State of New Jersey
Department of Environmental Protection

State Implementation Plan (SIP)
For Regional Haze

August 2019

Preface

Pursuant to the requirements of 42 U.S.C. § 7491 (Sections 169 and 169A of the Clean Air Act) and the Federal Regional Haze Rules at 40 C.F.R. § 51.308, New Jersey is revising its New Jersey State Implementation Plan to address the requirements for improving visibility in the mandatory Class I Federal areas, including the Brigantine Wilderness Area of the Edwin B. Forsythe National Wildlife Refuge. Elements of this State Implementation Plan address the federal requirements pursuant to 40 C.F.R. § 51.308(f). In addition, this State Implementation Plan addresses Regional Planning, State and Federal Land Manager coordination, and contains a commitment to provide State Implementation Plan, which require the State to submit periodic implementation plan upgrades and progress reports. This document outlines New Jersey's long-term plan for dealing with visibility-impairing air pollution within its borders and from out-of-state sources that transport emissions to New Jersey's federal Class I area.

Acknowledgments

The New Jersey Department of Environmental Protection acknowledges the efforts and assistance of the many agencies and individuals whose contributions were instrumental in the preparation of this State Implementation Plan Revision. In particular, the New Jersey Department of Environmental Protection wishes to acknowledge the many individuals within the United States Department of the Interior, Fish and Wildlife Service, in particular the staff and management of the Brigantine Wilderness Area and the Air Quality Branch; the United States Environmental Protection Agency, Region 2; the Mid-Atlantic/Northeast Visibility Union; the Northeast States for Coordinated Air Use Management; and the Mid-Atlantic Regional Air Management Association; as well as staff within the New Jersey Department of Environmental Protection for their assistance and guidance.

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Acronyms and Abbreviations

$\mu g/m^3$	Microgram per cubic meter
AERR	Air Emissions Reporting Requirements
AL	Alabama
AMPD	Air Markets Program Division
BART	Best Available Retrofit Technology
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CEHA	New Jersey's County Environmental Health Act
C.F.R.	Code of Federal Regulations
CHP	Combined Heat and Power
CO	Carbon monoxide
CT	Connecticut
DC	District of Columbia
DE	Delaware
DEP	Department of Environmental Protection
dv	Deciview
EGU	Electric Generating Unit
FL	Florida
FLM	Federal Land Manager
GA	Georgia
HEDD	High Electrical Demand Day
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
ICI	Industrial/Commercial/Institutional
IL	Illinois
I/M	Inspection and Maintenance (I & M)
IMPROVE	Interagency Monitoring of Protected Visual Environments
IN	Indiana
km	Kilometer
KY	Kentucky
LA	Louisiana
LTS	Long-Term Strategy
MA	Massachusetts
MATS	Mercury and Air Toxics Standards
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association

MD	Maryland
ME	Maine
MI	Michigan
Mm^{-1}	Megameter
MMBTU	1,000,000 British Thermal Union
MO	Missouri
MS	Mississippi
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NC	North Carolina
NEEDS	National Electric Energy Data System
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NH	New Hampshire
NH_3	Ammonia
NHDES	New Hampshire Department of Environmental Services
NJ	New Jersey
N.J.A.C.	New Jersey Administrative Code
N.J.R.	New Jersey Registry
NJDEP (DEP)	New Jersey Department of Environmental Protection
N.J.S.A.	New Jersey Statutes Annotated
NLEV	National Low Emission Vehicle Program
NO_2	Nitrogen dioxide
NO_3	Nitrate
NO_x	Oxides of Nitrogen
NO_y	Total reactive nitrogen
NP	National Park
NSR	New Source Review
NY	New York
O_2	Oxygen
OC	Organic Carbon Mass
OH	Ohio
OM	Organic Compound Mass
ORVR	Onboard Refueling Vapor Recovery
OTC	Ozone Transport Commission
PA	Pennsylvania
PM	Particulate Matter
$PM_{2.5}$	Fine Particulate Matter (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers)
PM_{10}	Particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers
ppb	Parts per billion
ppm	Parts per million
PSD	Prevention of Significant Deterioration
RACT	Reasonably Available Control Technology
RGGI	Regional Greenhouse Gas Initiative
RI	Rhode Island
RPG	Reasonable Progress Goal
RPO	Regional Planning Organization
SIP	State Implementation Plan
SO_2	Sulfur Dioxide

SO_4	Sulfate
SO_x	Oxides of Sulfur
SOA	Secondary organic aerosol
TN	Tennessee
TX	Texas
URP	Universal Rate of Progress
USEPA	United States Environmental Protection Agency
U.S.C.	United States Code
VA	Virginia
VOC	Volatile Organic Compounds
VT	Vermont
VTDEC	Vermont Department of Environmental Conservation
WV	West Virginia

Chapter 1 Introduction and Background

1.1 Introduction

The federal Clean Air Act[1] sets a national goal to restore visibility to its natural conditions in many of the national parks, wilderness areas and memorial parks in the United States of America. New Jersey is home to one of these areas, the Brigantine Wilderness Area in the Edwin B. Forsythe National Wildlife Refuge, hereafter called the Brigantine Wilderness Area. Section 169A of the Clean Air Act of 1977 sets 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 man-made air pollution.*

The USEPA promulgated rules[2] outlining the goal for States and Tribes to achieve natural visibility goal by 2064. These rules provide the basis for defining current and future goals for both natural background and interim milestones, and a process to achieve the milestones.

New Jersey is proposing a revision to the New Jersey State Implementation Plan (SIP) to establish long-term strategies and to set the 2028 reasonable progress goals for the Brigantine Wilderness Area. The purpose of the emission control strategies and the goals is to address New Jersey's contribution to visibility impairment at Brigantine Wilderness Area. It is important to note that based on the analysis conducted by New Jersey and MANE-VU, New Jersey has determined that it does not significantly contribute to any Class I areas in any other state other than the Brigantine Wilderness Area in New Jersey.[3]

This document outlines New Jersey's long-term strategy (2018 to 2028) for dealing with visibility-impairing air pollution within its borders and from out-of-state sources that transport pollution to the Brigantine Wilderness Area.

Elements of this SIP address the core requirements pursuant to 40 C.F.R. 51.308(f) for New Jersey's sources identified as contributing to any Class I area including the Brigantine Wilderness Area. In addition, this SIP addresses regional planning, State and Federal Land Manager coordination, and contains a commitment to provide SIP revisions and the January 31, 2025 progress review as required by 40 C.F.R. § 51.308 (f) and (g), which require the State to submit periodic implementation plan upgrades and progress reports.

More details on the history of the Federal Regional Haze Rule[4] and the 1990 Clean Air Amendments are included in Appendix A.

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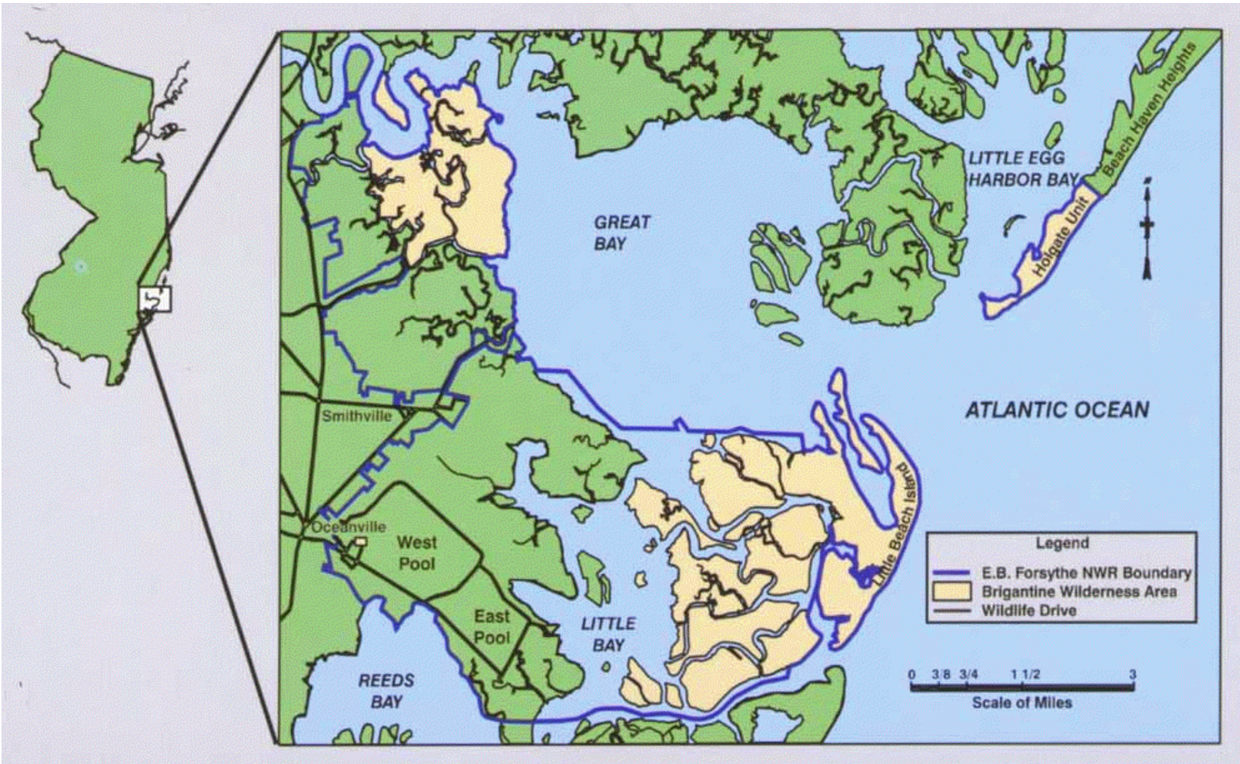
[1] 42 U.S.C. § 7491
[2] 40 C.F.R § 51.300-309
[3] Selection of States for MANE-VU Regional Haze Consultation (2018). MANE-VU Technical Support Committee.(Appendix E)
[4] 40 C.F.R § 51.308

1.2 Description of Brigantine Wilderness Area

The Brigantine Wilderness Area is part of the larger Edwin B. Forsythe National Wildlife Refuge located in Brigantine, an island city in Atlantic County, New Jersey. It is in Southern New Jersey on the Atlantic coast, about 11 miles north of Atlantic city. The Brigantine Wilderness Area of the Edwin B. Forsythe National Wildlife Refuge is managed by the United States Fish and Wildlife Service of the Department of the Interior.

Figure 1-1: Map of Brigantine Wilderness Area



This unique and valuable resource is the home and stop-over point for migratory birds and water fowl along the eastern coast of our country. Over 290 different species of birds have been observed within the wilderness area. At the peak season for bird migration in early November, concentrations of over 100,000 ducks and geese have been seen in the saltwater marshes of the refuge. The refuge itself attracts over 300,000 visitors per year who come to watch the birds or enjoy the scenic views of the Atlantic Ocean, Great Bay, Little Bay, Reeds Bay, and Little Egg Harbor area.

Figure 1-2: Pictures from Brigantine Wilderness Area

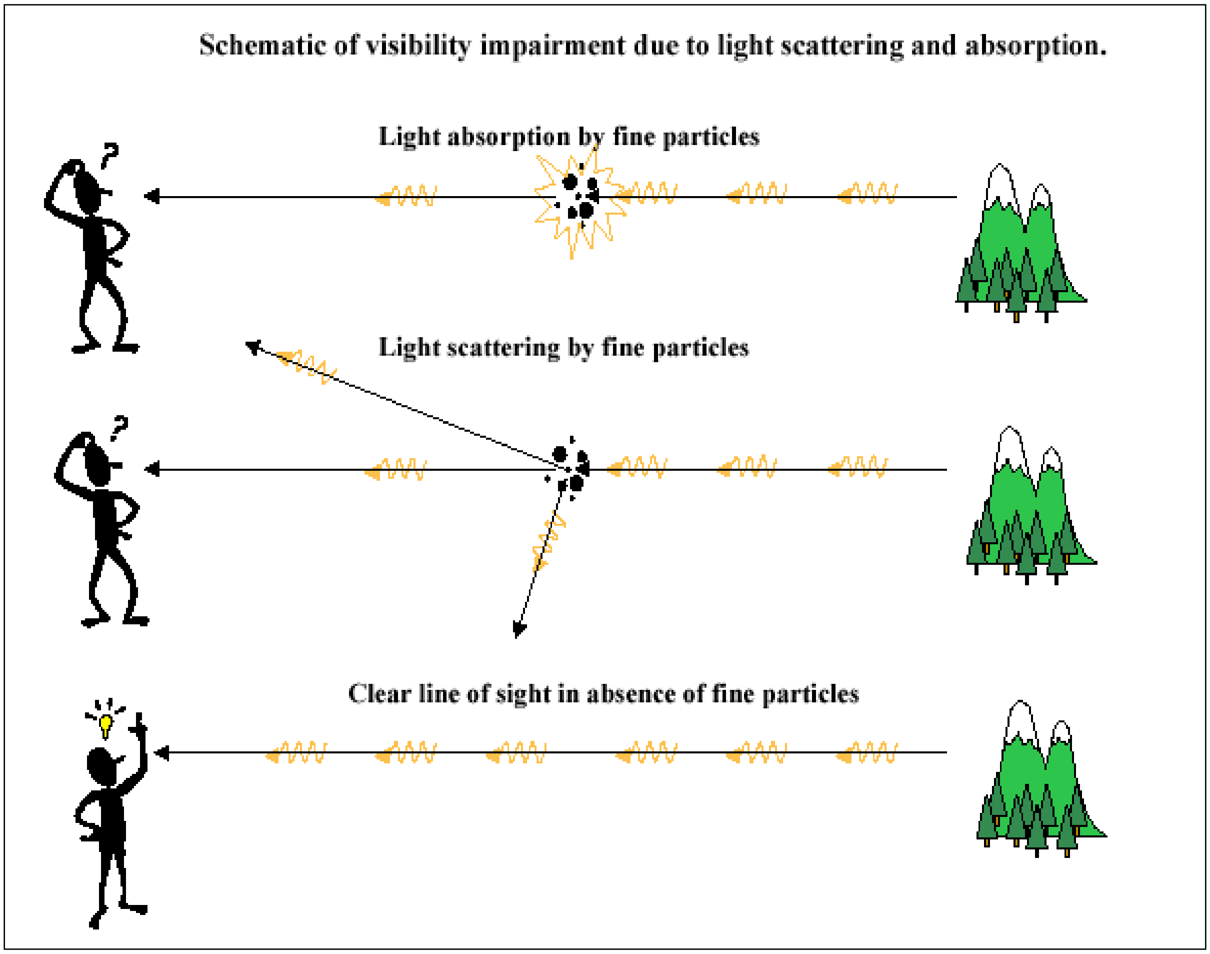
The nearby attraction of Atlantic City, New Jersey draws over 35 million visitors per year and the views of the Brigantine Wilderness Area from Atlantic City are enjoyed by all. The exceptional natural character and charm of the Brigantine Wilderness Area create an oasis of beauty within the most densely populated state in the nation.

1.3 Regional Haze in Brigantine Wilderness Area

Regional Haze is not caused by the air pollution from any one specific source but is caused by the emission of air pollution from numerous anthropogenic sources located over a wide geographic area. The solution to Regional Haze can only be found by looking at all emissions of visibility-impairing pollutants over a wide geographic area.

Regional Haze is caused by the scattering or absorption of light particles in the atmosphere from air pollution. This absorption and scattering effect of fine particles is illustrated in Figure 1-3.

Figure 1-3: Absorption and Scattering Effect of Fine Particles



This real effect on air quality is further illustrated on the next page in the pictures in Figure 1-4 and Figure1-5 taken at the Brigantine Wilderness Area on a clear day and on a hazy day. Note that the skyline of Atlantic City is visible on the clear day and obscured from view on the hazy day.

Figure 1-4: Brigantine Wilderness Area on a Clear Day

Figure 1-5: Brigantine Wilderness Area on a Hazy Day

The haziness seen in the figures represents air pollution arising from local and regional sources to obscure visual range. Different pollutants have different effects on visibility and a standardized metric (equation) to calculate visibility impairment was developed using the known concentrations of the individual pollutants or components. As will be seen in the Regional Haze Visibility Equation in the next section, many of the components contributing to visibility impairment are the same air pollutants of concern with respect to the formation of ozone and fine particulate matter, namely: sulfate, nitrate, organic mass and elemental carbon. Fine particulate matter and ozone, formed from oxides of nitrogen and volatile organic compounds, are important health concerns in New Jersey. Besides contributing to regional haze and other welfare effects, they also contribute to wide-spread human health effects.[5]

[5] State Implementation Plan (SIP) Revision for the Attainment and Maintenance of the Ozone National Ambient Air Quality Standard, 8-Hour Ozone Attainment Demonstration, Final, October 29, 2007. (Appendix J)

Chapter 2 Calculations and Visibility Conditions

2.1 Regional Haze Visibility Equation

The degree of visibility impairment is expressed in deciviews, a unitless value. The calculation of visibility impairment utilizes two equations, one to calculate light extinction coefficient (Bext), and then its transformation into visibility impairment as expressed in deciviews (dv). The latest equation, approved by the Interagency Monitoring of Protected Visual Environments (IMPROVE) Steering Committee, to calculate the light extinction coefficient is:

Equation 1[6]

Bext ≈ 2.2 x f_S (RH) x [Small Ammonium Sulfate] + 4.8 x f_L (RH) x [Large Ammonium Sulfate] + 2.4 x f_S (RH) x [Small Ammonium Nitrate] + 5.1 x f_L (RH) x [Large Ammonium Nitrate] + 2.8 x [Small Organic Mass] + 6.1 x [Large Organic Mass] + 10 x [Elemental Carbon] + 1 x [Fine Soil Mass] + 1.7 x fss (RH) x [Sea Salt Mass] + 0.6 x [Coarse Mass] + Rayleigh Scattering (Site Specific) + 0.33 x (Mm^{-1}/ppb) x [Nitrogen Dioxide (ppb)]

Where:

Bext = The light extinction coefficient in inverse megameters [Mm-1]

fs (RH) and **fL (RH)** = Humidity factor associated with small and large mode mass size distributions

fss (RH) = Humidity factor associated with Sea Salt

Light extinction and Rayleigh scattering units are inverse megameters (Mm^{-1}), concentrations shown in bracketed units are microgram per cubic meter (μg/m^3), and the water growth terms, *f*(RH), do not have units. The nitrogen dioxide (NO_2) light absorption term will not be used for MANE-VU and nearby region sites due to no NO_2 concentration data being available at those sites. The organic compound mass (OM) to organic carbon mass (OC) ratio is 1.8 (OM=1.8*OC). Sulfate, nitrate and organics are split into small and large particle components based on their mass. For masses less than 20 μg/m^3, the fraction in the large mode is estimated by dividing the total concentration of the component by 20 μg/m^3 with the remaining in the small mode. If the total concentration of a component exceeds 20 μg/m^3, all of it is assumed to be in the large mode. The small and large modes of sulfate and nitrate have associated hygroscopicity, f_S(RH) and f_L(RH), respectively, while f_{SS}(RH) is for sea salt.

Site-specific Rayleigh scattering is calculated by IMPROVE Steering Committee for the elevation of the site, as well as, annual average temperature of each IMPROVE monitoring site.

[6] Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics). December 18. 2018. (Appendix I)

Equation 2

Once light extinction is calculated, visibility levels or haze index (in deciviews (dv)) can be calculated using the following equation:

$$\textbf{Haze index in Deciviews (dv)} = 10 \ln (bext/10)$$

where ln is the natural log function and Bext is calculated using the IMPROVE equation for light extinction as previously described. The calculated deciviews are unitless values where the higher the value, the greater amount of visibility impairment exists.

Not all visibility metrics used by MANE-VU states for the first implementation period can be used for the second implementation period. Recent amendments to the Regional Haze rule (USEPA, 2017)[7] allow states to use the same metrics for the 20 percent clearest days however baseline and current haze metrics for the 20 percent most impaired days must now be calculated for the 20 percent most impaired days caused by anthropogenic emissions. USEPA has recommended metrics for determining 20 percent most impaired days in Chapter 2 of the December 2018 technical guidance (USEPA 2018).[8] MANE-VU states have since agreed to use the recommended metrics for the second implementation period.

2.2 Baseline, Natural and Current Visibility Conditions for Brigantine Wilderness Area

40 CFR 51.308(f)(1) of the Regional Haze rules requires states to address regional haze in each mandatory Class I Federal area located within the State and in each mandatory Class I Federal area located outside the State that may be affected by emissions from within the State. Specifically, the plan must contain:

- Baseline, natural and current visibility conditions for the most impaired and clearest days. These six conditions must be quantified in deciviews.
- Actual progress made on the most impaired and clearest days toward natural visibility conditions (1) since the baseline period and (2) in the previous implementation period. These four calculations must be quantified in deciviews.
- The difference between current and natural visibility conditions for the most impaired and clearest days. These two calculations must be quantified in deciviews.
- The 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, (2007–2018), 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 USEPA, in its 2017 Regional Haze Rule (RHR) 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

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[7] 82 Fed. Reg. 3078; January 10, 2017

[8] USEPA Technical Guidance on Tracking Visibility Progress for the Second Implementation Period. December 2018. https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf

also more consistent with the definition of visibility impairment in 40 CFR 51.301. While not changing the wording, USEPA made clear that going forward, ‘‘most impaired days’’ would refer to those with the greatest anthropogenic visibility impairment. The approach for the 20 percent of days with the best visibility to represent good visibility conditions for Reasonable Progress Goal (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.

Natural background conditions, the conditions that would exist in the absence of all man-made pollution, represents the visibility goal for each Class I area to achieve in 2064. Natural background concentrations of naturally occurring air contaminants were estimated, using the USEPA guidance and Equations 1 and 2 above.

Natural haze levels are calculated for both 20 percent clearest days and 20 percent most impaired days, because changing natural processes lead to variability in natural visibility. Achievement of these goals through constant annual incremental improvement in the Haze Index (in dv) such that natural conditions will be reached by 2064 is termed a “uniform rate of progress (URP)” (also referred to as the glide path).

Equations 1 and 2 were used to calculate the baseline visibility impairment in the Brigantine Wilderness Area.

The RHR requires states to evaluate current regional haze conditions at Class I areas subject to the rule relative to conditions during a historic baseline period. The historic baseline period is the five-year period from 2000 through 2004 and current five-year period is 2013 through 2017.

Brigantine Wilderness Area has an estimated natural background visibility of 5.52 deciviews on the 20 percent clearest days and 10.69 deciviews on the 20 percent most impaired days. Table 2-1 shows the comparison between natural, baseline and current visibility at Brigantine Wilderness Area.

Table 2-1: Comparison of Natural, Baseline, and Current Visibility Conditions in Deciviews for the 20 percent Clearest and 20 percent Most Impaired at Brigantine Wilderness Area[9]

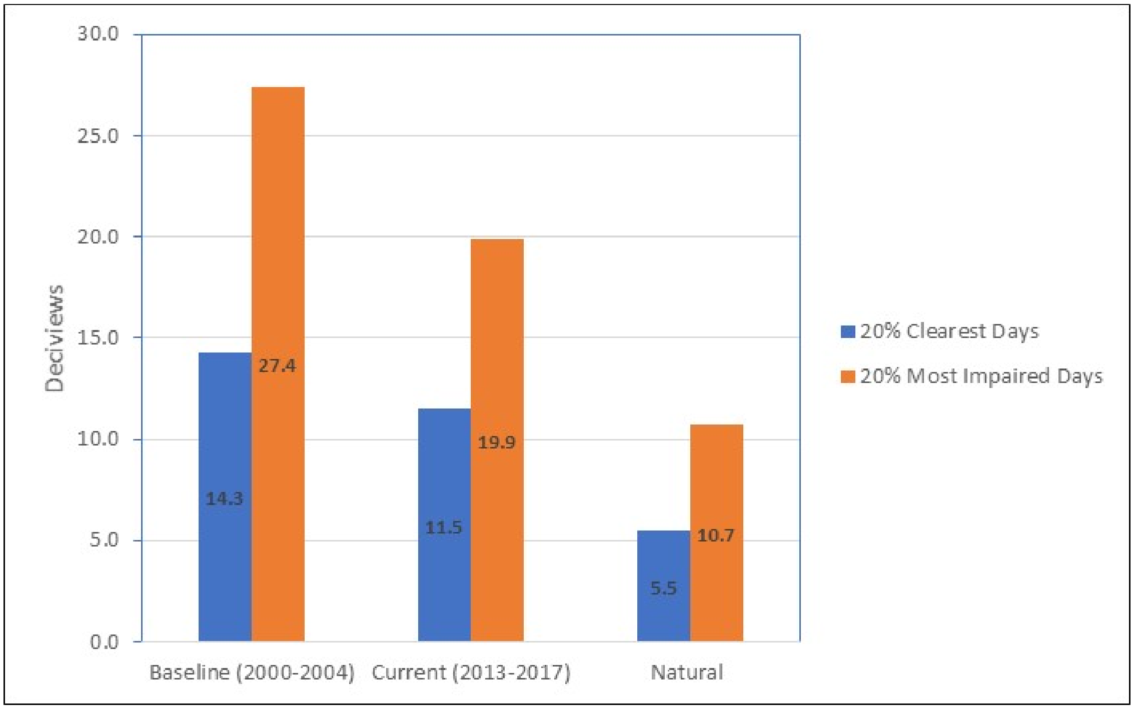
	Baseline (2000-2004)	Current (2013-2017)	Natural Visibility (2064)
Clearest	14.33	11.48	5.52
Most Impaired	27.43	19.86	10.69

2.3 Progress to date for the Most Impaired and Clearest Days at Brigantine Wilderness Area

This subsection presents progress made to date towards the natural visibility condition since the baseline period, and the actual progress made during the previous implementation period for both the most impaired and the clearest days. Figure 2-1 shows the progress to date.

[9] See “Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics), December 18, 2018 revision” for how the values on Table 2-1 were developed. (Appendix I)

Figure 2-1: Progress to date for Natural, Baseline, and Current Visibility Conditions at Brigantine Wilderness Area.



2.4 Differences between Current and Natural Visibility Conditions at Brigantine Wilderness Area

As of 2017, the current visibility condition at Brigantine Wilderness Area exceeds natural visibility conditions by 5.96 deciviews on the 20% clearest days and by 9.17 deciviews on the 20% most impaired days. Table 2-2 shows the differences between current and natural visibility conditions at Brigantine Wilderness Area.

Table 2-2: Current (2017) vs Natural Visibility Conditions at Brigantine Wilderness Area

<table>
<tr><th rowspan="2">Year</th><th colspan="2">Current Visibility (2017)</th><th colspan="2">Natural Visibility (2064)</th></tr>
<tr><th>20% Clearest Days</th><th>20% Most Impaired Days</th><th>20% Clearest Days</th><th>20% Most Impaired Days</th></tr>
<tr><td rowspan="3">2013–2017</td><td rowspan="3">11.48</td><td rowspan="3">19.86</td><td>5.52</td><td>10.69</td></tr>
<tr><td colspan="2">Difference</td></tr>
<tr><td>5.96</td><td>9.17</td></tr>
</table>

2.5 Uniform Rate of Progress

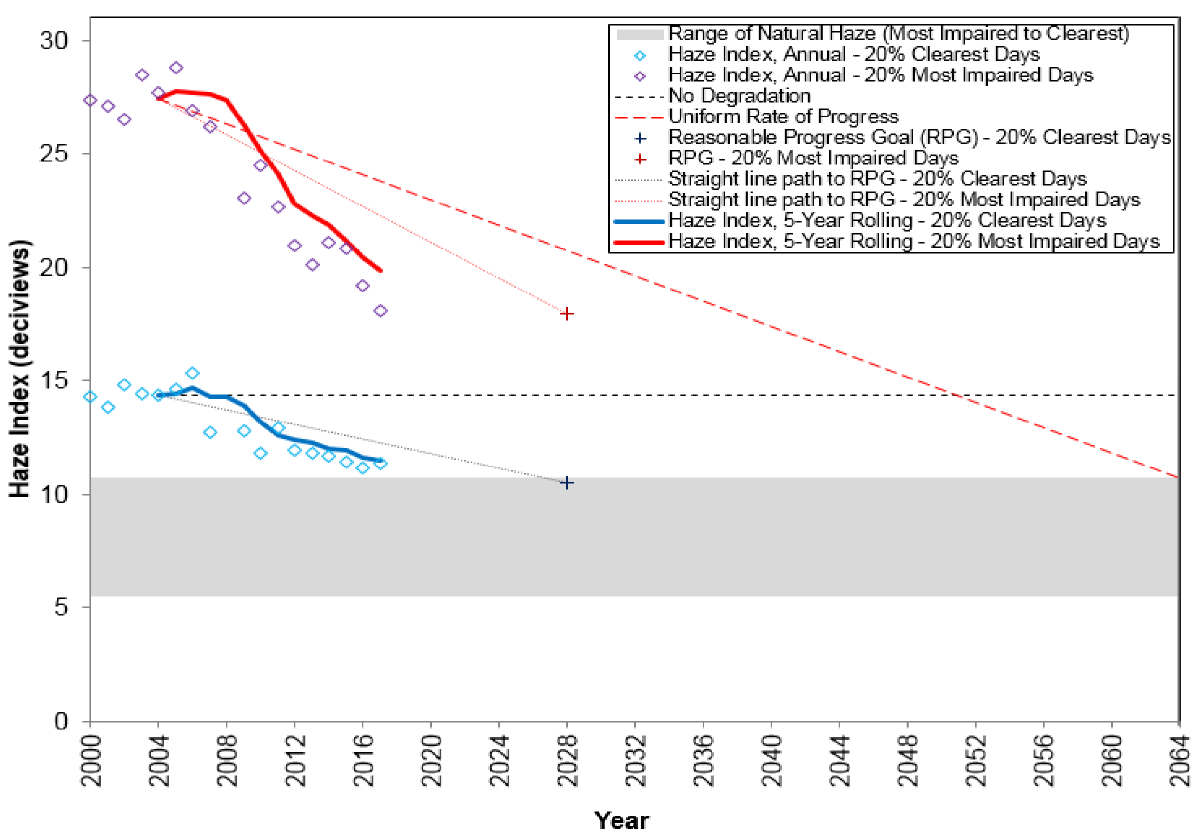
The uniform rate of progress (URP) defines, in deciviews per year, the rate of visibility improvement that would be maintained to attain natural visibility conditions by the end of 2064. The URP or glide path is represented in Figure 2-2 as a straight line between baseline conditions and 2064. DEP's calculations using most impaired days show the URP to be 0.28 deciviews per year. See Table 2-3. As seen in Figure 2-2, the reasonable progress goals established for 2028 at the Brigantine Wilderness Area are expected to provide visibility improvements at a greater rate than this rate.

Table 2-3: Uniform Rate of Progress for Brigantine Wilderness Area

2000–2004 Baseline Visibility (20% Most Impaired)	2064 Natural Visibility (20% Most Impaired Days)	Total Improvement Needed by 2028	Total Improvement Needed by 2064	Uniform Annual Rate of Improvement
27.43	10.69	6.72	16.74	0.28

The calculated URP line is drawn for the most impaired visibility days only. USEPA recommended in its draft guidance that states recalculate the value of the 2000–2004 baseline, or use an updated value provided by USEPA or the IMPROVE program. Figure 2-2 shows that Brigantine Wilderness Area is well below the 2018 URP level for the first SIP Planning period and currently below the 2028 URP level for the second planning period.

Figure 2-2: Visibility Metrics levels at Brigantine Wilderness Area



Chapter 3 Reasonable Progress Goals (RPGs) for Regional Haze

3.1 Introduction

New Jersey is required to establish the natural visibility conditions and reasonable progress goals for the Brigantine Wilderness Area,[10] to provide for progress towards achieving natural visibility in 2064. The goals must be set to provide improvement in visibility on the most impaired days and to ensure no degradation in visibility on the least impaired days. New Jersey set its natural visibility background conditions and its first progress goal for 2018 in its 2009 Regional Haze SIP.[11] The progress goal for 2028 is being set through this SIP revision.

In defining the reasonable progress goals, New Jersey worked with MANE-VU to determine potential reasonable measures that could be implemented by 2028, considering the cost of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts, and the remaining useful life of any potentially affected sources.[12] This analysis is commonly referred to as a four-factor analysis. In developing the 2028 reasonable progress goal, New Jersey relied upon information and analyses developed by New Jersey and MANE-VU to meet the requirements.

New Jersey consulted with states identified as contributing to the Brigantine Wilderness Area (see Chapter 5) through a process involving the states and the Federal Land Managers to set the 2028 progress goal.

New Jersey is proposing a progress goal of **17.97** deciviews for the Brigantine Wilderness Area for 2028 based on modeling projection.[13]

This chapter presents the goal and describes the process used by New Jersey to set it.

3.2 Brigantine Wilderness Area Visibility Goals

Table 3-1 summarizes the existing visibility conditions and the proposed goals as described in Chapter 2 and seen in Figure 2-2.

The uniform rate of improvement needed to achieve the 2028 reasonable progress goal on the 20% most impaired visibility days is 6.72 deciviews from the 2004 levels of 27.43 deciviews, or an average of 0.28 deciviews per year on the 20% worst visibility day.

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[10] 40 C.F.R. § 51.308 (f)
[11] New Jersey State Implementation Plan for Regional Haze. Final July 2009. https://www.nj.gov/dep/baqp/2008%20Regional%20Haze/Regional%20Haze.html
[12] 40 C.F.R. § 51.308 (d)(1)(i)(A)
[13] Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update. Final. https://otcair.org/manevu/Document.asp?fview=Reports

Table 3-1: Visibility Goals for the Brigantine Wilderness Area

Conditions	Deciviews
Natural Background Visibility on 20% most impaired visibility days (Goal in 2064)	10.69
Average Baseline Visibility on 20% clearest visibility days (2000-2004)	14.33
Average Baseline Visibility on 20% most impaired visibility days (2000-2004)	27.43
Uniform Rate of Progress on the 20% most impaired visibility days (2017)	23.80
Uniform Rate of Progress in 2028 on 20% most impaired visibility days	20.74
Modeled 2028 Base Case	18.16
Modeled Reasonable Progress Goal (2028 Control Case)	17.97

This uniform rate of progress goal is simply calculated by drawing a straight line from the baseline visibility level in 2004 to the target natural visibility levels in 2064. The uniform rate of progress for 2028 would be **20.74** deciviews. The modeled RPG – 20% Most Impaired Days is based upon regional photochemical modeling of the emission levels that are expected to occur in 2028. There are two modeled deciview levels for 2028: the 2028 Base Case and the 2028 Control Case. The 2028 Base Case represents the modeled deciview level for Brigantine Wilderness Area with existing controls, and the 2028 Control Case represents the modeled deciview level assuming all reasonable measures (Asks)(See Chapter 4) are implemented by States that contribute to visibility impairment at Brigantine Wilderness Area. More information regarding the regional photochemical modeling is provided in Chapter 6. New Jersey's reasonable progress goal is set at the 2028 Control Case modeled goal of **17.97** deciviews. The additional 0.19 deciviews from implementing the Asks ensures incremental progress towards the 2064 visibility goal.

3.3 Four Statutory Reasonable Progress Factors

In accordance with 40 C.F.R. § 51.308(f)(2)(i), when establishing reasonable progress goals for each Class I area, the state must consider the following four factors to identify measures that could be implemented to lower pollution considering the:

i. Cost of compliance
ii. Time necessary for compliance
iii. Energy and non-air quality environmental impacts
iv. Remaining useful life of any potentially affected sources

The SIP must include a demonstration showing how these factors were taken into consideration in setting the goal. These factors are sometimes called the "four statutory factors" since their consideration is required by the Clean Air Act.14

The plan must include reasonable measures based on this analysis and identify the visibility improvement that will result from those measures. These reasonable measures are New Jersey's long-term strategies and are discussed in more details in Chapter 4. If the state proposes a rate of progress slower than the URP, then an assessment of the number of years it

[14] Section 169A (g)(1) [42. U.S.C. 7491]

would take to attain natural conditions if visibility improvement continues at the rate proposed must be provided.

New Jersey and other MANE-VU Class I States provided this analysis[15] to contributing states for their consideration of the reasonable measures during the interstate consultation process. New Jersey worked to collect the information as part of the MANE-VU Four Factor/Contribution Assessment Workgroup, a subset of the Technical Support Committee.

During the first planning phase for regional haze, programs that were put in place focused on reducing sulfur dioxide (SO_2) emissions. The reductions achieved led to vast improvements in visibility at the MANE-VU Federal Class I Areas due to reduced sulfates formed from SO_2 emissions. This resulted in nitrates driving visibility impairment rather than sulfates during the colder months in some MANE-VU Class I Areas, including Brigantine. Nitrogen oxide (NO_x) emissions are an important precursor to the formation of nitrates.

Despite the progress made in the first planning period, additional progress is needed to continue to improve visibility. While many hazy days continue to be affected by high sulfate concentrations, some of the most impaired days are now dominated by nitrates, particularly on cooler days, when nitrogen emissions are more likely to contribute to the formation of nitrates rather than participating in the formation of ozone. Therefore, New Jersey and MANE-VU consider it reasonable to look closely at the sources of nitrates and the effectiveness of potential controls, in addition to maintaining reductions already achieved, in setting the 2028 reasonable progress goals.

During the first planning phase for regional haze, New Jersey and MANE-VU, through MARAMA and its contractor, MACTEC, with additional data collected by state staff, identified the following six source categories for further examination as reasonable measures:[16]

- Coal and Oil-fired Electric Generating Units (EGUs)
- Point and Area Source Industrial, Commercial and Institutional Boilers
- Cement Kilns
- Heating Oil
- Residential Wood Combustion
- Outdoor Wood Boilers

A four factor analysis was applied to control options identified for each of the source categories during the first planning period for regional haze.[17] For the second planning period, the same sources were identified as the top emitting sources. New Jersey worked with other states in MANE-VU to evaluate the identified sources. Sector level information needed to assess the four factors for the sources were updated through a contract issued by MARAMA to SRA International Inc.[18] In identifying the emission reduction measures to be included in the long-term strategy, all types of anthropogenic emissions contributing to visibility degradation in Class I areas, including those from mobile sources, stationary sources (such as factories), area

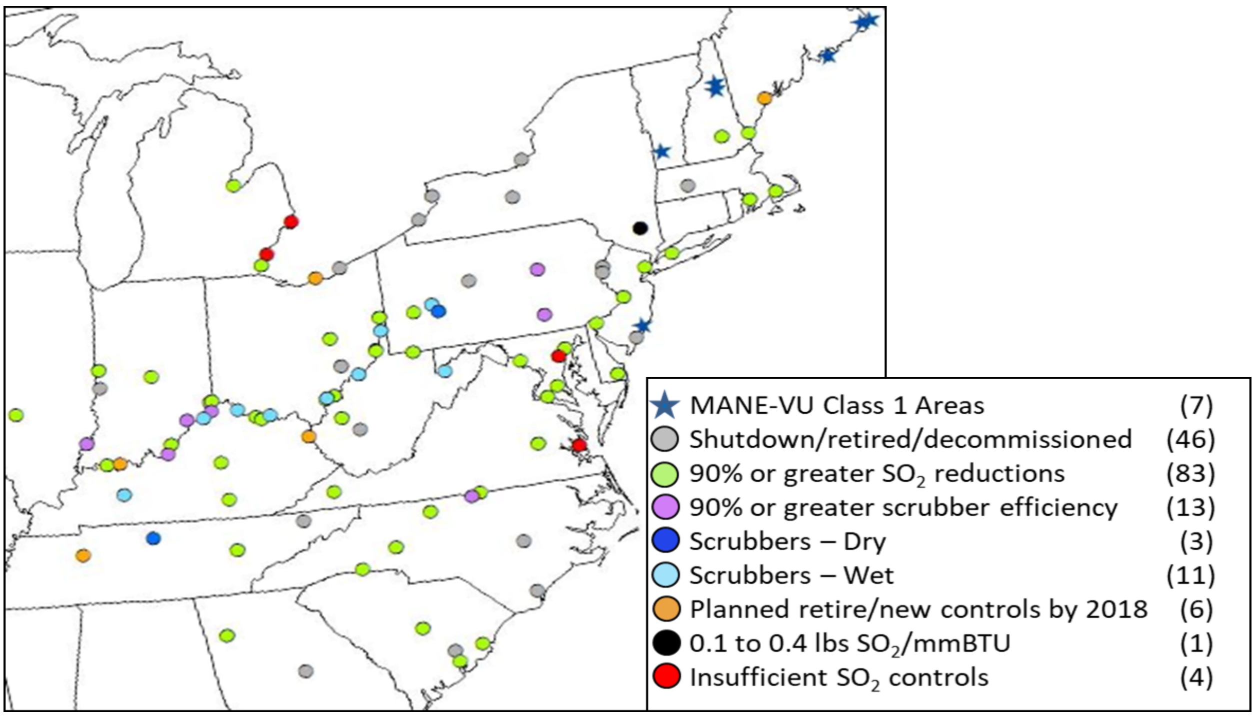
[15] Memo from MANE-VU Technical Support Committee to MANE-VU Air Directors, “Re: Four-Factor Data Collection,” March 30, 2017. (Appendix H).
[16] MACTEC Federal Programs, Inc., Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas, July 9, 2007 (Appendix H)
[17] ibid
[18] Ed Sabo, 2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas, January 31, 2016. (Appendix H)

sources (such as residential wood stoves and small boilers), and prescribed fires, were addressed.

A summary of the sectors that reasonably contribute to visibility impairment include:

EGUs
Information from the initial round of CALPUFF modeling was collated on the 444 EGUs that were determined to warrant further scrutiny based on their emissions of SO_2 and NO_X.[19] Several sources of data were available for information regarding the capacity and installed controls on individual units. This included information from NEEDS v5.15[20], ERTAC EGU v2.5L2[21], data collection on NO_X controls conducted by Maryland Department of Environment, and MANE-VU's "167 Stack Retrospective."[22] The individual facility information is in the spreadsheet titled "EGU Data for Four-factor Analyses (Only CALPUFF Units)."[23] A synopsis of the collected information is provided in Figure 3-1.

Figure 3-1: Status of Controls at Top 167 EGUs



[19] MANE-VU Technical Support Committee, "EGU Data for Four-Factor Analyses (Only CALPUFF Units)," January 10, 2017. https://otcair.org/manevu/document.asp?Fview=Reports
[20] US EPA, "NEEDS v.5.15 User Guide," August 2015.
[21] ERTAC Workgroup, "Documentation of ERTAC EGU CONUS Versions 2.5 and 2.5L2," December 12, 2016.
[22] MANE-VU Technical Support Committee, *Status of the Top 167 Electric Generating Units (EGUs) That Contributed to Visibility Impairment at MANE-VU Class I Areas during the 2008 Regional Haze Planning Period*, July 25, 2016. (Appendix H)
[23] MANE-VU Technical Support Committee, "EGU Data for Four-Factor Analyses (Only CALPUFF Units)," January 10, 2017. (Appendix H)

ICI Boilers
Information was also collected on the 50 facilities that according to 2011 Q/d analysis contributed the most to visibility impact in each Class I area from sulfate emissions.[24] Many of these facilities were duplicates and therefore the total number of sites from which data was collected was 82. Later in the data collection process the number of sources was limited to only sources that cumulatively contributed to 50% of the impairment. The facilities are listed in Table 3-2 with information on 2011 SO_2 emissions and number of Class I areas affected. See Figure 3-2 for location of the facilities.

Table 3-2: 82 Industrial Sources Evaluated for Impact at MANE-VU Class I Areas

State	Facility ID	Facility Name	2011 SO_2 Tons	#Sites Top 50 (a)	#Sites >= 50% (b)
IL	**7793311**	Tate & Lyle Ingredients Americas, LLC	102.90	5	3
IL	**8065311**	Aventine Renewable Energy Inc.	21.51	5	5
IN	**3986511**	Indiana Harbor East	1,332.52	5	0
IN	**4553211**	Indiana University	2,467.99	1	0
IN	**4873211**	Ball State University	1,045.58	4	0
IN	**4885311**	Citizens Thermal	124.94	5	4
IN	**5552011**	University of Notre Dame Du Lac	4,291.94	2	0
IN	**7364611**	Sabic Innovative Plastics Mt. Vernon, LLC	9,570.03	5	4
IN	**7376411**	Tate & Lyle, Lafayette South	908.83	4	0
IN	**7376511**	ArcelorMittal Burns Harbor Inc.	309.55	5	5
IN	**8181811**	Alcoa Inc., Warrick Operations	1,495.20	5	2
IN	**8192011**	US Steel, Gary Works	1,063.30	5	3
IN	**8198511**	ESSROC Cement Corp	1,516.32	1	0
IN	**8223611**	Eli Lilly & Co., Clinton Labs	4,434.03	2	0
KY	**6096411**	E I DuPont, Inc.	2,045.96	1	0
KY	**7352311**	Century Aluminum Sebree, LLC	1,917.99	5	2
KY	**7365311**	Isp Chemicals Inc.	2,207.50	1	0
MA	**7236411**	Solutia, Inc.	19,696.90	2	0
MD	**6117011**	Naval Support Facility, Indian Head	1,728.88	1	0
MD	**7763811**	Luke Paper Company	2,133.08	5	5
MD	**8239711**	Sparrows Point, LLC	2,033.07	1	1
ME	**5253911**	Madison Paper	1,444.64	2	0
ME	**5691611**	Huhtamaki Inc., Waterville	1,420.05	1	0
ME	**5692011**	FMC Biopolymer	992.04	2	0
ME	**5974211**	Woodland Pulp, LLC	680.87	2	0
ME	**7764711**	Verso Paper, Androscoggin Mill	1,018.69	2	0
ME	**7945211**	The Jackson Laboratory	1,754.70	1	0
ME	**8200111**	Sappi, Somerset	983.53	2	0
MI	**8126511**	Escanaba Paper Company	297.11	2	0
MI	**8160611**	St. Mary's Cement, Inc. (U.S.)	1,279.00	2	0
MI	**8483611**	US Steel, Great Lake Works	1,046.43	5	5
NC	**7920511**	Blue Ridge Paper Products, Canton Mill	2,043.68	5	5
NC	**8048011**	KapStone Kraft Paper Corporation	1,467.51	1	0
NC	**8122511**	DAK Americas, LLC	2,181.00	1	0
NH	**7199811**	Dartmouth College	22,024.21	1	0
NH	**7866711**	Gorham Paper & Tissue, LLC	2,400.59	1	0

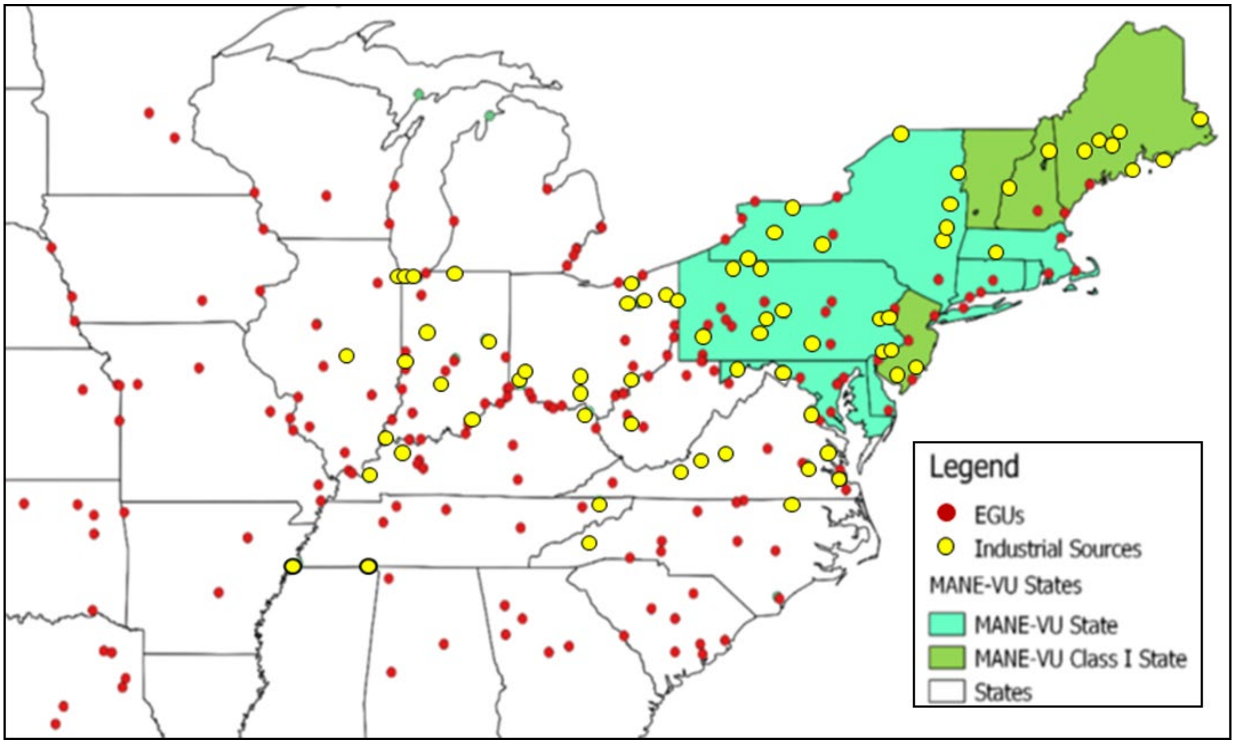
[24] MANE-VU Technical Support Committee, MANE-VU Updated Q/d*C Contribution Assessment, April 6, 2016.(Appendix G)

State	Facility ID	Facility Name	2011 SO_2 Tons	#Sites Top 50 (a)	#Sites >= 50% (b)
NJ	**12804611**	Gerresheimer Moulded Glass	3,007.04	1	0
NJ	**8093211**	Atlantic County Utilities Authority Landfill	907.88	1	0
NY	**7814711**	Morton Salt Division	1,143.29	4	1
NY	**7968211**	Alcoa, Massena Operations (West Plant)	805.13	4	2
NY	**7991711**	International Paper Ticonderoga Mill	1,917.74	4	3
NY	**8090911**	Norlite Corporation	2,887.99	1	0
NY	**8091511**	Kodak Park Division	681.06	5	5
NY	**8105211**	Lafarge Building Materials, Inc.	2,102.47	5	5
NY	**8176611**	Cargill Salt Co – Watkins Glen Plant	1,280.09	3	0
NY	**8325211**	Finch Paper LLC	2,265.36	1	1
OH	**15485811**	Fluor-B&W Portsmouth LLC	102.90	1	0
OH	**7219511**	Youngstown Thermal	21.51	1	0
OH	**7416411**	Cargill, Incorporated - Salt Division (Akron)	1,516.32	4	0
OH	**7997111**	Morton Salt, Inc.	4,434.03	5	5
OH	**8008811**	AK Steel Corporation	2,045.96	4	0
OH	**8063611**	BDM Warren Steel Operations, LLC	1,917.99	5	0
OH	**8130511**	Kraton Polymers U.S. LLC	2,207.50	5	1
OH	**8131111**	P. H. Glatfelter Company - Chillicothe Facility	19,696.90	5	5
OH	**8170411**	City of Akron Steam Generating	1,728.88	5	0
OH	**8252111**	The Medical Center Company	2,133.08	5	2
OH	**9301711**	DTE St. Bernard, LLC	2,033.07	3	0
PA	**3186811**	Penn State Univ	1,444.64	5	0
PA	**3881611**	Hercules Cement CO LP/Stockertown	1,420.05	5	1
PA	**4966711**	United Refining CO/Warren PLT	992.04	2	0
PA	**6463511**	PPG Ind/Works No 6	680.87	1	0
PA	**6532511**	Amer Ref Group/Bradford	1,018.69	3	0
PA	**6582111**	Intl Waxes Inc/Farmers Valley	1,754.70	5	3
PA	**6582211**	Keystone Portland Cement/East Allen	983.53	3	0
PA	**6652211**	Phila Energy Sol Ref/PES	297.11	1	0
PA	**7409311**	USS Corp/Edgar Thompson Works	1,279.00	4	0
PA	**7872711**	MILL Appleton Papers/Spring Mill	1,046.43	2	0
PA	**7873611**	Sunoco Inc (R&M)/Marcus Hook Refinery	2,043.68	5	2
PA	**8204511**	USS/Clairton Works	1,467.51	4	0
PA	**9248211**	Team Ten/Tyrone Paper Mill	2,181.00	5	1
TN	**3982311**	Eastman Chemical Company	22,024.21	5	5
TN	**4963011**	Packaging Corporation of America	2,400.59	1	0
TN	**5723011**	Cargill Corn Milling	3,007.04	2	0
VA	**4182011**	Smurfit Stone Container Corporation - West Point	907.88	1	0
VA	**4183311**	GP Big Island LLC	1,143.29	1	0
VA	**4938811**	Huntington Ingalls Incorporated -NN Shipbldg Div	805.13	1	0
VA	**5039811**	Roanoke Cement Company	1,917.74	4	1
VA	**5748611**	Radford Army Ammunition Plant	2,887.99	5	1
VA	**5795511**	Philip Morris Usa Inc - Park 500	681.06	1	0
WV	**4878911**	Dupont Washington Works	2,102.47	5	1
WV	**4987611**	Capitol Cement – ESSROC Martinsburg	1,280.09	3	1
WV	**5782411**	Bayer Cropscience	2,265.36	5	1

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

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

Figure 3-2: Map of 82 Identified EGUs and Industrial Sources



Cement Kilns
Sector level information is needed to perform the four-factor analysis for cement kilns. The analysis used the default control factors included in MARAMA's Emissions Modeling Framework (EMF) system based on EPA's CoST Manual.[25] Site specific data for individual cement kilns in the list of the 82 industrial sources were included in the Q/d analysis to determine the industrial sources with the most impact on Class I areas.

Heating Oil, Residential Wood Stoves (RWS) and Outdoor Wood-fired Boilers (OWB)
Sector level information needed to assess the four factors for heating oil, residential wood stoves and outdoor wood-fired boilers was updated. Information on the cost of controls was updated in MARAMA's EMF system to allow for states to have access to more recent information if they opt to use EMF. 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."[26] Since heating oil, RWS and OWB are area sources, no specific point source data was collected.

New Jersey's long-term strategies developed to address visibility impairment at Brigantine Wilderness Area is discussed in Chapter 4 of this SIP revision.

[25] US EPA, *Control Strategy Tool (CoST) Development Documentation*, June 9, 2010.
[26] Appendix H

Chapter 4 Long-term Strategies (Asks)

According to the federal Regional Haze rule (40 CFR 51.308 (f)(2)(i) through (iv)), all states must consider, in their Regional Haze SIPs, the emission reduction measures identified by Class I States as being necessary to make reasonable progress in any Class I area. After reviewing the four-factor analysis and other technical analyses discussed in the reports listed later in this section, New Jersey and MANE-VU determined reasonable measures to present to contributing states during consultation. These reasonable measures were labeled as the MANE-VU “Asks.” The “Asks” were documented in three separate statements that were agreed to as a regional strategy by New Jersey and the MANE-VU States to “ask” to be addressed in the regional haze SIP’s of all contributing states. They apply to states within and outside MANE-VU who were identified as contributing to visibility impairment in any MANE-VU Class I areas, including the Brigantine Wilderness Area, and the USEPA. The Asks adopted by New Jersey and other MANE-VU Class I States for the second implementation period, were set forth by New Jersey and other MANE-VU States on August 25, 2017, and are included in Appendix C. 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 for the states and tribes that contribute to MANE-VU’s Class I Areas and should be addressed in their regional haze SIP updates.

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

Additionally, MANE-VU examined annual emission inventories to find emission sectors that should be considered for further analysis. Electric Generating Units (EGUs) emitting SO_2 and NO_x and industrial point sources emitting SO_2 were found to be sectors with high emissions that warranted further scrutiny. Mobile sources were not considered in this analysis because any “Ask” concerning mobile sources would be made to EPA and not during the intra-RPO and inter-RPO consultation process between the states and tribes. MANE-VU member states agreed to a course of action that includes pursuing the adoption and implementation of the following emission management strategies. Each element of the “Ask” described below is followed by a brief discussion of situations and outcomes that led to consensus among MANE-VU states.

The technical analyses used by New Jersey to determine reasonable measures are documented in Chapter 3 and in the following reports:

- Contributions to Regional Haze in the Northeast and Mid-Atlantic United States (referred to as the Contribution Assessment). August 2006. (Appendix G);
- Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I areas) (referred to as the Reasonable Progress Report) MACTEC 2007. (Appendix H);
- Five-Factor Analysis of BART-Eligible Sources: Survey of Options for Conducting BART Determinations. June 2007 (Appendix J);
- Assessment of Control Technology Options for BART-Eligible Sources: Steam Electric Boilers, Industrial Boilers, Cement Plants and paper and Pulp Facilities. March 2005. (Appendix J);

- Beyond Sulfate: Maintaining Progress towards Visibility and Health Goals. December 2012. (Appendix J);
- 2016 Updates to the Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas (Appendix H);
- Impact of Wintertime SCR/SNCR Optimization on Visibility Impairing Nitrate Precursor Emissions. November 2017. (Appendix J);
- High Electric Demand Days and Visibility Impairment in MANE-VU. December 2017. (Appendix J);
- Benefits of Combined Heat and Power Systems for Reducing Pollutant Emissions in MANE-VU States. March 2016. (Appendix J);
- 2016 MANE-VU Source Contribution Modeling Report - CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources April 4, 2017 (Appendix F);
- Contribution Assessment Preliminary Inventory Analysis. October 10, 2016. (Appendix G);
- EGU Data for Four-Factor Analyses – Only CALPUFF Units. (Appendix H);
- Four-Factor Data Collection Memo. March 2017. (Appendix H);
- Status of the Top 167 Stacks from the 2008 MANE-VU Ask. July 2016. (Appendix H).

4.1 The MANE-VU Intra-RPO "Asks"

1. "Electric Generating Units (EGUs) with a nameplate capacity larger than or equal to 25 MW 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."

The aim of the first "Ask" is to reduce year-round emissions by simply expanding the use of already-installed controls for which requirements are lacking that would otherwise ensure their year-round operation. This would help to mitigate visibility impairment due to winter-time NO_x emissions that have been shown to account for a greater proportion of visibility impairment on the 20% most impaired days. This "Ask" is a reasonable control strategy because it is already being implemented successfully in several states, including several states within MANE-VU, and the equipment already exists. During the consultation process, New Jersey and other MANE-VU states worked collaboratively to define the EGU capacity threshold and honed the language that characterizes the desired operation of controls year-round. MANE-VU states ultimately came to consensus with the addition of an option to find alternative, equivalent emissions reductions if year-round operation of controls was not considered "reasonable" by the contributing State.

2. "Emission sources modeled by New Jersey and MANE-VU that have the potential for 3.0 Mm^{-1} or greater visibility impacts at the Brigantine Wilderness Area and at other MANE-VU Class I areas, as identified by New Jersey and MANE-VU contribution analyses (see table 4-1 below)–perform a four-factor analysis for reasonable installation or upgrade to emission controls."

Table 4-1

State	Facility Name	Facility/ ORIS ID	Unit IDs	Max Extinction
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		7.5
NH	Merrimack	2364	2	3.3
NJ	B L England	2378	2,3	5.6
NY	Finch Paper LLC	8325211	12	5.9
NY	Lafarge Building Materials Inc.	8105211	43101	8.1
PA	Brunner Island	3140	1,2	4.0
PA	Brunner Island	3140	3	3.8
PA	Homer City	3122	1	9.3
PA	Homer City	3122	2	8.1
PA	Homer City	3122	3	3.3
PA	Keystone	3136	1	3.2
PA	Keystone	3136	2	3.1
PA	Montour	3149	1	4.4
PA	Montour	3149	2	4.1
PA	Shawville	3131	3,4	3.6

This “Ask” targets stationary sources that have the greatest contribution to visibility impairment at MANE-VU Class I areas, as modeled by MANE-VU.[27] While this “Ask” does not suggest specific controls, it is considered reasonable to have the greatest contributors to visibility impairment conduct a four-factor analysis that would determine whether emission control measures should be pursued and what would be reasonable for each source.

The facilities included in Table 4-1 were refined from an analysis of 130 EGU sources and 138 Industrial sources that impact Brigantine and other MANE-VU and nearby Class I areas.[28] The analysis determined that over 60% of the EGU sources and about 15% of the Industrial sources had a modeled visibility extinction of 1.0 inverse mega meters (Mm^{-1}) or greater. These sources were considered top emitters and were further analyzed. About 85% of the “top emitters” are EGU sources and 52% are Industrial sources that impact New Jersey’s Class I Area. 35% of the top EGU sources and 15% of the top Industrial sources that impact Brigantine have a modeled visibility extinction of 3.0 Mm^{-1} or greater. As part of the Regional Haze planning process, New Jersey is asking contributing states to conduct a four-factor analysis for these sources. New Jersey chose 3.0 Mm^{-1} as an appropriate visibility impairment threshold because the sources at or above this threshold contribute the largest percentage of visibility impairing pollutants that impact Brigantine and other MANE-VU Class I areas. By requesting a four-factor analysis of these sources, a planned shutdown, or other factors, may be considered when determining what installation or upgrade of controls would be reasonable.

[27] Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union. 2011 Based Modeling Platform Support Document – October 2018 Update. (Appendix C)
[28] 2016 MANE-VU CALPUFF Point Source Contribution Modeling Analysis (Appendix F)

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

a. distillate oil to 0.0015% sulfur by weight (15 ppm),

b. #4 residual oil within a range of 0.25 to 0.5% sulfur by weight,

c. #6 residual oil within a range of 0.3 to 0.5% sulfur by weight.

This "Ask" is an extension of the original MANE-VU "Ask" on ultra-low sulfur fuel oil, specifically the second phase of more stringent sulfur content standards that have already been implemented in many MANE-VU states. Connecticut, Delaware, District of Columbia, Maine, Massachusetts, New Jersey, New York, Rhode Island and Vermont have adopted rules to satisfy this "Ask". To date, Maryland, New Hampshire and Pennsylvania do not have rules in place to satisfy this "Ask". It was considered reasonable to request that all contributing states that have not already implemented these standards pursue them as expeditiously as practicable. In the second, current iteration of the MANE-VU "Ask", contributing states upwind of MANE-VU are also being requested to pursue this standard.

4. "EGUs and other large point emission sources larger 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."

This "Ask" was developed to maintain the significant improvements in visibility during the first phase of the regional haze program achieved by natural gas taking the place of much of the fuel use previously coming from coal, but that has the potential to be lost should market conditions swing back to favor coal. The Federal Land Management agencies recommended that MANE-VU pursue control strategies to enforce these visibility gains. The threshold of 250 MMBTU per hour heat input was based on prior BART analysis. Concerns were raised about locking in the lower emission permit rates on EGUs during periods of natural gas curtailment so an exception for this situation was added to this specific "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:

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.

High electric demand days are days when higher than usual electrical demands bring additional generation units online, many of which are infrequently operated and may have significantly higher emission rates than the rest of the generation fleet. Peaking combustion turbine is defined for the purposes of this "Ask" as a turbine capable of generating 15 megawatts or more, that commenced operation prior to May 1, 2007, is used to generate electricity all or part of which is delivered to the electric power distribution grid for commercial sale and that operated less than or equal to an average of 1752 hours (or 20%) per year during 2014 to 2016;"

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

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

The purpose of this “Ask” is to reduce emissions from energy generation by lowering overall usage through energy efficiency and promoting cleaner technologies. During the consultation process, the broadness and specificity of the language used was adjusted. It is expected that states will report on their individual states progress in improving energy efficiency, using Combined Heat and Power, and requiring clean Distributed Generation in their states. Comparisons of all contributing states progress to using cleaner energy sources can then be made using the Regional Haze SIP data.

4.2 The MANE-VU Inter-RPO “Asks”

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

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

- The 2010 SO_2 standard,
- 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 federal CAA and state rulemaking processes, it is expected that there will be opportunities for stakeholders and the public to comment on how states intend to address the measures in the Asks.

To address the impact on mandatory Class I Federal areas within the MANE-VU region, the Mid-Atlantic and Northeast States will pursue a coordinated course of action designed to assure reasonable progress toward preventing any future and remedying any existing impairment of visibility in mandatory Class I Federal areas. The States will also leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment.

Per the Regional Haze rule[29], 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 reasonable progress goal for regional haze include the following “emission management” strategies:

1. Electric Generating Units (EGUs) with a nameplate capacity larger than or equal to 25MW with already installed 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 4-2);

Table 4-2

State	Facility Name	Facility/ ORIS ID	Unit IDs	Max Extinction
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, where the standards are as follows:
    a. distillate oil to 0.0015% sulfur by weight (15 ppm),
    b. #4 residual oil within a range of 0.25 to 0.5% sulfur by weight,
    c. #6 residual oil within a range of 0.3 to 0.5% sulfur by weight.

4. EGUs and other large point emission sources greater than 250 MMBTU per hour heat input that have switched operations to lower emitting fuels–pursue updating permits,

[29] 40 C.F.R § 51.308

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 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.

4.3 The MANE-VU EPA and FLM "Ask"

The transport range of visibility impairing pollutants has been demonstrated to be extensive and well beyond the MANE-VU region. For example, a wildfire near Fort McMurray, Alberta in western Canada last year brought visibility impairing fine particulate matter and ozone over 2,000 miles into the region at concentrations that contributed to exceedances of these health standards in some locations. Clearly, states located beyond those that MANE-VU chose to consult for regional haze can play an active role in impairing visibility at the MANE-VU Class I areas. Further, even though onroad vehicles produce a significant portion of the visibility impairing pollutants that affect our Class I areas, they are beyond our states' ability to regulate. Therefore, the MANE-VU Class I area states need additional help from the Environmental Protection Agency and Federal Land Managers in pursuing important reasonable emission control measures.[30] These include, but are not limited to:

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

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

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

4.4 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. Details are provided in the modeling Technical Support Document.[31]

[30] Statement of the Mid-Atlantic/Northeast Visibility Union Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028). (Appendix B)
[31] Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union. 2011 Based Modeling Platform Support Document – October 2018 Update. (Appendix C)

4.5 Progress Report on the Status of Approved Measures from First Regional Haze Planning Period

The Regional Haze rule at 40 CFR 51.308(f)(5) states that “So the plan revision will serve also as a progress report, the State must address in the plan revision the requirements of paragraphs (g)(1) through (g)(5) of this section.”

The MANE-VU states developed reasonable measures during the first planning period after much research and analysis to combat regional haze. This resulted in the adoption of two documents on June 20, 2007 that provide the technical basis for consultation among interested parties and define the basic strategies for controlling pollutants that cause visibility impairment at Class I areas in the eastern United States. 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”. These are “Asks” from the first planning period.

During the first implementation period, New Jersey agreed to and adopted the strategies (“Asks”) for controlling pollutants that cause visibility impairment identified by MANE-VU. The Asks are as follows:

- Timely Implementation of Best Available Retrofit Technology (BART) requirements.
- Electric Generating Unit (EGU) Controls Including Controls at 167 Key Sources That Most Affect MANE-VU Class I Areas
- Low Sulfur Fuel Oil Strategy.
- Continued Evaluation of Other Control Measures.

New Jersey met all the identified reasonable measures requested during the first implementation period.

4.6 New Jersey’s Long-Term Strategies

New Jersey is required to submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I Federal area within and outside the State that may be affected by emissions from within the State in accordance with 40 C.F.R. § 51.308(d)(3). The long-term strategy must include enforceable emission limitations, compliance schedules and other measures necessary to achieve the reasonable progress goals established by states where the Class I areas are located. This section describes how New Jersey plans to meet the long-term strategy requirements defined by New Jersey and MANE-VU. These long-term strategies are referred to as the “Asks”.

During the first implementation period, New Jersey’s sources were identified as contributing to visibility impairment at the Brigantine Wilderness Area, a Class I area located in New Jersey. Additionally, Maine, New Hampshire and Vermont determined that New Jersey contributed to their Class I areas: Acadia National Park and Moosehorn Wilderness Area, Great Gulf Wilderness Area and Presidential Range/Dry River Wilderness Area, and Lyebrook Wilderness Area, respectively. To address the contributions, New Jersey took steps to reduce the impact of sources in New Jersey on these Class I areas, by addressing and implementing the reasonable measures, or Asks, agreed upon by MANE-VU States during the first implementation period.

For the second implementation period, New Jersey and MANE-VU's analysis estimated that New Jersey significantly contributed to visibility impairment at Brigantine Wilderness Area because its contribution was at least 2% of the sulfate and nitrate concentrations measured at Brigantine. (See Contributions for Class I States Table in Appendix E). New Jersey and MANE-VU's analysis also determined that New Jersey did not significantly contribute to other MANE-VU Class I areas as its contribution was less than 2% of the sulfate and nitrate concentration for all the other MANE-VU Class I areas.

New Jersey participated in the consultation process with other states that contribute to visibility impairment at MANE-VU Class I areas. New Jersey's actions to meet and comply with the Asks for the second planning period are described in detail in the following subsections. New Jersey's actions include other control strategies that will help reduce emissions and improve visibility.

4.6.1 Year-round Use of EGU Control Technologies

This MANE-VU Ask requires Electric Generating Units ≥ 25MW with already installed NO_x and/or SO_2 controls to run their controls on a year-round basis to ensure the most effective use of control technologies or obtain equivalent alternative emission reductions.

The control limits required by New Jersey's NO_x Reasonably Available Control Technology (RACT) rules[32] are implemented year-round. In addition, New Jersey's operating permits require that units run their controls on a year-round basis whenever the units are in operation to ensure the most effective use of control technologies. These enforceable measures minimize emissions of haze precursors. New Jersey meets the requirements of this Ask.

4.6.2 Four-factor Analysis of Sources with Potential for 3.0 Mm-1 or Greater Visibility Impacts

This MANE-VU Ask requires 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 the MANE-VU contribution analyses, to perform a four-factor analysis for reasonable installation or upgrade of emission controls. The BL England facility located in Upper Township, Cape May County, New Jersey was identified by MANE-VU (See Table 4-1 in Chapter 4) as having units with the potential for 3.0 Mm^{-1} or greater visibility impact at any MANE-VU Class I area. The two units identified are Units 2 and 3.

Unit 2 was planned to be shut down in 2017 based on an Administrative Consent Order (ACO), but the Order was amended to provide for its operation until May 1, 2019 at the request of PJM for electrical grid reliability purposes.[33] Unit 2 was expected to shut down and thereafter repower to natural gas as expeditiously as possible. The B.L. England facility permanently shut down in May 2019 and will no longer be building a new unit with natural gas. On April 23, 2019, RC Cape May Holdings LLC submitted a letter to the DEP Southern Air Compliance and Enforcement office requesting that DEP provide written notice of satisfaction of B.L. England's ACOs because PJM no longer requires B.L. England's output.

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[32] N.J.A.C 7:27-19: Control and Prohibition of Air Pollution by Oxides of Nitrogen https://www.nj.gov/dep/aqm/rules27.html

[33] RC Cape May Holdings LLC Administrative Consent Order Amendment, June 6, 2017 (Appendix J)

Unit 3 was “mothballed” as of June 8, 2018. “Mothballed means it can be used if required by PJM in the future for reliability purposes. Unit 3 was also included in an Administrative Consent Order that provided the regulatory approval for Unit 3’s operation until May 1, 2019.[34] However, the BL England facility permanently shut down in May 2019.

Due to the shutdown of BL England in May 2019, no further action on these units will be needed. Therefore, New Jersey has met the requirements of this Ask.

4.6.3 Low Sulfur Fuel Oil Strategy

This MANE-VU Ask requires each MANE-VU state that has not yet fully adopted an ultra-low sulfur fuel oil standard as requested by MANE-VU in 2007 to pursue this standard as expeditiously as possible and before 2028, depending on supply availability.

On October 25, 2010, New Jersey adopted rules[35] to modify the sulfur in fuel limits in accordance with the definition of reasonable measures needed to meet the goal of the MANE-VU “Ask”. The New Jersey rule (N.J.A.C. 7:27-9 et seq.) lowered the sulfur content of all distillate fuel oils (#2 fuel oil and lighter) to 15 ppm beginning on July 1, 2016. The sulfur content of #4 fuel oil was lowered to 2,500 ppm and for #6 fuel oil to a range of 3,000 to 5,000 ppm sulfur content beginning July 1, 2014.[36]

New Jersey has met all the requirements of this Ask.

4.6.4 Updating Permits, Enforceable Agreements, and/or Rules to Lock in Lower Emission Rates

This MANE-VU Ask requires EGUs and other large emission sources greater than 250 MMBTU per hour heat input that have switched operations to lower emitting fuels to pursue updating permits, enforceable agreements, and/or rules to lock in lower emission rates for SO_2, NO_x, and PM.

New Jersey EGUs and other large point emission sources that have switched operations to lower emitting fuels are already locked into the lower emission rates for SO_2, NO_x and PM by permits, enforceable agreements and/or rules. These units are required to amend their permits through the New Source Review (NSR) process if they plan to switch back to coal or fuel that will increase emissions. A change in fuel, unless already allowed in the permit, would be a modification.[37] N.J.A.C. 7:27-22 requires that an application to modify the permit be submitted prior to the change in fuel.

New Jersey has met the requirements for this Ask.

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[34] ibid
[35] N.J.A.C. 7:27-9: Sulfur in Fuels (42 N.J.R. 2244) https://www.nj.gov/dep/aqm/rules27.html
[36] The maximum sulfur content of #6 fuel oil varies depending on the county where the fuel oil is burned. The northern part of New Jersey has a lower maximum sulfur content for residual fuel oil at 3,000 ppm while the southern part of New Jersey has a maximum sulfur content of 5,000 ppm. See N.J.A.C. 7:27-9 et seq. https://www.nj.gov/dep/aqm/rules27.html
[37] N.J.A.C 7:27-22.1

4.6.5 Controls for Peaking Units on High Electric Demand Days

This MANE-VU Ask requires controls for NOx emissions from peaking combustion turbines that have the potential to operate on high electric demand days, where emission rules have not been adopted.

New Jersey adopted regulations38 to control peaking combustion turbines39 that have the potential to operate on high electric demand days.40 The control levels adopted by New Jersey on March 20, 2009, are below those requested by this "Ask". The "Ask" requests NOx emission standards of no greater than 25 ppm at 15% O2 for natural gas and 42 ppm at 15% for fuel oil, but at a minimum meet NOx emissions standards of no greater than 42 ppm at 15% O2 for natural gas and 96 ppm at 15% O2 for fuel oil. New Jersey's regulations require 0.75 pounds of NOx per MWh for natural gas, and 1.20 pounds of NOx per MWh for oil, for combined cycle combustion turbine or a regenerative cycle combustion turbine, and 1.00 pounds of NOx per MWh for natural gas, and 1.60 pounds of NOx per MWh for oil, for simple cycle turbine combustion turbine.

New Jersey has met the requirements of this Ask.

4.6.6 Energy Efficiency

This MANE-VU Ask requires that States consider and report in their SIPs on measures or programs to decrease energy demand using energy efficiency and increase the use within their state of Combined Heat and Power (CHP) and other clean Distributed Generation technologies including fuel cells, wind, and solar.

In 1977, New Jersey enacted a law requiring a regularly updated Electricity Master Plan to address the production, distribution, consumption and conservation of electricity in New Jersey. The law requires the Plan to include not only long-term objectives, but also interim measures that are consistent with and necessary to achieving those objectives. The Energy Master Plan was updated in October of 2008 and the last update was finalized in December 2011.[41] Components of the Energy Master Plan address ways to increase energy efficiency in the State. New Jersey Board of Public Utilities (NJBPU) released an updated draft plan[42] on June 10, 2019. The new comprehensive draft plan provides an initial blueprint for the total conversion of New Jersey's energy profile to 100 percent of clean energy by 2050.

On July 6, 2007, Governor Corzine signed the Global Warming Response Act.[43] The Act requires New Jersey to reduce greenhouse gas emissions by 20 percent by 2020, and by 80

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[38] N.J.A.C. 7:27-19: Control and Prohibition of Air Pollution from Oxides of Nitrogen http://www.state.nj.us/dep/aqm/currentrules/Sub19.pdf

[39] Peaking combustion turbine is defined for the purposes of this "Ask" as a turbine capable of generating 15 megawatts or more, that commenced operation prior to May 1, 2007, is used to generate electricity all or part of which is delivered to electric power distribution grid for commercial sale and that operated less than or equal to an average of 1,752 hours (or 20%) per year during 2014 to 2016.

[40] High electric demand days are days when higher than usual electrical demands bring additional generation units online, many of which are infrequently operated and may have significantly higher emissions rates of the generation fleet.

[41] http://nj.gov/emp/docs/pdf/2011_Final_Energy_Master_Plan.pdf

[42] https://nj.gov/emp/pdf/Draft%202019%20EMP%20Final.pdf

[43] N.J.S.A 26:2C-37

percent by 2050. Measures to meet these requirements will also help reduce SO_2, PM, and NO_x emissions and improve visibility.

On January 29, 2018, Governor Phil Murphy signed an Executive Order[44] directing New Jersey's return to full participation in the Regional Greenhouse Gas Initiative (RGGI). Specifically, the Executive Order directs DEP to initiate rulemaking by February 28, 2018. In addition, Governor Murphy sent a letter[45] on February 16, 2018 to the RGGI states notifying them of New Jersey's intent to rejoin RGGI "as a partner in reducing greenhouse gas emissions, improving the health of residents, and growing the economy in our region." New Jersey adopted riles and formally rejoined RGGI on June 17, 2019.[46] RGGI is part of Governor Murphy's goal to achieve 100% clean energy by 2050. New Jersey's participation in RGGI will shift the State's power sector towards clean and renewable energy sources such as wind, solar, and fuel cells, and will help reduce emissions and improve visibility.

New Jersey has met the requirements for this Ask.

4.6.7 Additional Class I State Required Measures

The Clean Air Act and the USEPA Regional Haze Rule require states with Class I areas to address emissions from construction activities and implement smoke management plans. This subsection describes New Jersey's actions for these categories.

4.6.7.1 Emission Reductions Due to Ongoing Air Pollution Programs

New Jersey is required to consider emission reductions from ongoing pollution control programs in its regional haze SIP revision in accordance with 40 C.F.R. § 51.308(f)(2)(iv)(A). The control measures listed in Tables 4-3 and 4-4 will impact emissions by 2028.

Table 4-3: New Jersey's Post 2002 Control Measures

Measure	Effective Start Date of Benefits	Pollutant	New Jersey Administrative Code	USEPA Approval
Adhesives & Sealants	2009	VOC	NJAC 7:27-26	7/22/10
Architectural Coatings 2005	2005	VOC	NJAC 7:27-23	11/30/05
Asphalt Paving (cutback and emulsified)	2009	VOC	NJAC 7:27-16.19	8/3/10
Asphalt Production Plants	2009, 2011	NO_x	NJAC 7:27-19.9	8/3/10
Case by Case NO_x and VOC (FSELs/AELs)	2009	NO_x, VOC	NJAC 7:27-16, 19	8/3/10
Consumer Products 2005	2005	VOC	NJAC 7:27-24	1/25/06
Consumer Products 2009	2009	VOC	NJAC 7:27-24	7/22/10
CTG: Fiberglass Boat Manufacturing Materials (2008 CTG);	2018	VOC	7:27-16.14	Pending
CTG: Industrial Cleaning Solvents (2006 CTG);	2018	VOC	7:27-16.24	Pending
CTG: Misc. Metal and Plastic Parts Coatings (2008 CTG);	2018	VOC	7:27-16.15	Pending
CTG: Paper, Film, and Foil Coatings (2007 CTG);	2018	VOC	7:27-16.7	Pending

[44] http://nj.gov/infobank/eo/056murphy/pdf/EO-7.pdf
[45] http://www.state.nj.us/dep/aqes/docs/letter-to-rggi-governors20180222.pdf
[46] https://www.state.nj.us/dep/aqes/docs/co2-budget-adoption.pdf

Measure	Effective Start Date of Benefits	Pollutant	New Jersey Administrative Code	USEPA Approval
CTG: Printing	2009	VOC	NJAC 7:27-16.7	8/3/10
Diesel Vehicle Retrofit Program	2008-2015	PM	NJAC 7:27-32, 14	NA
EGU: BL England ACO	2000-2015	NO_x, PM, SO_2	NA	NA
EGU: Coal-fired Boilers, Oil and Gas Fired Boilers	2013	NO_x, PM, SO_2	NJAC 7:27-4.2, 10.2, 19.4	8/3/10
EGU: High Electric Demand Day (HEDD)	2009, 2015	NO_x	NJAC 7:27-19.29	8/3/10
EGU: PSEG-Consent Decree	2002-2010	NO_x, PM, SO_2	NA	Filed 7/26/02; amended 11/30/06
Glass Manufacturing	2012	NO_x	NJAC 7:27-19.10	8/3/10
ICI Boilers 2009	2009-2011	NO_x	NJAC 7:27-19.7	8/3/10
ICI Boilers, Turbines and Engines 2005	2007-2010	NO_x	NJAC 7:27-27.19	7/31/07
IM: Program Revisions 2009	2010	VOC, NO_x, CO	NJAC 7:27-15	9/16/11
IM: Diesel Smoke Cutpoint	2010, 2011	PM, NO_x	NJAC 7:27-14	Pending
IM: Heavy Duty OBD	2018	All	NJAC 7:27-14	Pending
Low Sulfur Fuel Oil	2014, 2016	PM, SO2, NO_x	NJAC 7:27-9	1/3/12
Mercury Rule	2006-2012	Hg, PM, SO_2, NO_x	NJAC 7:27-27	NA
Mobile Equipment Refinishing (Autobody)	2005	VOC	NJAC 7:27-16	7/2/04
Municipal Waste Combustors (Incinerators)	2009, 2010	NO_x	NJAC 7:27-19.13	8/3/10
Natural Gas Engines 2017		NO_x	NJAC 7:27-19.8	Pending
Natural Gas Turbines 2017		NO_x	NJAC 7:27-19.5	Pending
New Jersey Low Emission Vehicle (LEV) Program	2009 (1)	All	NJAC 7:27-29	2/13/08
NO_x Budget	1999, 2003	NO_x, SO_2	NJAC 7:27-30	10/1/07
Permitting/Nonattainment New Source Review (NNSR)	Ongoing	All	7:27-8,18, 22	NA
Petroleum Storage	2010-2019	VOC	NJAC 7:27-16.2	8/3/10
Portable Fuel Containers 2005	2005-2015 (1)	VOC	NJAC 7:27-24	1/25/06
Portable Fuel Containers 2009	2009-2019 (1)	VOC	NJAC 7:27-24	7/22/10
Refinery Consent Decree: ConocoPhillips	2006-2014	PM, SO_2, NO_x, VOC	NA	Filed 1/27/05
Refinery Consent Decrees: Valero (Paulsboro)	2006-2014	PM, SO_2, NO_x, VOC	NA	Filed 6/16/05
Sewage and Sludge Incinerators	2009	NO_x	NJAC 7:27-19.28	8/3/10
Solvent Cleaning	2005	VOC	NJAC 7:27-16	7/2/04
Phase I and II Gasoline Vapor Recovery	2003	VOC	NJAC 7:27-16	7/2/04
Phase I and II Gasoline Vapor Recovery	2018	VOC	NJAC 7:27-16	7/2/04
Stationary Gas Turbines and Engines (NO_x ACT)	2020	NO_x	7:27-19.5, 19.8	Pending
Vehicle Idling Rule Amendments	2011	PM, NO_x	NJAC 7:27-14.1, 14.3	4/14/09
Voluntary Mobile Measures	2017 (1)	All	NA	NA

Table 4-4: Control Measures Post 2011

State or Federal	Sector	Control Measure	Effective Start Date of Benefits	Pollutant	New Jersey Administrative Code (NJAC)	USEPA Approval
State	Point, Area	CTG: Fiberglass Boat Manufacturing Materials (2008 CTG);	2018	VOC	7:27-16.14	Pending
State	Point, Area	CTG: Industrial Cleaning Solvents (2006 CTG);	2018	VOC	7:27-16.24	Pending
State	Point, Area	CTG: Misc. Metal and Plastic Parts Coatings (2008 CTG);	2018	VOC	7:27-16.15	Pending
State	Point, Area	CTG: Paper, Film, and Foil Coatings (2007 CTG);	2018	VOC	7:27-16.7	Pending
State	Point, Area	Low Sulfur Fuel Oil Phase 1	2014	PM, SO_2, NO_x	7:27-9	1/3/12
State	Point, Area	Low Sulfur Fuel Oil Phase 2	2016	PM, SO_2, NO_x	7:27-9	1/3/12
State	Point, Area	Permitting/Nonattainment New Source Review (NNSR)	Ongoing	All	7:27-8,18, 22	NA
State	Point, Area	Stationary Gas Turbines and Engines (NO_x ACT)	2020	NO_x	7:27-19.5, 19.8	Pending
State	Point	EGU: BL England ACO	2007 - 2019	NO_x, PM, SO_2	NA	NA
State	Point	EGU: Coal-fired Boilers, Oil and Gas Fired Boilers	2013	NO_x, PM, SO_2	7:27-4.2, 10.2, 19.4	8/3/10
State	Point	EGU: High Electric Demand Day (HEDD)	2009, 2015	NO_x	7:27-19.5	8/3/10
State	Point	Glass Manufacturing	2012	NO_x	7:27-19.10	8/3/10
State	Point	Petroleum Storage	2009-2017	VOC	7:27-16.2	8/3/10
State	Area	Portable Fuel Containers	2009-2019	VOC	7:27-24	7/22/10
State	Area	Phase I and II Gasoline Vapor Recovery	2018	VOC	7:27-16.3	Pending
State	Onroad	IM: Diesel Smoke Cutpoint	2011	All	7:27-14	Pending
State	Onroad	IM: Heavy Duty OBD	2018	All	7:27-14	Pending
State	Onroad	New Jersey Low Emission Vehicle (LEV) Program	2009 (1)	All	7:27-29	2/13/08
State	Onroad, Nonroad	Voluntary Mobile Measures	2017 (1)	All	NA	NA
Federal	Point, Area	Boiler/Process Heater NESHAP	2016	All	NA	NA
Federal	Point, Area	Natural Gas Turbine NSPS	2017	NO_x	NA	NA
Federal	Point, Area	RICE NESHAP	2017	All	NA	NA
Federal	Point, Area	RICE NSPS	2017	NO_x, CO	NA	NA
Federal	Point	EGU: CSAPR	2017	NO_x	NA	NA
Federal	Point	EGU: Mercury and Air Toxics Standards (MATS), Coal- and oil-fired	2016	PM, SO_2, NO_x	NA	NA
Federal	Point	Process Heater NSPS	2017	NO_x	NA	NA

State or Federal	Sector	Control Measure	Effective Start Date of Benefits	Pollutant	New Jersey Administrative Code (NJAC)	USEPA Approval
Federal	Point	Refinery Consent Decree: ConocoPhillips	2014	NO_x	NA	NA
Federal	Point	Refinery Consent Decree: Valero (Paulsboro)	2014	PM	NA	NA
Federal	Area	Refueling ORVR	1998 (1)	All	NA	NA
Federal	Area	Residential Woodstove NSPS	2014	All	NA	NA
Federal	Onroad	Fleet Turnover 2018	2018	All	NA	NA
Federal	Onroad	Heavy-Duty Vehicle Standards and Diesel Fuel Sulfur Control	2004-2010 (1)	All	NA	NA
Federal	Onroad	National Low Emission Vehicle Program (NLEV)	1999 (1)	All	NA	NA
Federal	Onroad	Tier 1 Vehicle Program	1994 (1)	All	NA	NA
Federal	Onroad	Tier 2 Vehicle Program/Low Sulfur Fuels	2004 (1)	All	NA	NA
Federal	Onroad	Tier 3 Vehicle Program/ Fuel Standards	2017 (1)	All	NA	NA
Federal	Nonroad	Diesel Compression Ignition Engines	1996 - 2015 (1)	All	NA	NA
Federal	Nonroad	Diesel Marine Engines over 37 kW: Category 1 Tier 2, Category 3 Tier 1	2004 (1)	All	NA	NA
Federal	Nonroad	Diesel Marine Engines over 37 kW: Category 2 Tier 2	2007 (1)	All	NA	NA
Federal	Nonroad	Diesel Marine Engines over 37 kW: Category 3 Tier 2	2011 (1)	All	NA	NA
Federal	Nonroad	Diesel Marine Engines over 37 kW: Category 3 Tier 3	2016 (1)	All	NA	NA
Federal	Nonroad	Large Industrial Spark-Ignition Engines over 19 kW (>50 hp) Tier 1	2004 (1)	All	NA	NA
Federal	Nonroad	Large Industrial Spark-Ignition Engines over 19 kW (>50 hp) Tier 2	2007 (1)	All	NA	NA
Federal	Nonroad	Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder Tier 0	1998 (1)	All	NA	NA
Federal	Nonroad	Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder Tier 2	2002 (1)	All	NA	NA
Federal	Nonroad	Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder Tier 3	2008 (1)	All	NA	NA
Federal	Nonroad	Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder Tier 4	2014 (1)	All	NA	NA
Federal	Nonroad	Recreational Vehicles (Snowmobiles, Off-road Motorcycles, All-terrain Vehicles)	2006 - 2012 (1)	All	NA	NA
Federal	Nonroad	Spark Ignition Engines, Equipment, and Vessels at or below 19 kW (Lawn and Garden and Small Watercraft)	1997 - 2016 (1)	All	NA	NA

Legend/Notes:
NA = Not Applicable
EGU - Electric Generating Unit
ICI = Industrial, Commercial and Institutional Boilers
IM = Inspection and Maintenance for Motor Vehicles
OBD = On-board Diagnostics
RICE = Reciprocating Internal Combustion Engines
MACT = Maximum Achievable Control Technology
CTG = Control Technology Guideline
All = NOx, VOC, CO, PM2.5, PM10
1. Turnover rule which means measure has cumulative benefits each year until complete fleet or equipment turnover

4.6.7.2 Measures to Mitigate Impacts from Construction Activities

New Jersey is required to consider measures to mitigate the impacts of construction activities in accordance with 40 C.F.R. § 51.308(f)(2)(iv)(B).

Construction activities are sources of fugitive dust, inorganic (or crustal) forms of directly emitted particulate matter (PM), as well as directly emitted carbonaceous PM from the exhaust emissions of construction equipment. During high wind events, fine crustal PM has been shown to be transported over very long distances and contribute to regional haze. While much of the windblown emissions are coarse PM, smaller particles are also present.

The following measures are currently implemented by New Jersey to mitigate impacts from construction activities:

- ***Standards[47] That Reduce "Fugitive Dust" Emissions from Construction*** –These Standards were adopted by the New Jersey Department of Transportation and the New Jersey Department of Agricultures under the "Soil Erosion and Sediment Control Standards: Standards for Dust control." The Standard covers the control of dust on construction sites and roads, the control of flowing sediment from accessing construction sites, and the control of on-site construction traffic to minimize land disturbance.

- ***Rules to Address Exhaust Emissions***–New Jersey has existing rules to limit the idling of vehicles and equipment.[48] On November 16, 2009, New Jersey promulgated a rule revision to further reduce allowable smoke from on-road diesel engines.[49] These measures will help reduce emissions and regional haze.

- ***General Conformity Rules–***Federal actions taken in New Jersey must comply with the Federal General Conformity Rules[50] in a nonattainment or maintenance area for ozone, fine particulate matter (PM2.5), and CO. The general Conformity Rule requires that VOC, NO_x, CO and PM2.5 direct and indirect emissions from a project that exceed *de minimis* levels be mitigated, unless the activities are exempt. Emissions reductions

[47] Standards for Soil Erosion and Sediment Control in New Jersey. Promulgated by the New Jersey State Soil Conservation Committee. Adopted July 1999.
[48] N.J.A.C. 7:27-14.3 for diesel fueled vehicles and N.J.A.C. 7:27-15.8 for gasoline fueled vehicles.
[49] N.J.A.C. 7:27-14: Control and Prohibition of Air Pollution from Diesel-Powered Motor Vehicles (Including Idling) (41 N.J.R. 4195 (b)). http://www.nj.gov/dep/aqm/CPR-041708.pdf
[50] 40 CFR 93.150

obtained through the implementation of measures required by the Federal conformity regulation will also reduce emissions from projects and help reduce regional haze.

The Clean Air Act[51] requires that Federal actions conform to a state's State Implementation Plan (SIP). Specifically, the Clean Air Act requires that the action/activity will not:

- Cause or contribute to any new violation of any National Ambient Air Quality Standard (NAAQS) in any area;
- Increase the frequency or severity of any existing violation of any NAAQS in any area; or,
- Delay timely attainment of any NAAQS or any required interim emission reductions or any other milestones in any area.

Federal actions taken in New Jersey must comply with the Federal General Conformity Rules[52] for PM2.5 in the 13 counties in maintenance of the PM2.5 standard and in the entire State for 8-hour ozone.

Additionally, New Jersey will consider additional mitigating measures for construction activities on a case-by-case basis depending on the size and nature of the construction being done and the review of the potential emissions on the property in relation to any potential off-site impacts. To implement these requirements, the DEP can use existing authority under the Waterfront Development Rules, as well as Environmental Impact Statements required pursuant to the National Environmental Policy Act and/or Executive Order. In addition, any unreasonable off-site air quality impacts during construction can be addressed by New Jersey's general prohibition of air pollution at N.J.A.C. 7:27-5 et seq. Mitigation measures would be required if construction activities unreasonably interfere with the enjoyment of life or property.

4.6.7.3 Source Retirement and Replacement Schedules

New Jersey is required to consider source retirement and replacement schedules in developing its long-term-strategies in accordance with 40 C.F.R. § 51.308(f)(2)(iv)(C). The EGU point sources retired in the inventories used in the MANE-VU contribution assessment are in Table 4-5.

Table 4-5: EGU Units Retired in the Regional Haze Inventories

Facility Name	ORIS ID	CAMD Unit ID	Inventory Offline Date
BL England	2378	1	2013
BL England	2378	2,3	1/1/2020
Bergen	2398	3001	5/1/2015
Burlington Generating Station	2399	4001,12001,14001,16001, 18001,28001,30001,32001,34001	5/1/2015
Cedar Station	2380	2001,3001,4001	5/1/5012
Deepwater	2384	1,8	5/1/2015

[51] 42 U.S.C. 7506
[52] 40 C.F.R 93.150

Facility Name	ORIS ID	CAMD Unit ID	Inventory Offline Date
Edison	2400	1001,3001,5001,7001,9001,11001 13001,15001,17001,19001,21001,23001	5/1/2015
Essex	2401	2001,4001,10001,12001,14001,16001, 18001,20001,22001,24001,26001,28001,35001	5/1/2015
Howard M Down	2434	6001	2012
Hudson Generating Station	2403	2	12/31/2017
Kearny Generating Station	2404	15001,16001,17001	5/1/2015
Mercer Generating Station	2408	7001	5/1/2015
Mercer Generating Station	2408	1,2	12/31/2017
Mickleton	8008	1001	5/1/2015
Missouri	2383	10001,11001,12001	5/1/2015
National Park	2409	1001	5/1/2015
Sewaren Generating Station	2411	1,2,3,4	12/31/2014
Sewaren Generating Stations	2411	1,2,3,4	1/1/2018
Sewaren Generating Station	2411	12001	5/1/2015
Werner	2385	9001,10001,11001,12001	5/1/2015

There are no non-EGU point sources the New Jersey that were considered when developing the 2028 emissions projections.

4.6.7.4 Agricultural and Forestry Smoke Management

New Jersey is required to consider smoke management techniques for the purposes of agricultural and forestry management in developing reasonable progress goals in accordance with 40 C.F.R. § 51.308(f)(2)(iv)(D). New Jersey addresses smoke management through its Open Burning rules, as follows:

- ***Open Burning –*** The existing New Jersey open burning rules[53] limit all types of open burning within the State. These rules have been in effect since 1956, with subsequent revisions further restricting open burning. The rules prohibit open burning and have been successful in minimizing burning throughout the State. The limited instances where open burning is allowed, only after a person obtains an air pollution control and Forest Fire Service permit, include:
  - Prescribed burning,
  - Limit agricultural management burning as follows:
    - Infested plant life,
    - Herbaceous plant life and hedgerows,
    - Orchard pruning and culling,
    - Land clearing for farming,
  - Emergencies,
  - Dangerous material.

All New Jersey open burning permits prohibit open burning on days forecasted as unhealthy for air quality. This condition currently applies in all but emergency situations.

[53] N.J.A.C. 7:27-2 https://www.nj.gov/dep/aqm/rules27.html

New Jersey coordinates with Forest Fire Service to consider the effects on the Brigantine Wilderness Area when reviewing open burning permit applications for certain nearby areas, especially for prescribed burning.

New Jersey's periodic area source emissions inventory includes estimated emissions from open burning, such as the following:

- ***Prescribed Burning*** – Prescribed burning is one of the few categories where open burning is allowed by permit in New Jersey, as discussed above, under specific conditions for public safety reasons. Prescribed burning is conducted or supervised by the Bureau of Forest Fire Management, to ensure public safety. Prescribed burning, when properly conducted, minimizes the potential future threat of large and serious uncontrolled wildfires that could seriously jeopardize human life and property. In addition, it reduces the number of wildfires and the visibility impairment associated with uncontrolled wildfire.

- ***Agricultural Management Burning*** – Open burning is currently allowed with a permit in New Jersey, but limited in its scope, are conducted on agricultural lands. These categories include infested plant life, herbaceous plant life and hedgerows, orchard pruning and culling and land clearing for agricultural purposes. DEP issues open burning permits to agricultural operations and establishments and ensures that only certain agricultural materials are burned.

New Jersey has several existing measures that help improve visibility at Brigantine Wilderness Area and other Class I areas impacted by emissions from New Jersey. These measures include:

- ***Residential Wood Burning Outreach and Education***–Fine particulate matter from wood smoke contributes to regional haze. Residential wood burning from woodstoves and fireplaces is one of the largest sources of direct fine particulate matter, PM2.5, emissions in New Jersey. Although New Jersey does not regulate wood stoves and fireplaces, DEP continues to provide educational outreach to the public. The DEP has a website that provides information to the public on proper wood burning techniques, health effects of wood burning, and links to other useful web pages related to reducing emissions from wood smoke.[54] New Jersey's County Environmental Health Act (CEHA) agencies also help communities where wood smoke is prevalent and is a nuisance problem to residents.

4.6.7.5 Anticipated Net Impact on Visibility due to projected Emissions Changes over the Long-term Strategy Period

New Jersey is required to consider the net effect on visibility resulting from changes projected in point, area, and mobile source emissions over the period addressed by the long-term strategy, in accordance with 40 CFR § 51.308(f)(2)(iv)(E).

Photochemical modeling for the 2018-2028 implementation period was conducted through the collaboration between New Jersey and MANE-VU after consultation with states within and outside of MANE-VU, EPA and the FLMs. Two modeling cases were completed - a 2028 base

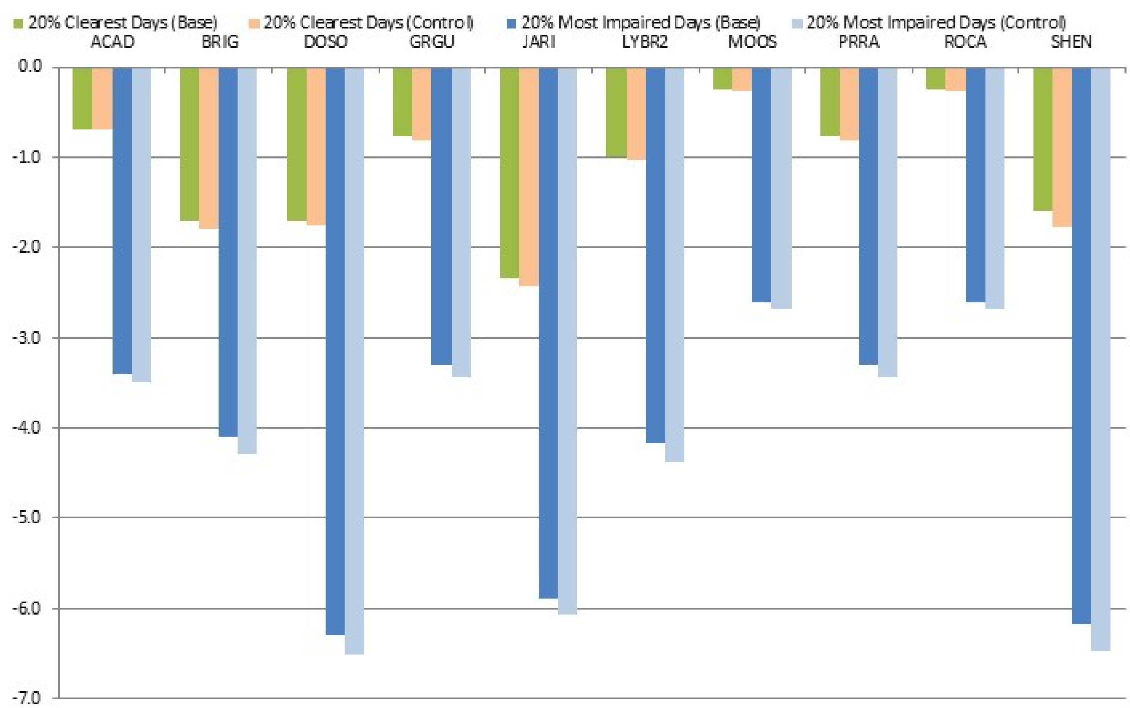
[54] http://www.state.nj.us/dep/baqp/woodburning.html

case that considers only on-the-books controls and a 2028 control case that considers implementation of the MANE-VU "Ask."

MANE-VU did not separate out individual state impacts on visibility when conducting the modeling exercise, but the resulting change in visibility in deciviews, on the 20% most impaired and 20% clearest days, from the 2011 baseline for the two modeling runs are shown in Figure 4-1.[55]

Even though the visibility improvement between the base and control case is small, states are expected to do their part to ensure incremental progress towards the 2064 visibility goal.

Figure 4-1: Change in Visibility (Deciviews) from 2011 to 2028 for Base and Control Case MANE-VU Gamma Photochemical Modeling on 20% Most Impaired and 20% Clearest Days



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

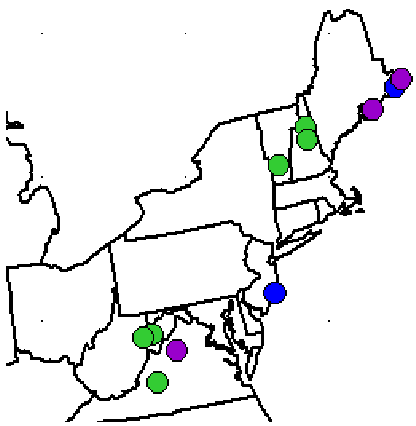
Chapter 5 Consultation

The Regional Haze Rule and the Clean Air Act (CAA) require consultation between the states, tribal nations and Federal Land Managers (FLMs) responsible for managing Class I areas. New Jersey completed its consultation requirement in conjunction with MANE-VU, which can be found in Appendix D.

Chapter 6 Regional Modeling and Source Attribution Studies

Section 308(f) of the 1999 regional haze regulations required each State to revise and submit a regional haze SIP to EPA by July 31, 2018 and every ten years thereafter; therefore, the end date for the second implementation period is 2028. A 2017 Regional Haze Rule revision extended the SIP submittal date to July 31, 2021 but left the end date for the second implementation period at 2028. MANE-VU States have collectively agreed to submit SIPs before the July 31, 2021 deadline. This SIP requires modeling to demonstrate reasonable further progress towards background visibility conditions at Class I areas and to set 2028 RPGs using estimates of visibility following controls anticipated as the result of the consultation process between the states and FLMs. The controls will be included in each state's long-term strategy and deemed to be reasonable following a four-factor analysis.

Figure 6-1: MANE-VU and nearby Federal Class I Areas



MANE-VU Class I Areas
- Maine: Acadia, Campobello, Moosehorn
- New Hampshire: Great Gulf, Presidential-Dry River
- Vermont: Lye Brook
- New Jersey: Brigantine

Nearby Class I Areas
- West Virginia: Dolly Sods, Otter Creek
- Virginia: James River Face, Shenandoah

National Park Service
US Forest Service
US Fish & Wildlife Service

6.1 Contributing States and Regions to MANE-VU Class I Areas

The MANE-VU Contribution Assessment for the first implementation period used various modeling techniques, air quality data analysis, and emissions inventory analysis to identify source categories and states that contribute to visibility impairment in Brigantine Wilderness Area, other MANE-VU Class I areas, and Shenandoah National Park (NP). With respect to sulfate, based on estimates from four different techniques, the Contribution Assessment for the first implementation period estimated that emissions from within MANE-VU in 2002 were responsible for about 25-30 percent of the sulfate at Class I areas and 15-20 percent at Shenandoah NP (see Chapter 8 of the Contribution Assessment. Appendix G). The contribution of sulfate at these Class I areas from other regions, Canada, and outside the modeling domain were also significant.

For the second implementation period, New Jersey and other MANE-VU Class I states considered the modeling results documented in the Selection of States (Appendix E) to determine which states should be consulted in developing the long-term strategy for improving visibility in MANE-VU Class I areas.

Because sulfate was the primary pollutant of concern, and nitrates from NO_x emission sources play a more significant role than they had in the first planning period, New Jersey and MANE-VU chose an approach to contribution assessments that focused on sulfates and included nitrates when they could be included in a technically sound fashion. Additionally, New Jersey and MANE-VU examined annual inventories of emissions to find sectors that should be considered for further analysis. EGUs emitting SO_2 and NO_x and industrial point sources emitting SO_2 were found to be point source sectors of high emissions that warranted further scrutiny. Mobile sources were also found to be an important sector in terms of NO_x emissions. Since power plants and mobile sources generally dominate state and regional NO_x emissions inventories, only industrial sources emitting SO_2 emissions were selected for further analysis[56] .

After this initial work, New Jersey and MANE-VU initiated a process of screening states and sectors for contribution using two tools, Q/d and CALPUFF. Finally, results of this contribution analysis were then compared to air mass trajectories, to better understand the source areas of the country where wind patterns transported emissions to cause the 20% most impaired visibility days in a MANE-VU Class I area including the Brigantine Wilderness Area.

Both techniques (Q/d and CALPUFF) provided estimates for potential visibility impacting masses. Rather than relying solely on one technique for identifying contributing states, both techniques were included by means of an average of each relative contribution calculation for NO_3 and SO_4. Since nitrates and sulfates have similar visibility impairment for similar ambient air concentrations, they weighted equally in the impact calculations and Q/d and CALPUFF results were also equally weighed when both were available. Since 2015 CALPUFF results were not available for the District of Columbia, Florida, Louisiana, Mississippi, Rhode Island, Texas, and Vermont, only Q/d results were considered for those states. The MANE-VU Class I areas with Interagency Monitoring of Protected Visual Environments (IMPROVE) monitors include -- Acadia, Brigantine, Great Gulf, Lye Brook & Moosehorn. Several nearby Class I areas with IMPROVE monitors outside the MANE-VU region, such as Dolly Sods, James River Face and Shenandoah, were also used as receptors. The results were compared with a similar study published in 2012.[57] The James River Face Wilderness Area 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.

Table 6-1 provides average percentile contributions for each analyzed state to five MANE-VU Class I Areas, using monitored emissions data on the 20% most impaired day to determine what pollution is leading to anthropogenic visibility impacts. The scores for the 36 states total 100 (or 100%). States listed towards the top of the table (in orange shading) are each estimated to contribute 3 percent or greater of the 36 state total contributions. States in the pink shade contribute 2 to 3 percent and states listed in green contribute less than 2 percent in this ranking. In addition, the table provides the maximum percentage that a state contributes to any Class I area in MANE-VU and the average mass estimated by the four methods. The column furthest to the right provides a relative mass factor of NO_3 and SO_4 combined which was used as a filter to ensure the major NO_3 and SO_4 mass contributing states are identified and to determine if a state contributing a relatively low amount of mass was identified as a contributing state at one or more of the MANE-VU Class I Areas.

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[56] Contribution Assessment Preliminary Inventory Analysis. https://otcair.org/MANEVU/Upload/Publication/Reports/Contribution%20Assessment%20Preliminary%20Inventory%20Analysis.pdf

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

For areas other than Brigantine, New Jersey's impact is well below 2% and the aggregate contribution of New Jersey and other states with impacts less than New Jersey's is small. New Jersey had its highest level of impacts at Brigantine Wilderness Class I area, 2.2%.

Table 6-1: Percent Mass-Weighted 2011 Sulfate and Nitrate contribution for top 36 Eastern States to all MANE-VU Class I areas: consolidated (maximum to any Class I area), individual MANE-VU Class I areas, and average contributed mass (mass factor)[58]

Rank	Maximum		Acadia		Brigantine		Great Gulf		Lye Brook		Moosehorn		Mass Factor	
1	PA	20.0	PA	12.4	PA	19.9	PA	15.6	PA	20.0	PA	10.5	PA	2.11
2	OH	11.3	OH	10.1	OH	8.8	OH	10.9	OH	11.3	OH	10.2	OH	1.06
3	NY	10.0	ME	8.3	MD	6.5	IN	8.0	NY	10.0	IN	8.0	IN	0.64
4	ME	8.3	IN	6.9	WV	6.4	NY	7.6	IN	7.4	TX	6.3	WV	0.61
5	IN	8.0	MI	6.0	NY	6.1	MI	6.6	TX	5.4	MI	6.0	MI	0.54
6	MI	6.6	NY	5.8	IN	5.4	TX	4.9	WV	5.3	NY	5.9	VA	0.47
7	MD	6.5	TX	4.7	TX	5.1	WV	4.7	MI	5.1	ME	5.6	KY	0.47
8	WV	6.4	MA	4.4	VA	4.8	IL	3.7	KY	4.2	WV	4.8	TX	0.44
9	TX	6.3	WV	3.9	KY	4.7	NH	3.7	IL	2.7	KY	4.2	NY	0.42
10	VA	4.8	NH	3.4	MI	4.5	KY	3.6	MO	2.5	IL	3.9	MD	0.40
11	KY	4.7	KY	3.4	NC	2.7	MO	3.1	LA	2.4	MA	3.4	NC	0.34
12	MA	4.4	IL	2.8	AL	2.6	ME	2.9	VA	2.4	MO	3.3	MA	0.27
13	IL	3.9	NC	2.7	LA	2.5	WI	2.6	NC	2.3	NH	3.1	NH	0.26
14	NH	3.7	MD	2.7	NJ	2.2	LA	2.2	MD	2.3	LA)	2.8	ME	0.25
15	MO	3.3	VA	2.5	IL	2.1	VA	2.1	AL	2.03	MD	2.6	AL	0.22
16	LA	2.8	MO	2.4	TN	2.01	NC	2.1	WI	1.9	AL	2.5	LA	0.21
17	NC	2.7	AL	2.2	GA	1.97	MD	2.1	OK	1.6	VA	2.4	TN	0.18
18	AL	2.6	FL	2.1	MO	1.9	VT	2.1	ME	1.6	NC	2.2	GA	0.17
19	WI	2.6	LA	2.1	FL	1.5	AL	1.8	TN	1.5	OK	1.8	MO	0.16
20	NJ	2.2	GA	1.9	MA	1.4	OK	1.8	GA	1.3	WI	1.8	FL	0.13
21	FL	2.1	WI	1.8	OK	1.4	MA	1.8	IA	1.2	TN	1.7	IL	0.12
22	VT	2.1	TN	1.5	NH	1.1	GA	1.8	MA	1.2	GA	1.7	OK	0.12
23	TN	2.01	IA	1.5	NE	1.0	IA	1.7	CT	1.2	IA	1.5	VT	0.09
24	GA	1.97	CT	1.3	AR	1.0	AR	1.3	AR	1.2	CT	1.4	NJ	0.09
25	OK	1.8	OK	1.2	CT	1.0	TN	1.3	NH	1.1	AR	1.4	IA	0.07
26	IA	1.7	AR	1.2	WI	0.9	KS	1.0	MN	1.0	KS	1.2	WI	0.07
27	CT	1.4	NJ	1.0	ME	0.9	NE	0.8	FL	1.0	NJ	0.9	CT	0.07
28	AR	1.4	MN	0.9	IA	0.9	CT	0.7	KS	0.8	MS	0.8	MS	0.07
29	KS	1.2	KS	0.8	SC	0.8	MS	0.7	NJ	0.8	NE	0.8	AR	0.06
30	NE	1.0	NE	0.8	MS	0.8	SC	0.5	MS	0.7	VT	0.8	SC	0.05
31	MN	1.0	SC	0.8	DE	0.6	MN	0.5	NE	0.6	SC	0.8	MN	0.04
32	MS	0.8	MS	0.6	KS	0.6	FL	0.5	SC	0.5	FL	0.7	NE	0.03
33	SC	0.8	VT	0.6	MN	0.6	NJ	0.4	VT	0.3	MN	0.5	RI	0.02
34	DE	0.6	RI	0.5	RI	0.3	RI	0.2	RI	0.2	DE	0.2	KS	0.02
35	RI	0.5	DE	0.2	DC	0.2	DE	0.2	DE	0.1	RI	0.1	DE	0.02
36	DC	0.2	DC	0.1	VT	0.2	DC	0.1	DC	0.1	DC	0.1	DC	0.016

The significance of the color coding is to differentiate the percent contribution scores for the states. The scores for the 36 states total 100 (or 100%). States within the orange shaded area are each estimated to contribute 3 percent or greater of the total 36 State contributions. States in pink shaded area contribute 2 to 3 percent and States in green shaded area contribute less than 2 percent. If a State was estimated to contribute 2 percent

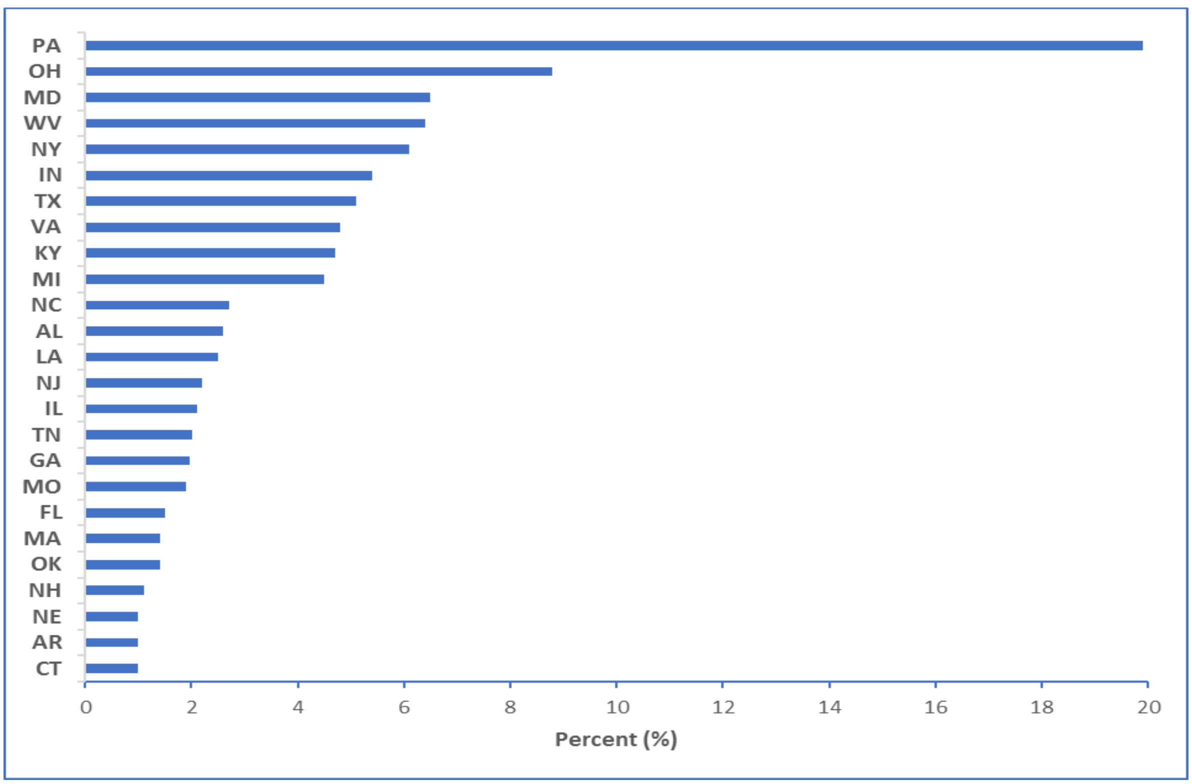
[58] Analysis uses monitored emissions data on the 20% most impaired day to determine what pollution is leading to anthropogenic visibility impacts.

or more, it is considered a contributing State. However, States were removed from consideration if their mass factor was below 1% (0.01 µg/m^3).

6.2 States and Sources Contributing to Visibility Impairment at Brigantine Wilderness Area

Modeling of point source contributions (electrical generating units (EGUs) and industrial/institutional units) to federal Class I areas undertaken in 2016 by New Hampshire Department of Environmental Services (NHDES) and Vermont Department of Environmental Conservation (VTDEC)[59] was used to estimate the visibility impairment attributable to SO_2 and NO_x on the 20% most impaired days that were contributed by other states to Brigantine Wilderness Area. 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 MARAMA 2011 typical daily industrial/institutional SO_2 and NO_x emissions. As with other Class I areas in MANE-VU and nearby, emissions from Pennsylvania and Ohio have a large impact in New Jersey. Figure 6-2 depicts states' collective impact. Individual sources are given in Table 6-2.

Figure 6-2: 2011-2015 Percent Mass Weighted Sulfate and Nitrate Contribution for Brigantine Wilderness Area



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

[59] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources, April 4, 2017. (Appendix F).

Table 6-2: Individual Electric Generating Unit Sources Contributing to Visibility Impairment at Brigantine Wilderness Area Based on CALPUFF modeling with 2015 CAMD Emissions

State	Facility Name	Facility/ ORIS ID	Unit	Contributions to Brigantine		
				24-hr Max SO_4 Ion (µg/m3)	24-hr Max NO_3 Ion (µg/m3)	Est. Extinction (Mm-1)
VA	Yorktown Power Station	3809	3	0.88	0.11	10.9
PA	Homer City	3122	1	0.61	0.19	9.2
PA	Homer City	3122	2	0.54	0.17	8.1
OH WV	Muskingum River Harrison Power Station	2872	5 1 (25%), 2 (20%)	0.63 0.11	0.04 0.12	7.7 7.0
VA	Yorktown Power Station	3809	1,2	0.54	0.11	7.0
OH	Avon Lake Power Plant	2836	12	0.55	0.06	6.7
NJ	B L England	2378	2,3	0.23	0.27	5.6
OH	Muskingum River	2872	1,2,3,4	0.30	0.09	4.4
PA	Montour	3149	1	0.17	0.23	4.4
PA	Montour	3149	2	0.14	0.23	4.1
MI	Belle River		2	0.23	0.12	4.0
PA	Brunner Island	3140	1,2	0.19	0.17	4.0
PA	Brunner Island	3140	3	0.19	0.15	3.8
IN	Rockport	6166	MB1,MB2	0.27	0.08	3.8
MD	Herbert A Wagner	1554	3	0.24	0.03	3.8
MI	Belle River		1	0.21	0.12	3.7
PA	Shawville	3131	3,4	0.25	0.07	3.6
KY	Big Sandy	1353	BSU1,BSU2	0.29	0.04	3.5
OH	Gen J M Gavin	8102	1	0.24	0.09	3.3
PA	Homer City		3	0.07	0.21	3.3
WV	Kammer	3947	1,2,3	0.21	0.08	3.2
MI	St. Clair	1743	1,2,3,4,...6	0.17	0.11	3.1
OH	Gen J M Gavin	8102	2	0.22	0.08	3.1
PA	Keystone	3136	1	0.17	0.11	2.8
MI	St. Clair	1743	7	0.22	0.04	2.8
PA	Keystone	3136	2	0.16	0.11	2.7
GA	Harllee Branch	709	3&4	0.21	0.02	2.6
MD	C P Crane	1552	2	0.08	0.17	2.6
WV	Pleasants Power Station	6004	1	0.09	0.16	2.6

MI	Trenton Channel	1745	9A	0.19	0.04	2.6
OH	W H Zimmer Generating Station	6019	1	0.15	0.08	2.6
IN	Wabash River Gen Station	1010	2,3,4,5,6	0.22	0.03	2.5
MD	Brandon Shores	602	2	0.06	0.10	2.5
OH	Killen Station	6031	2	0.13	0.07	2.4
TN	Johnsonville	3406	1 thru 10	0.19	0.02	2.4
MD	Brandon Shores	602	1	0.06	0.07	2.3
MA	Brayton Point	1619	4	0.15	0.06	2.3
OH	Kyger Creek	2876	1,2,3,4,5	0.13	0.09	2.3
WV	Kanawha River	3936	1,2	0.17	0.03	2.3
IN	Tanners Creek	988	U4	0.18	0.03	2.2
KY	Mill Creek	1364	1,2,3	0.16	0.04	2.2
MI	St. Clair	1743	6	0.16	0.01	2.0

6.3 Class I Areas Affected by New Jersey Sources

For MANE-VU states, 2002 is the base year for the first round of regional haze State Implementation Plans (SIPs), 2011 is the base year for the current round of regional haze SIPs and 2017 is the latest year Interagency Monitoring of Protected Visual Environments (IMPROVE) data was available for this report. The years chosen to determine if emissions from New Jersey are significantly impacting visibility at other Class I areas based on CALPUFF modeling in conjunction with the Q/d analysis were the same years used in the MANE-VU Source Contribution Modeling Report using 2015 emissions.[60]

CALPUFF modeling results used for comparison with trajectory analyses include states having an electric generating unit (EGU) source or industrial, commercial, and institutional (ICI) source with at least a 1 Mm^{-1} light extinction impact to a Class I area. Table 6-3 shows the results of this modeling for New Jersey and other MANE-VU states' sources. For example, New Jersey had one EGU and 2 ICI modeled to have greater than 1 Mm^{-1} light extinction at Brigantine using 2015 emissions.

[60] ibid.

Table 6-3: Contribution of MANE-VU States to Class I Areas

Class I Area	*Brigantine*	*Dolly Sods*
o Connecticut	1 EGU	
o Maine	1 EGU	
o Maryland	7 EGUs and 2 ICI	6 EGU and 1 ICI
o Massachusetts	3 EGUs	
o New Hampshire	1 EGUs	
o New Jersey	**1 EGU and 2 ICI**	**1 EGU**
o New York	3 EGUs and 1 ICI	1 EGU
o Pennsylvania	12 EGUs and 5 ICI	11 EGUs and 2 ICI

Class I Area	*Shenandoah*
o Maine	
o Maryland	7 EGUs and 2 ICI
o Massachusetts	
o New Hampshire	
o New Jersey	**1 EGUs**
o New York	1 EGUs
o Pennsylvania	11 EGUs and 3 ICI

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 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 (MANE-VU Class I areas and the Class I areas closest to the MANE-VU region). Those originating in New Jersey are shown in Table 6-4 to Table 6-6. Note that even though New Jersey has 2 ICI sources modeled to have greater than 1 Mm^{-1} light extinction at Brigantine, only one is shown in Table 6-6 because the other one did not make the top 5 list of ICI contributors.

Table 6-4: New Jersey 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 95th**	**2011 Met 2011 95th**	**2015 Met 2011 95th**	**2015 Met 2015 95th**	**Distance (mi)**
Brigantine	4	B L England	2378	1	**12.0**	4.2	2.4	--	17
Brigantine	10	B L England	2378	2,3	**6.1**	1.9	1.2	8.1	17

Table 6-4 provides impacts among multiple phases of modeling; each of these phases represent 2011 95th percentile emissions impacts, but differ in the year of meteorology (2002, 2011, or 2015). For comparison, 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.

The maximum values upon which each are ranked are bolded in blue font. For example, B L England is ranked fourth out of ten EGUs affecting Brigantine in Table 6-4 based on the 2002 data/2011 meteorology extinction value of 12.0. EGUs at BL England are the primary impairing point sources in New Jersey.

Table 6-5: New Jersey Visibility Impairing EGU Point Sources (2015 emissions data)

	Facility Info				Extinction Value (Mm^{-1})				
Class I area	**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)**
Brigantine	8	B L England	2378	2,3	5.6	1.7	1.1	6.1 (5.6)	17

Table 6-5 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 95th percentile emission impacts (shown in red text) among the three years of meteorology.

Table 6-6: New Jersey Visibility Impairing Industrial/Institutional Sources (2011 emissions data)

	Facility Info				Extinction Value (Mm^{-1})			
Class I area	**Rank**	**Facility**	**ORIS ID**	**Unit IDs**	**2002 Met 2015 Emis**	**2011 Met 2011 Emis**	**2015 Met 2011 Emis**	**Distance (mi)**
Brigantine	5	Atlantic County Utilities Authority Landfill	8093211	All	0.9	1.7	0.6	9

6.4 Baseline Emissions

40 CFR Section 51.308(f)(2)(iii) requires New Jersey to identify the baseline emissions information on which the long-term strategy is based. New Jersey used the 2011 MANE-VU Emissions Inventory Gamma Version as its baseline inventory. Analyses of monitored data and meteorological data concluded that for the Ozone Transport Region (OTR), 2010, 2011 and 2012 are the candidate base years to model for future ozone NAAQS planning and 2011 is the best base year for future Regional Haze and annual PM2.5 NAAQS planning. Transport patterns of 2011 ozone events in the OTR confirm that using 2011 would be appropriate. When other factors were considered including availability of a national emission inventory, research data availability, and decisions on base years by nearby RPOs and EPA more weight was given to using 2011 as a base year. As a result, 2011 was determined to be the best candidate base year for this multi-pollutant platform (Ozone, Regional Haze and PM2.5). More details can be found in the document “Future Modeling Platform Base Year Determination” produced by the MANE-VU Technical Support Committee (MANE-VU Technical Support Committee 9 October 2013).

40 CFR Section 51.308(f)(2)(iii) also requires that “the emissions information [analyzed] must include, but need not be limited to, information on emissions in a year at least as recent as the

most recent year for which the State has submitted emission inventory information to the Administrator in compliance with the triennial reporting requirements of subpart A of this part," which given the extension of deadlines for submission of Regional Haze SIP would be 2014.

The MANE-VU technical analysis focused on the use of 2011 as the basis for developing long term strategies. This decision was made for several reasons. Primarily, 2014 was not found to be conducive for transport of haze precursor emissions, whereas work showed that both 2011 and 2015 were years, in which the meteorology was favorable to the transport of emissions regionally. Use of emissions that occurred during a year that is chosen according to EPA guidance[61] is important; since, when developing long term strategies, sectors and states that are reasonably anticipated to cause visibility impairment may not all warrant further consideration. Secondarily, regional efforts were undertaken to develop SIP quality emissions inventories based on 2011. Basing strategies on inventories that have not been quality assured to the same level could lead to an inappropriate selection of strategies.

The initial analysis of 2011 inventory examined all potential sectors that could impact visibility and can be found in the technical memorandum *Contribution Assessment Preliminary Inventory Analysis* (Appendix F). The inventory used in this analysis came from the Beta version of the regional modeling platform. This analysis also included projections to 2018 that considered rules that were going into effect between 2011 and 2018 and known unit shutdowns and fuel switches. From this analysis SO_2 emissions from coal-fired EGUs were found to be by far the most important emissions sector that could lead to impairment of visibility. A secondary list of sectors that resulted as having a potential to impair visibility were:

1. Residential combustion area sources (SO_2),
2. Industrial point combustion sources (SO_2),
3. Oil fired power plants (SO_2),
4. Marine engines (SO_2),
5. Coal fired power plants (NO_X),
6. Heavy duty diesel vehicles(NO_X), and
7. Nonroad diesel equipment (NO_X).

SO_2 emissions from marine emissions were not considered further because major emission reductions from the implementation of 1000ppm sulfur levels due to the regulations implemented to comply with the North American Emission Control Area (75 FR 22896) were projected to reduce SO_2 emissions from the sector substantially beginning in 2015. There was no expectation that marine SO_2 emissions would change drastically between 2011 and 2014.

NO_X emissions from nonroad diesel equipment were also not considered further because of major emission reductions from the implementation of Tier 4 emission standards that were projected to reduce NO_X emissions from the sector gradually beginning in 2014 (40 CFR 1039.101). There was no expectation that nonroad NO_X emissions would change drastically between 2011 and 2014.

NO_X emissions from onroad heavy-duty vehicles and SO_2 emissions from residential combustion area sources were both moved forward to the regional MANE-VU strategy, though no major changes were expected in emissions between 2011 and 2014 for onroad heavy duty vehicles. Regarding residential combustion area sources, low sulfur fuel oil rules were the main

[61] US EPA, "Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze" (US EPA, December 2014).

factor affecting emissions between 2011 and 2014. The associated strategy focused on adopting the low sulfur fuel oil rule where it was not already adopted. Emissions were not expected to change between 2011 and 2014 in areas where the rule was not adopted.

The remaining four categories of point sources were further analyzed. Given the importance of choosing a year with meteorology that is conducive for haze formation, particularly with emissions from EGUs, rather than use 2014, the MANE-VU states selected 2015. 2015 emissions data was obtained from AMPD and included in *2016 MANE-VU Source Contribution Modeling Report–CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources* (MANE-VU, April 2017) (Appendix B), which in part allowed strategies to focus on point sources that would reasonably be anticipated to impact visibility.

Additionally, when one reviews the emissions trends in Section 9 of this SIP revision, one finds very little difference in NO_X emission totals between 2011 and 2014 for each sector (Figure 9-1) and little difference in SO_2 emission totals between 2011 and 2014 for all sectors except EGUs (Figure 9-12). EGUs were the one sector that 2015 CEM data was specifically updated, this also shows that no different assumptions, as to which sectors were of importance for inclusion in the long-term strategy, would have had occurred.

6.5 Modeling Techniques Used

The following documents describe preliminary and final modeling runs conducted by MANE-VU and used in developing the long-term strategy:

- MANE-VU Updated Q/d*C Contribution Assessment (MANE-VU, April 2016) (Appendix 8-3)
- 2016 MANE-VU Source Contribution Modeling Report–CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources (MANE-VU, April 2017) (Appendix 8-5)
- Regional Haze Metrics Trends and HYSPLIT Trajectory Analyses (Appendix 8-6)

As documented in the MANE-VU *Selection of States*, MANE-VU initiated a process of screening states and sectors for contribution using two tools, Q/d and CALPUFF. In addition, results of the trajectory analyses were used to identify transport patterns and can be used in conjunction with other MANE-VU contribution analysis tools (CALPUFF modeling and Q/d analyses) to determine states to be included in the consultation process. The three modeling techniques are described in more detail below.

6.5.1 Weighted Q/d

The weighted emissions over distance (Q/d) method is a method for estimating sulfate and nitrate contributions to a receptor. The empirical formula that relates emission source strength and estimated impact is expressed through the following equation:

$$I = C_i(Q/d)$$

In this equation, the strength of an emission source, Q, is linearly related to the impact, I, that it will have on a receptor located a distance, d, away. As in the previous analysis, distances were computed using the Haversine function, using an earth radius of 6371 km^2. The effect of meteorological prevailing winds can be factored into this approach by establishing the constant, Ci, as a function of the “wind direction sectors” relative to the receptor site.

Q/d is largely accepted as a screening tool and is consistent with the conclusions of EPA's interagency air quality modeling report dated July 2015.[62] Per a report by NACAA, Q/d analysis is considered a highly conservative screening tool when assuming 100% conversion of SO_2 gas to the particulate form (NH3SO4) that affects visibility.[63]

The MANE-VU Technical Support Committee (Connecticut Department of Energy and Environmental Protection (CTDEEP)) used the Q/d method to estimate sulfate contributions to a receptor.[64] The analysis was done using ARC MAP® software.

The MANE-VU Class I areas with Interagency Monitoring of Protected Visual Environments (IMPROVE) monitors -- Acadia, Brigantine, Great Gulf, Lye Brook & 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.[65] The James River Face Wilderness Area 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 6-3.

Figure 6-3: Receptors for the 2015 C_i(Q/d) Analysis

The assessment showed the relative importance of sulfates compared to other pollutants regarding light extinction at the IMPROVE sites analyzed (see Figure 6-4), which led to the conclusion that SO_2 was the most accurate and most relevant estimation for determining the impact of states' emissions to the visibility impairment of the MANE-VU Class I areas.

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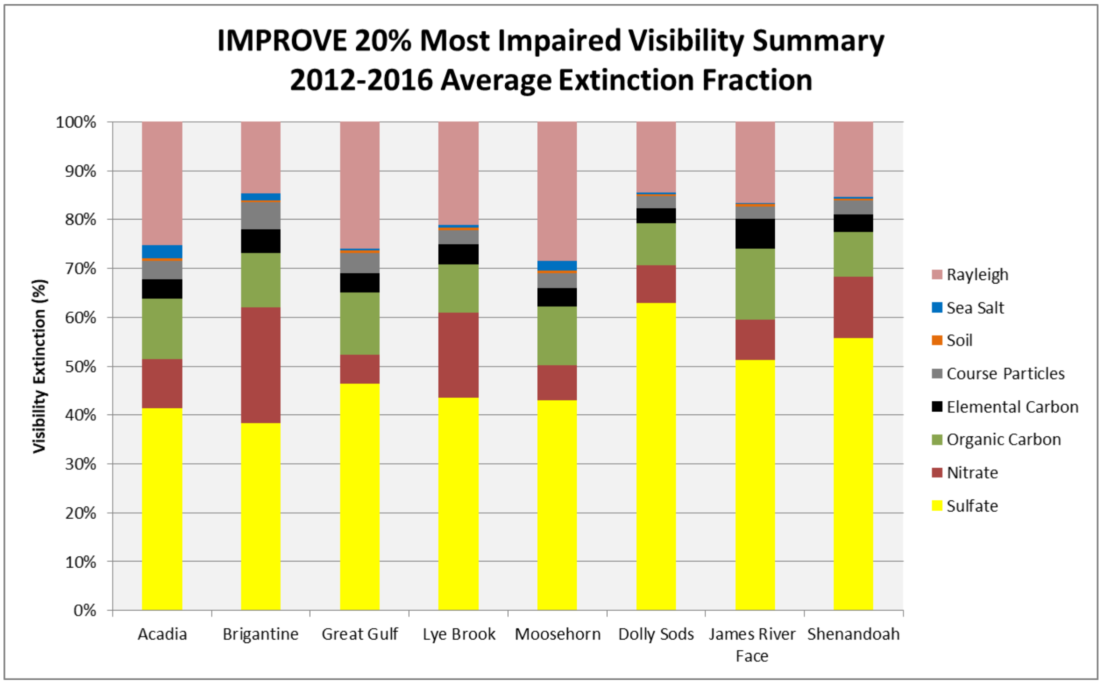
[62] US EPA, Interagency Work Group on Air Quality Modeling Phase 3 Summary Report: Near-Field Single Source Secondary Impacts.
[63] National Association of Clean Air Agencies, PM2.5 Modeling Implementation for Projects Subject to National Ambient Air Quality Demonstration Requirements Pursuant to New Source Review.
[64] MANE-VU Technical Support Committee, *MANE-VU Updated Q/d*C Contribution Assessment*. (Appendix G).
[65] NESCAUM, 2012. *Contributions to Regional Haze in the Northeast and Mid-Atlantic United States: Preliminary Update through 2007*. http://www.nescaum.org/topics/regional-haze/regional-haze-documents

Emissions of NO_x were considered in the final analysis and factored into Q/d calculations with chemistry information provided by CALPUFF modeling.

Figure 6-4: Speciation at MANE-VU and Neighboring Class I Areas



For all the analyses historical and current, Ohio was determined to be one of the top two contributors for all the eight Class I areas reviewed. Pennsylvania also continues to be one of the top three 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 the emissions reductions achieved were not equally applied among the neighboring states. Table 6-7 below displays the Q/d quantitative contributions to the MANE-VU and neighboring Class I areas between the 2012 analysis (2007 emissions) and the 2015 analysis (2011 data).

Table 6-7: Top Five Contributing U.S. States for Total State SO_2 Emissions over the Three Analyses (Q/d)[66]

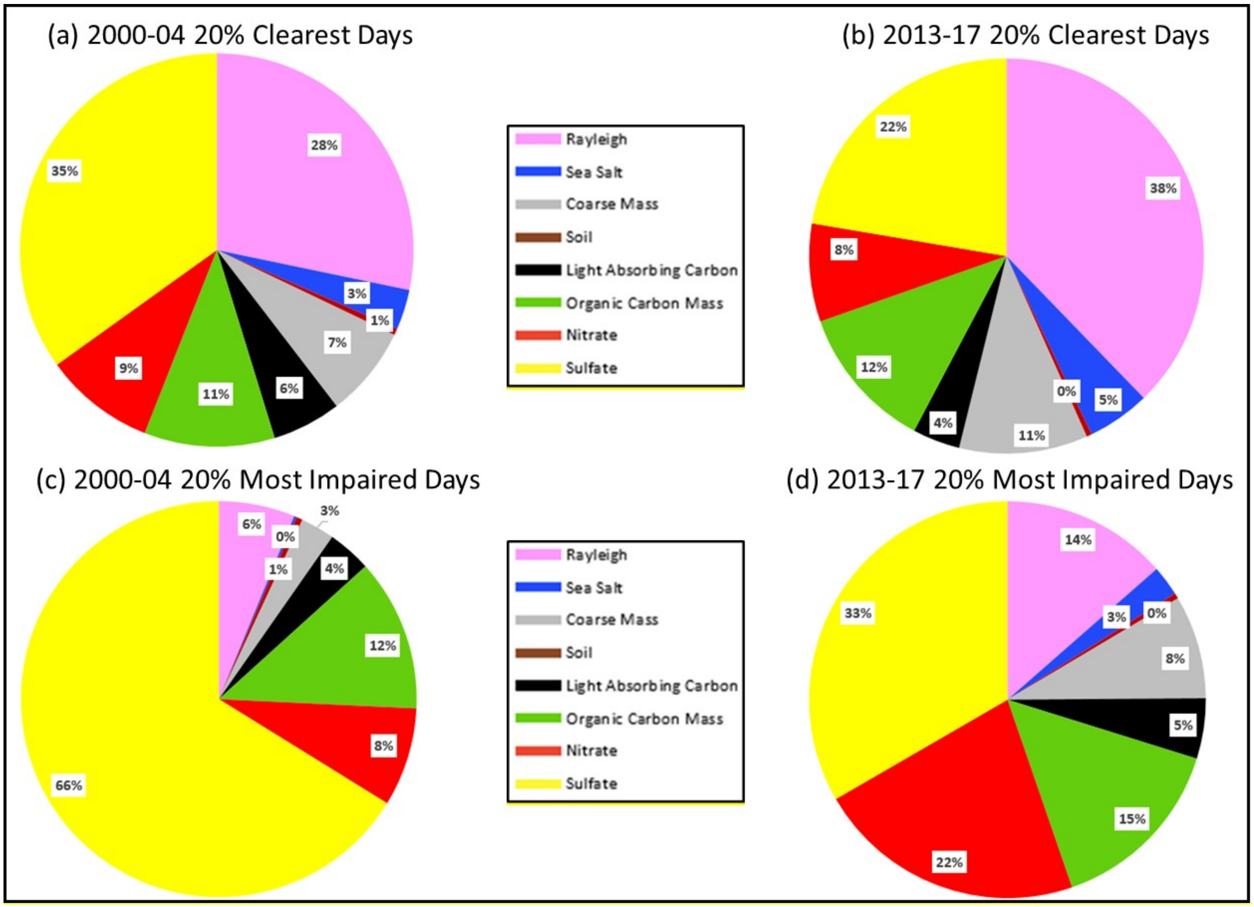
Class I Area (Receptor)	Rank	2012 Analysis (2007* emissions)	Emissions Contributions (μg/m^3)	2015 Analysis (2011 emissions)	Emissions Contributions (μg/m^3)
Acadia	1	Pennsylvania	0.18	Ohio	0.11
	2	Ohio	0.13	Pennsylvania	0.08
	3	Indiana	0.08	Indiana	0.06
	4	Michigan	0.07	Michigan	0.04
	5	Georgia	0.06	Illinois	0.04
		New Jersey	0.01	New Jersey	0.01
Brigantine	1	Pennsylvania	0.40	Pennsylvania	0.14

[66] MANE-VU Technical Support Committee, *MANE-VU Updated Q/d*C Contribution Assessment, April 6, 2016.* (Appendix G)

Class I Area (Receptor)	Rank	2012 Analysis (2007* emissions)	Emissions Contributions (µg/m³)	2015 Analysis (2011 emissions)	Emissions Contributions (µg/m³)
	2	Maryland	0.20	Ohio	0.12
	3	Ohio	0.19	Maryland	0.06
	4	Indiana	0.11	Indiana	0.05
	5	West Virginia	0.10	Kentucky	0.05
		New Jersey	0.07	New Jersey	0.01
Dolly Sods	1	Pennsylvania	0.50	Ohio	0.29
	2	Ohio	0.43	West Virginia	0.14
	3	West Virginia	0.32	Pennsylvania	0.13
	4	Indiana	0.15	Indiana	0.10
	5	North Carolina	0.06	Kentucky	0.07
		New Jersey	0.01	New Jersey	0.00
Great Gulf	1	Pennsylvania	0.15	Ohio	0.10
	2	Ohio	0.12	Pennsylvania	0.06
	3	Indiana	0.07	Indiana	0.05
	4	Michigan	0.06	Michigan	0.04
	5	New York	0.05	Illinois	0.03
		New Jersey	0.01	New Jersey	0.00
James River Face	1	New to analysis	N/A	Ohio	0.15
	2		N/A	Pennsylvania	0.10
	3		N/A	Indiana	0.09
	4		N/A	Kentucky	0.07
	5		N/A	West Virginia	0.07
		New Jersey	N/A	New Jersey	0.00
Lye Brook	1	Pennsylvania	0.29	Pennsylvania	0.13
	2	Ohio	0.16	Ohio	0.12
	3	New York	0.09	Indiana	0.05
	4	Indiana	0.08	New York	0.05
	5	Michigan/West Virginia	0.07	Michigan	0.04
		New Jersey	0.01	New Jersey	0.00
Moosehorn	1	Pennsylvania	0.16	Ohio	0.08
	2	Ohio	0.11	Indiana	0.06
	3	Indiana	0.08	Illinois	0.04
	4	Michigan	0.07	Michigan	0.03
	5	Texas/Missouri/Illinois/West Virginia/New York	0.03/0.04	Texas	0.03
		New Jersey	0.01	New Jersey	0.00
Shenandoah	1	Pennsylvania	0.42	Ohio	0.21
	2	Ohio	0.32	Pennsylvania	0.15
	3	West Virginia	0.20	Indiana	0.08
	4	Maryland	0.15	West Virginia	0.08
	5	Indiana	0.12	Virginia	0.07
		New Jersey	0.01	New Jersey	0.00

Analysis of visibility by species help policy decision makers determine what control strategies to consider for the second regional haze implementation planning period. Figure 6-5 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 Brigantine Wilderness Area for the 20 percent most impaired days with varying levels of increases or slight decrease for other species. The percent contribution from nitrates has, like other Class I areas examined for this report, increased, here from 8% to 22%.

Figure 6-5: Brigantine Wilderness Area Species Percent Contribution to Baseline (2000-04) and Current (2013-17) Haze Index Levels



6.5.2 CALPUFF

For the second implementation period SIPs, New Hampshire Department of Environmental Services (NHDES) in conjunction with Vermont Department of Environmental Conservation (VTDEC) carried out air pollution transport modeling[67] with the CALPUFF dispersion model, which was used to simulate sulfate and nitrate formation and transport in MANE-VU and nearby regions. The modeling effort focused on EGUs and large industrial and institutional sources in the eastern and central United States.

The 2016 modeling effort built on the 2002 point source contribution modeling performed by MANE-VU for the 2008 member states' Regional Haze SIP submittals for the first implementation period. CALPUFF simulates atmospheric transport, transformation, and dispersion through the treatment of air pollutant emissions from stacks or area sources as a series of discrete puffs. The 2016 modeling was performed for specific Class I Area receptor locations in and near the MANE-VU RPO (Dolly Sods, James River Face, Otter Creek, and Shenandoah). Two emissions years were analyzed: 2011 and 2015 with 3 years of meteorological data: 2002, 2011, and 2015.

CALPUFF was used as a screening tool because it produces accurate evaluation of atmospheric dispersion over greater spatial distances and it was EPA's preferred model for long-range transport for the purposes of assessing NAAQS and/or PSD increments, at the time of the analysis for regional haze. New Jersey and MANE-VU began the regional haze analysis prior to the removal of CALPUFF from EPA's list of approved models. With the 2017 revisions to the guideline on air quality models,[68] EPA established a screening approach for long-range transport assessments for NAAQS and PSD increments, which provides a technically credible and appropriately flexible way to use CALPUFF or other Lagrangian models as a screening technique. CALPUFF was used to screen and identify sources for further analysis in this evaluation, not to force controls. The same CALPUFF platform was used during the first and second regional haze planning period. The model performed well[69,70] during the two periods.

6.5.3 HYSPLIT Trajectory Analyses[71]

Trajectories can identify the frequency and general direction of air masses that are transported to a Class I area. However, trajectories don't distinguish emissions density nor what area along the 72-hour projection is most likely to contribute emissions that impact the Class I areas. Two types of maps were created for each Class I area. The first map showed the frequency (count) of hourly trajectory endpoints in each of the 25x25 mile grid squares on a map to help define transport patterns to a Class I area during the most impaired visibility days. The second set of maps showed individual trajectories for each day to show seasonal differences in transport patterns.

[67] 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources, April 4, 2017 (Appendix F)
[68] EPA Guideline to Air Quality Models. January 2017. (Appendix W to 40 CFR Part 51)
[69] Appendix D of the 2006 MANE-VU Contribution Assessment Report. Appendix D: Development of Parallel CALPUFF Dispersion Modeling Platforms for Sulfate Source Attribution Studies in the Northeast U.S (Appendix G)
[70] 2016 MANE-VU Source Contribution Modeling Report. April 4, 2017. (Appendix F)
[71] MANE-VU Regional Haze Metrics Trends and HYSPLIT Trajectory Analyses. May 2017. (Appendix F)

Chapter 7 Monitoring Strategy for the Brigantine Wilderness Area

7.1 Introduction

Visibility conditions representative of those within the Brigantine Wilderness Area are monitored by the federally operated Interagency Monitoring of Protected Visual Environments program, or also known as the IMPROVE monitoring program. In 1985, the IMPROVE monitoring program was established to measure visibility impairment in mandatory Class I areas throughout the United States. This monitoring is designed to aid the creation of Federal and State Implementation Plans for the protection of visibility in Class I areas stipulated in the 1977 amendments to the Clean Air Act. Data from the IMPROVE monitoring program have been collected since the early 1990s at the Brigantine Wilderness Area.

The IMPROVE monitoring sites are operated and maintained through a formal cooperative relationship between the USEPA, the U.S. National Park Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management, and U.S. Forest Service. In 1991, several additional organizations joined the effort. These organizations include the National Association of Clean Air Agencies (formerly State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials), Western States Air Resources Council, Mid-Atlantic Regional Air Management Association, and the Northeast States for Coordinated Air Use Management.

IMPROVE Program Objectives

Data collected at these sites are used by land managers, industry planners, scientists, public interest groups, and air quality regulators to understand and protect the visual air quality resource in Class I areas. Most importantly, the IMPROVE program scientifically documents the visual air quality of wilderness areas and national parks. Program objectives include:

- Establish current visibility and aerosol conditions in mandatory Class I areas,
- Identify chemical species and emission sources responsible for existing man-made visibility impairment,
- Document long-term trends for assessing progress towards the national visibility goals,
- Provide regional haze monitoring representing all visibility-protected Federal Class I areas where practical, as required by the USEPA's Regional Haze Rule.

7.2 Monitoring Information and Strategy for the Brigantine Wilderness Class I Area

A monitoring strategy is required for measuring, characterizing, and reporting regional haze visibility impairment that is representative of all mandatory Class I Areas within the State in accordance with 40 C.F.R. § 51.308(d)(4). The monitoring strategy for New Jersey relies upon the continued availability of the IMPROVE network.

The IMPROVE monitor for the Brigantine Wilderness Area (indicated as BRIG1 in the IMPROVE monitoring network database) is located outside the Edwin B. Forsythe National Wildlife Refuge Headquarters in Oceanville, New Jersey at an elevation of 5 meters, a latitude of 39.47˚ and a longitude of -74.45˚ and is shown in Fig. 8-1.

Figure 7-1: The IMPROVE Monitor at the Brigantine Wilderness Area

The monitoring station is located as close as practicable to, but not within, the wilderness area to limit and protect the ecological and biological resources of the wilderness area. The proximity of the monitor to the wilderness area ensures that the air monitoring data collected is representative of the air quality within the wilderness area.

Regional haze data for Brigantine Wilderness Area are collected by an IMPROVE monitor that is operated and maintained by the U.S. Fish and Wildlife Service. In 2007, DEP established at the same location a monitoring station that measures trace level SO_2 and PM2.5 using continuous and Federal reference methods for sample collection. A visibility camera was also installed in 2007. This station replaces the one previously located nearby at the Nacote Creek Research station in Galloway Township.

The DEP monitoring station provides information needed to ascertain attainment of any National Ambient Air Quality Standard including progress to the national visibility goals.

The monitoring at this site includes:

- Continuous Ozone,
- Fine Particulate–PM2.5 (measured by the Federal Reference Method),
- Fine Particulate–PM2.5 (measured by a continuous instrument),
- Continuous SO_2,

An On-Site Camera to observe visibility levels.[72]
The DEP will operate and maintain the monitoring site at the Brigantine Wilderness Area for the foreseeable future, although this is contingent upon continued federal and state funding. Any network changes will be subject to a joint annual review process by both the DEP and the USEPA.

Assuming continued availability of the IMPROVE monitoring data, New Jersey developed a monitoring strategy that is representative of the Class I area and addresses the transport of pollutants from other areas to the Class I area. This program meets the requirements of 40 C.F.R. §51.305. The measurement of ozone, SO_2 and fine particulate concentrations, along with the continued collection of data by the IMPROVE program, will provide data from this location that can be used to assess transported pollutants and their sources. Information that can be directly correlated with the on-site Camera will be collected and made available for analysis.

[72] The camera results from Brigantine is available on a real time basis at http://www.hazecam.net/brigantine.html

Chapter 8 Emissions Trends and Inventory

New Jersey is required by 40 CFR Section 51.308(f)(2)(iii) to document the technical basis including emissions information, on which the State is relying to determine the emission reduction measures that are necessary to make reasonable progress in each mandatory Class I Federal area it affects. Section 51.308 (g)(5) requires an assessment of any significant changes in anthropogenic emissions within and outside the State..

New Jersey is also required by 40 CFR Section 51.308 (g)(4) to analyze trends in emissions of visibility impairing pollutants. In addition, Section 51.308(f)(2)(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 New Jersey and the Eastern/Mid-Atlantic United States.

8.1 Analysis of Change in Emissions of Pollutants Contributing to Visibility Impairment

New Jersey summarized emissions of visibility impairing pollutants from all sources and activities within the state for the period from 2002 to 2014. The most recent year for which New Jersey has submitted emission estimates to fulfill the requirements of 40 CFR 51 Subpart A (also known as the Air Emissions Reporting Requirements, or AERR) is 2014. In this summary, New Jersey has provided estimates for nitrogen oxides (NO_x), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), 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).[73] NEI data categories include point sources, nonpoint sources, non-road mobile sources, and on-road 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 source 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 Electric Generating Units (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

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

NEI. Prior to 2011, EPA included vehicle refueling at gasoline service stations in the area sector and beginning with 2011 it was included in the onroad sector.

- NEI Nonroad mobile sources represent vehicles and equipment that are not designed to operate on roadways. Examples include aircraft, ships, railroad locomotives, construction equipment, recreational boats and vehicles, and lawn & 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 of 2011 NEI v2, EPA includes vehicle refueling at gasoline service stations in the onroad sector instead of the area or nonpoint sector.

Under the Air Emissions Reporting Requirements (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. New Jersey has provided a summary of NO_x and SO_2 emissions for AMPD sources for the years 2016 and 2017.

In addition to the New Jersey-specific data, 2002–2014 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 Mid-Atlantic and Northeast Visibility Union (MANE-VU) states, including Connecticut (CT), Delaware(DE), the District of Columbia (DC), Maine (ME), Maryland (MD), Massachusetts (MA), New Hampshire (NH), New Jersey (NJ), New York (NY), Pennsylvania (PA), Rhode Island (RI), and Vermont (VT). Similar summaries are also shown for the states listed in the MANE-VU Inter-RPO Ask[74] as having the potential to contribute to visibility impairment in MANE-VU Class I areas. These states include Alabama (AL), Florida (FL), Illinois (IL), Indiana (IN), Kentucky (KY), Louisiana (LA), Michigan (MI), Missouri (MO), North Carolina (NC), Ohio (OH), Tennessee (TN), Texas (TX), Virginia (VA), and West Virginia (WV). This group of states is referred to hereinafter as the "Non-MANE-VU Ask states".

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[74] Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action with MANE-VU toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028). (Appendix B)

8.1.1 Nitrogen Oxides (NO_x)

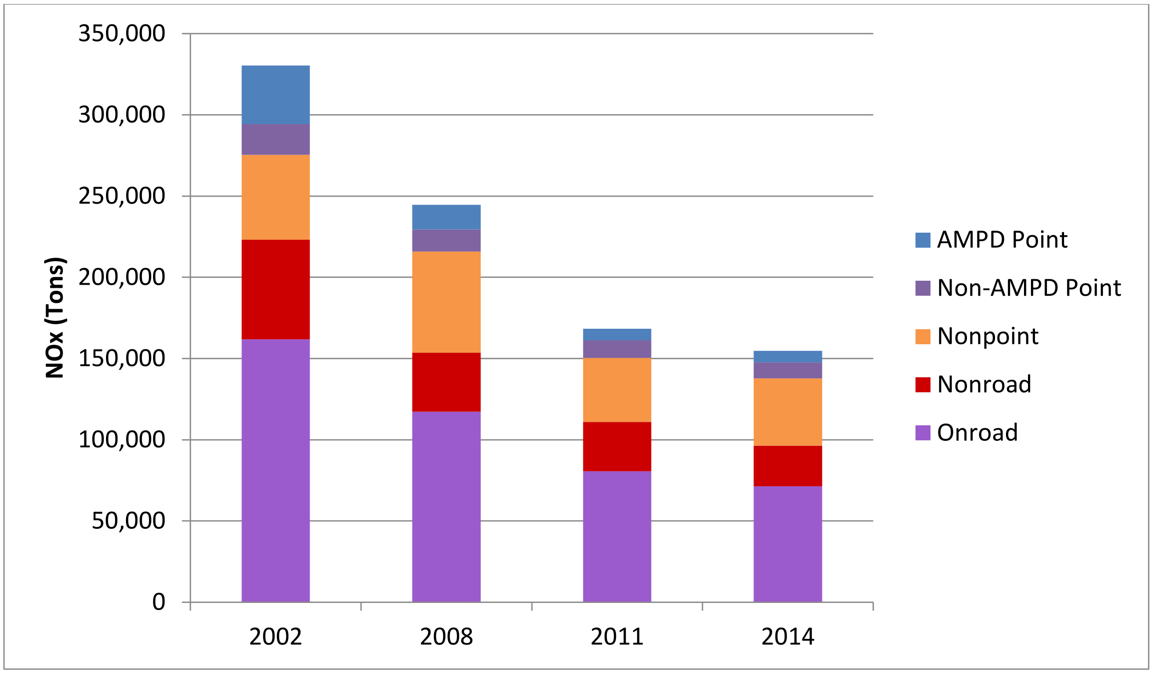
Table 9-1 shows a summary of NOx emissions from all NEI data categories–point, nonpoint, non-road, and onroad for the period from 2002 to 2014 in New Jersey. This summary is also shown graphically in Figure 9-1. Table 9-2 shows additional data years for New Jersey's point sources that report to EPA's AMPD.

Table 8-1: NO_x Emissions in New Jersey for all NEI Data Categories, 2002–2014 (Tons)

NEI Category	2002	2008	2011	2014	NO_x Reduction (2002–2014)	Percent NO_x Reduction 2002–2014
AMPD Point	36,163	15,147	7,040	7,096	-29,067	-80%
Non-AMPD Point*	18,787	13,591	10,882	9,778	-9,009	-48%
Nonpoint**	52,187	62,264	39,373	41,292	-10,895	-21%
Nonroad***	61,360	36,342	30,303	25,055	-36,305	-59%
Onroad****	161,872	117,208	80,699	71,433	-90,439	-56%
Total	**330,369**	**244,552**	**168,297**	**154,655**	**-175,714**	**-53%**

Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Figure 8-1: NO_x Emissions in New Jersey for all NEI Data Categories, 2002–2014



Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Table 8-2: NO_x Emissions from EPA AMPD Sources in New Jersey, 2016–2017 (Tons)

2016	2017
4,382	3,443

NO_x emissions have shown a steady decline in New Jersey over the period from 2002 to 2014, particularly in the point, nonroad and onroad mobile sectors. Reductions in point emissions are due primarily to the NO_x budget program for power plants, power plant and refinery consent decrees and New Jersey's High Electric Demand Day (HEDD) and multi-pollutant power plant rules, as well as the Cross-State Air Pollution Rule (CSAPR) and state of the art controls on EGU units in New Jersey including peaking units. Sources of NO_x emissions in New Jersey that report to EPA's AMPD programs showed additional significant declines in emissions from 2014 to 2017 due to New Jersey's HEDD rule Phase II and EGU standards that became effective in 2014 and 2015, showing a significant decrease in EGU emissions after these dates. In addition, point sources in New Jersey are declining more than shown in this evaluation because the point source sector in this evaluation includes airports which are not declining in EPA's inventories. Reductions in nonroad emissions are due to new engine standards for nonroad vehicles and equipment because 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[75], Control of Emissions from Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters Per Cylinder[76], and Control of Emissions from Nonroad Spark-Ignition Engines and Equipment[77]. 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[78]. Federal requirements for onroad mobile sources and fuels are being strengthened even further with the Tier 3 requirements[79]. More information on programs to control emissions from mobile sources can be found on EPA's Transportation, Air Pollution, and Climate Change website[80]. 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.

Starting in 2008, marine vessels and underway rail emissions were included in NEI nonpoint emissions instead of nonroad emissions. This is the main reason for the increase in nonpoint NO_x emissions in 2008 when compared to the 2002 levels. In future years these nonroad sources are showing decreases due to Federal rules for new engine standards for nonroad vehicles and equipment. Most nonpoint area source NOx emissions, approximately 75 percent, are from residential and commercial natural gas fuel combustion for heating purposes. Additional area source NOx emissions are from distillate fuel combustion, residential wood burning, prescribed burning and forest fires. Increases in emissions from 2011 to 2014 are due to increases in natural gas consumption and EPA methodology changes for fuel combustion emissions from boilers and engines, and for wildfires and prescribed burning.

Tables 9-3 and 9-4 and Figures 9-2 and 9-3 show a steady decline in NO_x emissions from 2002 to 2014 for almost all the MANE-VU states and the Non-MANE-VU Ask states. Much of this decline in NO_x emissions 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).

[75] https://www.gpo.gov/fdsys/pkg/FR-2004-06-29/pdf/04-11293.pdf
[76] https://www.gpo.gov/fdsys/pkg/FR-2008-06-30/pdf/R8-7999.pdf
[77] https://www.gpo.gov/fdsys/pkg/FR-2008-10-08/pdf/E8-21093.pdf
[78] 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)
[79] Tier 3 Motor Vehicle Emission and Fuel Standards, Final Rule (https://www.gpo.gov/fdsys/pkg/FR-2014-04-28/pdf/2014-06954.pdf)
[80] https://www.epa.gov/air-pollution-transportation

Table 8-3: Total NO_x Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	NO_x Reduction (2002–2014)	Percent NO_x Reduction (2002–2014)
CT	115,012	93,080	72,828	63,003	-52,009	-45%
DE	57,345	42,790	29,436	27,684	-29,661	-52%
DC	15,169	13,189	9,403	8,566	-6,603	-43%
ME	85,995	71,606	59,785	52,346	-33,649	-39%
MD	291,299	205,239	165,185	138,496	-152,803	-52%
MA	287,077	168,599	136,892	127,304	-159,773	-56%
NH	69,036	66,595	47,947	49,880	-19,156	-28%
NJ	330,369	244,552	168,297	154,655	-175,714	-53%
NY	537,513	442,093	387,262	330,782	-206,731	-38%
PA	718,261	616,320	561,928	492,755	-225,506	-31%
RI	29,917	18,963	22,489	24,716	-5,201	-17%
VT	28,764	20,903	19,635	15,697	-13,067	-45%
Total	**2,565,756**	**2,003,930**	**1,681,086**	**1,485,883**	**-1,079,873**	**-42%**

Figure 8-2: Total NO_x Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014

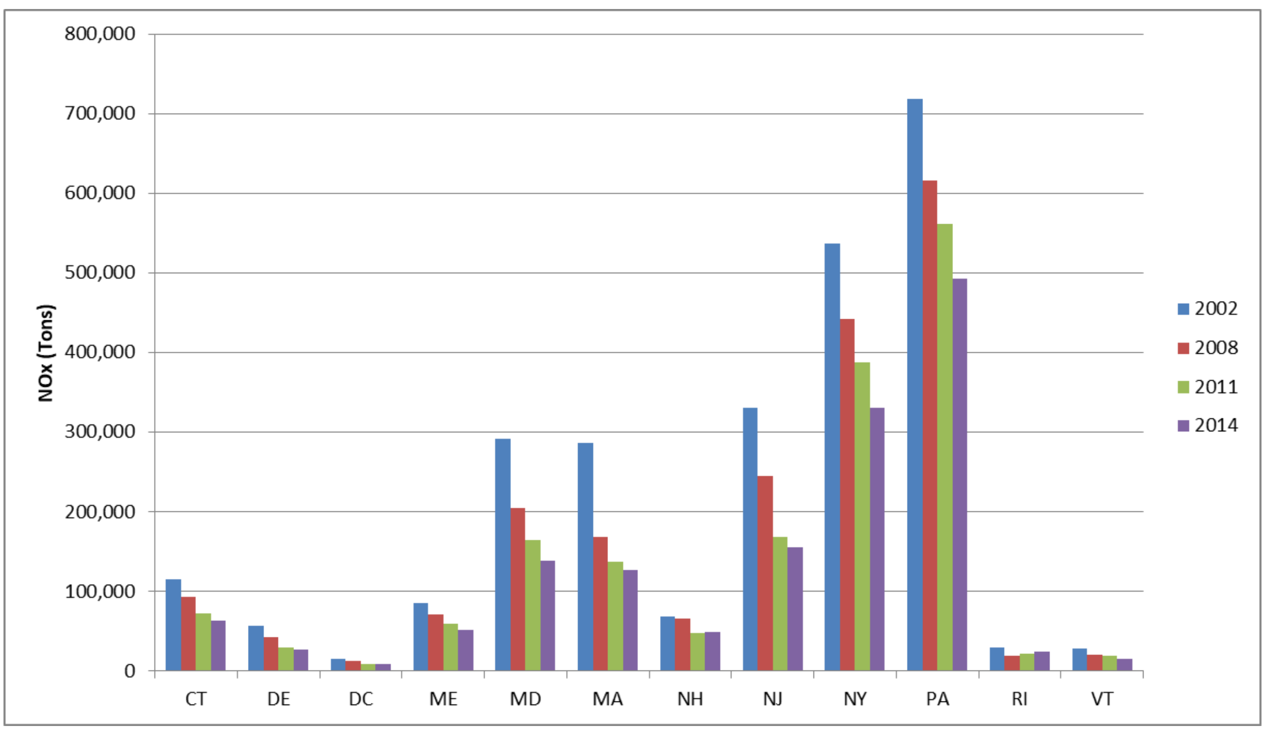


Table 8-4: Total NO_x Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	NO_x Reduction (2002–2014)	Percent NO_x Reduction (2002–2014)
AL	494,699	369,943	345,285	314,187	-180,512	-36%
FL	1,092,044	853,858	609,704	558,725	-533,319	-49%
IL	847,488	638,926	507,075	453,108	-394,380	-46%
IN	723,294	545,953	443,116	395,719	-327,575	-45%
KY	484,708	378,216	324,803	281,468	-203,240	-42%
LA	723,164	496,880	519,018	361,543	-361,621	-50%
MI	684,627	628,254	444,088	382,946	-301,681	-44%
MO	542,019	425,645	365,593	357,946	-184,073	-34%
NC	596,536	434,596	366,131	305,674	-290,862	-49%
OH	948,927	740,029	583,802	429,038	-519,889	-55%
TN	557,649	416,702	320,085	265,631	-292,018	-52%
TX	1,894,041	1,515,796	1,268,310	1,225,152	-668,889	-35%
VA	511,048	373,229	310,821	273,733	-237,315	-46%
WV	381,774	213,495	171,715	184,782	-196,992	-52%
Total	**10,482,018**	**8,031,522**	**6,579,546**	**5,789,652**	**-4,692,366**	**-45%**

Figure 8-3: Total NO_x Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014

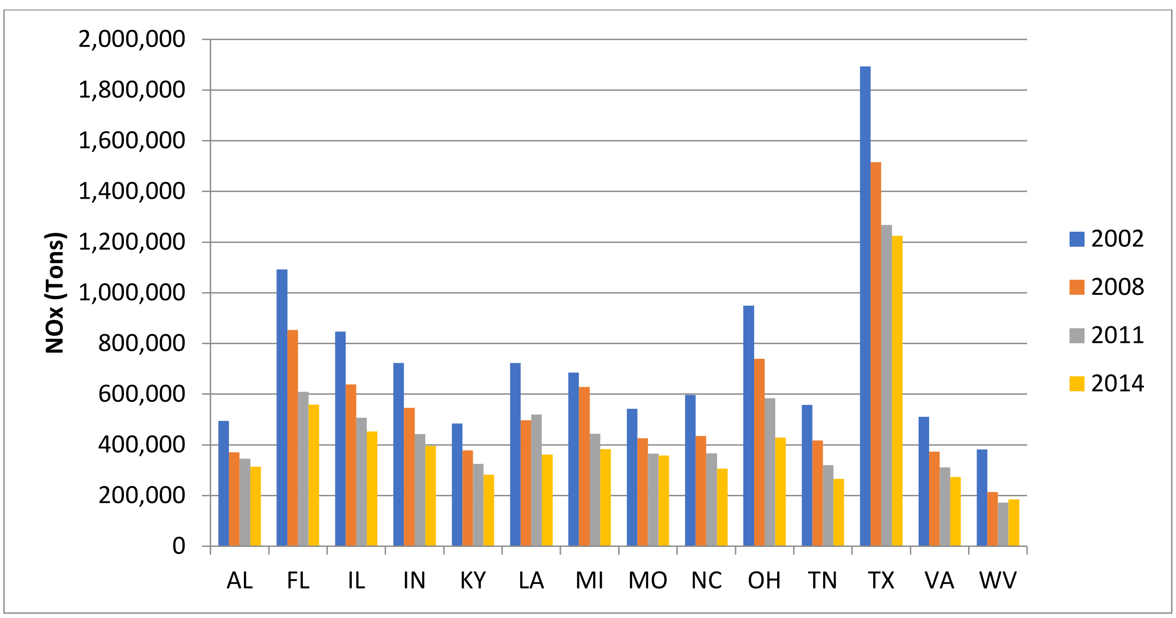


Table 9-5 and Figure 9-4 show AMPD NO_x data trends for the MANE-VU states from 2002 to 2017, and Table 9-6 and Figure 9-5 show AMPD NO_x data trends for the Non-MANE-VU Ask states from 2002 to 2017. Tables 9-5 and 9-6 show significant decreases in NO_x emissions for the AMPD sources between 2002 and 2017 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 8-5: NO_x Emissions from AMPD Sources in the MANE-VU States, 2002–2017 (Tons)

State	2002	2008	2011	2014	2016	2017	NOx Reduction 2002-2017	Percent NOx Reduction 2002-2017	NOx Reduction 2011-2017	Percent NOx Reduction 2011-2017
CT	6,329	4,133	1,667	1,955	1,058	1,052	-5,277	-83%	-615	-37%
DC	798	291	320	108	68	67	-731	-92%	-253	-79%
DE	12,292	11,545	3,748	1,791	1,308	889	-11,403	-93%	-2,859	-76%
MA	32,940	10,002	5,113	4,107	2,883	2,372	-30,568	-93%	-2,741	-54%
MD	76,519	40,327	22,536	15,053	9,395	6,112	-70,407	-92%	-16,424	-73%
ME	1,154	680	575	539	288	263	-891	-77%	-312	-54%
NH	6,873	4,650	3,951	2,753	1,326	1,070	-5,803	-84%	-2,881	-73%
NJ	36,163	15,147	7,040	7,096	4,382	3,443	-32,720	-90%	-3,597	-51%
NY	85,989	47,556	31,075	22,214	16,222	11,253	-74,736	-87%	-19,822	-64%
PA	218,712	187,771	149,620	125,612	79,450	37,148	-181,564	-83%	-112,473	-75%
RI	640	462	630	518	448	470	-170	-27%	-161	-25%
VT	230	296	117	161	167	139	-91	-40%	22	19%
Total	**478,640**	**322,858**	**226,393**	**181,908**	**116,995**	**64,278**	**-414,363**	**-87%**	**-162,115**	**-72%**

Figure 8-4: NO_x Emissions from AMPD Sources in the MANE-VU States, 2016–2017

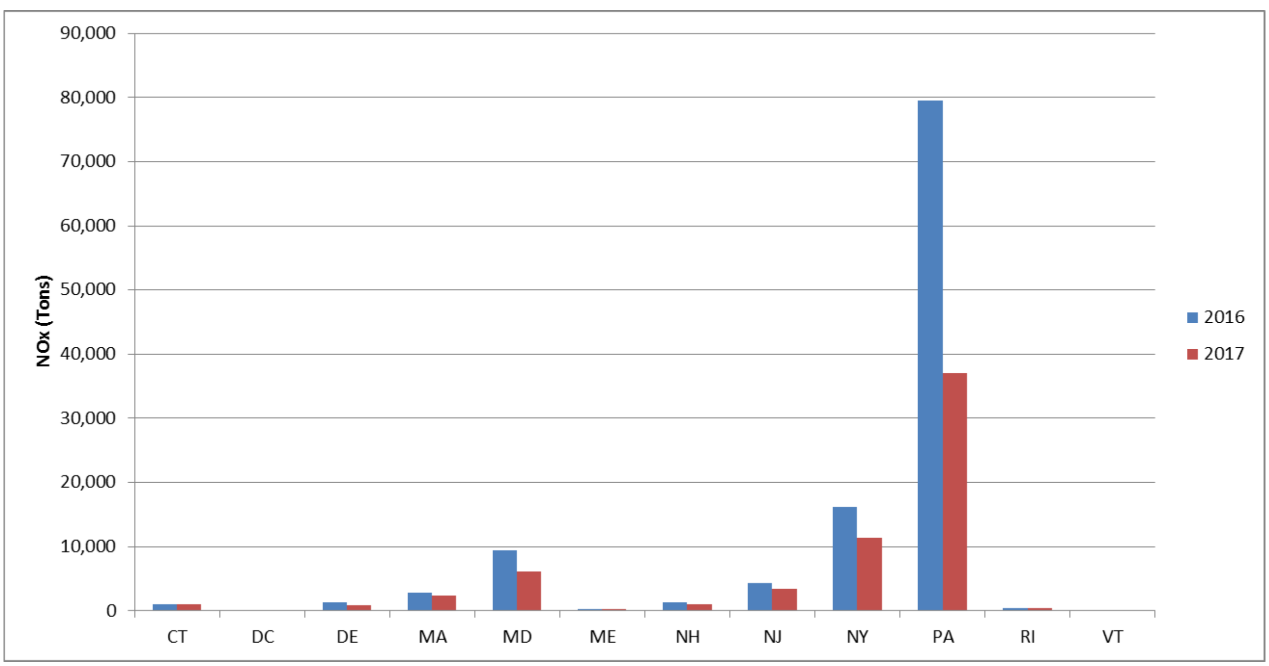
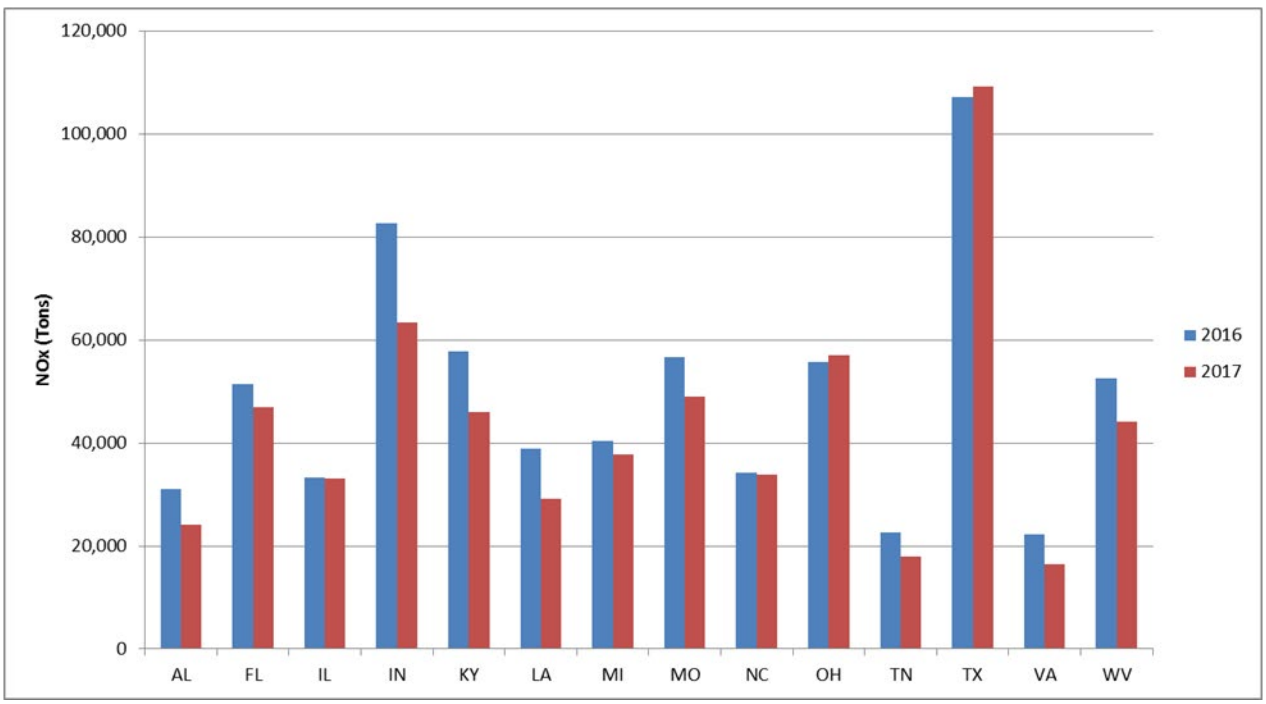


Table 8-6: NO_x Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2002–2017 (Tons)

State	2002	2008	2011	2014	2016	2017	NOx Reduction 2002-2017	Percent NOx Reduction 2002-2017	NOx Reduction 2011-2017	Percent NOx Reduction 2011-2017
AL	161,559	114,587	64,579	51,850	31,127	24,085	-137,474	-85%	-40,494	-63%
FL	258,378	161,297	58,854	62,984	51,442	46,907	-211,471	-82%	-11,947	-20%
IL	174,247	124,787	73,892	49,758	33,298	33,066	-141,181	-81%	-40,825	-55%
IN	281,146	198,948	120,941	109,708	82,615	63,421	-217,725	-77%	-57,520	-48%
KY	198,599	157,995	92,180	86,980	57,764	46,053	-152,546	-77%	-46,127	-50%
LA	80,365	49,875	48,024	37,264	38,836	29,249	-51,116	-64%	-18,775	-39%
MI	132,633	108,117	72,286	56,833	40,366	37,739	-94,894	-72%	-34,548	-48%
MO	139,799	88,742	63,419	74,252	56,692	49,692	-90,107	-64%	-13,727	-22%
NC	145,706	61,669	48,889	44,288	34,287	33,761	-111,944	-77%	-15,127	-31%
OH	370,497	237,585	103,591	89,346	55,756	57,039	-313,458	-85%	-46,552	-45%
TN	158,853	89,673	30,819	22,382	22,610	18,201	-140,652	-89%	-12,618	-41%
TX	253,861	159,668	148,073	122,540	107,158	109,914	-143,948	-57%	-38,159	-26%
VA	78,868	50,887	37,651	27,648	22,280	16,545	-62,322	-79%	-21,106	-56%
WV	225,834	101,046	58,223	72,970	52,584	44,079	-181,755	-80%	-14,144	-24%
Total	**2,660,345**	**1,704,876**	**1,021,422**	**908,805**	**686,815**	**609,752**	**-2,050,593**	**-77%**	**-411,670**	**-40%**

Figure 8-5: NO_x Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2016–2017



8.1.2 Particulate Matter Less Than 10 Microns (PM10)

Table 9 -7 shows a summary of PM10 emissions from all NEI data categories–point, nonpoint, non-road, and onroad for the period from 2002 to 2014 in New Jersey. This summary is also shown graphically in Figure 9-6.

In New Jersey, PM10 emissions steadily decreased in the point, nonpoint, and nonroad categories for the period from 2002 to 2014. 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 New Jersey have been working on making these categories more accurate since the 2002 inventory and it is still an ongoing process.

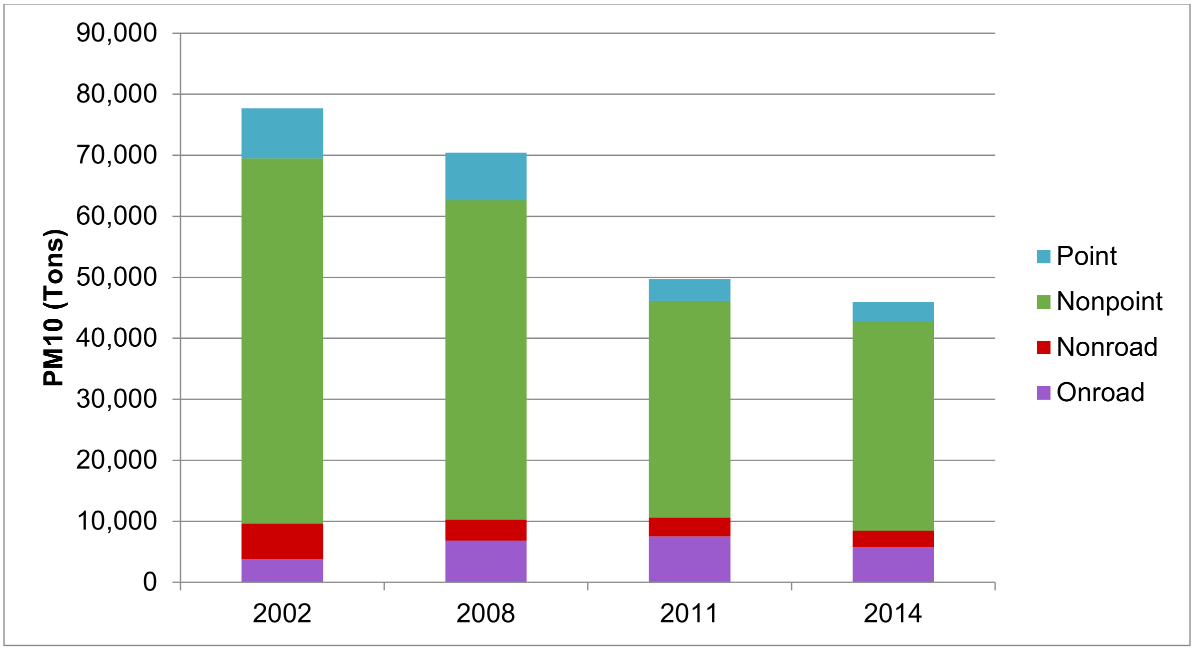
When looking at the following tables and charts, it should be noted that non-combustion PM10 emissions (e.g. paved & unpaved road dust, agricultural dust, etc.) are unadjusted, that is, they represent the raw mass emissions before adjustment with transport fractions. Emission estimates using EPA's calculation 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 8-7: PM10 Emissions in New Jersey for all NEI Data Categories, 2002–2014 (Tons)

NEI Category	2002	2008	2011	2014	PM10 Reduction (2002–2014)	Percent PM10 Reduction (2002–2014)
Point*	8,261	7,834	3,601	3,100	-5,161	-62%
Nonpoint**	59,836	52,319	35,530	34,392	-25,444	-43%
Nonroad***	5,821	3,463	3,072	2,713	-3,108	-53%
Onroad****	3,805	6,814	7,540	5,741	1,936	51%
Total	**77,723**	**70,431**	**49,742**	**45,946**	**-31,777**	**-41%**

Notes:
1. Nonpoint includes unadjusted fugitive dust.
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Figure 8-6: PM10 Emissions in New Jersey for all NEI Data Categories, 2002–2014



Notes:
1. Nonpoint includes unadjusted fugitive dust.
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

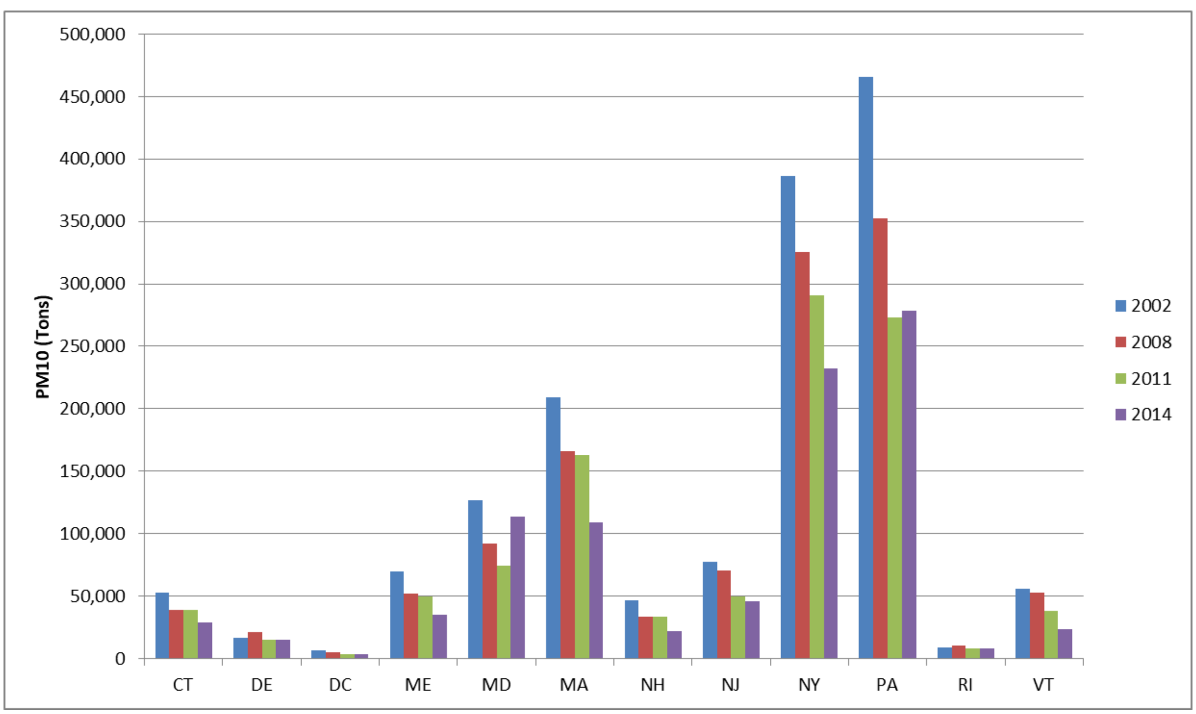
Table 9-8 and Figure 9-7 show total PM10 emissions from all NEI data categories in the MANE-VU states. Similarly, Table 9-9 and Figure 9-8 show total PM10 emissions from all data categories in the Non-MANE-VU Ask states. PM10 emissions in the MANE-VU and Non-MANE-VU Ask states show no pattern over the 2002 to 2014 period. Some of the large declines in PM10 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 8-8: Total PM10 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	PM10 Reduction (2002–2014)	Percent PM10 Reduction (2002–2014)
CT	53,267	39,048	39,097	28,842	-24,425	-46%
DE	17,165	21,544	15,071	14,896	-2,269	-13%
DC	6,839	5,211	3,410	3,865	-2,974	-43%
ME	69,543	52,311	49,526	35,606	-33,937	-49%
MD	126,986	92,156	74,522	114,097	-12,889	-10%
MA	209,076	165,801	162,952	109,218	-99,858	-48%
NH	46,551	33,814	33,379	21,985	-24,566	-53%
NJ	77,723	70,431	49,742	45,946	-31,777	-41%
NY	386,381	325,041	290,566	232,441	-153,940	-40%
PA	465,435	352,392	273,067	278,725	-186,710	-40%
RI	9,103	10,267	8,387	8,400	-703	-8%
VT	55,937	53,130	38,373	23,422	-32,515	-58%
Total	**1,524,005**	**1,221,145**	**1,038,093**	**917,443**	**-606,562**	**-40%**

Note: Nonpoint includes unadjusted fugitive dust.

Figure 8-7: Total PM10 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014



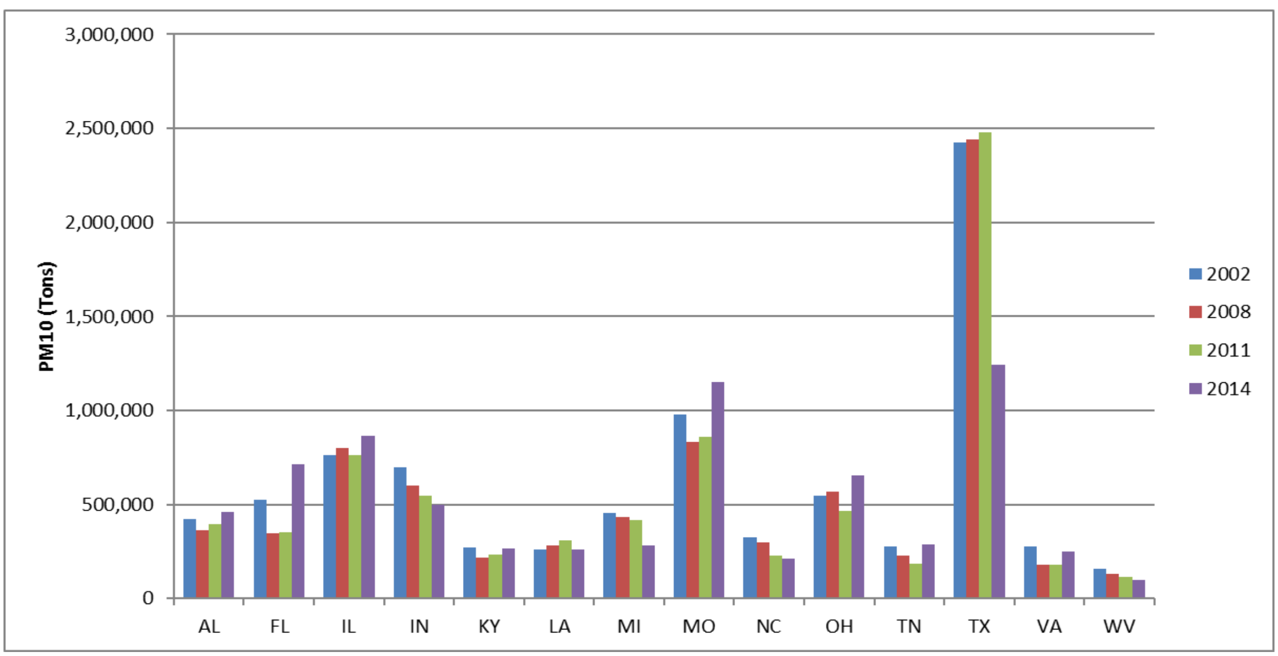
Note: Nonpoint includes unadjusted fugitive dust.

Table 8-9: Total PM10 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	PM10 Reduction (2002–2014)	Percent PM10 Reduction (2002–2014)
AL	425,221	363,195	393,530	460,695	+35,474	+8%
FL	527,753	348,091	351,483	713,703	+185,950	+35%
IL	764,273	797,788	762,584	863,923	+99,650	+13%
IN	696,591	602,105	544,131	495,961	-200,630	-29%
KY	270,051	219,956	232,735	265,370	-4,681	-2%
LA	259,793	281,998	307,928	263,360	+3,567	+1%
MI	455,348	431,311	418,847	282,519	-172,829	-38%
MO	977,691	831,795	861,980	1,153,343	+175,652	+18%
NC	327,059	300,866	230,453	213,800	-113,259	-35%
OH	544,239	568,210	467,023	655,947	+111,708	+20%
TN	278,733	227,616	182,467	286,276	+7,543	+3%
TX	2,424,752	2,440,498	2,478,052	1,245,310	-1,179,442	-49%
VA	277,684	179,593	179,646	249,306	-28,378	-10%
WV	156,682	133,479	115,661	99,561	-57,121	-36%
Total	**8,385,869**	**7,726,500**	**7,526,521**	**7,249,074**	**-1,136,794**	**-14%**

Note: Nonpoint includes unadjusted fugitive dust.

Figure 8-8: Total PM10 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014



Note: Nonpoint includes unadjusted fugitive dust.

8.1.3 Particulate Matter Less Than 2.5 Microns (PM2.5)

Table 9-10 shows a summary of PM2.5 emissions from all NEI data categories for the period from 2002 to 2014 in New Jersey. This summary is also shown graphically in Figure 9-9. Point source increases from 2002 to 2008 are due to reporting, grouping and methodology changes. EPA began requiring PM2.5 emission reporting in 2002. PM2.5 emissions were not reported to New Jersey's emission statements program in 2002, therefore, they were estimated. Reporting to New Jersey's emission statement program began in 2003. Also, as discussed previously, starting in 2008, air and rail yard emissions were included in point sources instead of in nonroad. Point source emissions decreased between 2008 and 2014 due to New Jersey power plant and refinery consent decrees and regulations. PM2.5 emissions steadily decreased in the nonroad category for the period from 2002 to 2014. The decrease in PM2.5 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 residential wood burning and fugitive dust categories, which have varied significantly. EPA and New Jersey have been working on making these categories more accurate since the 2002 inventory and it is still an ongoing process.

As discussed in the PM10 section, when looking at the following tables and charts, it should be noted that non-combustion PM2.5 emissions (e.g. paved & 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.

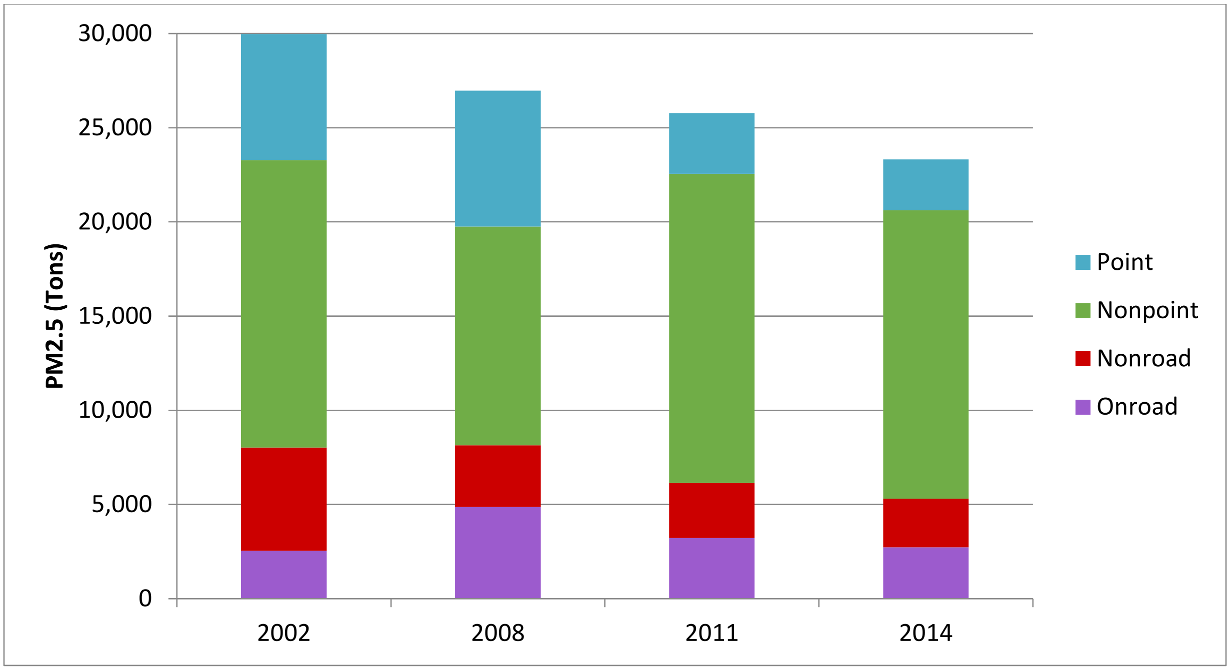
New Jersey's 2008 NEI inventory reflects adjusted fugitive dust emissions, while the other years are unadjusted.

Table 8-10: PM2.5 Emissions in New Jersey for all NEI Data Categories, 2002–2014 (Tons)

NEI Category	2002	2008	2011	2014	PM2.5 Reduction (2002–2014)	Percent PM2.5 Reduction (2002–2014)
Point*	6,683	7,212	3,229	2,695	-3,988	-60%
Nonpoint**	15,272	11,607	16,419	15,196	-77	-1%
Nonroad***	5,483	3,284	2,917	2,571	-2,912	-53%
Onroad****	2,537	4,863	3,220	2,735	+198	+8%
Total	**29,975**	**26,966**	**25,785**	**23,197**	**-6,779**	**-23%**

Notes:
Nonpoint includes unadjusted fugitive dust for all years except 2008 which is adjusted.
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Figure 8-9: PM2.5 Emissions in New Jersey for all NEI data Categories, 2002–2014



<u>Notes:</u>
Non-point includes unadjusted fugitive dust for all years except 2008 which is adjusted.
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

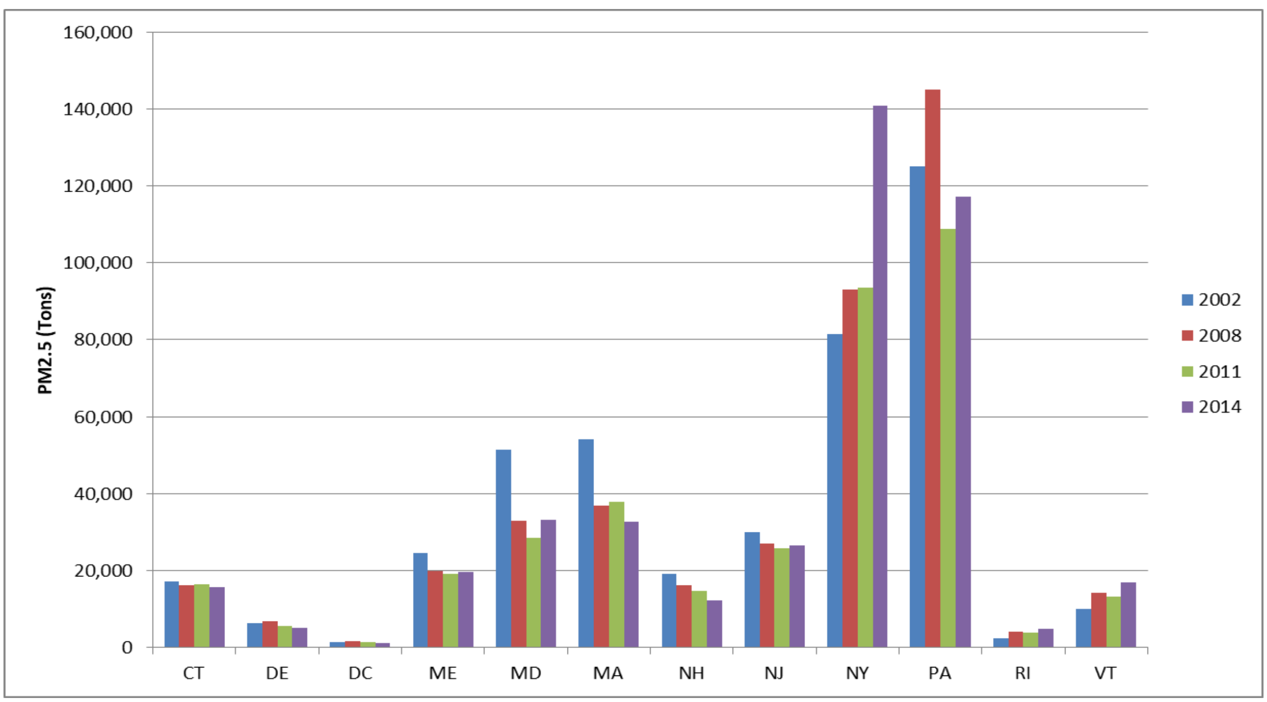
Table 9-11 and Figure 9-10 show total PM2.5 emissions from all NEI data categories in the MANE-VU states. Similarly, Table 9-12 and Figure 9-11 show total PM2.5 emissions from all data categories in the Non-MANE-VU Ask states. PM2.5 emissions in the MANE-VU and Non-MANE-VU Ask states are varied from 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 8-11: Total PM2.5 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	PM2.5 Reduction (2002–2014)	Percent PM2.5 Reduction (2002–2014)
CT	17,183	16,190	16,545	13,088	-4,095	-24%
DE	6,288	6,838	5,549	4,174	-2,114	-34%
DC	1,343	1,694	1,361	1,263	-80	-6%
ME	24,515	19,930	19,045	16,270	-8,245	-34%
MD	51,465	32,947	28,499	29,848	-21,617	-42%
MA	54,140	36,965	37,770	32,192	-21,948	-40%
NH	19,207	16,257	14,710	11,358	-7,849	-41%
NJ	29,976	26,966	25,785	**23,197**	-6,779	-23%
NY	81,427	93,027	93,611	81,699	+272	+0%
PA	124,964	145,016	108,748	108,665	-16,299	-13%
RI	2,433	4,163	3,949	4,310	+1,877	+77%
VT	10,167	14,280	13,351	11,593	+1,426	+14%
Total	**423,107**	**414,275**	**368,924**	**337,657**	**-85,450**	**-20%**

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

Figure 8-10: Total PM2.5 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014



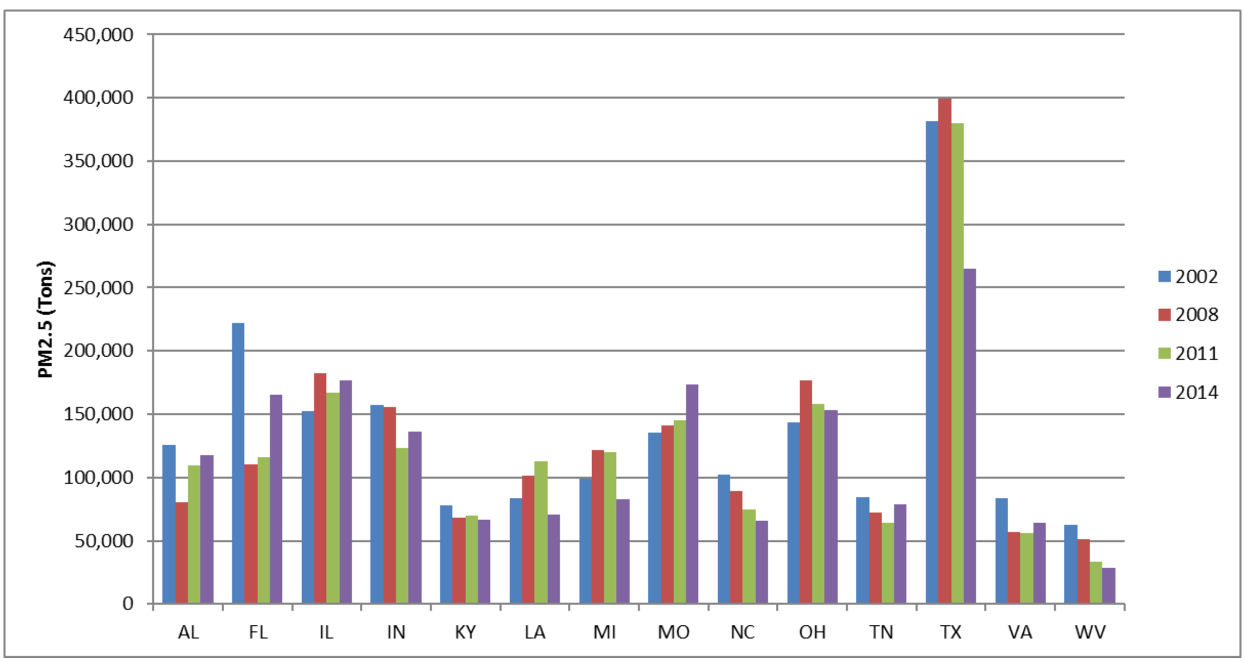
Note: Includes unadjusted fugitive dust, except NJ 2008 which is adjusted.

Table 8-12: Total PM2.5 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	PM2.5 Reduction (2002–2014)	Percent PM2.5 Reduction (2002–2014)
AL	125,441	80,622	109,345	117,272	-8,169	-6%
FL	222,204	109,965	116,396	165,534	-56,670	-25%
IL	152,316	182,344	166,699	176,836	+24,520	+16%
IN	157,078	155,982	123,193	136,613	-20,465	-13%
KY	77,952	68,484	69,665	66,812	-11,140	-14%
LA	83,989	101,593	112,415	70,884	-13,105	-16%
MI	98,713	121,710	120,121	82,780	-15,933	-16%
MO	135,832	140,955	145,230	173,260	+37,428	+27%
NC	101,965	89,613	74,844	66,023	-35,942	-35%
OH	143,671	176,599	157,995	153,291	+9,620	+7%
TN	84,176	72,333	63,949	79,020	-5,156	-6%
TX	381,212	399,176	379,886	264,976	-116,236	-30%
VA	83,567	57,083	56,157	64,340	-19,227	-23%
WV	62,269	50,936	33,712	28,929	-33,340	-53%
Total	1,910,383	1,807,395	1,729,607	1,646,569	-263,813	-14%

Note: Includes unadjusted fugitive dust

Figure 8-11: Total PM2.5 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014



Note: Includes unadjusted fugitive dust

8.1.3.1 Woodsmoke Particulate Matter (PM)

Source apportionment documented in Appendix B of the original MANE-VU Contribution Assessment 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[81] 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 emissions associated with fires were mainly from residential wood combustion.

The residential wood combustion component of the inventory, based on the MANE-VU 2011 Gamma emissions inventory (described in Section 9-2), is shown in Table 9-13 and Table 9-14. The data shows that residential wood combustion represents approximately 33% of the annual average PM2.5 emissions in the MANE-VU region. In New Jersey, residential wood combustion is estimated to be 27% of the 2011 inventory.

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

Table 8-13: MANE-VU 2011 Gamma Residential Wood Combustion Emissions (Tons)

State	CO	NH_3	NO_x	PM10-PRI	PM2.5-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**	**4,921**	**8,945**	**95,561**	**95,519**	**2,169**	**118,471**
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%**

[81] https://otcair.org/MANEVU/Upload/Publication/Reports/SmokeMgmt_TSD_090106.pdf

Table 8-14: MANE-VU 2011 Gamma State Level PM2.5 Residential Wood Emissions (Tons)

State	Res. Wood PM2.5	Total PM2.5	% of Total PM2.5 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	13%
MA	10,300	25,755	40%
NH	6,493	11,784	55%
NJ	**6,295**	**23,788**	**27%**
NY	22,939	69,185	33%
PA	23,634	88,044	27%
RI	1,451	3,488	42%
VT	7,140	10,522	68%

8.1.4 Sulfur Dioxide (SO_2)

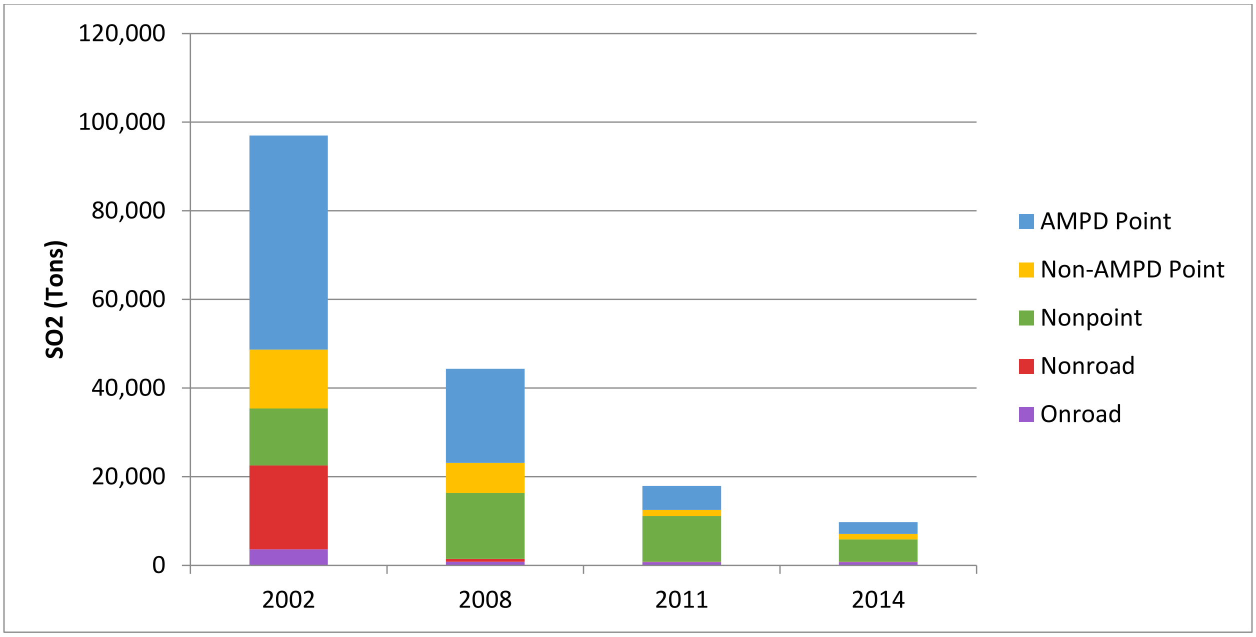
Table 9-15 shows SO_2 emissions from all NEI data categories for the period 2002 to 2014 in New Jersey. This data is also shown graphically in Figure 9-12. Table 9-16 shows additional data years for New Jersey's point sources that report to EPA's AMPD.

Table 8-15: SO_2 Emissions in New Jersey for all NEI Data Categories, 2002–2014 (Tons)

NEI Category	2002	2008	2011	2014	SO_2 Reduction (2002–2014)	Percent SO_2 Reduction (2002–2014)
AMPD Point	48,269	21,204	5,414	2,655	-45,615	-95%
Non-AMPD Point*	13,276	6,829	1,323	1,282	-11,993	-90%
Nonpoint**	12,883	14,884	10,342	5,051	-7,832	-61%
Nonroad***	18,882	596	88	68	-18,814	-100%
Onroad****	3,658	857	740	725	-2,933	-80%
Total	**96,967**	**44,370**	**17,907**	**9,781**	**-87,186**	**-90%**

Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Figure 8-12: SO_2 Emissions in New Jersey for all NEI Data Categories, 2002–2014



Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Table 8-16: SO_2 Emissions from EPA AMPD Sources in New Jersey, 2016–2017 (Tons)

2016	2017
1,725	1,722

SO_2 emissions have shown a steady significant decline in New Jersey over the period 2002 to 2014, particularly in the point, nonroad and onroad mobile sectors. Reductions in point emissions are primarily due to the acid rain program, New Jersey power plant consent decrees and regulations and Federal and State low sulfur fuel regulations. Sources of SO_2 emissions in New Jersey that report to EPA's AMPD programs continued to show declines from 2014 to 2017, as shown in Tables 9-15 and 9-16, due to New Jersey's HEDD rule Phase II and EGU standards that became effective in 2014 and 2015 and New Jersey's low sulfur fuel rule which became effective in 2014 and 2016.

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. Decreases in nonpoint are mostly due to Federal rules that reduced sulfur levels in nonroad mobile diesel fuel and due to a decline in the use of distillate oil for heating.

Table 9-17 and Figure 9-13 show total SO_2 emissions from all NEI data categories in the MANE-VU states for 2002 to 2014. A steady decrease in SO_2 emissions can be seen for each MANE-

VU state over this period. In addition to the Federal rules discussed above, additional strategies that have reduced SO2 are 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[82]. Since some components of the MANE-VU low sulfur fuel strategy have milestones of 2014, 2016, and 2018, and as MANE-VU states continue to adopt rules to implement the strategy, SO_2 emissions reductions are expected to continue well beyond the 2002 to 2014 timeframe shown in Table 9-15 and Figure 9-13. 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 8-17: Total SO_2 Emissions in the MANE-VU States for all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	SO_2 Reduction (2002–2014)	Percent SO_2 Reduction (2002–2014)
CT	38,102	19,443	15,334	12,445	-25,657	-67%
DE	86,999	44,282	13,883	4,330	-82,669	-95%
DC	4,051	1,273	1,829	252	-3,799	-94%
ME	33,585	23,362	15,528	11,242	-22,343	-66%
MD	324,015	264,487	71,751	48,490	-275,525	-85%
MA	156,778	76,256	51,338	18,890	-137,888	-88%
NH	55,246	45,666	31,257	8,554	-46,692	-84%
NJ	96,967	44,370	17,907	9,781	-87,186	-90%
NY	326,448	193,703	114,940	52,857	-273,591	-84%
PA	1,015,732	987,671	398,497	329,804	-685,928	-67%
RI	8,158	4,345	4,689	3,406	-4,752	-58%
VT	4,988	4,044	3,445	1,503	-3,485	-70%
Total	**2,151,071**	**1,708,903**	**740,397**	**501,552**	**-1,649,519**	**-77%**

[82] Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU Toward Assuring Reasonable Progress (http://otcair.org/MANEVU/Upload/Publication/Formal%20Actions/Statement%20on%20Controls%20in%20MV_072007.pdf)

Figure 8-13: Total SO_2 Emissions in the MANE-VU States for all NEI Data Categories, 2002–2014

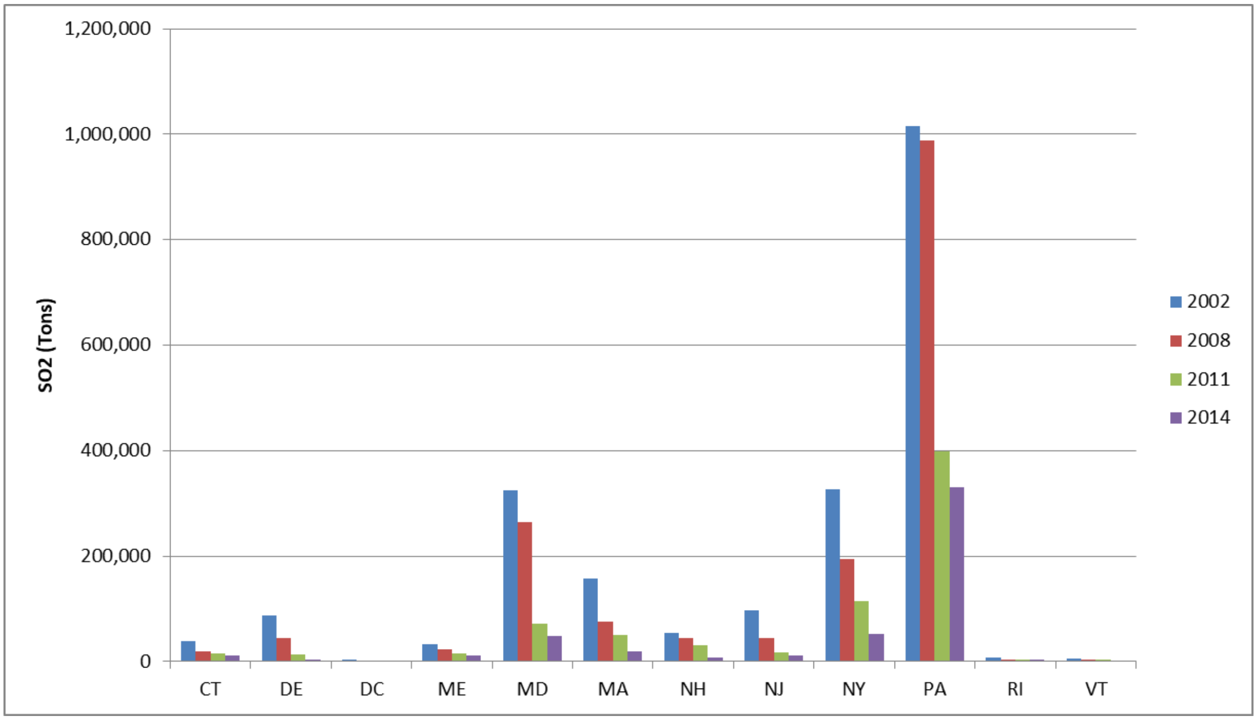


Table 9-18 and Figure 9-14 show total SO_2 emissions from all NEI data categories in the Non-MANE-VU Ask states for 2002 to 2014. Like MANE-VU states, decreases in SO_2 can be seen for all the Ask states over this period. In addition to the Federal rules, some of these decreases are attributable to the 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 8-18: Total SO_2 Emissions in the Non-MANE-VU Ask States for all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	SO_2 Reduction (2002–2014)	Percent SO_2 Reduction (2002–2014)
AL	606,778	438,066	271,687	193,886	-412,892	-68%
FL	926,576	485,705	231,895	236,648	-689,928	-74%
IL	536,620	385,948	287,312	191,331	-345,289	-64%
IN	960,539	690,040	424,984	345,279	-615,260	-64%
KY	533,614	382,044	271,432	222,090	-311,524	-58%
LA	359,641	249,149	228,997	171,510	-188,131	-52%
MI	490,487	415,620	273,393	185,320	-305,167	-62%
MO	421,708	414,816	257,510	168,808	-252,900	-60%
NC	585,453	290,648	117,772	70,067	-515,386	-88%
OH	1,286,023	877,070	680,338	376,573	-909,450	-71%
TN	432,890	324,690	159,164	92,498	-340,392	-79%
TX	989,242	637,591	540,665	456,508	-532,734	-54%
VA	362,478	200,581	106,386	75,660	-286,818	-79%
WV	580,073	349,331	122,109	112,405	-467,668	-81%
Total	**9,072,123**	**6,141,298**	**3,973,644**	**2,898,583**	**-6,173,540**	**-68%**

Figure 8-14: Total SO_2 Emissions in the Non-MANE-VU Ask States for all NEI Data Categories, 2002–2014

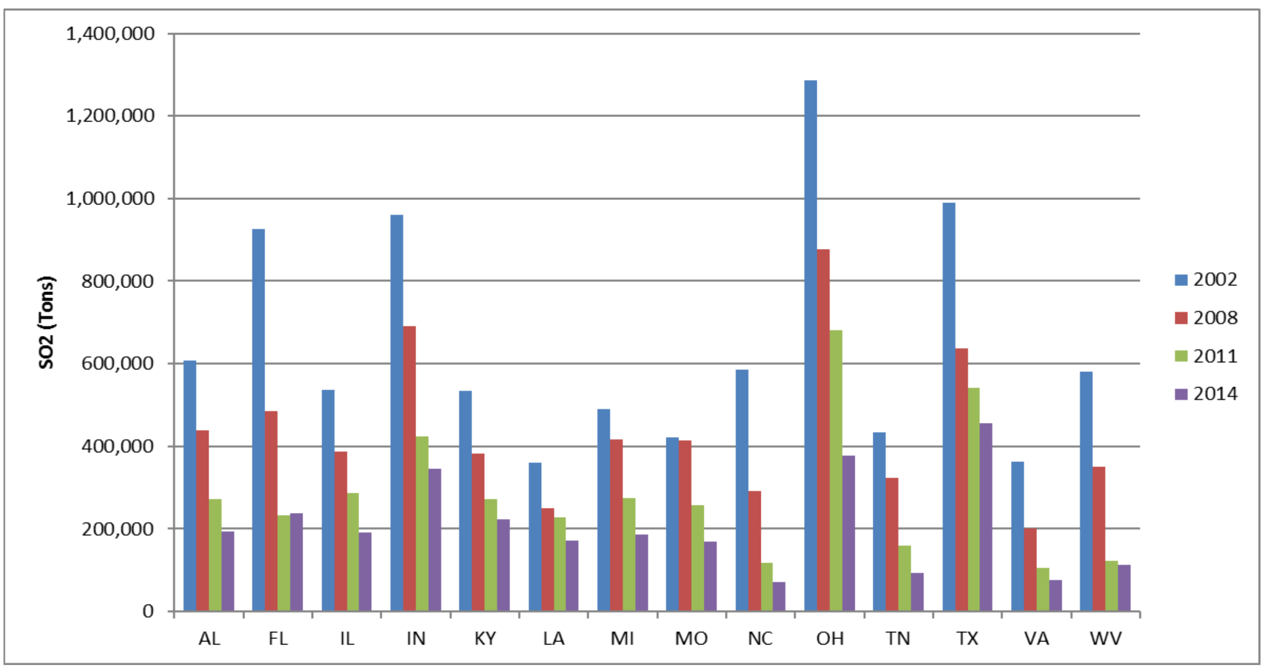


Table 9-19 and Figure 9-15 show AMPD SO_2 data trends for the MANE-VU states from 2002 to 2017, and Table 9-20 and Figure 9-16 show AMPD SO_2 data trends for the Non-MANE-VU Ask states from 2002 to 2017. Tables 9-19 and 9-20 show significant decreases in SO2 emissions for the AMPD sources between 2002 and 2017 for all applicable states in MANE-VU as well as the Non-MANE-VU Ask states.

Reductions in SO2 are most likely due to the acid rain program, power plant consent decrees, specific state rules, CAIR, CSAPR[83] (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 8-19: SO_2 Emissions from AMPD Sources in the MANE-VU States, 2002–2017 (Tons)

State	2002	2008	2011	2014	2016	2017	SO2 Reduction 2002-2017	Percent SO2 Reduction 2002-2017	SO2 Reduction 2011-2017	Percent SO2 Reduction 2011-2017
CT	10,814	3,955	752	1,478	362	421	-10,393	-96%	-332	-44%
DC	1,087	261	723	-	-	-	-1,087	-100%	-723	-100%
DE	32,236	31,808	9,306	829	513	545	-31,691	-98%	-8,761	-94%
MA	90,727	46,347	22,701	4,670	1,717	1,083	-89,644	-99%	-21,618	-95%
MD	255,360	227,198	32,275	23,553	16,729	8,087	-247,272	-97%	-24,188	-75%
ME	2,022	1,041	470	856	369	444	-1,579	-78%	-26	-6%
NH	43,947	36,895	24,445	2,636	573	473	-43,473	-99%	-23,972	-98%
NJ	48,269	21,204	5,414	2,655	1,725	1,722	-46,547	-96%	-3,693	-68%
NY	231,985	65,427	40,756	16,676	4,533	2,561	-229,424	-99%	-38,195	-94%
PA	889,766	831,915	330,539	270,332	98,006	69,790	-819,976	-92%	-260,749	-79%
RI	12	18	20	17	14	18	6	49%	-2	-10%
VT	6	2	1	2	1	1	-4	-79%	0	-20%
Total	**1,606,230**	**1,266,072**	**467,404**	**323,704**	**124,543**	**85,145**	**-1,521,085**	**-95%**	**-382,259**	**-82%**

[83] https://www.epa.gov/csapr

Figure 8-15: SO_2 Emissions from AMPD Sources in the MANE-VU States, 2016–2017

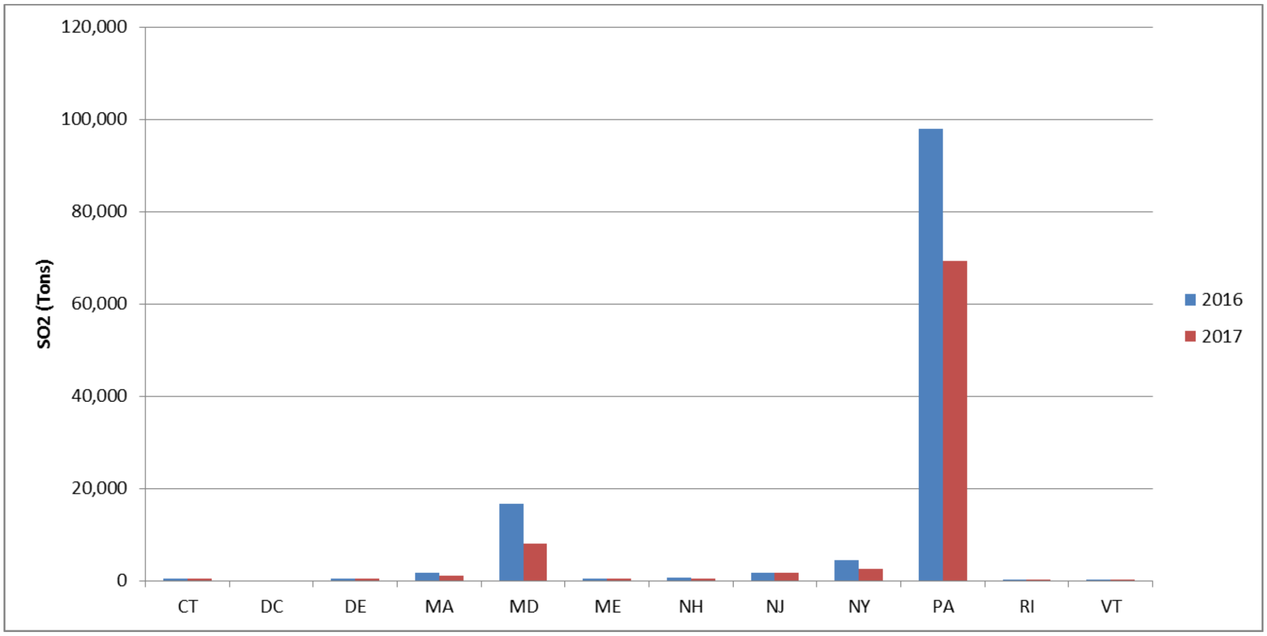
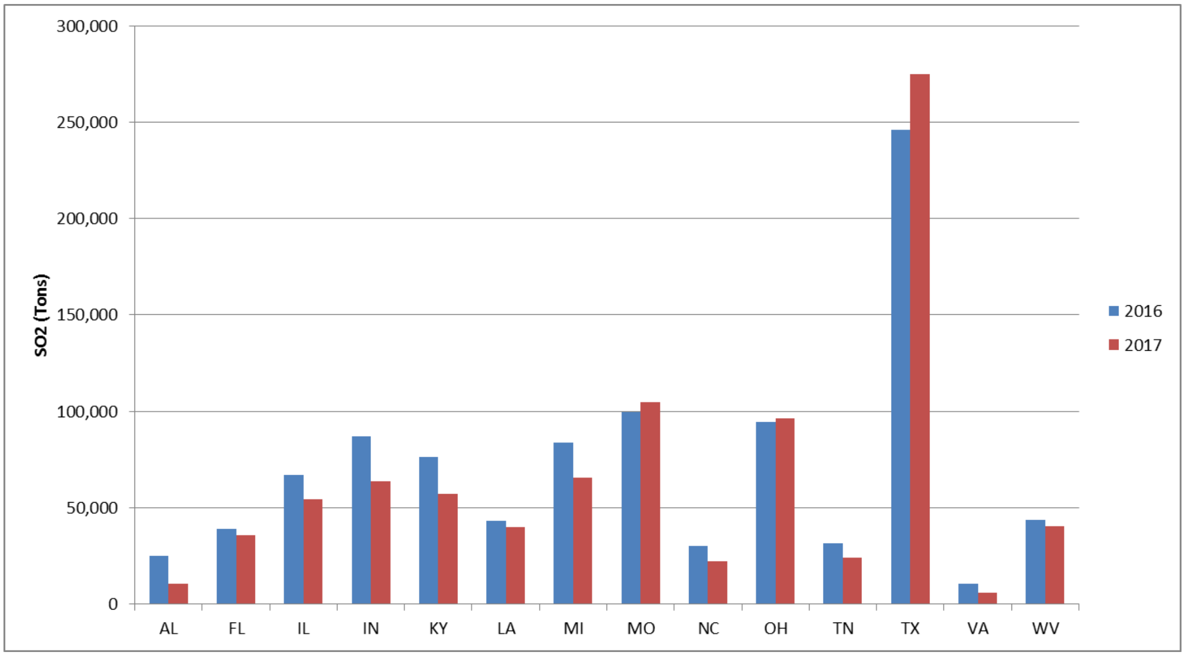


Table 8-20: SO_2 Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2002–2017 (Tons)

State	2002	2008	2011	2014	2016	2017	SO2 Reduction 2002-2017	Percent SO2 Reduction 2002-2017	SO2 Reduction 2011-2017	Percent SO2 Reduction 2011-2017
AL	448,248	357,547	179,256	119,898	25,034	10,478	-437,770	-98%	-168,779	-94%
FL	466,904	263,952	94,710	99,074	39,186	35,700	-431,204	-92%	-59,010	-62%
IL	353,699	257,431	205,630	122,463	66,993	54,511	-299,188	-85%	-151,119	-73%
IN	778,868	595,966	371,983	290,685	87,083	63,735	-715,133	-92%	-308,248	-83%
KY	482,653	344,874	246,399	202,042	76,424	57,119	-425,534	-88%	-189,280	-77%
LA	101,887	76,302	93,275	74,260	43,328	39,699	-62,189	-61%	-53,577	-57%
MI	342,999	326,501	222,702	152,942	84,019	65,369	-277,630	-81%	-157,333	-71%
MO	235,532	258,269	196,265	133,255	99,451	105,993	-129,540	-55%	-90,272	-46%
NC	462,993	227,030	77,985	42,862	30,136	22,265	-440,728	-95%	-55,720	-71%
OH	1,132,069	709,444	575,474	290,403	94,486	90,751	-1,041,318	-92%	-484,723	-84%
TN	336,995	208,069	120,353	58,434	31,270	24,312	-312,682	-93%	-96,041	-80%
TX	562,516	484,271	426,490	343,425	245,799	275,993	-286,522	-51%	-150,496	-35%
VA	230,846	125,985	68,071	33,088	10,316	5,791	-225,055	-97%	-62,280	-91%
WV	507,110	301,574	95,693	94,335	43,693	40,545	-466,565	-92%	-55,148	-58%
Total	**6,443,319**	**4,537,215**	**2,974,287**	**2,057,164**	**977,218**	**892,262**	**-5,551,057**	**-86%**	**-2,082,025**	**-70%**

Figure 8-16: SO_2 Emissions from AMPD Sources in the Non-MANE-VU Ask States, 2016–2017



8.1.5 Volatile Organic Compounds (VOCs)

Table 9-21 shows VOC emissions from all NEI data categories for the period 2002 to 2014 in New Jersey. This data is also shown graphically in Figure 9-17.

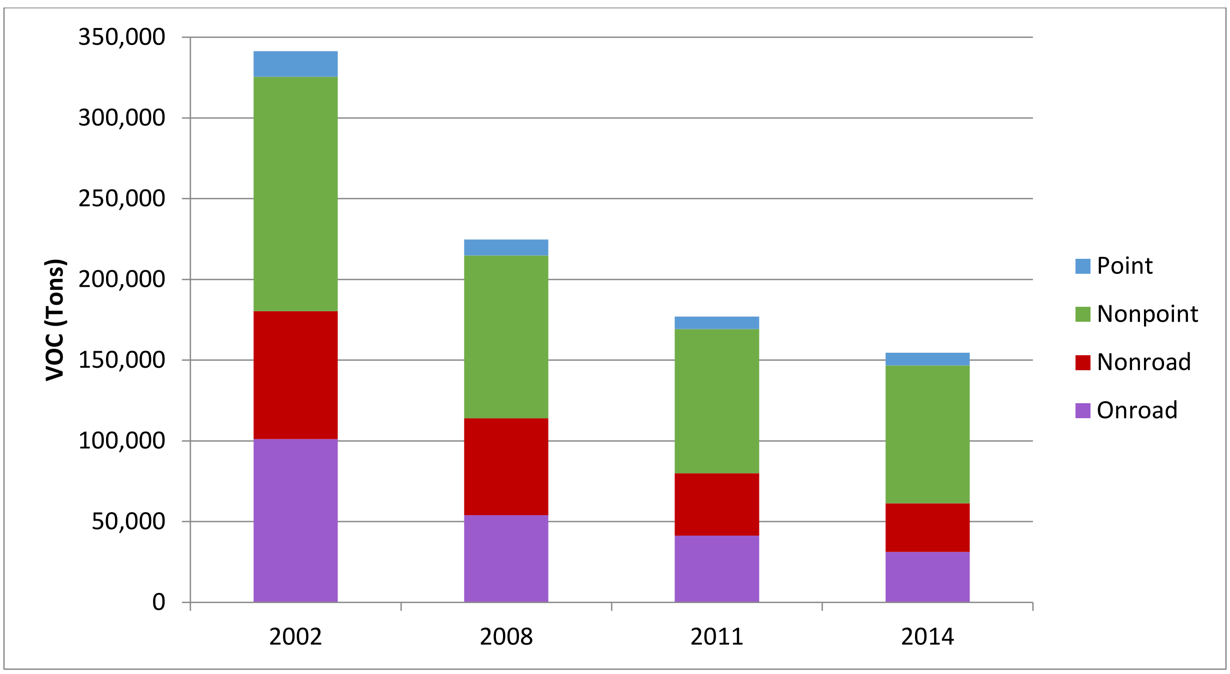
VOC emissions have shown a steady decline in New Jersey over the period 2002 to 2014. VOC decreases were achieved in all sectors due to Federal new engine standards for onroad and nonroad vehicles and equipment, the National and State low emission vehicle programs, area source rules such as consumer products, portable fuel containers, paints, autobody refinishing, asphalt paving applications, and solvent cleaning operations, and point source controls such as refinery consent decrees and New Jersey's VOC storage tank rule.

Table 8-21: VOC Emissions in New Jersey for all NEI Data Categories, 2002–2014 (Tons)

Category	2002	2008	2011	2014	VOC Reduction (2002–2014)	Percent VOC Reduction (2002–2014)
Point*	15,747	9,778	7,800	7,956	-7,791	-50%
Nonpoint**	145,124	100,807	89,250	85,331	-59,793	-41%
Nonroad***	79,310	60,034	38,698	30,068	-49,242	-62%
Onroad****	101,094	54,069	41,294	31,234	-69,860	-69%
Total	**341,276**	**224,688**	**177,043**	**154,589**	**-186,687**	**-55%**

Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Figure 8-17: VOC Emissions in New Jersey for all NEI Data Categories, 2002–2014



Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Table 9-22 and Figure 9-18 show total VOC emissions from all NEI data categories for the MANE-VU states during the period from 2002 to 2014. Except for PA, VOC emissions have declined in all MANE-VU states during this period.

The majority 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[84]. 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 decrease as older, more polluting vehicles are replaced by newer, cleaner ones.

PA's VOC emissions have increased due to emissions generated from the oil and gas industry and drilling for natural gas. New tools have been developed by EPA and MARAMA to estimate emissions from this source category based on the increased activity level in the northeast region.

Table 8-22: Total VOC Emissions from all NEI Data Categories in the MANE-VU States, 2002–2014 (Tons)

State	2002	2008	2011	2014	VOC Reduction (2002–2014)	Percent VOC Reduction (2002–2014)
CT	189,223	86,024	79,809	82,350	-106,873	-56%
DE	38,921	28,705	22,830	20,153	-18,768	-48%
DC	11,388	10,467	7,950	8,939	-2,449	-21%
ME	145,157	76,423	64,086	57,527	-87,630	-60%
MD	259,266	145,138	118,309	116,512	-142,754	-55%
MA	309,210	166,086	146,068	144,016	-165,194	-53%
NH	106,185	55,344	45,884	40,767	-65,418	-62%
NJ	341,276	224,688	177,043	154,589	-186,687	-55%
NY	544,016	519,566	416,915	410,573	-133,443	-25%
PA	449,637	432,590	372,135	477,338	+27,701	+6%
RI	41,448	23,770	23,186	23,499	-17,949	-43%
VT	47,157	29,131	27,869	27,366	-19,791	-42%
Total	**2,482,884**	**1,797,935**	**1,502,084**	**1,563,628**	**-919,256**	**-37%**

[84] http://otcair.org/document.asp?Fview=modelrules

Figure 8-18: Total VOC Emissions from all NEI Data Categories in the MANE-VU States, 2002–2014

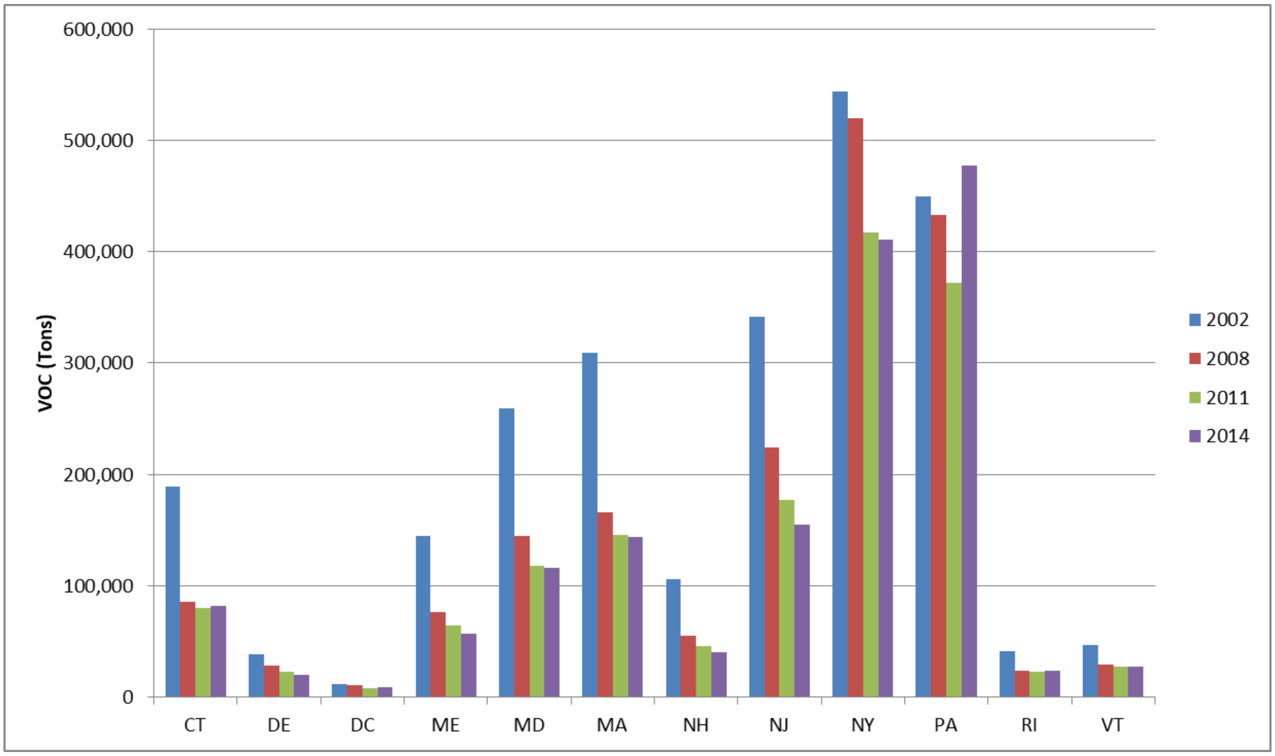


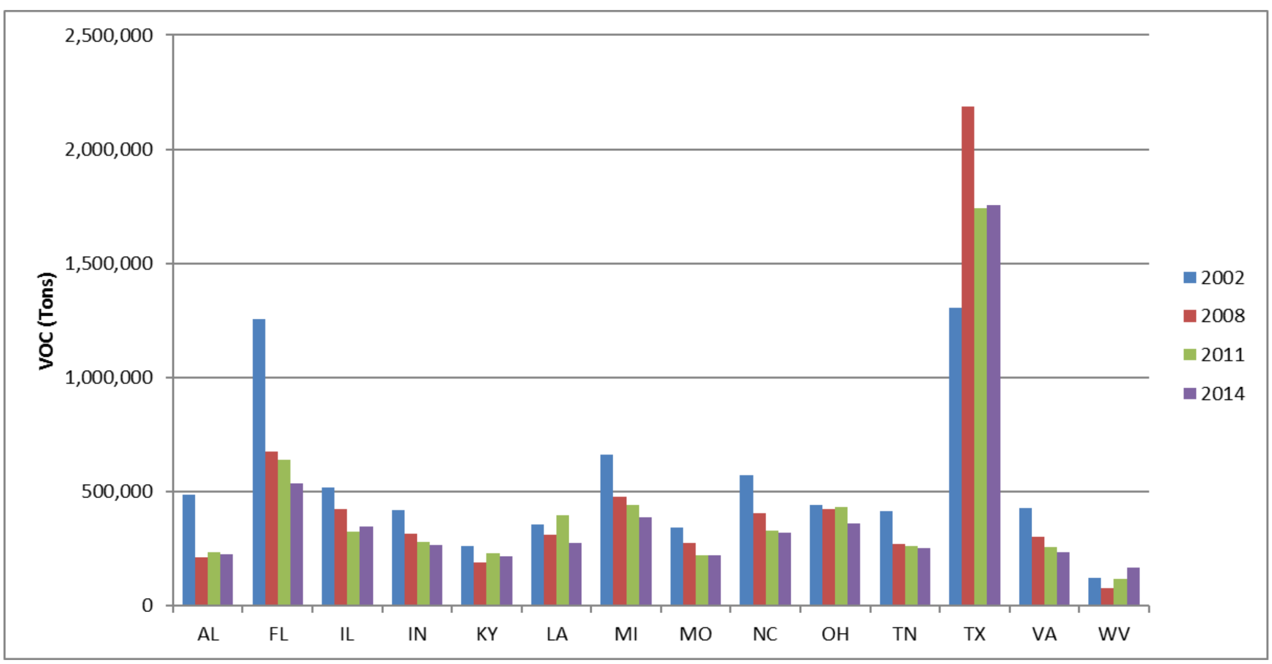
Table 9-23 and Figure 9-19 show total VOC emissions from all NEI data categories from the Non-MANE-VU Ask states. VOC emissions have declined from 2002 to 2014 in all of the Non-MANE-VU Ask states except TX and WV. Despite the increases in these states, overall total VOC emissions in the Non-MANE-VU Ask states have declined from 2002 to 2014.

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

Table 8-23: Total VOC Emissions from all NEI Data Categories in the Non-MANE-VU Ask States, 2002–2014 (Tons)

State	2002	2008	2011	2014	VOC Reduction (2002–2014)	Percent VOC Reduction (2002–2014)
AL	488,790	210,676	235,609	227,680	-261,110	-53%
FL	1,254,948	676,019	639,752	534,554	-720,394	-57%
IL	518,945	422,491	324,726	346,254	-172,691	-33%
IN	421,835	314,899	279,108	268,058	-153,777	-36%
KY	262,126	189,340	231,570	215,759	-46,367	-18%
LA	356,148	313,255	395,575	275,798	-80,350	-23%
MI	660,704	478,335	443,805	388,431	-272,273	-41%
MO	344,183	274,335	223,847	222,869	-121,314	-35%
NC	574,306	405,366	330,121	318,555	-255,750	-45%
OH	441,791	425,224	433,846	363,164	-78,627	-18%
TN	413,803	270,776	262,588	255,189	-158,614	-38%
TX	1,306,082	2,185,097	1,743,762	1,752,968	+446,886	+34%
VA	430,319	301,131	256,981	234,222	-196,097	-46%
WV	124,621	77,182	119,437	165,676	+41,055	+33%
Total	**7,598,602**	**6,544,127**	**5,920,726**	**5,569,177**	**-2,029,425**	**-27%**

Figure 8-19: Total VOC Emissions from all NEI Data Categories in the Non-MANE-VU Ask States, 2002–2014



8.1.6 Ammonia (NH_3)

Table 9-24 shows NH_3 emissions from all NEI data categories for the period 2002 to 2014 in New Jersey. This data is also shown graphically in Figure 9-20.

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 reporting, grouping and methodology changes, not actual emission increases. NH_3 emissions were not reported to New Jersey's emission statements program in 2002, therefore, they were estimated by EPA. Reporting to New Jersey's emission statement program began in 2003. In addition, as discussed previously, EPA included airport emissions in point sources in 2008.

Nonpoint increases and decreases from 2002 to 2014 are due to reporting, grouping and methodology changes. In 2002, 2008 and 2014 New Jersey submitted emissions from domestic and wild animals and human perspiration to the EPA NJ was the only state to calculate and submit these emissions. EPA included them in the 2008 and 2014 NEI, however, did not include them in the 2002 or 2011 NEI, thereby causing a discrepancy. Also, as discussed previously, in 2008 EPA included marine vessels and rail in the nonpoint category.

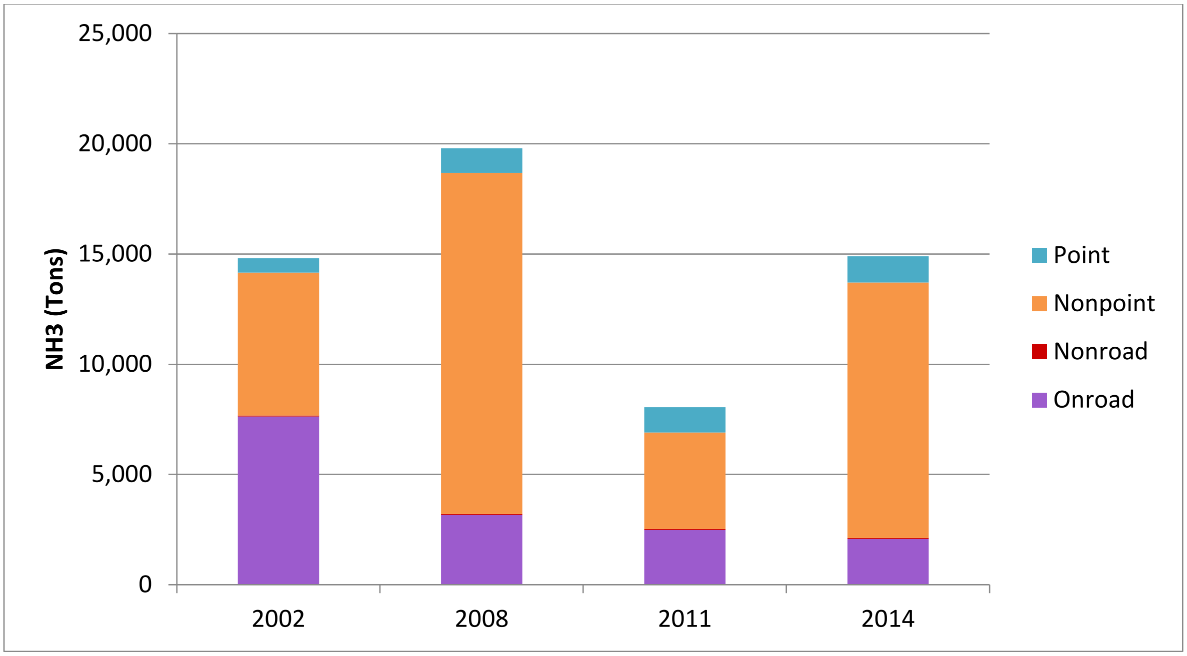
In summary, overall, ammonia emissions have decreased from 2008 to 2014, as 2002 emissions are not comparable due to methodology changes.

Table 8-24: NH_3 Emissions in New Jersey for all NEI Data Categories, 2002–2014 (Tons)

Category	2002	2008	2011	2014	Percent NH_3 Reduction (2002–2014) NH_3	Percent NH_3 Reduction (2008–2014)
Point*	644	1,123	1,150	1,184	84%	5%
Nonpoint**	6487	15,472	4,372	11,590	79%	-25%
Nonroad***	41	44	43	45	11%	2%
Onroad****	7,635	3,164	2,484	2,075	-73%	-34%
Total	**14,807**	**19,804**	**8,049**	**14,895**	**1%**	**-25%**

Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and 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 and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Figure 8-20: NH_3 Emissions in New Jersey for all NEI Data Categories, 2002–2014



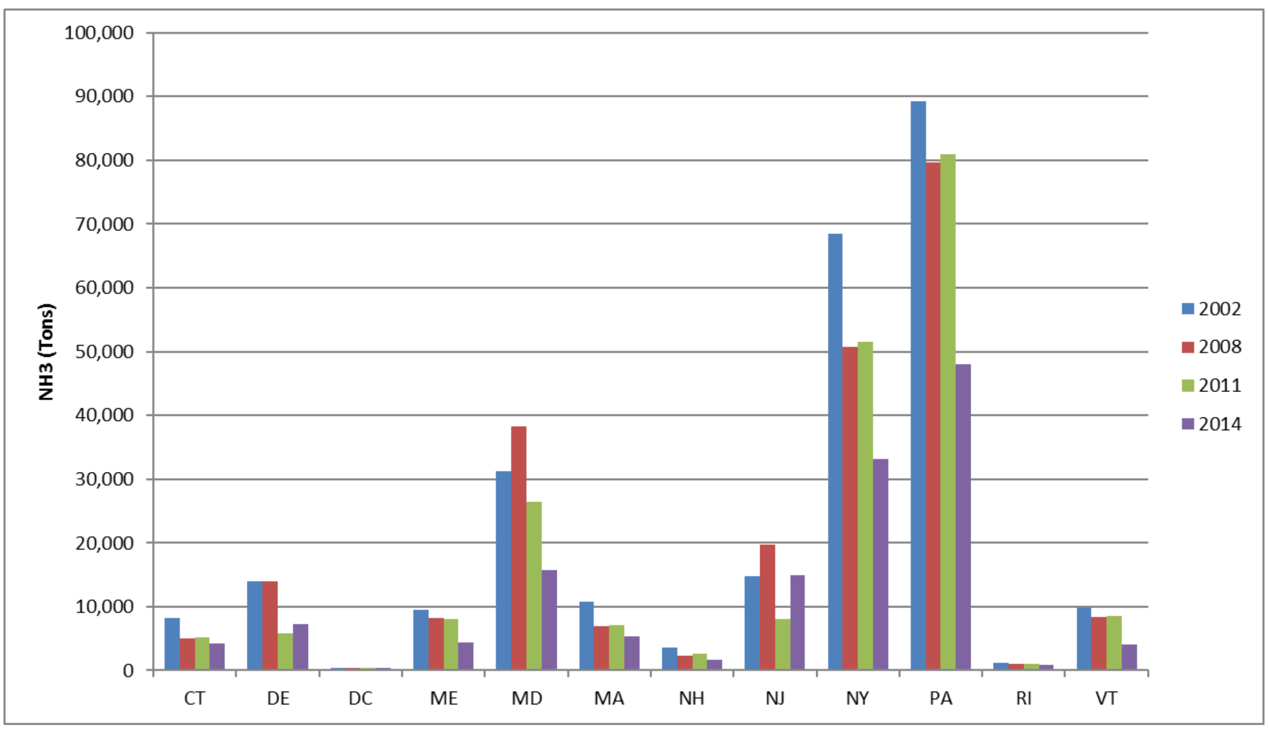
Notes:
*Non-AMPD Point includes airports and railroad switch yards after 2002
**Nonpoint includes commercial marine vessels and underway railroad after 2002. Nonpoint includes Stage II refueling in 2002 through 2008 and excludes it after 2008.
***Nonroad includes airports, railroad and commercial marine vessels in 2002 and excludes them after 2002.
**** Onroad 2011 was subsequently revised in the EPA and NJ modeling platforms. See Table 9-31. Also, onroad includes Stage II refueling after 2008.

Table 9-25 and Figure 9-21 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 2014 are lower than they were for earlier years. New Jersey's ammonia emissions are generally estimated to be the same in 2014, compared to 2002 in the EPA NEI. New Jersey's emissions trend is different than other states because, as discussed above, New Jersey was the only state to submit domestic and wild animal and human perspiration ammonia emissions. EPA included these emissions in the 2008 and 2014 NEI, however, did not include them in 2002 and 2011 NEI, thereby causing the discrepancy. The decreases shown from 2008 to 2014 are more comparable for New Jersey data.

Table 8-25: Total NH_3 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	Percent Reduction (2002–2014)	Percent Reduction (2008–2014)
CT	8,194	4,989	5,200	4,194	-49%	-16%
DE	13,920	13,975	5,771	7,252	-48%	-48%
DC	421	354	330	317	-25%	-11%
ME	9,557	8,207	8,024	4,356	-54%	-47%%
MD	31,278	38,288	26,429	15,746	-50%	-59%
MA	10,794	6,929	7,177	5,411	-50%	-22%
NH	3,567	2,311	2,684	1,645	-54%	-29%
NJ	14,807	19,804	8,049	14,895	1%	-25%
NY	68,536	50,737	51,487	33,110	-52%	-35%
PA	89,263	79,588	80,871	48,000	-46%	-40%
RI	1,202	1,092	1,075	862	-28%	-21%
VT	9,810	8,379	8,567	4,148	-58%	-51%
Total	**261,350**	**234,652**	**205,665**	**139,936**	**-46%**	**-40%**

Figure 8-21: Total NH_3 Emissions in the MANE-VU States from all NEI Data Categories, 2002–2014 (Tons)

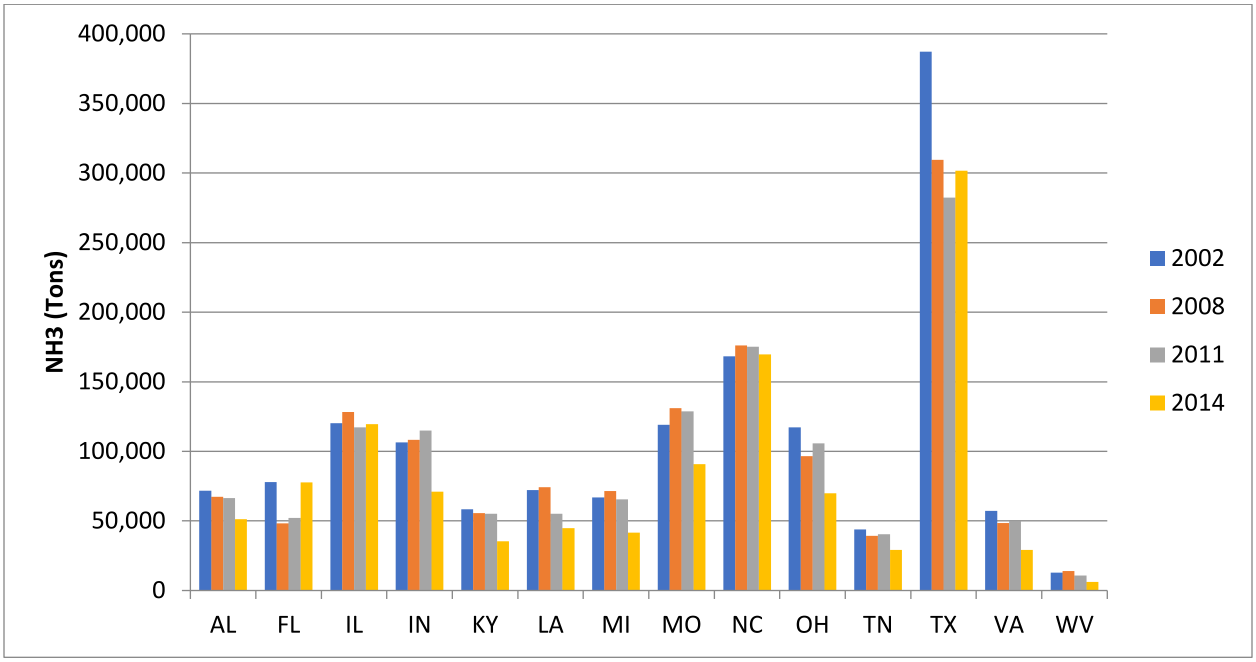


Total ammonia emissions for all NEI data categories for the Non-MANE-VU Ask states are shown in Table 9-26 and Figure 9-22. Again, some year to year variability in ammonia emissions can be seen. In most of the Non-MANE-VU Ask states, 2014 emissions are lower than they were for previous years. For every Non-MANE-VU Ask state, 2014 emissions are lower than they were for at least one of the earlier years.

Table 8-26: Total NH_3 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014 (Tons)

State	2002	2008	2011	2014	Percent NH_3 Reduction (2002–2014)	Percent NH_3 Reduction (2008–2014)
AL	71,627	67,454	66,494	51,329	-28%	-24%
FL	77,959	48,211	52,218	77,637	-0%	61%
IL	120,222	128,348	117,209	119,481	-6%	-7%
IN	106,354	108,301	115,038	71,036	-33%	-34%
KY	58,406	55,558	55,265	35,476	-390%	-36%
LA	72,094	74,188	55,272	44,703	-38%	-40%
MI	66,954	71,406	65,507	41,500	-38%	-42%
MO	119,101	131,113	128,753	90,853	-24%	-31%
NC	168,398	176,143	175,127	169,777	1%	-4%
OH	117,152	96,512	105,793	69,854	-40%	-28%
TN	43,831	39,213	40,364	29,237	-33%	-25%
TX	387,228	309,529	282,413	301,772	-22%	-3%
VA	57,150	48,462	49,935	29,151	-49%	-40%
WV	12,832	14,100	10,668	6,162	-52%	-56%
Total	**1,479,309**	**1,368,541**	**1,320,058**	**1,137,969**	**23%**	**-17%**

Figure 8-22: Total NH_3 Emissions in the Non-MANE-VU Ask States from all NEI Data Categories, 2002–2014 (Tons)



8.2 Modeling Inventories

New Jersey is required to document the technical basis, including modeling, on which the State is relying to determine emissions reduction strategies in accordance with 40 C.F.R. § 51.308(f)(2)(iii).

The baseline inventory is intended to be used to assess progress in making emission reductions. MANE-VU and New Jersey 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 9.3 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, with some slight variations. As the States, EPA and other 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 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, including EGUs (ERTAC version 2.7), and EPA's 2028 'el' Modeling Platform.

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[85], the Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update. (Appendix D) and the Documentation of ERTAC EGU CONUS Versions 2.7 Reference and CSAPR Update Compliant Scenario (Documentation currently in progress). The following is a summary of the Gamma inventory.

8.3 Modeling Inventory Summaries

Tables 9-27 through 9-34 summarize the MANE-VU 2002 and the MANE-VU 2011 Gamma emissions inventories and 2028 Gamma emissions projections for MANE-VU and New Jersey. The inventory sectors shown in the tables below for the modeling inventories summaries vary in definition from the sectors shown in the EPA NEI inventory summaries above and from each other. Also note that the NEI and 2002 inventories include unadjusted fugitive dust, while the Gamma inventories included adjusted fugitive dust.

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 and wild fires 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 and wild fires and adjusted fugitive dust).
- Biogenic Sources

[85] "McDill and McCusker, 2018. “Technical Support Document: Emission Inventory Development for 2011 and Projections to 2020 and 2023 for the Northeastern U.S. Gamma Version,” January 29, 2018. http://marama.org/technical-center/emissions-inventory/2011-gamma-inventory-and-projections

Table 8-27: MANE-VU 2002 Emissions Inventory Summary–MANE-VU States[86]

	VOC	NO_x	PM2.5	PM10	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 8-28: MANE-VU 2011 Gamma Emissions Inventory Summary–MANE-VU States[87]

	VOC	NO_x	PM2.5	PM10	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	**1,541,101**	**1,673,526**	**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

[86] Pechan, 2006. "Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3." November 20, 2006. Available online: http://www.marama.org/technical-center/emissions-inventory/2002-inventory-and-projections/mane-vu-2002-emissions-inventory
[87] "McDill and McCusker, 2018. "Technical Support Document: Emission Inventory Development for 2011 and Projections to 2020 and 2023 for the Northeastern U.S. Gamma Version," January 29, 2018. http://marama.org/technical-center/emissions-inventory/2011-gamma-inventory-and-projections

Table 8-29: MANE-VU 2028 Gamma Emissions Projections Summary–MANE-VU States[88]

	VOC	NOx	PM2.5	PM10	NH3	SO2
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

Table 8-30: MANE-VU 2002 Emissions Inventory Summary–New Jersey[89]

	VOC	NO_x	PM2.5	PM10	NH_3	SO_2
Point	14,401	51,593	4,779	6,072	-	61,217
Area*	167,882	26,692	19,350	61,601	17,572	10,744
Nonroad**	83,919	63,479	4,997	5,495	43	15,686
Onroad	89,753	152,076	2,469	3,725	7,382	3,649
Anthropogenic Total	**355,955**	**293,840**	**31,595**	**76,893**	**24,997**	**91,296**
Biogenics	181,617	1,813	-	-	-	-
TOTAL	**537,572**	**295,653**	**31,595**	**76,893**	**24,997**	**91,296**

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

[88] Technical Support Document for 2028 Gamma Projections
[89] Pechan, 2006. "Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3." November 20, 2006. Available online: http://www.marama.org/technical-center/emissions-inventory/2002-inventory-and-projections/mane-vu-2002-emissions-inventory

Table 8-31: MANE-VU 2011 Gamma Emissions Inventory Summary–New Jersey[90]

	VOC	NO_x	PM2.5	PM10	NH_3	SO_2
EGU Point	254	6,285	763	774	265	4,698
Non-EGU Point*	7,483	11,579	2,451	2,811	885	2,067
Area**	93,644	23,829	10,229	10,437	655	6,649
Nonroad***	39,845	45,579	3,482	3,677	48	3,774
Onroad****	41,998	100,400	4,229	8,368	2,419	726
Oil/Gas	86	407	18	19	3	4
Other	4,097	143	2,617	50	3,974	101
Anthropogenic Total	**187,406**	**188,222**	**23,788**	**26,135**	**8,250**	**18,018**
Biogenics	116,029	1,334	-	-	-	-
TOTAL	**303,435**	**189,557**	**23,788**	**26,135**	**8,250**	**18,018**

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 8-32: MANE-VU 2028 Emissions Projection Summary–New Jersey

	VOC	NO_x	PM2.5	PM10	NH_3	SO_2
EGU Point	455	4,666	1,511	1,512	282	2,111
Non-EGU Point*	7,619	11,097	2,401	2,765	942	1,970
Area**	88,553	24,475	9,799	9,994	598	572
Nonroad***	26,923	25,370	1,913	2,045	63	300
Onroad****	14,639	24,878	1,480	5,850	1,759	244
Oil/Gas	105	409	22	23	4	4
Other	4,255	143	2,818	5,486	4,073	101
Anthropogenic Total	**142,548**	**91,038**	**19,944**	**27,676**	**7,721**	**5,302**
Biogenics	116,029	1,334	-	-	-	-
TOTAL	**258,577**	**92,372**	**19,944**	**27,676**	**7,721**	**5,302**

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

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[90] "McDill and McCusker, 2018. “Technical Support Document: Emission Inventory Development for 2011 and Projections to 2020 and 2023 for the Northeastern U.S. Gamma Version,” January 29, 2018. http://marama.org/technical-center/emissions-inventory/2011-gamma-inventory-and-projections

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FAA, 2013. "Terminal Area Forecast Summary Fiscal Years 2012-2040. 2014." https://aspm.faa.gov/main/taf.asp

Chapter 9 Commitment

New Jersey is on target with meeting the 2018 goal for the Brigantine Wilderness Area and anticipates that the measures included in the MANE-VU "Ask" will be sufficient to attain the 2028 proposed progress goal if these reductions are achieved in New Jersey and all contributing states by 2028. New Jersey commits to revise and submit a regional haze implementation plan by July 31, 2028, and every ten years thereafter, in accordance with the requirements listed in Section 51.308(f) of the federal rule for regional haze.

Chapter 10 Public Commentary

New Jersey is offering this State Implementation Plan for a 30 day public comment period and will hold a public hearing on this plan should one be requested. New Jersey will document the public participation process, including formal comments submitted to the State of New Jersey by the Federal Land Managers, the USEPA or any member of the public. Responses to comments will be included as an Appendix to the final SIP and any appropriate or necessary changes to the SIP will be made based upon acceptable and meaningful public comments.