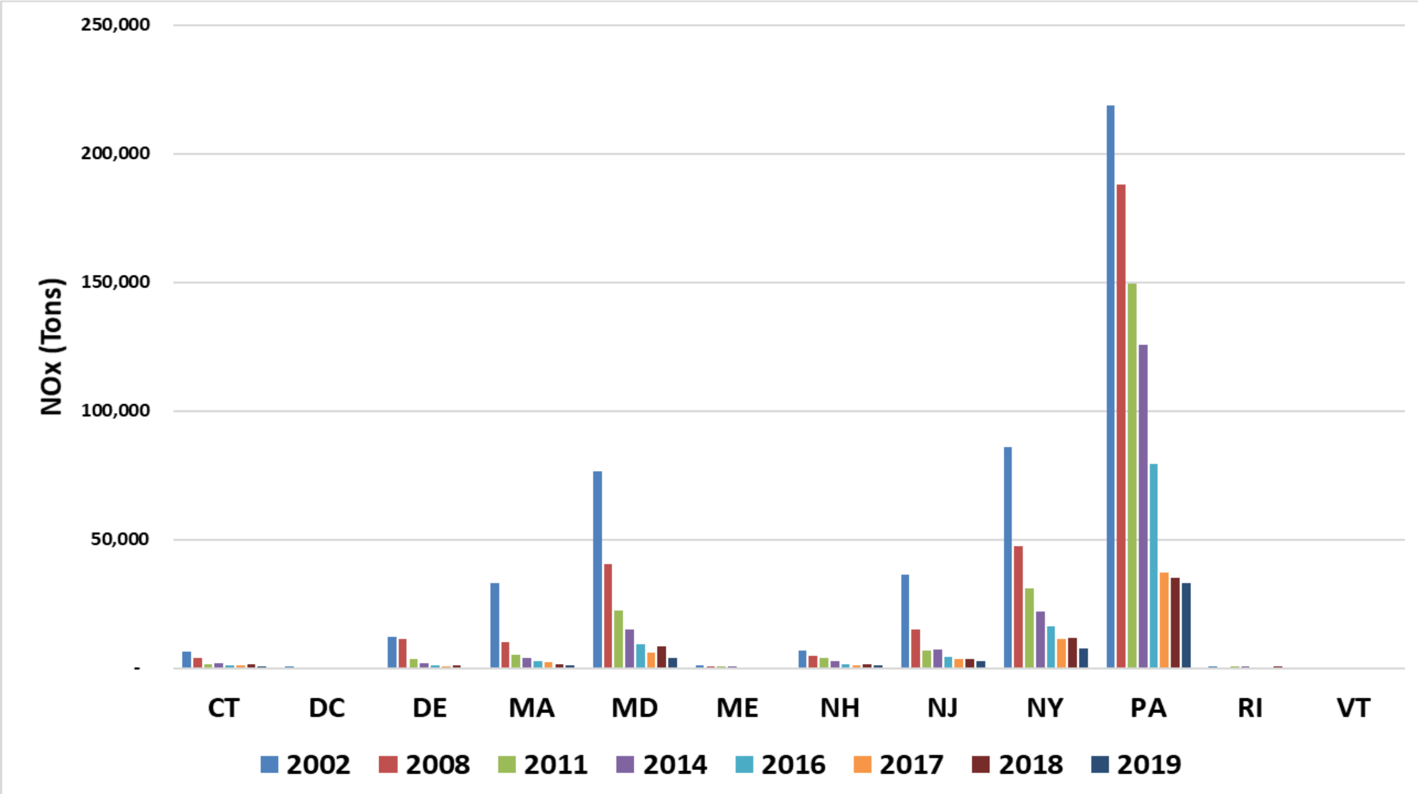
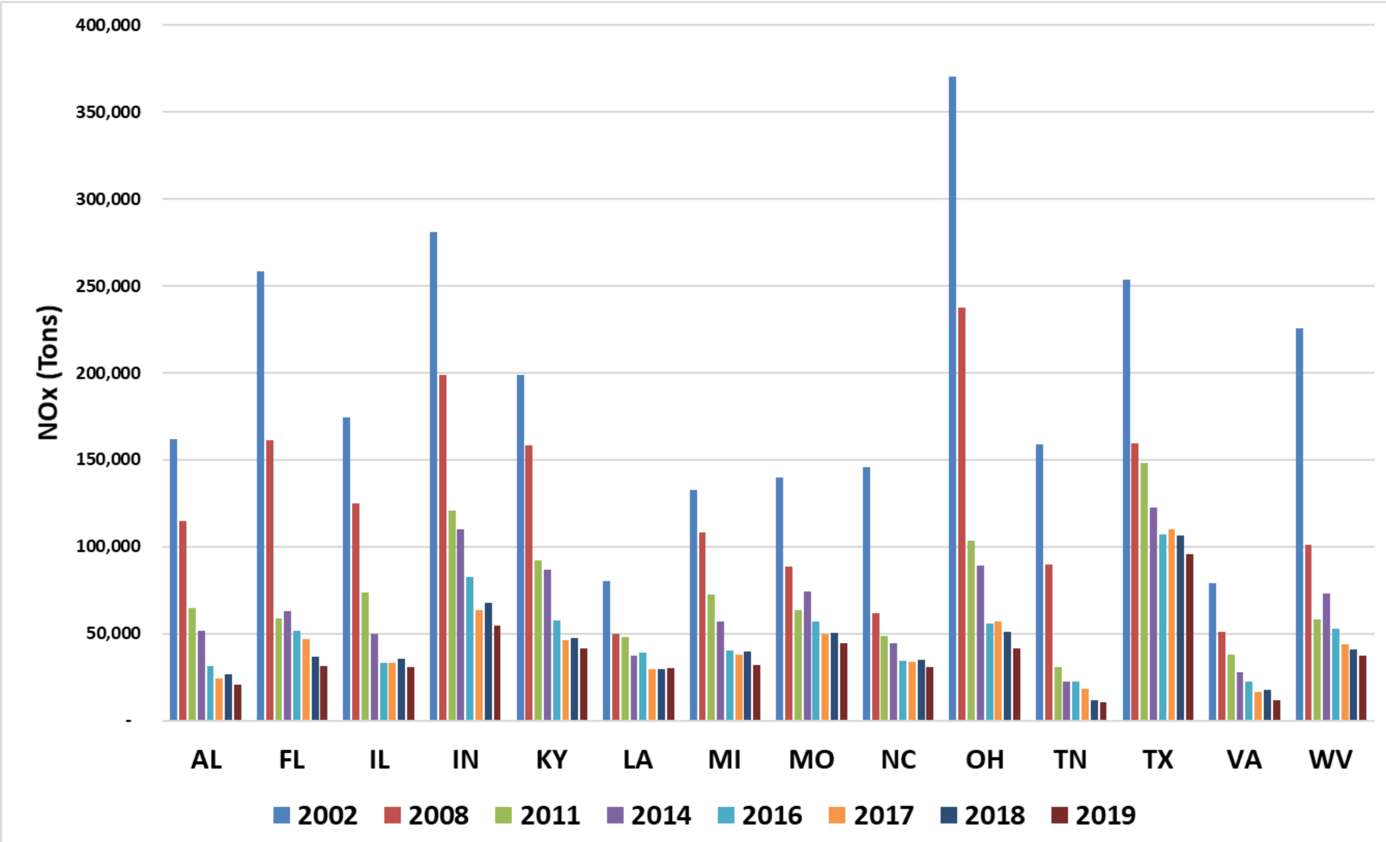


Table 5-8: NO_X Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2002–2019 (tons/yr)

State	2002	2008	2011	2014	2016	2017	2018	2019	NO_X Change 2002-2019	Percent NO_X Change 2002-2019
AL	161,559	114,587	64,579	51,850	31,127	24,085	26,728	20,571	-140,988	-87%
FL	258,378	161,297	58,854	62,984	51,442	49084	36,875	31,251	-227,127	-88%
IL	174,247	124,787	73,892	49,758	33,298	33,066	35,310	30,655	-143,592	-82%
IN	281,146	198,948	120,941	109,708	82,615	63,421	67,776	54,464	-226,682	-81%
KY	198,599	157,995	92,180	86,980	57,767	46,057	47,503	41,341	-157,258	-79%
LA	80,365	49,875	48,024	37,264	38,836	29,249	29,575	29,848	-50,517	-63%
MI	132,623	108,117	72,286	56,833	40,366	37,739	39,550	31,741	-100,882	-76%
MO	139,799	88,742	63,419	74,252	56,692	49,692	50,393	44,165	-95,634	-68%
NC	145,706	61,669	48,889	44,288	34,287	33,761	34,663	30,748	-114,958	-79%
OH	370,497	237,585	103,591	89,346	55,756	57,039	51,172	41,349	-329,148	-89%
TN	155,996	89,673	30,819	22,382	22,610	18,201	11,629	10,263	-145,733	-94%
TX	253,861	159,668	148,073	122,540	107,158	109,901	106,258	95,562	-158,299	-62%
VA	78,868	50,887	37,651	27,648	22,280	16,545	17,740	11,506	-67,362	-85%
WV	225,371	101,046	58,223	72,970	52,584	44,079	40,925	37,012	-188,359	-84%
Total	**2,657,015**	**1,704,876**	**1,021,422**	**908,805**	**686,817**	**611,919**	**596,096**	**510,476**	**-2,146,539**	**-81%**

Figure 5-16: NO_X Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2002–2019



5.4.3 Particulate Matter Less Than 10 Microns (PM_{10})

Table 5-9 shows a summary of PM_{10} emissions from all NEI data categories – point, nonpoint, nonroad, and onroad for the period from 2002 to 2017 in Maine. This summary is also shown graphically in Figure 5-17.

In Maine, PM_{10} emissions steadily decreased in the point, nonpoint, and nonroad categories for the period from 2002 to 2017. The variations in the onroad are due to changes in emission inventory calculation methodologies, which resulted in higher particulate matter estimates in the other years than in 2002. The large variation in emissions in the nonpoint category is due to changes in calculation methodologies for residential wood burning and fugitive dust categories, which have varied significantly. EPA and Maine have been working on making these categories more accurate since the 2002 inventory, and it is still an ongoing process.

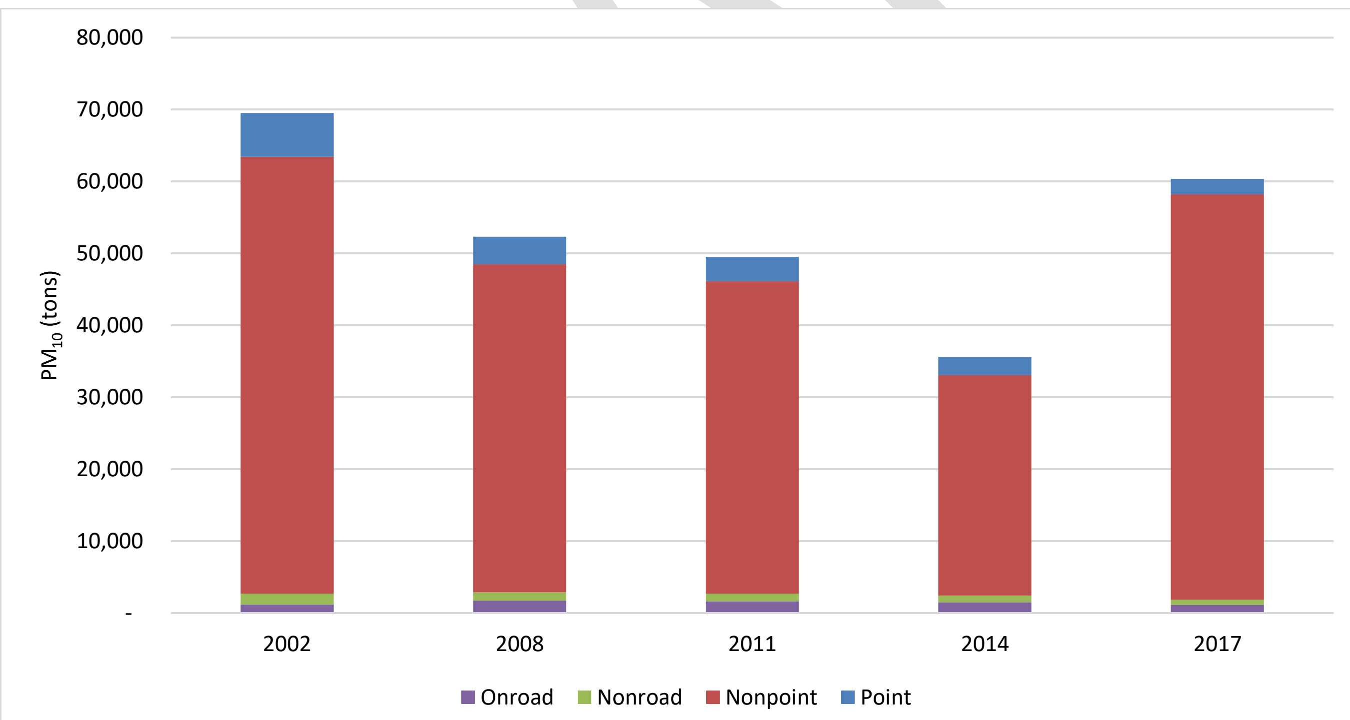
When looking at the following tables and charts, it should be noted that non-combustion PM_{10} emissions (e.g., paved and unpaved road dust, agricultural dust, etc.) are unadjusted - that is, they represent the raw mass emissions before adjustment with transport fractions. Emission estimates using EPA's calculation methodologies for fugitive dust are generally significantly higher than observed monitored data. Therefore, EPA developed transport fractions to reduce the fugitive dust emissions to account for particulate emissions that settle out or are "trapped" by obstructions such as vegetation and buildings. EPA requests that the emissions be submitted to the NEI without any adjustments, then they perform the adjustments prior to modeling the inventory.

Table 5-9: PM_{10} Emissions in Maine for all NEI Data Categories, 2002–2017 (tons/yr)

Category	2002	2008	2011	2014	2017	PM10 Change (2002 - 2017)	% PM10 Change (2002 - 2017)
Point	6,124	3,831	3,399	2,558	2,130	-3,994	-65%
Nonpoint	60,723	45,614	43,409	30,617	56,374	-4,349	-7%
Nonroad	1,519	1,123	1,068	944	686	-833	-55%
Onroad	1,178	1,744	1,649	1,487	1,157	-21	-2%
Total	**69,543**	**52,311**	**49,526**	**35,606**	**60,347**	**-9,196**	**-13%**

Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008 but excludes it after 2008.
The increase in PM_{10} emissions between 2014 and 2017 NEI years is the result of methodology changes affecting unpaved road dust, residential wood combustion, and industrial boilers/ICEs biomass combustion sectors.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Figure 5-17: PM_{10} Emissions in Maine for all Data Categories, 2002–2017 (tons/yr)



Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Table 5-10 and Figure 5-18 show total PM_{10} emissions from all NEI data categories in the MANE-VU states. Similarly, Table 5-11 and Figure 5-19 show total PM_{10} emissions from all data categories in the Non-MANE-VU Ask states. PM_{10} emissions in the MANE-VU and Non-MANE-VU Ask states show no pattern over the 2002 to 2017 period. Some of the large declines in PM_{10} emissions from 2002 to subsequent years, as well as some of the increases in 2014, are most likely due to changes in estimation methodologies for categories such as yard waste burning, paved and unpaved fugitive road dust, and residential wood combustion.

Table 5-10: Total PM_{10} Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	Change (2002 – 2017)	Percent Change (2002 – 2017)
CT	53,267	39,048	39,097	28,842	29,058	-24,209	-45%
DE	17,165	21,544	15,071	14,896	17,213	48	<1%
DC	6,839	5,211	3,410	3,865	3,771	-3,068	-45%
ME	69,543	52,311	49,526	35,606	60,347	-9,196	-13%
MD	126,986	92,156	74,522	114,097	91,366	-35,620	-28%
MA	209,076	165,801	162,952	109,218	65,922	-143,154	-68%
NH	46,551	33,814	33,379	21,985	21,142	-25,409	-55%
NJ	77,723	70,431	49,742	45,946	44,487	-33,236	-43%
NY	386,381	325,041	290,566	232,441	195,140	-191,241	-49%
PA	465,435	352,392	273,067	278,725	193,114	-272,321	-59%
RI	9,103	10,267	8,387	8,400	7,148	-1,955	-21%
VT	55,937	53,130	38,373	23,422	43,618	-12,319	-22%
Total	**1,524,005**	**1,221,145**	**1,038,093**	**917,443**	**772,327**	**-751,678**	**-49%**

Figure 5-18: Total PM_{10} Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017

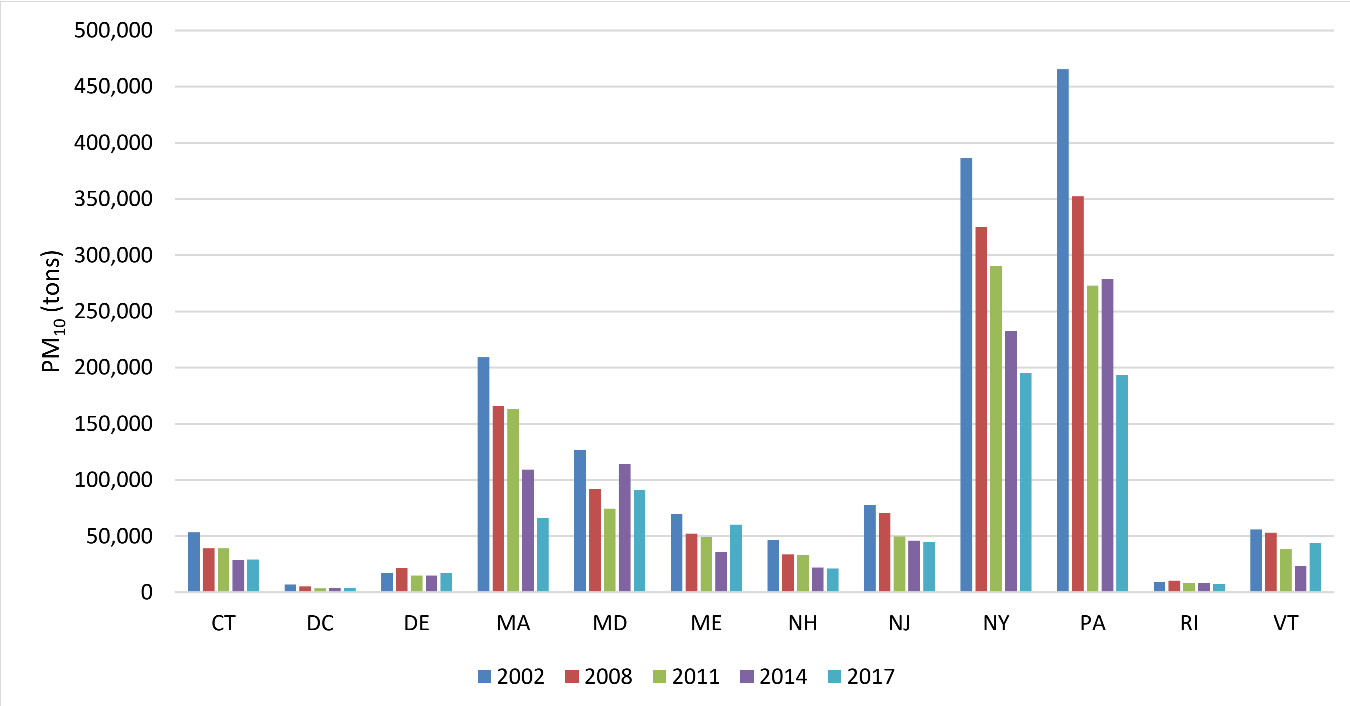
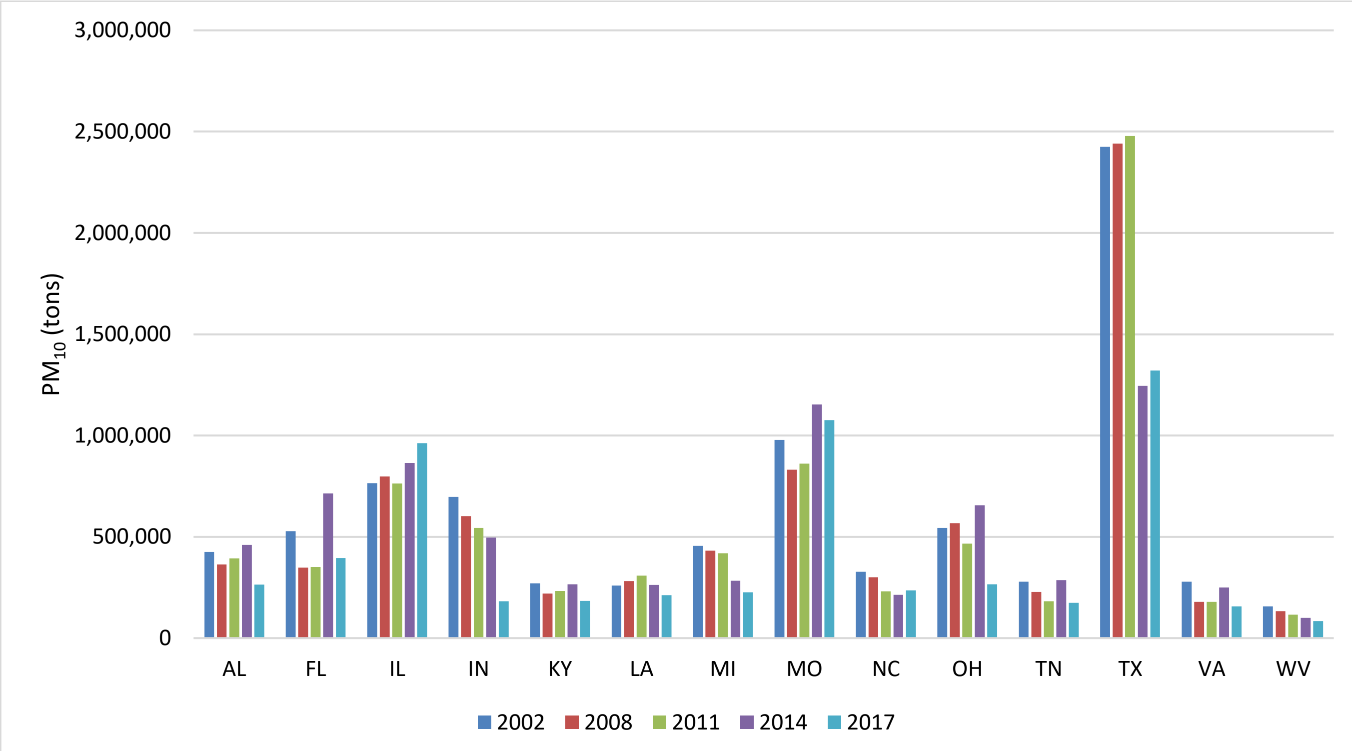


Table 5-11: Total PM_{10} Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	Change (2002 – 2017)	Percent Change (2002 – 2017)
AL	425,221	363,195	393,530	460,695	264,039	-161,182	-38%
FL	527,753	348,091	351,483	713,703	394,521	-133,232	-25%
IL	764,273	797,788	762,584	863,923	961,665	197,392	26%
IN	696,591	602,105	544,131	495,961	182,138	-514,453	-74%
KY	270,051	219,956	232,735	265,370	184,276	-85,775	-32%
LA	259,793	281,998	307,928	263,360	211,710	-48,083	-19%
MI	455,348	431,311	418,847	282,519	226,978	-228,370	-50%
MO	977,691	831,795	861,980	1,153,343	1,075,415	97,724	10%
NC	327,059	300,866	230,453	213,800	235,638	-91,421	-28%
OH	544,239	568,210	467,023	655,947	265,620	-278,619	-51%
TN	278,733	227,616	182,467	286,276	174,588	-104,145	-37%
TX	2,424,752	2,440,498	2,478,052	1,245,310	1,320,222	-1,104,530	-46%
VA	277,684	179,593	179,646	249,306	156,187	-121,497	-44%
WV	156,682	133,479	115,661	99,561	83,681	-73,001	-47%
Total	**8,385,869**	**7,726,500**	**7,526,521**	**7,249,074**	**5,736,679**	**-2,649,190**	**-32%**

Figure 5-19: Total PM_{10} Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2017



5.4.4 Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$)

Table 5-12 shows a summary of $PM_{2.5}$ emissions from all NEI data categories for the period from 2002 to 2017 in Maine. This summary is also shown graphically in Figure 5-20. Point source increases from 2002 to 2008 are due to changes in reporting, grouping and methodology. EPA began requiring $PM_{2.5}$ emission reporting in 2002. Also, as discussed previously, starting in 2008, air and rail yard emissions were included in point sources instead of in nonroad. $PM_{2.5}$ emissions steadily decreased in the nonroad category for the period from 2002 to 2017. The decrease in $PM_{2.5}$ emissions is because of federal new engine standards for nonroad vehicles and equipment. There is an overall decrease in onroad emissions due to federal and state regulations. The increase in emissions in the onroad category from 2002 to 2008 is due to changes in emission inventory calculation methodologies and a model change, as previously stated, which resulted in higher fine particulate matter estimates in the years after 2002. The large variation in emissions in the nonpoint category is due to changes in calculation methodologies for the residential wood burning and fugitive dust categories, which have varied significantly. EPA and Maine have been working on making these categories more accurate since the 2002 inventory, and it is still an ongoing process.

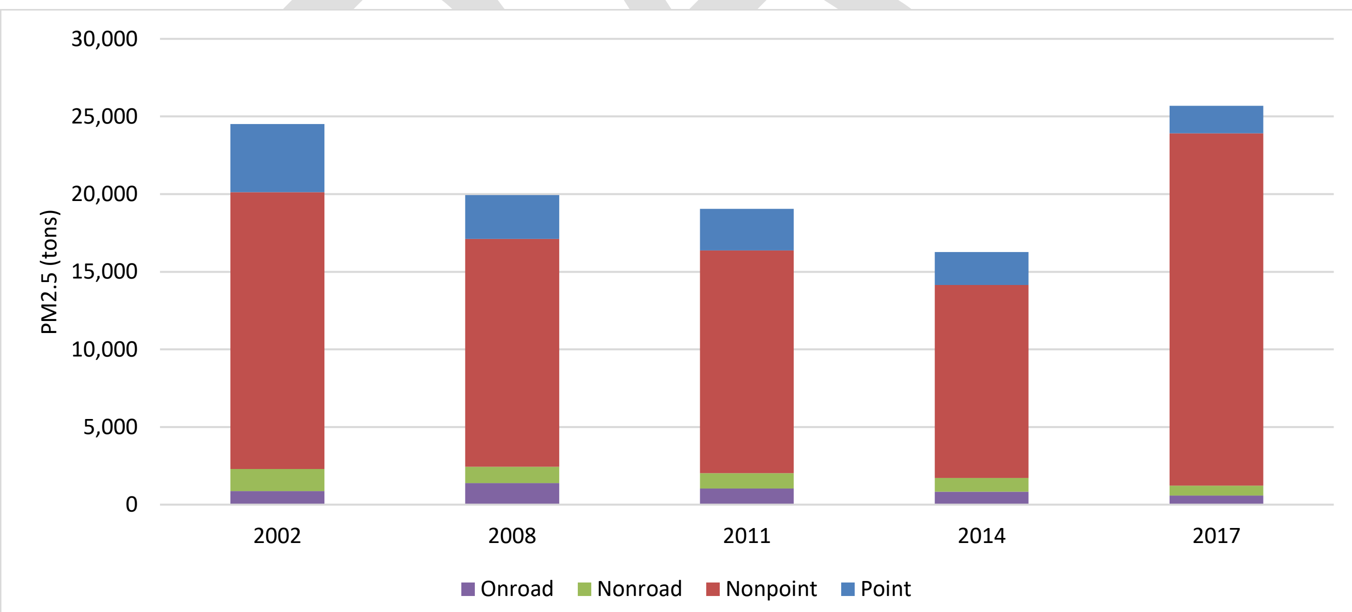
As discussed in the PM_{10} section, when looking at the following tables and charts, it should be noted that non-combustion $PM_{2.5}$ emissions (e.g., paved and unpaved road dust, agricultural dust, etc.) are unadjusted, that is, they represent the raw mass emissions before adjustment with transport fractions. Emission estimates using EPA's calculation methodologies for fugitive dust are generally significantly higher than observed monitored data. Therefore, EPA developed transport fractions to reduce the fugitive dust emissions to account for particulate emissions that settle out or are "trapped" by obstructions such as vegetation and buildings. EPA requests that the emissions be submitted to the NEI without any adjustments, then they perform the adjustments prior to modeling the inventory.

Table 5-12: $PM_{2.5}$ Emissions in Maine for all NEI Data Categories, 2002 – 2017 (tons/yr)

NEI Category	2002	2008	2011	2014	2017	$PM_{2.5}$ Change (2002 – 2017)	Percent $PM_{2.5}$ Change (2002 – 2017)
Point	4,389	2,824	2,671	2,116	1,763	-2,626	-60%
Nonpoint	17,825	14,667	14,338	12,429	22,700	4,875	27%
Nonroad	1,424	1,053	1,001	883	643	-781	-55%
Onroad	876	1,387	1,036	843	576	-300	-34%
Total	**24,515**	**19,930**	**19,045**	**16,270**	**25,681**	**1,166**	**5%**

Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008. Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
The increase in $PM_{2.5}$ emissions between 2014 and 2017 NEI years is the result of methodology changes affecting unpaved road dust, residential wood combustion, and industrial boilers/ICEs biomass combustion sectors.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Figure 5-20: $PM_{2.5}$ Emissions in Maine from all Data Categories, 2002–2017 (tons/yr)



Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

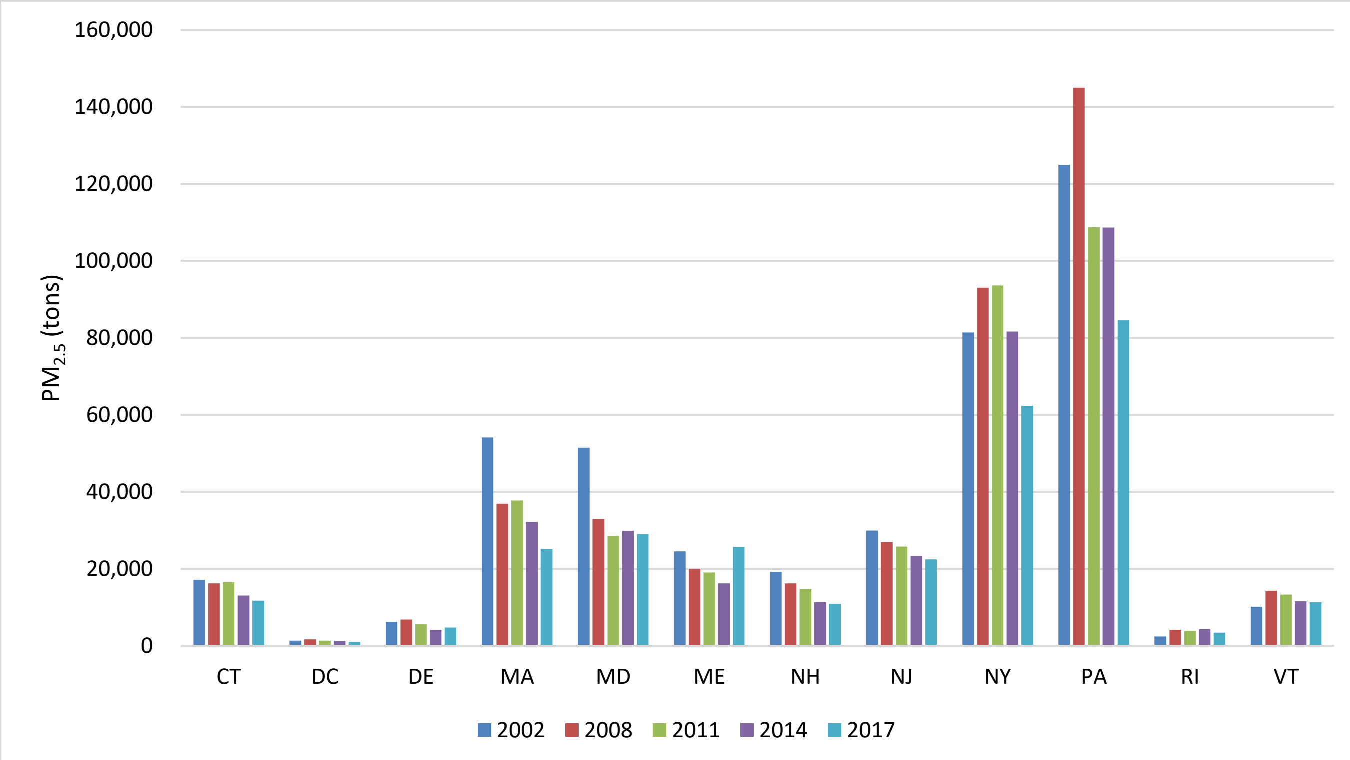
Table 5-13 and Figure 5-21 show total $PM_{2.5}$ emissions from all NEI data categories in the MANE-VU states. Similarly, Table 5-14 and Figure 5-22 show total $PM_{2.5}$ emissions from all data categories in the Non-MANE-VU Ask states. $PM_{2.5}$ emissions in the MANE-VU and Non-MANE-VU Ask states vary from year to year and state to state. In some states, emissions have declined or remained constant; in others, there are increases. As with New Jersey, these variations are most likely due to changes in reporting and calculation methodologies.

Table 5-13: Total $PM_{2.5}$ Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	$PM_{2.5}$ Change (2002 – 2017)	Percent $PM_{2.5}$ Change (2002 – 2017)
CT	17,183	16,190	16,545	13,088	11,723	-5,460	-32%
DE	6,288	6,838	5,549	4,174	4,761	-1,527	-24%
DC	1,343	1,694	1,361	1,263	1,047	-296	-22%
ME	24,515	19,930	19,045	16,270	25,681	1,166	5%
MD	51,465	32,947	28,499	29,848	29,063	-22,402	-44%
MA	54,140	36,965	37,770	32,192	25,209	-28,931	-53%
NH	19,207	16,257	14,710	11,358	10,921	-8,286	-43%
NJ	29,976	26,966	25,785	23,197	22,427	-7,549	-25%
NY	81,427	93,027	93,611	81,699	62,387	-19,040	-23%
PA	124,964	145,016	108,748	108,665	84,590	-40,374	-32%
RI	2,433	4,163	3,949	4,310	3,441	1,008	41%
VT	10,167	14,280	13,351	11,593	11,283	1,116	11%
Total	**423,107**	**414,275**	**368,924**	**337,657**	**292,531**	-130,576	-31%

Notes: Includes unadjusted fugitive dust, except NJ 2008 which is adjusted.

Figure 5-21: Total $PM_{2.5}$ Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017

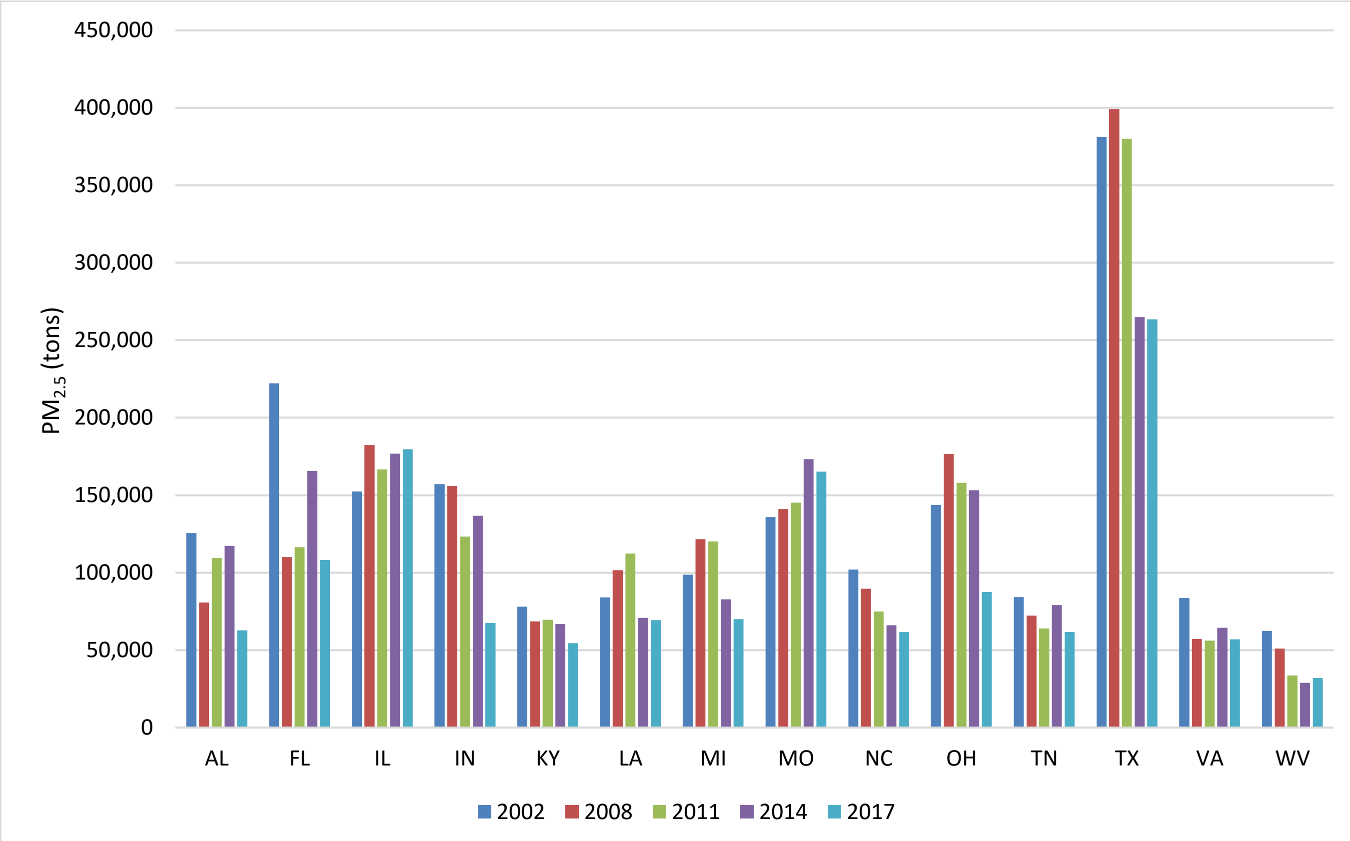


Notes: Includes unadjusted fugitive dust, except NJ 2008 which is adjusted.

Table 5-14: Total $PM_{2.5}$ Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	$PM_{2.5}$ Change (2002 – 2017)	Percent $PM_{2.5}$ Change (2002 – 2017)
AL	125,441	80,622	109,345	117,272	62,827	-62,614	-50%
FL	222,204	109,965	116,396	165,534	108,248	-113,956	-51%
IL	152,316	182,344	166,699	176,836	179,631	27,315	18%
IN	157,078	155,982	123,193	136,613	67,517	-89,561	-57%
KY	77,952	68,484	69,665	66,812	54,566	-23,386	-30%
LA	83,989	101,593	112,415	70,884	69,341	-14,648	-17%
MI	98,713	121,710	120,121	82,780	69,910	-28,803	-29%
MO	135,832	140,955	145,230	173,260	165,196	29,364	22%
NC	101,965	89,613	74,844	66,023	61,622	-40,343	-40%
OH	143,671	176,599	157,995	153,291	87,459	-56,212	-39%
TN	84,176	72,333	63,949	79,020	61,772	-22,404	-27%
TX	381,212	399,176	379,886	264,976	263,523	-117,689	-31%
VA	83,567	57,083	56,157	64,340	56,912	-26,655	-32%
WV	62,269	50,936	33,712	28,929	31,913	-30,356	-49%
Total	**1,910,383**	**1,807,395**	**1,729,607**	**1,646,569**	**1,340,439**	**-569,944**	**-30%**

Figure 5-22: Total $PM_{2.5}$ Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2017



5.4.5 Woodsmoke Particulate Matter (PM)

Source apportionment documented in Appendix B of the original MANE-VU Contribution Assessment[50] identified biomass combustion as a local source contributing to visibility impairment. Woodsmoke, a subset of biomass combustion, typically contributes more to visibility impairment in rural areas than in urban areas, with winter peaks in northern areas due to residential wood burning, and occasional large summer impacts at all sites from wildfires.

The MANE-VU Technical Support Document on Agricultural and Forestry Smoke Management in the MANE-VU Region concluded that fire from land management activities was not a major contributor to regional haze in MANE-VU Class I Areas, and that most emissions from fires were from residential wood combustion.

The residential wood combustion component of the inventory, based on the MANE-VU 2011 Gamma emissions inventory (described in Section 5-5), is shown in Table 5-15 and Table 5-16. The data shows that residential wood combustion represents approximately 33% of the annual average $PM_{2.5}$ emissions in the MANE-VU region. In Maine, residential wood combustion is estimated to be 42% of the 2011

[50] https://otcair.org/MANEVU/Upload/Publication/Reports/AppendixB--2006-1006.pdf

$PM_{2.5}$ inventory.

As discussed previously, there are large variations in emissions in the residential wood burning category due to changes in calculation methodologies. EPA and Maine have been working on making this category more accurate since the 2002 inventory and it is still an ongoing process.

Table 5-15: MANE-VU 2011 Gamma Residential Wood Combustion Emissions (tons/yr)

State	CO	NH_3	NO_X	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
CT	45,804	345	712	6,474	6,470	116	8,914
DE	6,685	57	108	963	962	18	1,201
DC	2,853	23	43	404	404	6	549
ME	41,650	315	485	6,316	6,316	188	7,048
MD	20,857	192	335	3,119	3,115	56	3,446
MA	70,644	577	1,080	10,306	10,300	209	12,711
NH	42,381	327	503	6,493	6,493	170	7,311
NJ	44,060	355	710	6,302	6,295	105	8,310
NY	150,460	1,065	1,899	22,946	22,939	554	27,943
PA	164,540	1,218	2,323	23,644	23,634	474	31,534
RI	10,178	79	178	1,452	1,451	28	1,941
VT	47,285	370	568	7,142	7,140	247	7,564
Res Wood Total	**647,397**	**4,923**	**8,944**	**95,561**	**95,519**	**2,171**	**118,472**
Total 2011 Emissions	**7,887,728**	**206,584**	**1,704,090**	**322,881**	**291,225**	**739,675**	**3,605,189**
% of Total	**8.2%**	**2.4%**	**0.5%**	**29.6%**	**32.8%**	**0.3%**	**3.3%**

Table 5-16: MANE-VU 2011 Gamma State Level $PM_{2.5}$ Residential Wood Emissions (tons/yr)

State	Res. Wood $PM_{2.5}$	Total $PM_{2.5}$	% of Total $PM_{2.5}$ In State
CT	6,470	13,203	49%
DE	962	4,273	23%
DC	404	1,110	36%
ME	**6,316**	**15,123**	**42%**
MD	3,115	24,951	12%
MA	10,300	25,755	40%
NH	6,493	11,784	55%
NJ	6,295	23,788	26%
NY	22,939	69,185	33%
PA	23,634	88,044	27%
RI	1,451	3,488	42%
VT	7,140	10,522	68%

5.4.6 Sulfur Dioxide

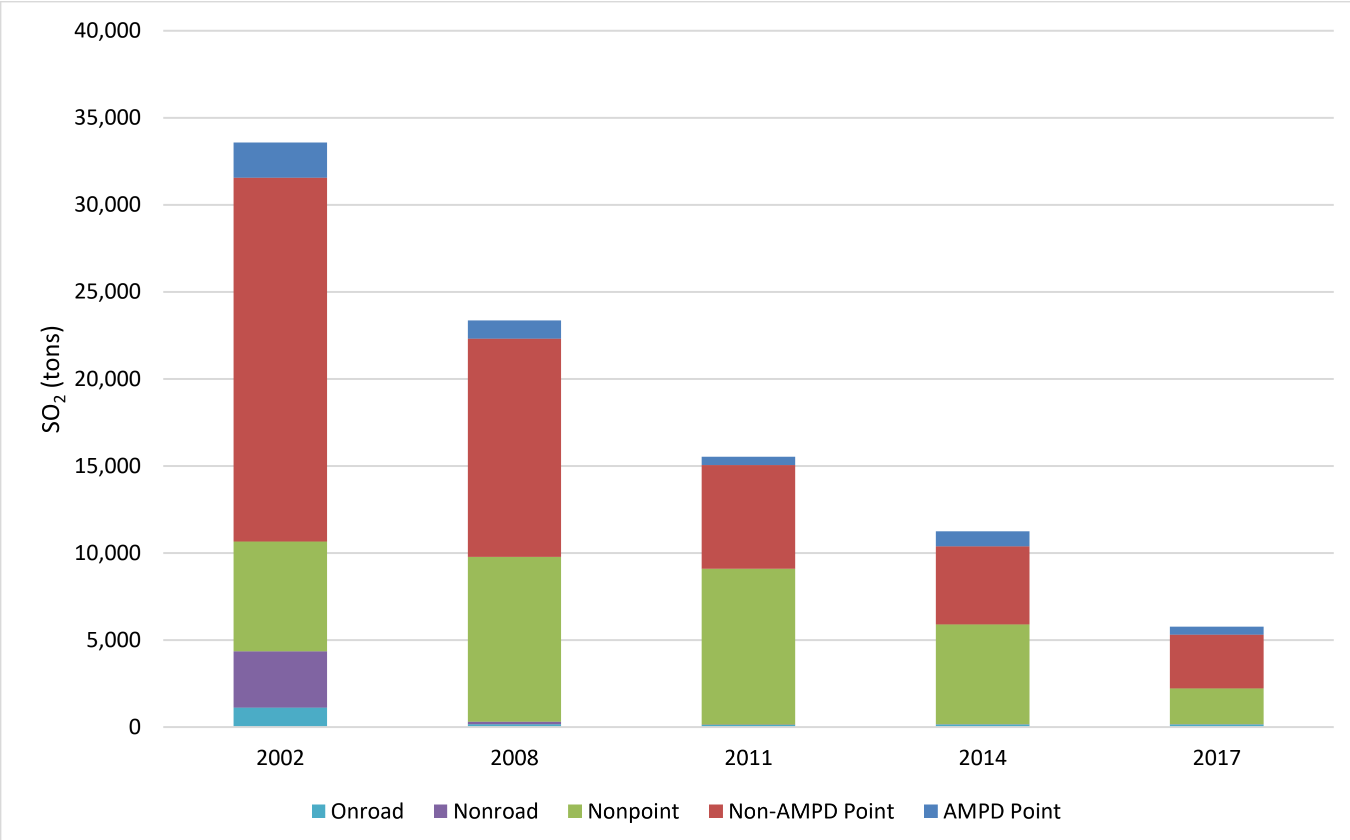
Table 5-17 shows SO_2 emissions from all NEI data categories for the period 2002 to 2017 in Maine. This data is also shown graphically in Figure 5-23. Table 5-18 shows additional data years for Maine's point sources that report to EPA's AMPD.

Table 5-17: SO_2 Emissions in Maine for all NEI Data Categories, 2002–2017 (tons/yr)

NEI Category	2002	2008	2011	2014	2017	SO_2 Change (2002 – 2017)	Percent SO_2 Change (2002 – 2017)
AMPD Point	2,022	1,041	470	856	444	-1,578	-78%
Non-AMPD Point	20,908	12,549	5,964	4,480	3,095	-17,813	-85%
Nonpoint	6,303	9,466	8,942	5,734	2,058	-4,245	-67%
Nonroad	3,231	135	23	20	17	-3,214	-99%
Onroad	1,122	172	129	152	148	-974	-87%
Total	**33,585**	**23,362**	**15,528**	**11,242**	**5,762**	**-27,823**	**-83%**

Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onoad also includes Stage II refueling after 2008.

Figure 5-23: SO_2 Emissions in Maine from all Data Categories, 2002–2017 (tons/yr)



Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Table 5-18: SO_2 Emissions from EPA AMPD Sources in Maine, 2016–2019 (tons/yr)

2016	2017	2018	2019
369	444	643	50

SO_2 emissions have shown a significant decline in Maine over the period 2002 to 2019, particularly in the point, nonroad and onroad mobile sectors. Reductions in point emissions are primarily due to the acid rain program and federal and state low sulfur fuel regulations. Sources of SO_2 emissions in Maine that report to EPA's AMPD programs show declines from 2016 to 2019, as shown in Tables 5-17 and 5-18.

The increase in nonpoint emissions from 2002 to 2008, and subsequent decreases are due to EPA moving the marine vessels and railroad emissions from the nonroad sector to the nonpoint sector. Decreases in nonpoint emissions are mostly due to federal rules that reduced sulfur levels in nonroad mobile diesel fuel, and to a decline in the use of distillate oil for heating.

Table 5-19 and Figure 5-24 show total SO_2 emissions from all NEI data categories in the MANE-VU states for 2002 to 2017. A steady decrease in SO_2 emissions can be seen for each MANE-VU state over this period. In addition to the federal rules discussed above – the acid rain program and federal rules for low sulfur fuel for mobile sources – some of these decreases are attributable to the MANE-VU 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 "Non-MANE-VU Ask" for states within MANE-VU for the first regional haze planning period.[51] 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 2017 timeframe shown in Table 5-17 and Figure 5-23. Other potential SO_2 emission decreases are due to source shutdowns and fuel switching due to the availability of less expensive natural gas in recent years.

Table 5-19: Total SO_2 Emissions in the MANE-VU States for all NEI Data Categories, 2002 – 2017 (tons/yr)

State	2002	2008	2011	2014	2017	SO_2 Change (2002 – 2017)	Percent SO_2 Change (2002 – 2017)
CT	38,102	19,443	15,334	12,445	2,692	-35,410	-93%
DE	86,999	44,282	13,883	4,330	1,448	-85,551	-98%
DC	4,051	1,273	1,829	252	90	-3,961	-98%
ME	33,585	23,362	15,528	11,242	5,762	-27,823	-83%
MD	324,015	264,487	71,751	48,490	20,130	-303,885	-94%
MA	156,778	76,256	51,338	18,890	6,256	-150,522	-96%
NH	55,246	45,666	31,257	8,554	5,972	-49,274	-89%
NJ	96,967	44,370	17,907	9,781	4,483	-92,484	-95%
NY	326,448	193,703	114,940	52,857	25,988	-300,460	-92%
PA	1,015,732	987,671	398,497	329,804	96,263	-919,469	-91%
RI	8,158	4,345	4,689	3,406	816	-7,342	-90%
VT	4,988	4,044	3,445	1,503	743	-4,245	-85%
Total	**2,151,071**	**1,708,903**	**740,397**	**501,552**	**170,645**	**-1,980,426**	**-92%**

[51] See Appendix R-1

Figure 5-24: Total SO_2 Emissions in the MANE-VU States for all NEI Data Categories, 2002–2017

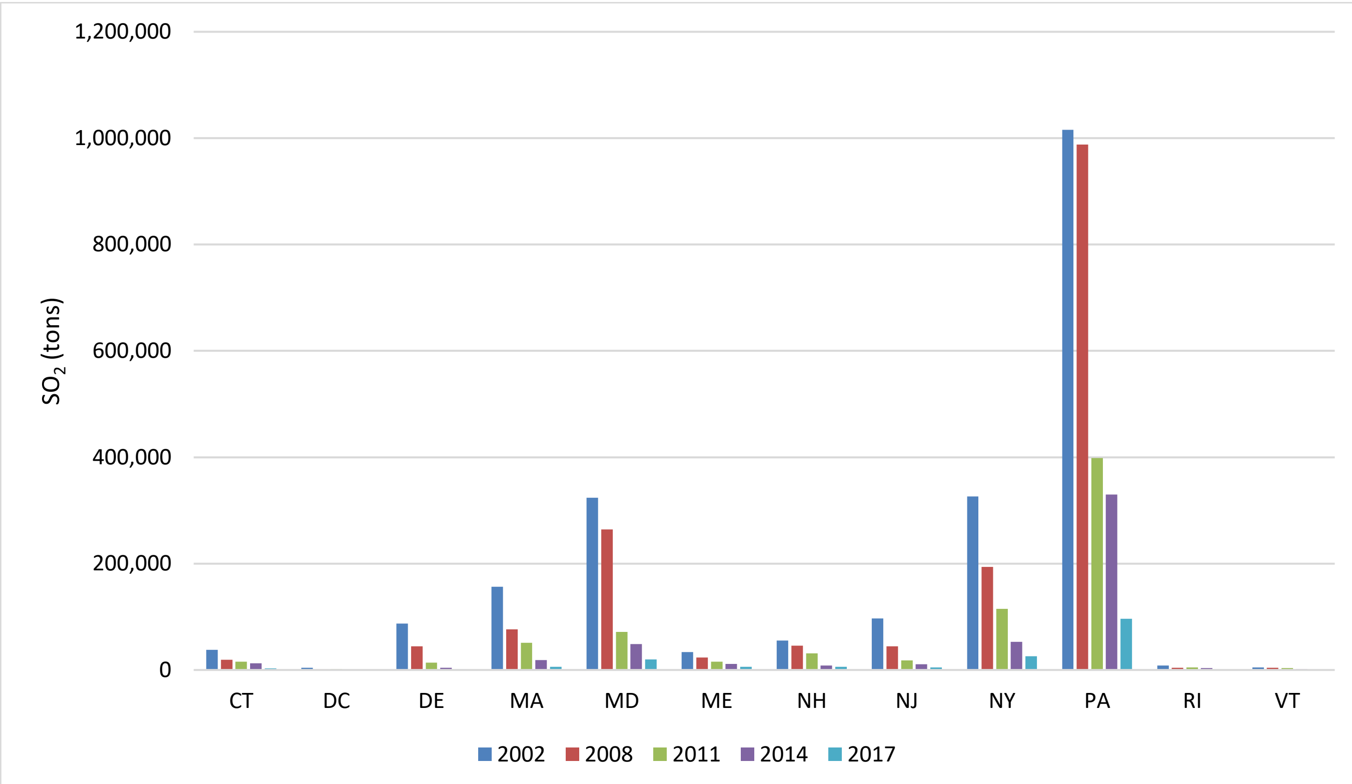


Table 5-20 and Figure 5-25 show total SO_2 emissions from all NEI data categories in the Non-MANE-VU Ask states for 2002 to 2017. Like MANE-VU states, decreases in SO_2 can be seen for all the MANE-VU Ask states over this period. In addition to the federal rules, some of these decreases are attributable 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 Best Available Retrofit Technology (BART) requirements and a 90% or greater reduction in SO_2 emissions at 167 stacks inside and outside of MANE-VU.

Table 5-20: Total SO_2 Emissions in the Non-MANE-VU Ask States for all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	SO_2 Change (2002 – 2017)	Percent SO_2 Change (2002 – 2017)
AL	606,778	438,066	271,687	193,886	55,399	-551,379	-91%
FL	721,898	335,270	163,081	153,735	72,069	-649,829	-90%
IL	536,620	385,948	287,312	191,331	94,085	-442,535	-82%
IN	960,539	690,040	424,984	345,279	101,092	-859,447	-89%
KY	533,614	382,044	271,432	222,090	70,125	-463,489	-87%
LA	359,641	249,149	228,997	171,510	140,630	-219,011	-61%
MI	490,487	415,620	273,393	185,320	83,719	-406,768	-83%
MO	421,708	414,816	257,510	168,808	119,252	-302,456	-72%
NC	585,453	290,648	117,772	70,067	42,539	-542,914	-93%
OH	1,286,023	877,070	680,338	376,573	125,921	-1,160,102	-90%
TN	432,890	324,690	159,164	92,498	45,427	-387,463	-90%
TX	989,242	637,591	540,665	456,508	386,832	-602,410	-61%
VA	362,478	200,581	106,386	75,660	26,517	-335,961	-93%
WV	580,073	349,331	122,109	112,405	46,391	-533,682	-92%
Total	**8,867,445**	**5,990,862**	**3,904,829**	**2,815,670**	**1,409,999**	**-7,457,446**	**-84%**

Figure 5-25: Total SO_2 Emissions in the Non-MANE-VU Ask States for all NEI Data Categories, 2002–2017

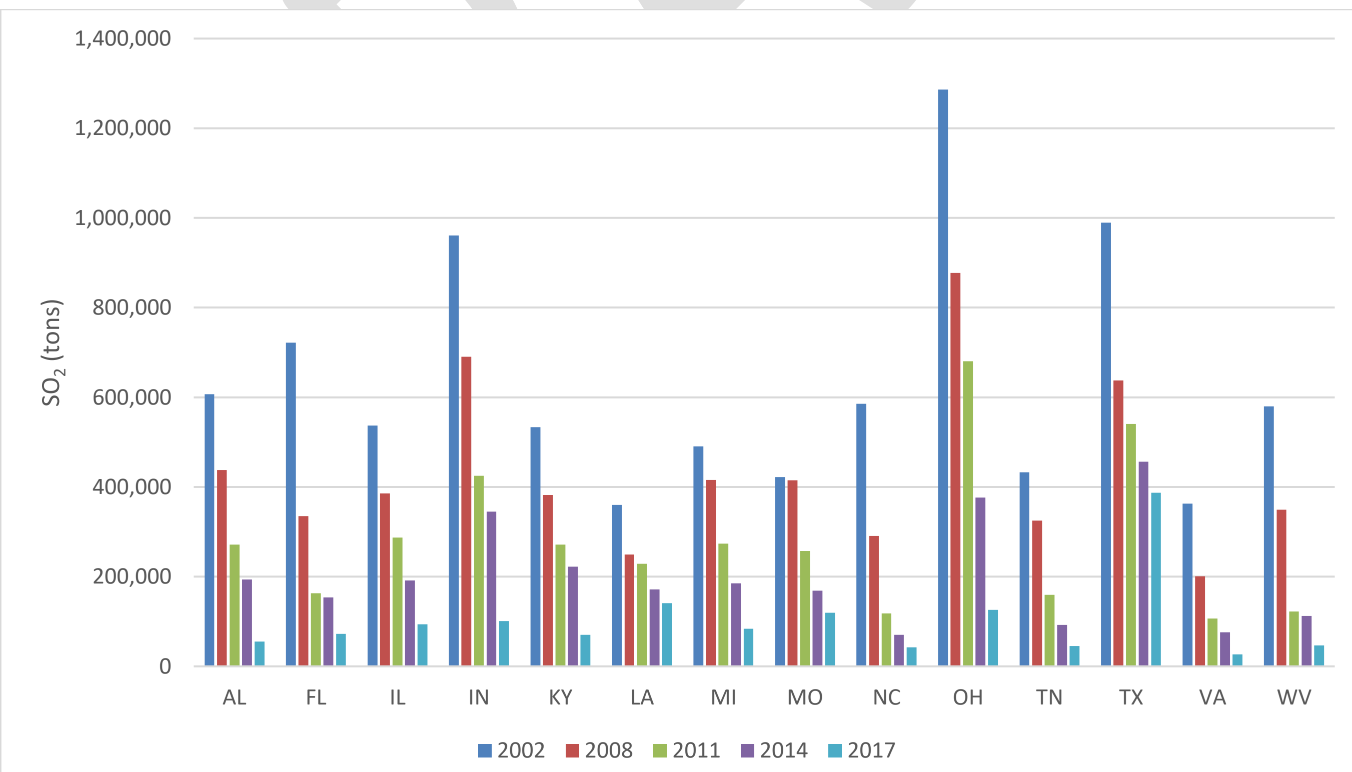


Table 5-21 and Figure 5-26 show AMPD SO_2 data trends for the MANE-VU states from 2002 to 2019, and Table 5-55 and Figure 5-27 show AMPD SO_2 data trends for the Non-MANE-VU Ask states from 2002 to 2019. Tables 5-21 and 5-22 show significant decreases in SO_2 emissions for the AMPD sources between 2002 and 2019 for all applicable states in MANE-VU as well as the Non-MANE-VU Ask states.

Reductions in SO_2 are most likely due to the acid rain program, power plant consent decrees, specific state rules, CAIR, CSAPR[52] (formerly CAIR), which requires NO_X and/or SO_2 emissions reductions from EGUs in 27 states in the eastern and central US and source retirements and fuel switching due to the availability of less expensive natural gas.

Table 5-21: SO_2 Emissions from AMPD Sources in the MANE-VU States, 2002–2019 (tons/yr)

State	**2002**	**2008**	**2011**	**2014**	**2016**	**2017**	**2018**	**2019**	**SO_2 Change 2002-2019**	**% SO_2 Change 2002-2019**
CT	10,814	3,955	752	1,478	362	421	690	132	-10,682	-99%
DC	1,087	261	723	-	-	-	-	-	-1,087	-100%
DE	32,236	31,808	9,306	829	513	545	644	279	-31,953	-99%
MA	90,727	46,347	22,701	4,670	1,717	1,083	742	194	-90,533	-100%
MD	255,360	227,198	32,275	23,553	16,754	8,121	11,325	5,572	-249,788	-98%
ME	2,022	1,041	470	856	369	444	643	50	-1,972	-98%
NH	43,947	36,895	24,445	2,636	573	473	1,197	417	-43,530	-99%
NJ	48,269	21,204	5,414	2,655	1,725	1,722	1,433	1,250	-47,019	-97%
NY	231,985	65,427	40,756	16,676	4,533	2,561	4,889	1,972	-230,013	-99%
PA	889,766	831,915	330,539	270,332	98,006	69,790	69,018	52,394	-837,372	-94%
RI	12	18	20	17	14	18	22	16	4	33%
VT	6	2	1	2	1	1	1	1	-5	-83%
Total	**1,606,230**	**1,266,072**	**467,404**	**323,704**	**124,567**	**85,179**	**90,604**	**62,277**	**-1,543,953**	**-96%**

52 https://www.epa.gov/csapr

Figure 5-26: SO_2 Emissions from AMPD Sources in the MANE-VU States, 2002–2019

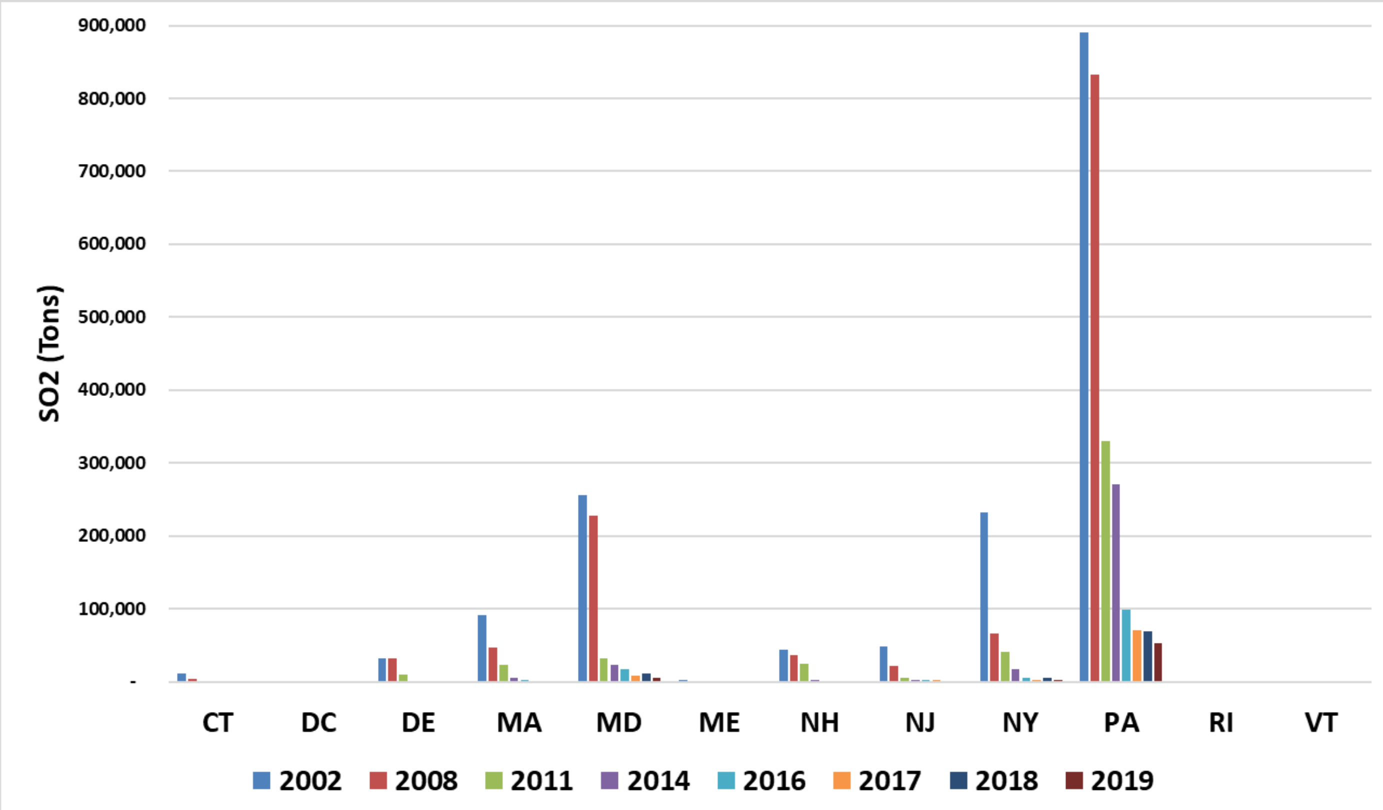
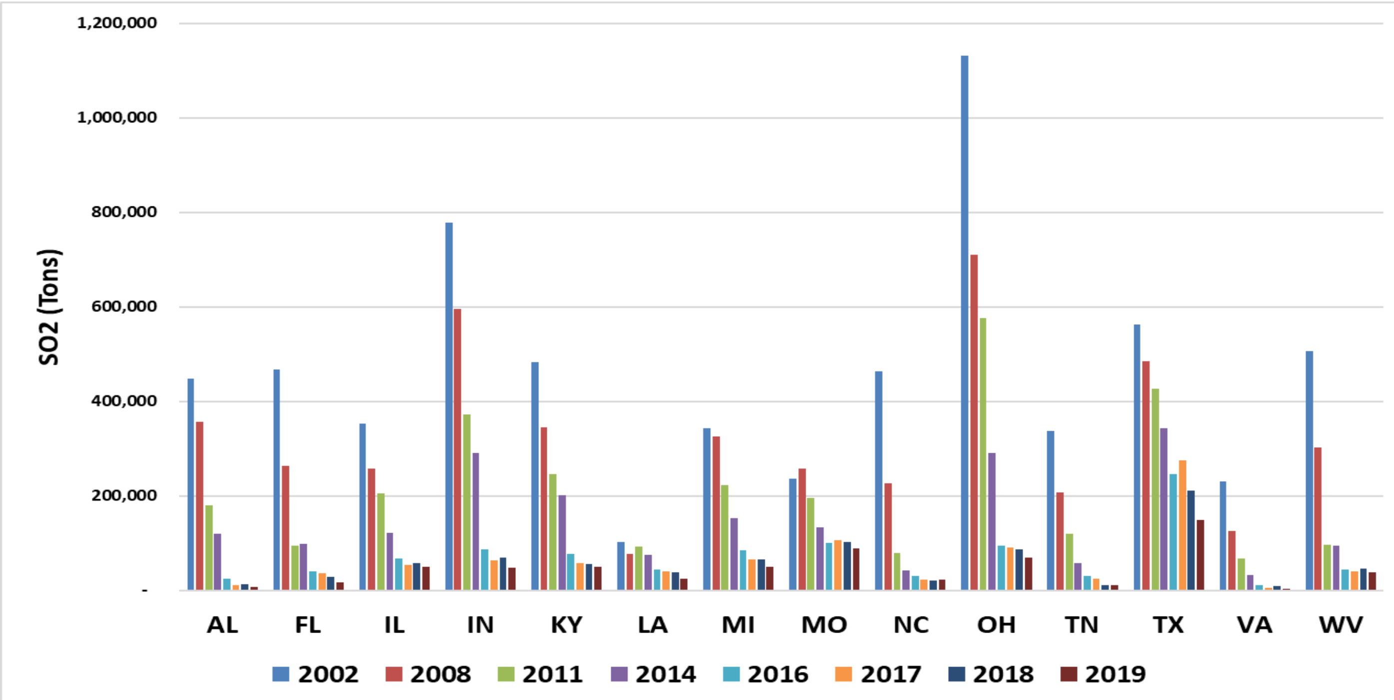


Table 5-22: SO_2 Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2002–2019 (tons/yr)

State	2002	2008	2011	2014	2016	2017	2018	2019	SO_2 Change 2002-2019	% SO_2 Change 2002-2019
AL	448,248	357,547	179,256	119,898	25,034	10,478	12,023	6,420	-441,828	-99%
FL	466,904	263,952	94,710	99,074	39,186	35,700	29,202	17,075	-449,829	-96%
IL	353,699	257,431	205,630	122,463	66,993	54,511	57,357	50,137	-303,562	-86%
IN	778,868	595,966	371,983	290,685	87,083	63,735	68,509	47,780	-731,088	-94%
KY	482,653	344,874	246,399	202,042	76,424	57,119	55,161	49,949	-432,704	-90%
LA	101,887	76,302	93,275	74,260	43,328	39,699	38,175	23,688	-78,199	-77%
MI	342,999	326,501	222,702	152,942	84,019	65,369	65,504	50,554	-292,445	-85%
MO	235,532	258,269	196,265	133,255	99,451	105,993	102,607	88,916	-146,616	-62%
NC	462,993	227,030	77,985	42,862	30,136	22,265	21,522	21,978	-441,015	-95%
OH	1,132,069	709,444	575,474	290,403	94,486	90,751	86,570	68,905	-1,063,164	-94%
TN	336,995	208,069	120,353	58,434	31,270	24,312	11,735	11,224	-325,771	-97%
TX	562,516	484,271	426,490	343,425	245,799	275,993	211,025	149,135	-413,381	-73%
VA	230,846	125,985	68,071	33,088	10,316	5,791	8,875	2,343	-228,503	-99%
WV	507,110	301,574	95,693	94,335	43,693	40,545	45,778	38,741	-468,369	-92%
Total	**6,443,319**	**4,537,215**	**2,974,287**	**2,057,164**	**977,218**	**892,262**	**814,042**	**626,846**	**-5,816,473**	**-90%**

Figure 5-27: SO_2 Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2002–2019



5.4.7 Volatile Organic Compounds

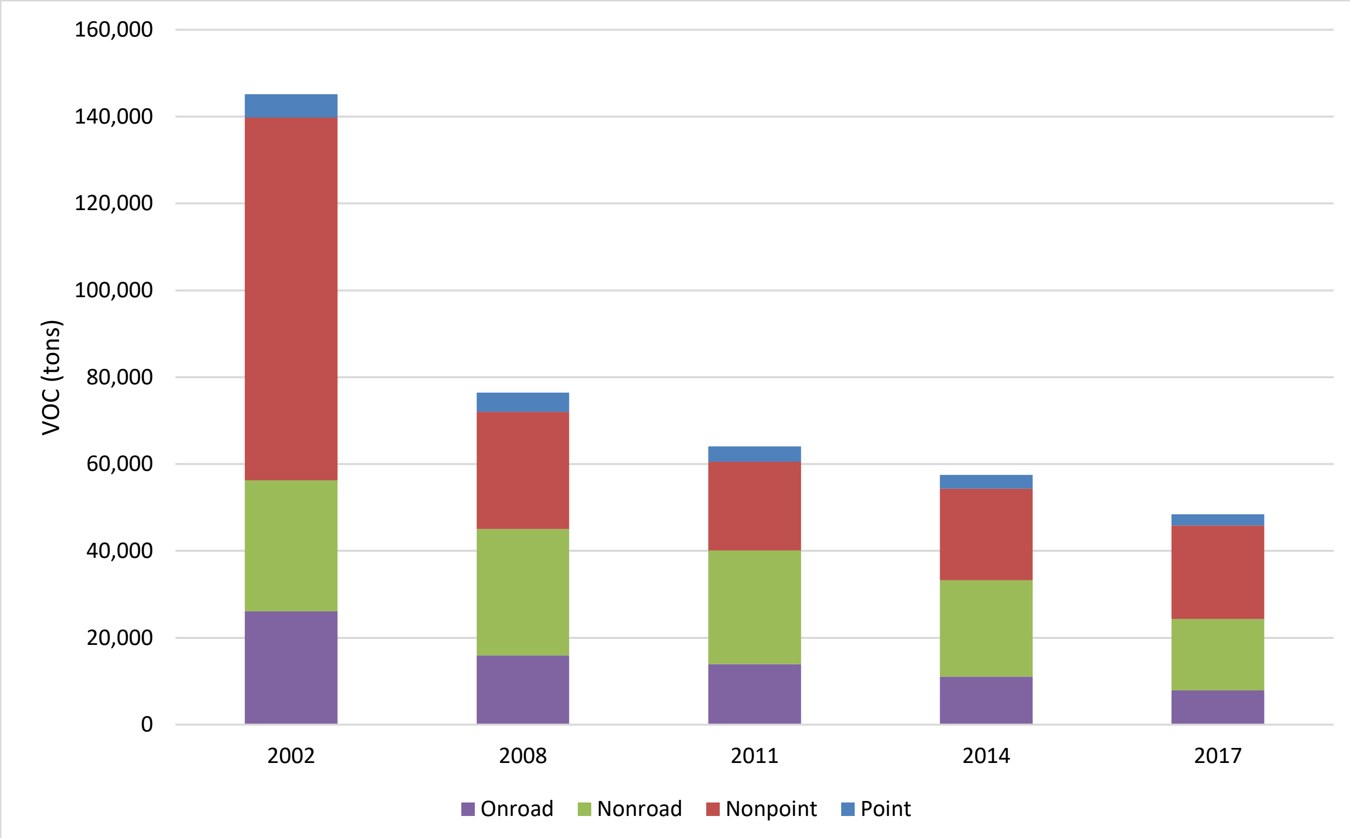
Table 5-23 shows VOC emissions from all NEI data categories for the period 2002 to 2017 in Maine. This data is also shown graphically in Figure 5-28. In general, VOC emissions have declined during this period; however, the sharp decrease in nonpoint VOC between 2002 and subsequent years is partly due to a revised methodology for residential wood combustion. Therefore, the decrease in nonpoint VOC between 2002 and subsequent years is artificially overstated.

Table 5-23: VOC Emissions in Maine for all NEI Data Categories, 2002–2017 (tons/yr)

Category	2002	2008	2011	2014	2017	VOC Change (2002 – 2017)	Percent VOC Change (2002 – 2017)
Point	5,360	4,371	3,552	3,204	2,578	-2,782	-52%
Nonpoint	83,511	27,024	20,446	21,061	21,550	-61,961	-74%
Nonroad	30,154	29,078	26,171	22,165	16,434	-13,720	-45%
Onroad	26,131	15,951	13,917	11,096	7,893	-18,238	-70%
Total	**145,157**	**76,423**	**64,086**	**57,527**	**48,454**	**-96,703**	**-67%**

Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Figure 5-28: VOC Emissions from all Data Categories in Maine, 2002–2017 (tons/yr)



Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Table 5-24 and Figure 5-29 show total VOC emissions from all NEI data categories for the MANE-VU states during the period from 2002 to 2017.

Most of the VOC decreases are from federal new engine standards for onroad and nonroad vehicles and equipment and the National low emission vehicle program. Additional VOC reductions are attributable to federal and state rules for 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 Ozone Transport Commission (OTC) Model Rules.[53] 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 onroad mobile sources have also decreased due to state motor vehicle Inspection & Maintenance (I & M) programs and the permeation of more on-board refueling vapor recovery (ORVR) equipped vehicles into the fleet. VOC emissions from nonroad and onroad mobile sources are expected to continue to

[53] https://otcair.org/document.asp?fview=modelrules

decrease as older, more polluting vehicles are replaced by newer, cleaner ones.

Table 5-24: Total VOC Emissions from all NEI Data Categories in the MANE-VU States, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	VOC Change (2002 – 2017)	% VOC Change (2002 – 2017)
CT	189,223	86,024	79,809	82,350	58,059	-131,164	-69%
DE	38,921	28,705	22,830	20,153	18,682	-20,239	-52%
DC	11,388	10,467	7,950	8,939	5,165	-6,223	-55%
ME	145,157	76,423	64,086	57,527	48,454	-96,703	-67%
MD	259,266	145,138	118,309	116,512	95,087	-164,179	-63%
MA	309,210	166,086	146,068	144,016	116,269	-192,941	-62%
NH	106,185	55,344	45,884	40,767	33,088	-73,097	-69%
NJ	341,276	224,688	177,043	154,589	143,384	-197,892	-58%
NY	544,016	519,566	416,915	410,573	273,152	-270,864	-50%
PA	449,637	432,590	372,135	477,338	388,427	-61,210	-14%
RI	41,448	23,770	23,186	23,499	17,965	-23,483	-57%
VT	47,157	29,131	27,869	27,366	20,922	-26,235	-56%
Total	**2,482,884**	**1,797,935**	**1,502,084**	**1,563,628**	**1,218,654**	**-1,264,230**	**-51%**

Figure 5-29: Total VOC Emissions from all Data Categories in the MANE-VU States, 2002–2017 (tons/yr)

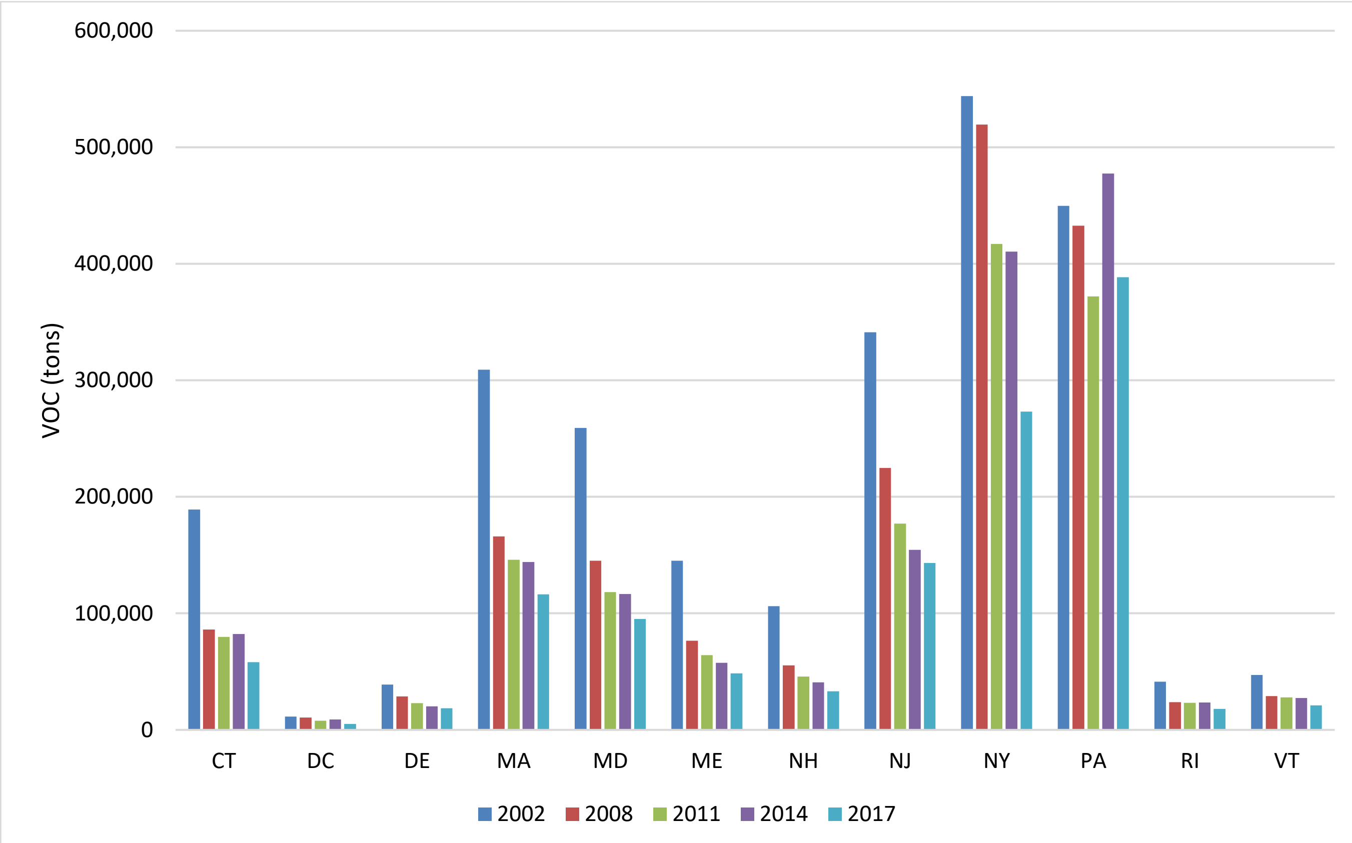


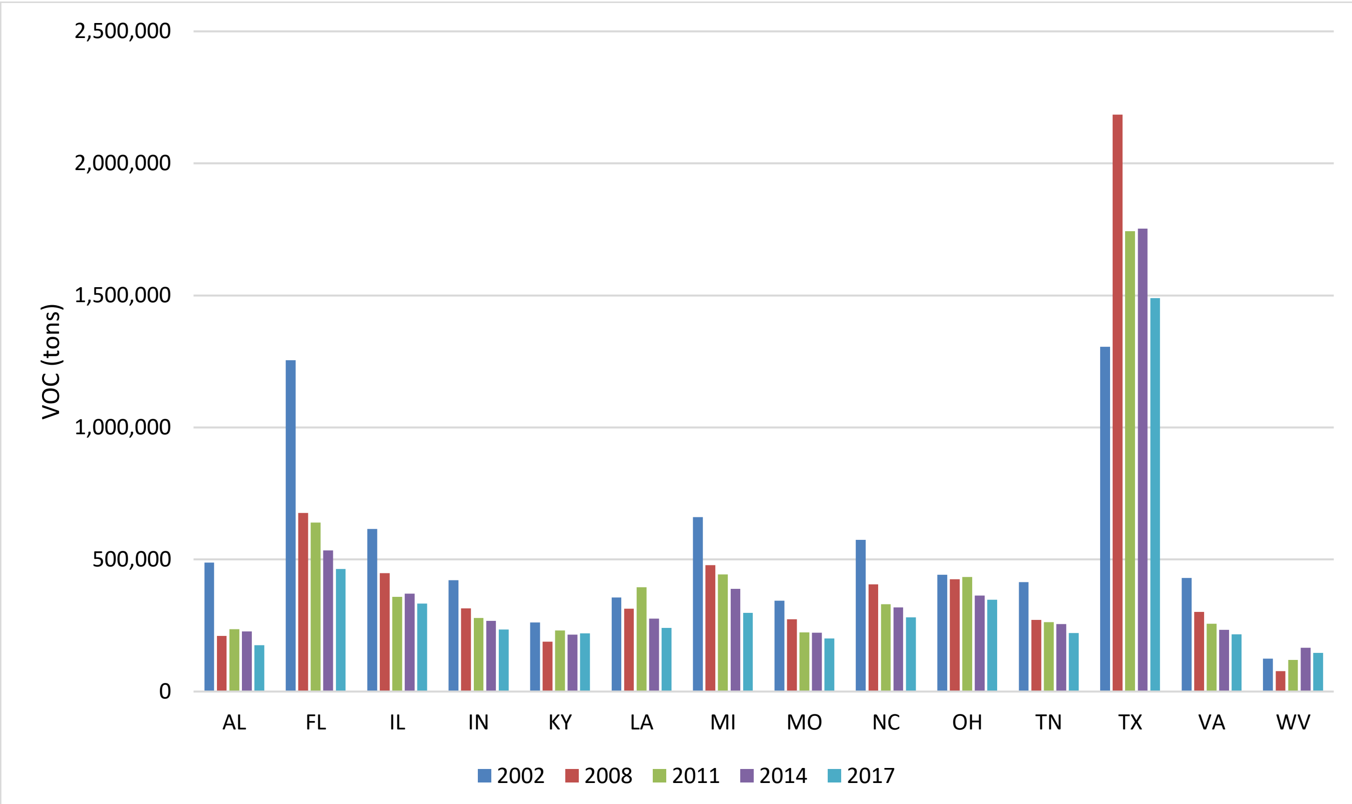
Table 5-25 and Figure 5-30 show total VOC emissions from all NEI data categories from the Non-MANE-VU Ask states. VOC emissions have declined from 2002 to 2017 in all Non-MANE-VU Ask states except TX and WV. Despite the increases in these states, overall total VOC emissions in the Non-MANE-VU Ask states have declined from 2002 to 2017.

Increases in TX and WV are most likely due to emissions generated from the oil and gas industry, drilling for natural gas, and EPA's new tools to estimate these emissions.

Table 5-25: Total VOC Emissions from all NEI Data Categories in the Non-MANE-VU Ask States, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	VOC Change (2002 – 2017)	% VOC Change (2002 – 2017)
AL	488,790	210,676	235,609	227,680	175,055	-313,735	-64%
FL	1,254,948	676,019	639,752	534,554	464,332	-790,616	-63%
IL	518,945	422,491	324,726	346,254	333,684	-185,261	-36%
IN	421,835	314,899	279,108	268,058	235,470	-186,365	-44%
KY	262,126	189,340	231,570	215,759	220,905	-41,221	-16%
LA	356,148	313,255	395,575	275,798	241,418	-114,730	-32%
MI	660,704	478,335	443,805	388,431	297,891	-362,813	-55%
MO	344,183	274,335	223,847	222,869	201,573	-142,610	-41%
NC	574,306	405,366	330,121	318,555	281,445	-292,861	-51%
OH	441,791	425,224	433,846	363,164	347,773	-94,018	-21%
TN	413,803	270,776	262,588	255,189	221,151	-192,652	-47%
TX	1,306,082	2,185,097	1,743,762	1,752,968	1,490,387	184,305	14%
VA	430,319	301,131	256,981	234,222	216,691	-213,628	-50%
WV	124,621	77,182	119,437	165,676	146,312	21,691	17%
Total	**7,598,602**	**6,544,127**	**5,920,726**	**5,569,177**	**4,874,098**	**-2,724,504**	**-36%**

Figure 5-30: Total VOC Emissions from all Data Categories in the Non-MANE-VU Ask States, 2002–2017 (tons/yr)



5.4.8 Ammonia

Table 5-26 shows NH_3 emissions from all NEI data categories for the period 2002 to 2017 in Maine. This data is also shown graphically in Figure 5-31. Although some year to year variability can be seen, there is still a general downward trend in ammonia emissions for Maine since 2002. Ammonia decreases were achieved in the onroad and nonroad sectors due to federal new engine standards for vehicles and equipment.

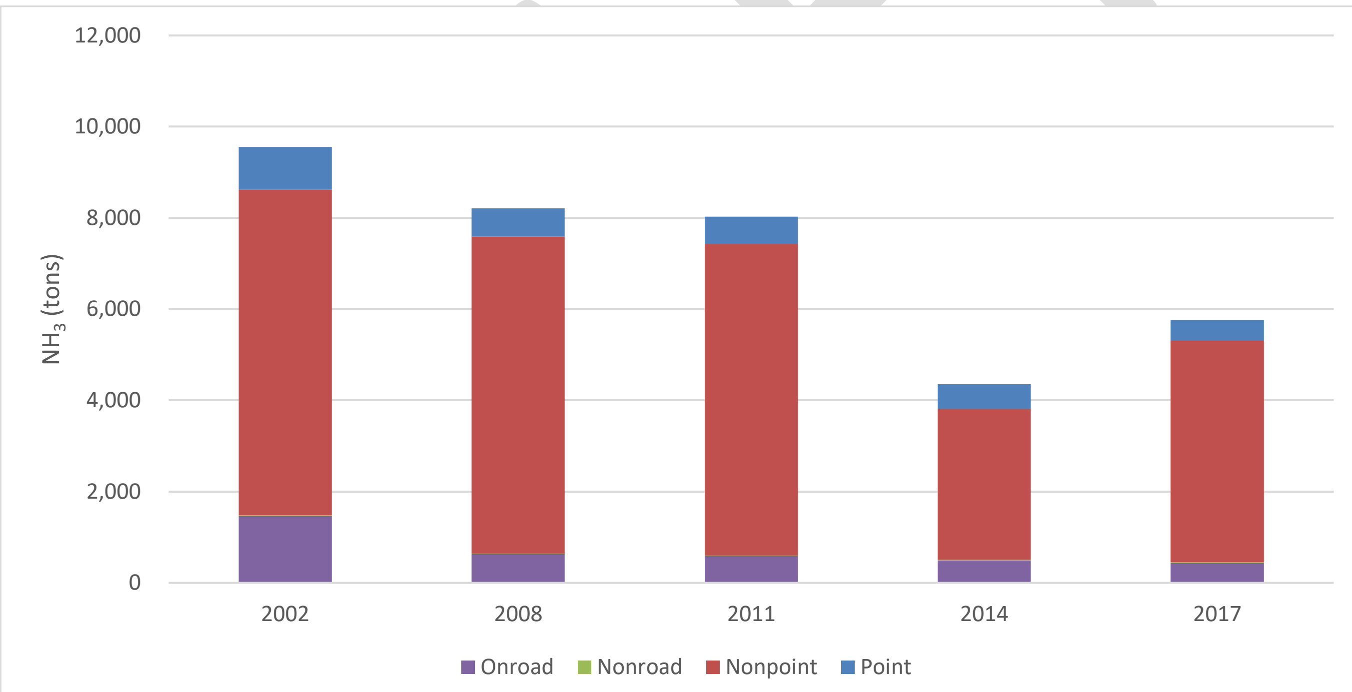
Point source increases from 2002 to 2008 are due to changes in reporting, grouping and methodology, not actual emission increases. As discussed previously, in 2008 EPA included airport emissions in point sources, and marine vessels and railroad emissions in the nonpoint category.

Table 5-26: NH_3 Emissions in Maine for all NEI Data Categories, 2002 – 2017 (tons/yr)

Category	2002	2008	2011	2014	2017	NH_3 Change (2002 – 2017)	Percent NH_3 Change (2002 – 2017)
Point	938	611	592	543	462	-476	-51%
Nonpoint	7,142	6,954	6,832	3,310	4,856	-2,286	-32%
Nonroad	11	13	14	14	14	3	27%
Onroad	1,467	628	586	489	434	-1,033	-70%
Total	9,557	8,207	8,024	4,356	5,765	-3,792	-40%

Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Figure 5-31: NH_3 Emissions in Maine from all Data Categories, 2002–2017 (tons/yr)



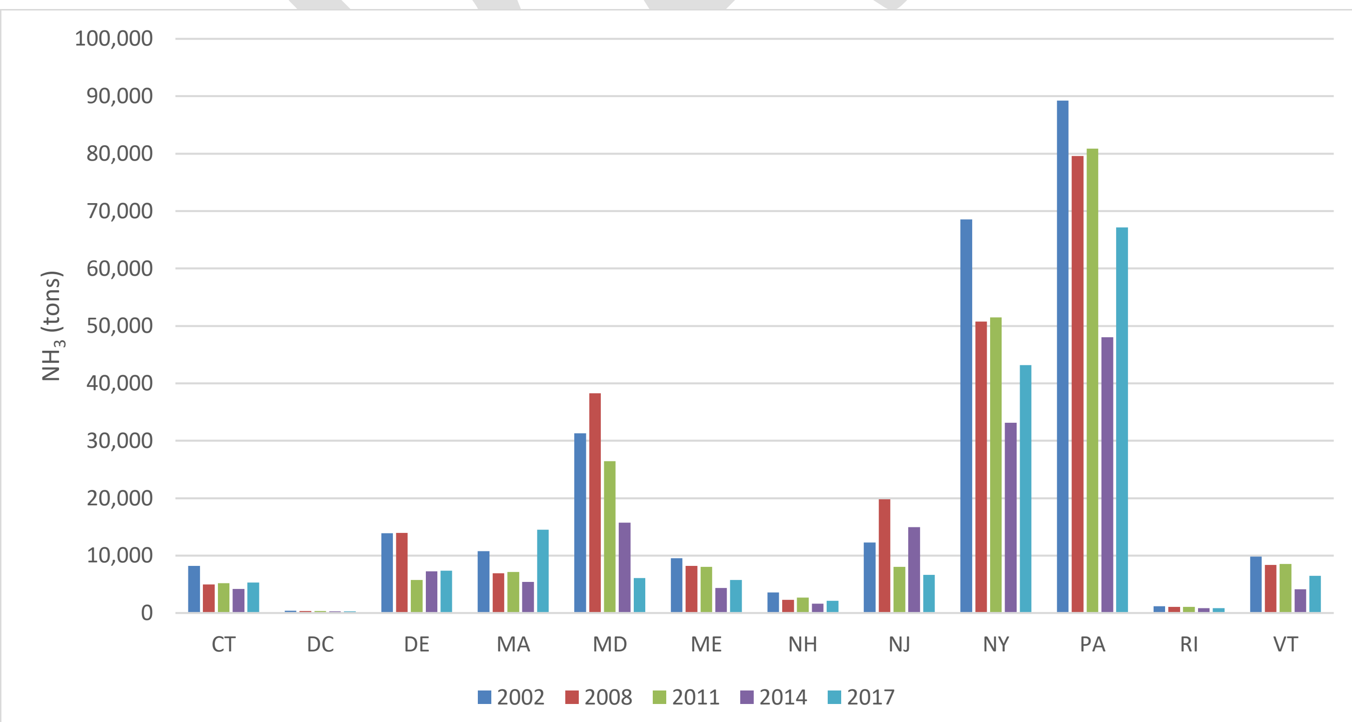
Notes:
Non-AMPD Point includes airports and railroad switch yards after 2002
Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint also includes Stage II refueling in 2002 through 2008, but excludes it after 2008.
Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
Onroad 2011 was subsequently revised in the EPA modeling platform. Onroad also includes Stage II refueling after 2008.

Table 5-27 and Figure 5-32 show total ammonia emissions for all NEI data categories combined for the MANE-VU states. Some year to year variability can be seen. However, for the majority of MANE-VU states, ammonia emissions for 2017 are lower than they were for earlier years.

Table 5-27: Total NH_3 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2017 (tons/yr)

State	2002	2008	2011	2014	2017	NH_3 Change (2002 – 2017)	Percent NH_3 Change (2002 – 2017)
CT	8,194	4,989	5,200	4,194	5,296	-2,898	-35%
DE	13,920	13,975	5,771	7,252	7,353	-6,567	-47%
DC	421	354	330	317	263	-158	-38%
ME	9,557	8,207	8,024	4,356	5,765	-3,792	-40%
MD	31,278	38,288	26,429	15,746	6,108	-25,170	-80%
MA	10,794	6,929	7,177	5,411	14,492	3,698	34%
NH	3,567	2,311	2,684	1,645	2,122	-1,445	-41%
NJ	14,807	19,804	8,049	14,895	14,976	169	1%
NY	68,536	50,737	51,487	33,110	43,180	-25,356	-37%
PA	89,263	79,588	80,871	48,000	67,183	-22,080	-25%
RI	1,202	1,092	1,075	862	873	-329	-27%
VT	9,810	8,379	8,567	4,148	6,490	-3,320	-34%
Total	**261,350**	**234,652**	**205,665**	**139,936**	**174,101**	**-87,249**	**-33%**

Figure 5-32: Total NH_3 Emissions in the MANE-VU States from all Data Categories, 2002–2017 (tons/yr)

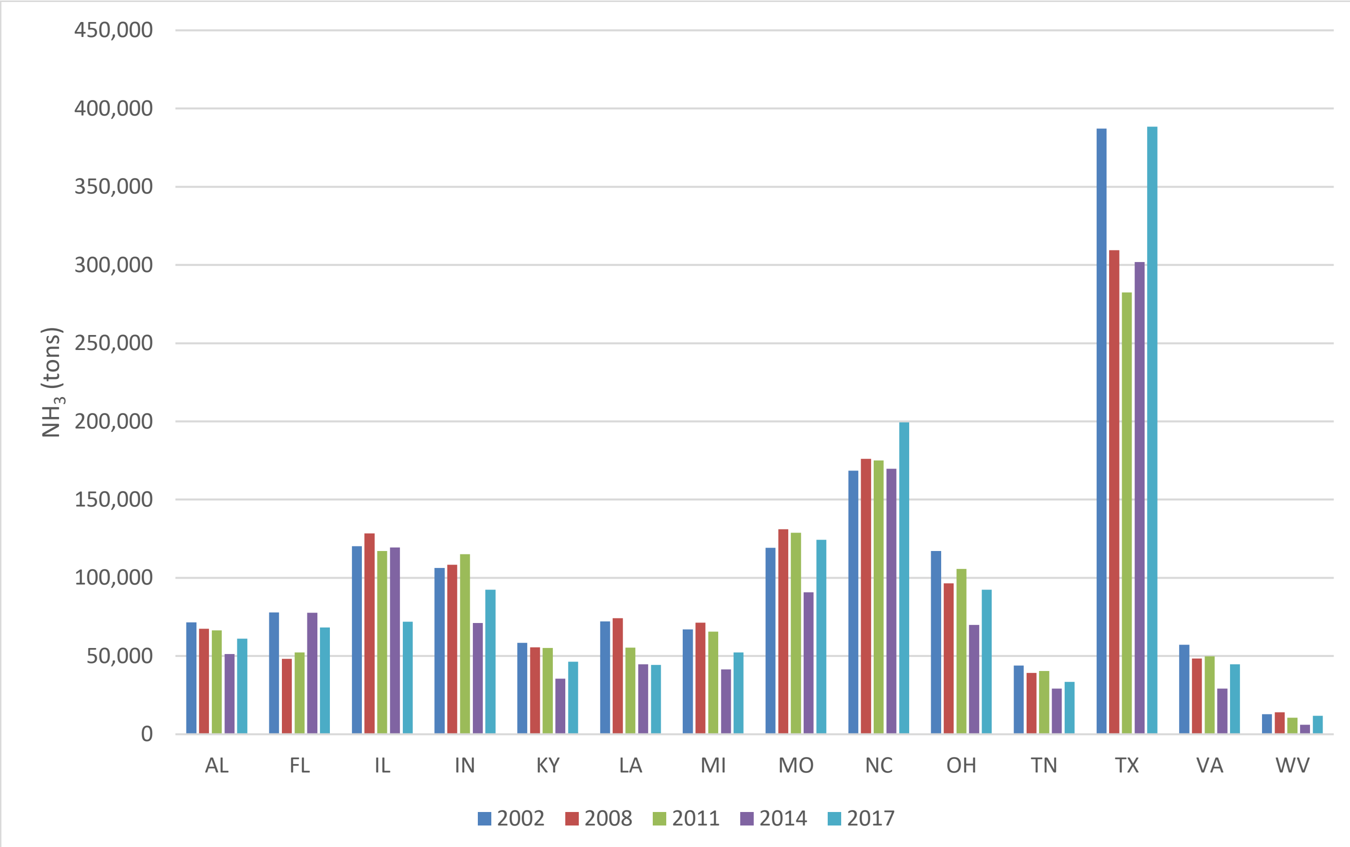


Total ammonia emissions for all NEI data categories for the Non-MANE-VU Ask states are shown in Table 5-28 and Figure 5-33. Again, some year to year variability in ammonia emissions can be seen. In most of the Non-MANE-VU Ask states, 2017 emissions are lower than they were for previous years.

Table 5-28: Total NH_3 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002 – 2017 (tons/yr)

State	2002	2008	2011	2014	2017	NH_3 Change (2002 – 2017)	Percent NH_3 Change (2002 – 2017)
AL	71,627	67,454	66,494	51,329	61,153	-10,474	-15%
FL	77,959	48,211	52,218	77,637	68,283	-9,676	12%
IL	120,222	128,348	117,209	119,481	71,951	-48,271	-40%
IN	106,354	108,301	115,038	71,036	92,297	-14,057	-13%
KY	58,406	55,558	55,265	35,476	46,390	-12,016	-21%
LA	72,094	74,188	55,272	44,703	44,395	-27,699	-38%
MI	66,954	71,406	65,507	41,500	52,261	-14,693	-22%
MO	119,101	131,113	128,753	90,853	124,221	5,120	4%
NC	168,398	176,143	175,127	169,777	199,395	30,997	-18%
OH	117,152	96,512	105,793	69,854	92,404	-24,748	-21%
TN	43,831	39,213	40,364	29,237	33,574	-10,257	-23%
TX	387,228	309,529	282,413	301,772	388,408	1,080	<1%
VA	57,150	48,462	49,935	29,151	44,768	-12,382	-22%
WV	12,832	14,100	10,668	6,162	11,815	-1,017	-8%
Total	**1,479,309**	**1,368,541**	**1,320,058**	**1,137,969**	**1,331,316**	**-147,993**	**-10%**

Figure 5-33: Total NH_3 Emissions in the Non-MANE-VU Ask States from all Data Categories, 2002–2017 (tons/yr)



5.5 Modeling Inventories

Maine is required to identify the baseline emission inventory on which emission reduction strategies are based in accordance with 40 C.F.R. § 51.308(d)(3)(iii). The baseline inventory is intended to be used to assess progress in making emission reductions. MANE-VU and Maine are using 2011 as the baseline year inventory. Future year inventories were developed for 2028 based on the 2011 base year. This future year emission inventory includes emissions growth due to projected increases in applicable source category as well as the emissions reductions due to the implementation of control measures.

The emissions dataset illustrated in Section 5.5.1 is the MANE-VU 2011 Gamma emissions inventory. The MANE-VU regional haze emissions Gamma Inventory was also used for modeling purposes. This inventory was developed by the Mid-Atlantic Regional Air Management Association (MARAMA), the Eastern Regional Technical Advisory Committee (ERTAC) EGU Workgroup, and EPA.

The 2011-based modeling platform is a combination of work performed by the state/local/tribal (S/L/T) air agencies and the EPA. Its basis is the 2011 NEI discussed above, but there may be some slight variations. As the states, EPA and air agencies developed the modeling inventory, certain changes may have been made from the base NEI to reflect corrections or improvements. In some cases, EPA also made efforts to make those corrections or updates in later versions of the NEI. The future year 2028 inventory was developed using a combination of S/L/T data and methods for projecting emissions from stationary sources and to rely on EPA's 2028 modeling platform for mobile source emission projections. More detailed information regarding the Gamma Inventory development and projections can be found in the Technical Support Document Emission Inventory Development for 2011 and Projections to 2020 and 2023 for the Northeastern U.S. Gamma Inventory, January 29, 2018, and the OTC/MANE-VU 2011 Based Modeling Platform Support Document - October 2018 Update. The following is a summary of the Gamma inventory.

5.5.1 Modeling Inventory Summaries

Tables 5-29 through 5-31 summarize the MANE-VU 2002 and the MANE-VU 2011 Gamma emissions inventories and 2028 Gamma emissions projections for MANE-VU. The inventory sectors shown in the tables below for the modeling inventory summaries vary in definition from the sectors shown in the EPA NEI inventory summaries above and from each other.

The 2002 modeling emissions inventory categories shown below include the following:

- Point (includes ERTAC Electric Generating Units and Non-EGU Point Sources, and does not include airports and rail yards as in the NEI summaries)
- Area Sources (includes Stage I and Stage II refueling, residential wood burning, agricultural ammonia and fires, prescribed fires and wildfires, and unadjusted fugitive dust, and does not include marine and rail as in the NEI summaries)
- Nonroad (includes marine and rail)
- Onroad (does not include gasoline Stage II refueling as in the NEI summaries)
- Biogenic Sources

The 2011 and 2028 Gamma emissions inventory categories shown below include the following:

- Point ERTAC Electric Generating Units
- Non-EGU Point Sources (includes airports and rail yards)
- Area Sources (includes Stage I refueling and residential wood burning, does not include marine and rail as in the NEI summaries)
- Nonroad (includes marine and rail)
- Onroad (includes gasoline Stage II refueling)
- Oil and Gas
- Other (includes agricultural ammonia and fires, prescribed fires and wildfires, and adjusted fugitive dust).
- Biogenic Sources

Table 5-29: MANE-VU 2002 Emissions Inventory Summary – MANE-VU States

	VOC	NO_X	$PM_{2.5}$	PM_{10}	NH_3	SO_2
Point	97,300	673,660	55,447	89,150	6,194	1,907,634
Area	1,528,141	262,477	332,729	1,455,311	249,795	316,357
Nonroad	572,751	431,631	36,084	40,114	287	57,257
Onroad	789,560	1,308,233	22,107	31,561	52,984	40,091
Anthropogenic Total	**2,987,752**	**2,676,001**	**446,367**	**1,616,136**	**309,260**	**2,321,339**
Biogenics	2,575,232	28,396	-	-	-	-
TOTAL	**5,562,984**	**2,704,397**	**446,367**	**1,616,136**	**309,260**	**2,321,339**

Notes:
Area includes Stage II refueling and unadjusted fugitive dust
Nonroad includes airports, rail and commercial marine vessels

Table 5-30: MANE-VU 2011 Gamma Emissions Inventory Summary – MANE-VU States

	VOC	NO_X	$PM_{2.5}$	PM_{10}	NH_3	SO_2
EGU Point	2,477	206,457	17,987	24,000	2,923	462,551
Non-EGU Point	53,046	155,892	28,669	37,773	4,950	108,301
Area	703,086	194,924	160,501	177,343	14,552	135,783
Nonroad	369,537	344,671	27,442	29,073	378	25,477
Onroad	362,357	717,012	27,133	52,081	18,094	4,793
Oil/Gas	29,028	53,405	1,676	1,766	14	2,102
Other	21,570	1,165	27,816	846	165,673	668
Anthropogenic Total	**1,541,101**	**1,673,526**	**291,225**	**322,881**	**206,584**	**739,675**
Biogenics	2,064,088	30,564				
TOTAL	**3,605,189**	**1,704,090**	**291,225**	**322,881**	**206,584**	**739,675**

Notes:
Non-EGU point includes airports and railroad switch yards
Area includes adjusted fugitive dust
Nonroad includes commercial marine vessels and underway railroad
Onroad includes Stage II refueling

Table 5-31: MANE-VU 2028 Gamma Emissions Projections Summary – MANE-VU States

	VOC	NO_X	$PM_{2.5}$	PM_{10}	NH_3	SO_2
EGU Point	4,871	85,182	15,060	19,115	3,114	196,760
Non-EGU Point	54,371	148,416	28,329	37,522	5,123	82,813
Area	659,063	177,995	150,922	167,001	13,641	28,159
Nonroad	219,807	193,233	13,773	14,752	475	1,967
Onroad	111,151	165,746	9,216	35,845	12,632	1,642
Oil/Gas	49,830	70,737	3,101	3,196	16	6,369
Other	22,084	1,384	29,956	147,913	169,064	771
Anthropogenic Total	**1,121,177**	**842,691**	**250,357**	**425,343**	**204,066**	**318,481**
Biogenics	2,064,088	30,564				
TOTAL	**3,185,265**	**873,256**	**250,357**	**425,343**	**204,066**	**318,481**

Notes:
Non-EGU point includes airports and railroad switch yards
Area includes adjusted fugitive dust
Nonroad includes commercial marine vessels and underway railroad
Onroad includes Stage II refueling

5.6 Assessment of Anthropogenic Sources that Have Impeded Progress (40 C.F.R. 51.308(g)(5))

To date, no anthropogenic sources have impeded Maine's reasonable progress.

6. MONITORING STRATEGY (40 C.F.R. 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 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 wilderness areas and national parks.

The IMPROVE program consists of monitoring sites operated and maintained through a formal cooperative relationship between the U.S. EPA, NPS, U.S FWS, 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 National Association of Clean Air Agencies), Western States Air Resources Council, Mid-Atlantic Regional Air Management Association, and Northeast States for Coordinated Air Use Management.

Maine's monitoring strategy relies on participation in the IMPROVE network and data analyses on the Federal Land Manager Database (FED) website. Maine DEP evaluates the monitoring network periodically and makes appropriate adjustments to it as necessary. However, Maine's commitment to following this strategy and providing continuing assessments of progress toward national visibility goals at mandatory 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, Maine 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 C.F.R. 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. Maine'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 C.F.R. 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 Areas both within and outside of the state.
  In order to determine which states should be consulted an analysis must be conducted to define which states, sources, or sectors reasonably contribute to visibility impairment. EPA's draft guidance document calls for a process for determining which sources or source sectors should be considered. The procedures that Maine DEP used to make this determination were described earlier in Section 3.2.1.

- **40 C.F.R. 51.308(f)(6)(iv)** Provide for the reporting of all visibility monitoring data to the

Administrator at least annually for Class I Areas within the state.
The Federal Land Manager submits the data, and the data are posted on the VIEWS website.

- **40 C.F.R. 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 Maine. In Section 5.4, Maine DEP has provided statewide emissions estimates of NO_X, SO_2, $PM_{2.5}$, VOC, and NH_3 for the most recent year for which data are available (2014 for all categories and 2017 for those facilities that report to EPA's AMPD). Maine DEP commits to update its statewide emissions inventory periodically.

- **40 C.F.R. 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 Maine DEP believes the current IMPROVE network is sufficient to adequately measure and report progress toward the regional haze goals set for Maine's Class I Areas, Maine DEP 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 MANE-VU 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); and
    - 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 realities will allow, Maine will continue using these and other data sources for the purposes of understanding visibility impairment and documenting progress toward national visibility goals for Class I Areas under the Regional Haze Rule.

7. CONCLUSION

This SIP update represents the culmination of years' worth of technical work performed in partnership with member states, tribes, EPA, and federal land managers.

It is important to note that many of the concerns about using the latest emissions inventory can be put into a perspective that indicates it is not a critical factor during this SIP update. Currently, 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 had already been analyzed and implemented by at least one member state. Thus, by virtue of their existing 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 also benefit Class I Areas outside the MANE-VU region.

Because Maine finds 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. Some Maine policies already in effect, such as low sulfur fuel requirements which took effect in 2018, will continue to produce SO_2 and PM emissions reductions that have not yet been realized and thus are not reflected in the 2017 emissions data used in this analysis. As a result, Maine expects visibility at its three Class I Areas, and in nearby Class I Areas that Maine emissions may impact, to continue to improve over the next ten years. Additionally, because most visibility-impairing pollutants are small particles, further reducing their ambient concentrations is expected to produce incremental public health benefits.