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Regional Haze State Implementation Plan

For the Second Implementation Period

2018 – 2028

Periodic Revision

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Executive Summary

Regional haze is “visibility impairment that is caused by the emission of air pollutants from numerous anthropogenic sources located over a wide geographic area. Such sources include, but are not limited to, major and minor stationary sources, mobile sources, and area sources.” (40 CFR 51.301) These emissions are transported over large regions and impact areas that include Maryland, other states, and national parks, forests, and wilderness areas (“Class I” Federal areas). The Clean Air Act mandates protection of visibility in Class I Federal areas. In 1999, the U.S. Environmental Protection Agency (EPA) finalized the Regional Haze Rule (64 Fed. Reg. 35714, July 1, 1999). The rule calls for state, tribal, and federal agencies to work together to improve visibility in 156 national parks and wilderness areas.

Under the Regional Haze Rule, states are required to develop a series of State Implementation Plans (SIPs) to address visibility impairment in Class I Federal areas and make reasonable progress toward achieving natural visibility conditions. Maryland’s Regional Haze SIP for the first implementation period, 2008-2018, became effective on August 6, 2012 (77 FR 39938, July 6, 2012). Maryland developed the SIP based on consultations with other states, the Federal Land Managers and work-products of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Regional Planning Organization (RPO).

Section 308(f) of the 1999 Regional Haze Rule also required each state to submit a revised SIP to EPA by July 31, 2018 and every ten years thereafter; therefore, the end date for this 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 (82 Fed. Reg. 3078, January 10, 2017). MANE-VU states have collectively agreed to submit SIPs before the July 31, 2021 deadline.

The SIP revision for the second implementation period must establish emissions reduction strategies and interim goals for 2028, reflecting on those strategies as well as trends from various sources including point, area, and mobile (both onroad and nonroad) source emissions, as well as biogenic, wildfire, and agricultural emissions. The SIP contains

- Monitoring strategies for evaluating visibility impacts,
- Baselines and trends, and
- Long-term strategies.

This SIP demonstrates that Maryland has met its long-term strategy obligations for 2028 visibility impairment through on-the-books state and federal regulations. In addition to extensive consultation with the MANE-VU states, Maryland consulted with Federal Land Managers (FLMs) responsible for the Class I Federal areas and the EPA in the development of the SIP.

Maryland will continue to coordinate with other states, FLMs, EPA, MANE-VU, and other RPOs to maintain and improve the visibility in Class I Federal areas. This coordination will include progress reports, SIP revisions, and face-to-face consultation meetings, as necessary.

1 Background and Overview

1.1 Introduction

Regional haze is "visibility impairment that is caused by the emission of air pollutants from numerous anthropogenic sources located over a wide geographic area. Such sources include, but are not limited to, major and minor stationary sources, mobile sources, and area sources." (40 CFR 51.301) These emissions are transported over large regions, including national parks, forests, and wilderness areas ("Class I" federal areas). The Clean Air Act (CAA) mandates protection of visibility in Class I Federal areas.

Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are significant components in the formation of fine particles. Particles affect visibility through the scattering and absorption of light, and fine particles - particles similar in size to the wavelength of light - are most efficient, per unit of mass, at reducing visibility. Therefore, reducing fine particles or $PM_{2.5}$ in the atmosphere is generally considered an effective method of reducing regional haze, and thus improving visibility. The most important sources of $PM_{2.5}$ and its precursors are coal-fired power plants, industrial boilers, and other combustion sources. Other significant contributors to $PM_{2.5}$ and visibility impairment include mobile source emissions, area sources, fires, and wind-blown dust.

The national goal declared in the CAA[1] is to return the visibility condition in our national parks and wilderness areas to their "natural" conditions by 2064. The goal of the Regional Haze Program is to make reasonable progress towards natural conditions. Because visibility impairment is caused by the transport of anthropogenically generated emissions across wide geographic areas and state and local boundaries, the solution to our visibility problem must be developed on a regional and national scale (See Section 1.3 of this SIP).

1.2 Regulatory Development

In 1977, Congress added provisions in the CAA to improve the visibility "in areas of great scenic importance." These areas, known as the mandatory Class I Federal Areas, are in 35 states and one territory (40 CFR 81.401-437) as shown on Figure 1-1. The Class I designation applies to national parks exceeding 6,000 acres, wilderness areas, and national memorial parks exceeding 5,000 acres, and all international parks that were in existence prior to 1977. Class I Federal areas include 156 national parks and wilderness areas.

[1] 42 U.S.C. §§7401-7671q

Figure 1-1: Federal Class I Areas

In 1999, EPA published the Regional Haze Rule[2] to improve air quality in the Nation's national parks and wilderness areas. The Rule required all States and the District of Columbia (States) to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment in the Class I Federal areas, in coordination with EPA, Tribal Nations, Federal Land Managers (FLM) representing the National Park Service, U.S. Fish and Wildlife Service, the U.S. Forest Service, and other interested parties.

EPA most recently revised the Regional Haze Rule on January 10, 2017.[3] This revision

- Clarified the relationship between the long-term strategy and the reasonable progress goals;
- Strengthened the FLM consultation requirements;
- Updated the SIP submittal deadlines for the second planning period to July 31, 2021;
- Adjusted the deadlines for progress report submissions; and
- Removed the requirement for progress reports to take the form of SIP revisions.

1.3 Regional Planning Organizations

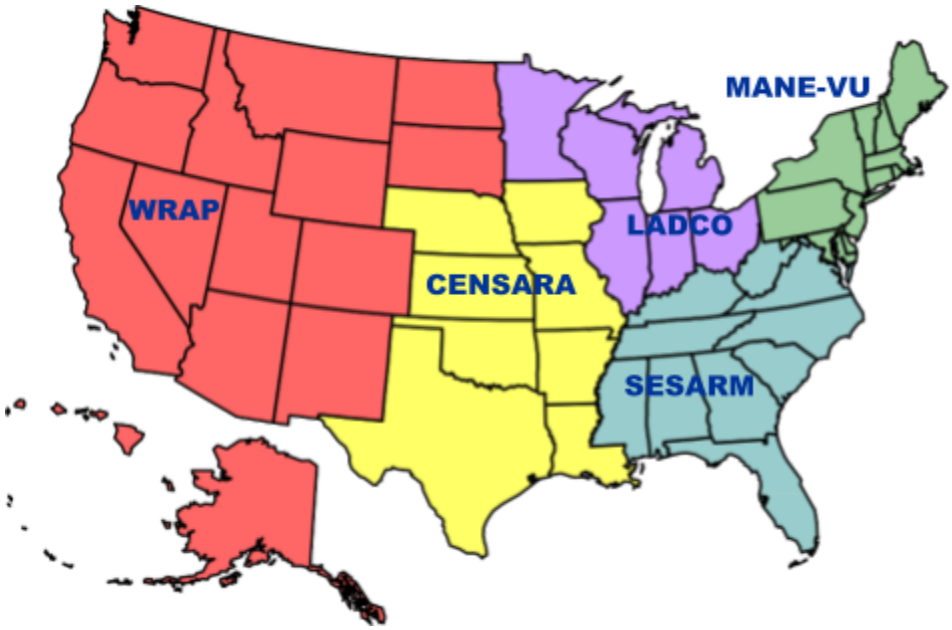
To aide states in their efforts to develop the technical basis for the states' implementation plans, five multi-state regional planning organizations have been established – Western Regional Air Partnership

[2] 64 Fed. Reg. 35714, July 1, 1999

[3] 82 Fed. Reg. 3078, January 10, 2017

(WRAP), Central States Air Resources Agencies (CENSARA), Lake Michigan Air Directors Consortium (LADCO), Mid-Atlantic/Northeast Visibility Union (MANE-VU), and Southeastern States Air Resource Managers (SESARM) (Figure 1-2). These organizations provide a forum for state air control administrators to develop regional strategies to address regional haze and to coordinate with other regions. Maryland is a member of MANE-VU.

Figure 1-2: Multi-state Regional Planning Organizations



The Mid-Atlantic Region Air Management Association (MARAMA), the Northeast States for Coordinated Air Use Management (NESCAUM), and the Ozone Transport Commission (OTC) established the Mid-Atlantic/Northeast Visibility Union (MANE-VU) regional planning organization to coordinate efforts to address visibility impairment at seven Class I Federal areas located in the Mid-Atlantic and Northeast corridor:

- Acadia National Park, ME;
- Brigantine Wilderness, NJ;
- Great Gulf Wilderness, NH;
- Lye Brook Wilderness, VT;
- Moosehorn Wilderness, ME;
- Presidential Range – Dry River Wilderness, NH; and
- Roosevelt Campobello International Park, New Brunswick, Canada.

1.4 Required Elements for State Implementation Plan Revisions

The Regional Haze Rule requires each State, as well as the District of Columbia and the Virgin Islands, to develop an implementation plan (SIP) for reducing regional haze. The plan must include goals aimed at improving visibility and a long-term plan for reducing pollutant emissions that contribute to visibility degradation.

The Regional Haze Rule focuses on developing long-term strategies based on reasonably determined controls in states that are reasonably anticipated to impact visibility at Class I Federal areas and encourages States to coordinate with each other through regional planning efforts. The core areas to be addressed in this SIP revision are codified at 40 CFR 51.308(f) – (i).

1.5 Area of Influence for MANE-VU Class I Federal Areas

The key differences between SIPs from States with Class I Federal areas and States without Class I Federal areas are the calculation of the baseline and natural visibility for their Class I Federal areas and the determination of reasonable progress goals. Class I States calculate baseline visibility conditions for the period between 2000 and 2004. The average impairment for the most and least impaired days are determined for each calendar year and compiled into the average of the five annual averages (40 CFR 51.308 (f)(1)(i)). The natural visibility conditions for the most and least impaired days are calculated by estimating the average deciview index based on available monitoring data and appropriate data analysis technique (40 CFR 51.308 (f)(1)(ii)). In contrast, States without Class I Federal areas are responsible for establishing a Long-term Strategy so that the Class I Federal areas affected by emissions from the state can make reasonable progress towards natural conditions. Maryland does not have a Class I Federal area located within its borders. As a result, the Regional Haze Rule requires Maryland, in consultation with MANE-VU and others, to identify where its emissions are most likely to influence visibility in Class I Federal areas. For the second implementation period, in order to identify states whose emissions are most likely to influence visibility in MANE-VU Class I Federal areas, MANE-VU prepared the *Selection of States*

for MANE-VU Regional Haze Consultation (2018) (Appendix 1). As detailed within the report, MANE-VU initiated a process of screening states and sectors for contribution using two tools - Q/d and CALPUFF.

During the first implementation period, Maryland was found to significantly affect Class I Federal areas.[4] For the second implementation period, MANE-VU's analysis of 32 eastern states estimated that Maryland contributed 1.65% to 4.32% of the anthropogenic visibility impairment to federal class I areas in the Eastern US States (see Section 2.4.3). Maryland continues to participate in the consultation process as part of MANE-VU.

1.6 What are Long-term Strategies?

Another core component of the SIP is to develop a long-term strategy that includes enforceable emissions limitations, compliance schedules, and other measures necessary to make reasonable progress in affected Class I Federal areas. Long-term Strategies extend through an entire ten-year planning period for the Regional Haze program, which in this case extends to 2028. States without Class I Federal areas but with sources identified to "affect" another State's Class I Federal area must consult with that State in order to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress.

1.7 What are Reasonable Progress Goals?

Reasonable Progress Goals must be set based on Long-term Strategies that consider certain statutory factors established by Congress that include the costs of compliance, time needed for compliance, and energy and non-air quality environmental impacts along with the remaining useful life of any potentially affected sources. For each Class I Federal area located within a State, the Class I State must establish goals (expressed in deciviews) that reflect the visibility conditions projected to be achieved as a result of the State's own long-term strategy, other States' long-term strategies and other emission reduction programs.

1.8 Periodic Updates and Revisions to SIPs

Other details addressed in this SIP include the process to submit periodic plan revisions to EPA every ten years, with the next revision due by 2028. In addition to submitting plan revisions every ten years, Maryland commits to evaluate and report progress towards the reasonable progress goals established for each Class I Federal area located outside Maryland. The 2017 Regional Haze Rule established the submittal date for the periodic progress report as January 31, 2025.

[4] The MANE-VU Class 1 areas affected by Maryland in the first implementation period include Acadia National Park, Brigantine Wildlife Refuge, Great Gulf Wilderness Area & Presidential Range-Dry River Wilderness Area, Lye Brook Wilderness Area, and Moosehorn Wildlife Refuge & Roosevelt Campobello International Park. The Class 1 areas proximate to MANE-VU that were affected by Maryland during the first implementation period include Dolly Sodds Wilderness / Otter Creek and Shenandoah National Park

2 Compliance with Federal Regional Haze Program Requirements

This section demonstrates the authority of Maryland to implement the Regional Haze program and that Maryland is undertaking measures deemed reasonable to complete by the end of the 2028 planning period. These measures are necessary for downwind Class I Federal areas to achieve natural visibility conditions on the most impaired days by 2064 and maintain visibility conditions on the clearest days.

2.1 § 51.308 (f) – Second Planning Period Requirements

Requirements for periodic comprehensive revisions of implementation plans for regional haze. Each State identified in § 51.300(b) must revise and submit its regional haze implementation plan revision to EPA by July 31, 2021, July 31, 2028, and every 10 years thereafter. The plan revision due on or before July 31, 2021, must include a commitment by the State to meet the requirements of paragraph (g) of this section. In each plan revision, the State must 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. To meet the core requirements for regional haze for these areas, the State must submit an implementation plan containing the following plan elements and supporting documentation for all required analyses

Maryland commits to submitting plan revisions to EPA as required under § 51.308 (g).

2.2 § 51.308 (f)(1) – Visibility Condition Calculations

Calculations of baseline, current and natural visibility conditions; progress to date; and the uniform rate of progress. For each mandatory Class I Federal area located within the State, the State must determine the following…

Maryland does not have any Class I Federal areas located within its borders and thus is not required to comply with § 51.308 (f)(1) or any of its subsections.

2.3 § 51.308 (f)(2) – Long-term Strategy

Long-term strategy for regional haze. Each State must submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I Federal area within the State and for each mandatory Class I Federal area located outside the State that may be affected by emissions from the State. The long-term strategy must include the enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress, as determined pursuant to (f)(2)(i) through (iv). In establishing its long-term strategy for regional haze, the State must meet the following requirements…

Maryland does not have any Class I Federal areas within its borders so it only must address sources that affect Class I Federal areas located outside of Maryland in its long-term strategy. 40 CFR § 51.308(f)(2) requires Maryland to ensure that its long-term strategy includes the enforceable emission limitations, compliance schedules, and other measures necessary to make reasonable progress goals established by states with federal class I areas. Sections 2.5.1 – 2.5.6 contain Maryland's long-term strategy for the second implementation period.

2.4 § 51.308 (f)(2)(i) – Determination of Effecting Sources and Evaluation of Four Factors

The State must evaluate and determine the emission reduction measures that are necessary to make reasonable progress by considering the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected anthropogenic source of visibility impairment. The State should consider evaluating major and minor stationary sources or groups of sources, mobile sources, and area sources. The State must include in its implementation plan a description of the criteria it used to determine which sources or groups of sources it evaluated and how the four factors were taken into consideration in selecting the measures for inclusion in its long-term strategy. In considering the time necessary for compliance, if the State concludes that a control measure cannot reasonably be installed and become operational until after the end of the implementation period, the State may not consider this fact in determining whether the measure is necessary to make reasonable progress.

The long-term strategy as outlined in 40 CFR § 51.308(f)(2) is the basis for the control of emissions that impair visibility in Class I Federal areas. Four factors are analyzed for sources to determine what control measures may be reasonable for implementation during the implementation period. The Regional Haze Rule provides several insights as to how to determine what sources need to be analyzed in development of a long-term strategy.

40 CFR § 51.308(f)(2) requires states to submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I Federal area within and outside the state which "may be affected by emissions from the State." 40 CFR § 51.308(f)(2)(ii) also requires states with Class I Federal areas to consult with any upwind state that is "reasonably anticipated to contribute to visibility impairment" at the Class I Federal area. These requirements make it clear that the long-term strategy is not to be based on all sources within a state, but only those that have an effect on visibility impairment at a Class I Federal area.

On August 25, 2017, MANE-VU finalized its Intra-RPO Ask[5] and Inter-RPO Ask[6]. These "Asks" were designed to identify reasonable emissions reduction strategies which must be addressed by MANE-VU and upwind states through their regional haze SIP updates. The origins of the MANE-VU Asks are rooted in the document *FINAL Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas, Methodology for Source Selection, Evaluation of Control Options, and Four Factor Analysis*, July 9, 2007[7] (hereinafter, the MACTEC Report). The purpose of the MACTEC Report was to evaluate a range of potential sulfur dioxide (SO_2), particulate matter (PM), and volatile organic compound (VOC) emissions control measures using the four statutory factors of cost of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining

5 https://otcair.org/MANEVU/Upload/Publication/Formal%20Actions/MANE-VU%20Intra-Regional%20Ask%20Final%208-25-2017.pdf

6 https://otcair.org/MANEVU/Upload/Publication/Formal%20Actions/MANE-VU%20Inter-Regional%20Ask%20Final%208-25-2017.pdf

7 https://s3.amazonaws.com/marama.org/wp-content/uploads/2019/10/13095230/Assessment_of_Reasonable_Progress_for_Haze_in_MANE_VU-2007.pdf

useful life of any potentially affected sources. Table 2-1 below, excerpted from the MACTEC Report, summarizes the four-factor analysis results from the emissions categories analyzed:

Table 2-1: Summary of MACTEC Report Four-Factor Analysis Results

Source Category	Primary Regional Haze Pollutant	Average Cost in 2006 dollars (per ton of pollutant reduction)	Compliance Timeframe	Energy and Non-Air Quality Environmental Impacts	Remaining Useful Life
Electric Generating Units	SO_2	IPM* v.2.1.9 predicts $775-$1,690 $170-$5,700 based on available literature	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, reduction in electricity production capacity, wastewater issues	50 years or more
Industrial, Commercial, Institutional Boilers	SO_2	$130-$11,000 based on available literature	2-3 years following SIP submittal	Fuel supply issues, potential permitting issues, control device energy requirements, wastewater issues	10-30 years
Cement and Lime Kilns	SO_2	$1,900-$73,000 based on available literature	2-3 years following SIP submittal	Control device energy requirements, wastewater issues	10-30 years
Heating Oil	SO_2	$550-$750 based on available literature. There is a high uncertainty associated with this cost estimate.	Currently feasible. Capacity issues may influence timeframe for implementation of new fuel standards	Increases in furnace/boiler efficiency, Decreased furnace/boiler maintenance requirements	18-25 years
Residential Wood Combustion	PM and VOC	$0-$10,000 based on available literature	Several years - dependent on mechanism for emission reduction	Reduce greenhouse gas emissions, increase efficiency of combustion device	10-15 years

* Integrated Planning Model (IPM®) application by ICF for MANE-VU

In 2015, SRA International, Inc. updated some of the cost information in the 2007 MACTEC Report and also added an evaluation of controls and costs for reducing nitrogen oxide (NO_x) emissions from electric generating units (EGUs) and industrial/commercial/institutional (ICI) boilers.

Three of the emissions source categories that were analyzed in the MACTEC report for the first regional haze implementation period were carried directly over to the current (second) regional haze implementation period because MANE-VU concludes that emissions controls to address these categories are reasonable based on the four statutory factors. These categories include:

- Coal and oil-fired EGUs
- ICI Boilers
- Use of heating oil

Carrying forward these categories is consistent with EPA's August 20, 2019 *Guidance on Regional Haze State Implementation Plans for the Second Implementation Period*[8], which states on page 39, "A state may consider in its analysis of control measures how it, other states, and EPA made reasonable progress decisions during the first implementation period and may consider final decisions already made in the second implementation period, if any."

8 https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf

The efforts that Maryland has made to address EGUs, ICI Boilers, and heating oil with respect to meeting the current MANE-VU Intra-RPO Asks are described in Section 2.5. In addition, a MANE-VU technical analysis, *2016 MANE-VU Source Contribution Modeling Report*[9] was used as a screening tool to derive a list of EGUs and large ICI boilers that warrant further consideration for a unit-specific four-factor analysis. The final list reflects those units listed in Tables 34 and 35 of the report that have an impact at any MANE-VU Class I area of 3 Mm^{-1} or more. Many MANE-VU states have completed, or are currently conducting, four-factor analyses for the units identified in their states.

As described in Section 2.5.2, two facilities in Maryland appear on the list. One facility, VERSO Luke Paper, has been permanently closed. The other facility, H.A. Wagner Generating Station, has agreed via legal consent agreement to cease the combustion of coal at, not only the Wagner Generating Station, but also the Brandon Shores Generating Station by 2025. Therefore, according to the statutory factor of remaining useful life for this facility, further control is not reasonable.

2.4.1 First Implementation Period

During the first planning period, MANE-VU considered 1% as the threshold for a state to be "reasonably anticipated to contribute to visibility impairment. During the first implementation period, modeling indicated that Maryland contributed more than one percent of all of the modeled Eastern U.S. anthropogenic visibility impairment to any of the five Class I Federal areas that are within 300 km (186.41 mi) of Maryland.

2.4.2 Examination of Monitored Data

For the second implementation period, MANE-VU updated its conceptual model of regional haze in *Contributions to Regional Haze in the Northeast and Mid-Atlantic United States: Preliminary Update Through 2007* (NESCAUM, March 2012) (Appendix 2). This model considered the monitored Class I areas within MANE-VU and Class 1 areas proximate to the MANE-VU region.

A review of recent IMPROVE[10] speciated visibility data shows the relative importance of sulfates compared to other pollutants in regard to light extinction at the IMPROVE sites analyzed (see Figure 2-1). This led to the conclusion that SO_2 was the most accurate and most relevant estimation for determining the impact of states' emissions to the visibility impairment of the MANE-VU Class I areas. Emissions of NO_x were considered in the final analysis and factored into Q/d calculations with chemistry information provided by CALPUFF modeling.

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

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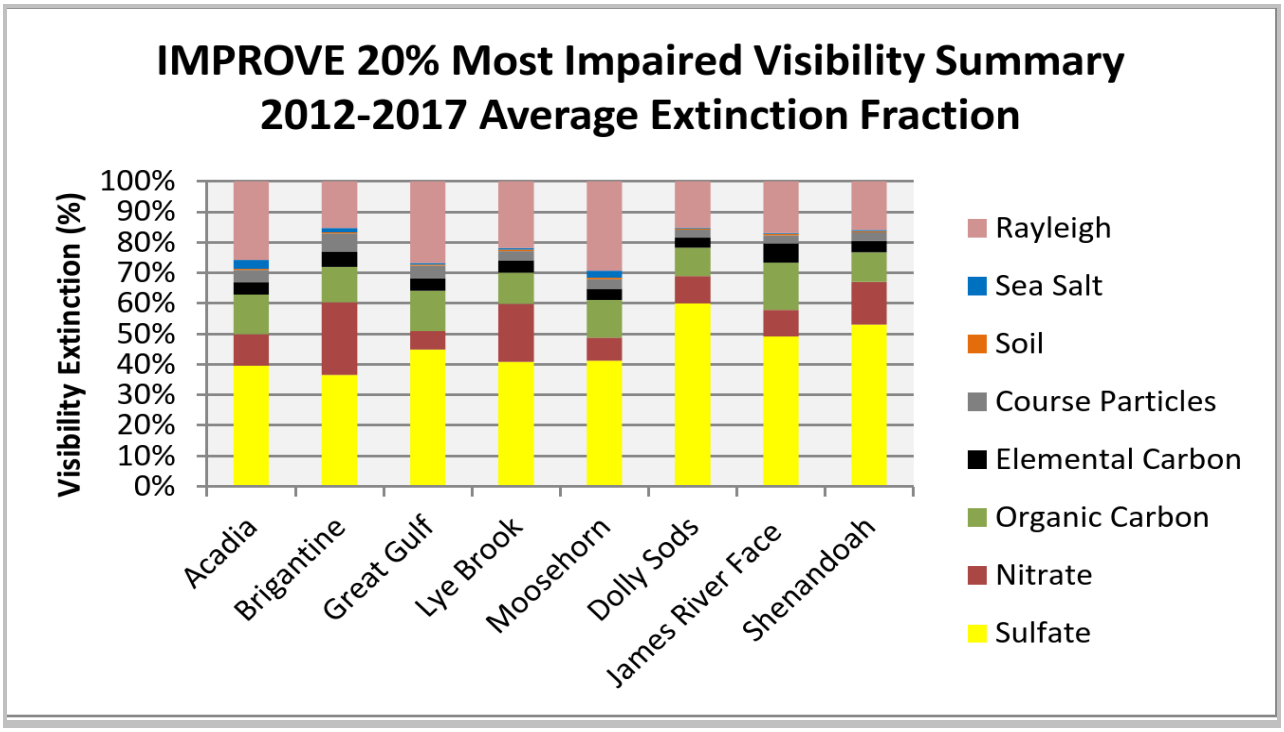
[9] https://otcair.org/MANEVU/Upload/Publication/Reports/MANE-VU%20CALPUFF%20Modeling%20Report%20Draft%2004-4-2017.pdf

[10] Interagency Monitoring of Protected Visual Environments. http://vista.cira.colostate.edu/Improve/

Figure 2-1: IMPROVE 20% Most Impaired Visibility Summary

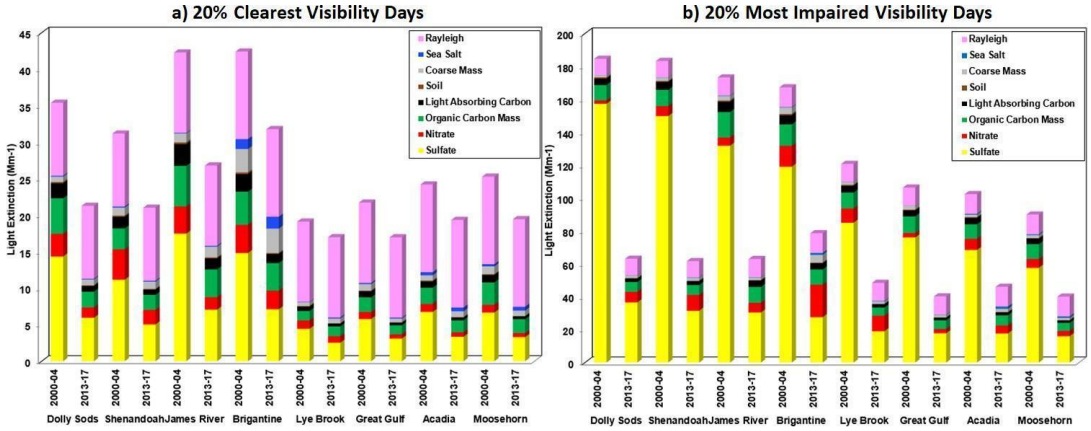


The research of IMPROVE monitor data at the MANE-VU and nearby Class I Federal areas[11] concluded that the sulfates from SO_2 emissions were still the primary driver behind visibility impairment in the region, though nitrates from NO_x emission sources play a more significant role than they had in the first planning period, in particular at Brigantine, New Jersey.

Analysis of IMPROVE data continued to factor in the change in metrics from 20% worst days to 20% most impaired days that 51.308 now requires to be used. This analysis is in the report *Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics)* (MANE- VU, December 2018) (Appendix 13). Figure 2-1 illustrates that using the 20% most impaired visibility days shows the dominance of sulfate in the extinction calculated from the 2000-2004 baseline data, how much that has decreased by the 2013-2017 period, how it is still the primary contributor to extinction at the Class I Federal areas within 300 km of Maryland, and how nitrates are now a major contributor at the Brigantine site. MANE-VU also added data from James River Face IMPROVE monitor into consideration as part of this analysis. This more recent data showing the importance of sulfates primarily, and nitrates at certain sites, supports the assumptions concerning pollutants of interest laid out in *Contributions to Regional Haze in the Northeast and Mid-Atlantic United States: Preliminary Update Through 2007* (NESCAUM, March 2012) (Appendix 2).

[11] Acadia National Park, Brigantine Wilderness, Great Gulf Wilderness, Lye Brook Wilderness, Moosehorn Wilderness, Dolly Sods Wilderness and Shenandoah National Park. Note that at this stage in the analysis James River Face was not included, but it was added into consideration at a later point.

Figure 2-2: Current and Baseline 5-Year Average Light Extinction at Class I Sites on 20 Percent Clearest and



Following the determination of the anthropogenic pollutants that impair visibility in the MANE- VU and nearby Class I Federal areas, MANE-VU conducted several contribution analyses.

2.4.3 Contribution Modeling Techniques Used

Maryland concurred with MANE-VU'S assessment of Maryland's impacts on downwind Class 1 areas. MANE-VU completed two contribution assessments - a meteorologically-weighted Q/d analysis and a CALPUFF modeling analysis. The following sections provide details on the analyses.

- Meteorologically-Weighted Q/d

The meteorologically-weighted emissions over distance (Q/d) method is a method for estimating sulfate and nitrate contributions to a receptor. NESCAUM employed this method for the first implementation period in the *Contributions to Regional Haze in the Northeast and Mid-Atlantic United States: Preliminary Update through 2007 (NESCAUM, March 2012)* (Appendix 2). The 2016 assessment for the second implementation period primarily uses the same methodology as in this previous study.

The following equation expresses the empirical formula used to relate emission source strength and estimated impacts.

$$I = C_i \left(Q / d \right)$$

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 6,371 km. The effect of meteorological prevailing winds represented by the constant, C_i, a function of the "wind direction sectors" relative to the receptor site.

MANE-VU determined that the Ci's, originally derived for the SO_2 emissions, were not appropriate substitutions for these other pollutants; this was most evident in the resulting over estimation of the impact of NO_x at the Class I areas with this methodology. This, in addition with the visibility assessment which also showed the relative importance of sulfates compared to other pollutants in regards to light extinction at the IMPROVE sites analyzed (see Figure 2-2), led MAVE-VU to conclude 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.

The emissions employed in the Q/d assessment used both the 2011 emissions that were selected based on the description in Section 2.6, as well as projections to 2018. Details of the meteorologically-weighted

Q/d analyses can be found in *MANE-VU Updated Q/d*C Contribution Assessment* (MANE-VU, April 2016) (Appendix 3).

32 eastern States were analyzed, and the list of states included was based on prior inclusion of the state in an interstate Federal cap-and-trade program under CAA § 110(a)(2)(d). The MANE-VU meteorologically-weighted Q/d work found that Maryland contributed between 1.65% and 4.32% to visibility impairment at any of the Class I Federal areas within 300 km of Maryland in 2011 and was projected to contribute between 3.35% and 8.89% to visibility impairment at any of the Class I Federal areas within 300 km of Maryland in 2018 based on the maximum daily impact. During this planning period, MANE-VU, through the intra-RPO consultation, considered 2% to be the threshold for a state to be "reasonably anticipated to contribute to visibility impairment." Detailed results for each of the 32 States considered are in Table 2-2.

Table 2-2: Q/d results using 2011 and 2018 inventory data for 32 states

	MANE-VU												SESARM			
	Acadia		Brigantine		Great Gulf		Lye Brook		Moosehorn		Dolly Sods		James River Face		Shenandoah	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
2011																
AL	3.20%	10	3.49%	12	2.98%	11	3.37%	11	2.84%	11	2.85%	11	3.88%	11	3.15%	13
AR	1.02%	24	1.00%	23	1.18%	22	1.04%	21	1.19%	23	0.79%	21	0.99%	20	0.84%	21
CT	0.08%	29	0.05%	30	0.02%	32	0.05%	29	0.06%	29	0.01%	30	0.01%	30	0.02%	30
DC	0.03%	32	0.07%	29	0.02%	30	0.02%	30	0.02%	31	0.02%	29	0.02%	29	0.05%	29
DE	0.44%	27	1.85%	19	0.14%	27	0.20%	26	0.36%	26	0.18%	26	0.25%	25	0.37%	24
GA	3.58%	9	3.73%	8	2.94%	12	2.76%	12	3.03%	10	3.01%	10	4.40%	7	3.53%	12
IA	2.14%	18	1.22%	22	2.39%	14	1.76%	18	1.89%	16	1.20%	18	1.38%	18	1.25%	19
IL	5.27%	5	3.65%	9	6.11%	5	4.63%	8	6.38%	5	3.73%	7	4.33%	8	3.79%	8
IN	8.34%	3	7.15%	3	10.22%	3	7.94%	3	9.43%	3	7.55%	4	8.73%	2	7.43%	3
KY	4.40%	7	5.71%	4	4.81%	7	5.03%	6	4.97%	8	5.74%	5	7.20%	4	5.61%	5
LA	1.96%	20	1.91%	17	1.79%	16	1.97%	15	1.75%	17	1.41%	17	1.82%	16	1.56%	18
MA	2.04%	19	0.71%	24	0.54%	24	0.51%	25	0.75%	24	0.24%	24	0.26%	24	0.33%	25
MD	**1.78%**	**22**	**4.32%**	**6**	**1.65%**	**17**	**1.84%**	**16**	**1.65%**	**18**	**4.09%**	**6**	**1.94%**	**15**	**3.53%**	**11**
ME	1.60%	23	0.09%	28	0.28%	25	0.07%	28	1.39%	21	0.04%	28	0.05%	28	0.06%	28
MI	7.01%	4	3.52%	11	7.95%	4	6.93%	4	7.65%	4	3.59%	8	3.29%	13	4.38%	6
MN	0.77%	25	0.34%	27	0.21%	26	0.78%	22	0.22%	28	0.40%	23	0.35%	23	0.47%	23
MO	4.17%	8	3.08%	13	4.75%	8	3.55%	9	5.20%	7	2.73%	13	3.28%	14	2.85%	15
MS	0.66%	26	0.67%	25	0.60%	23	0.67%	24	0.58%	25	0.51%	22	0.67%	22	0.56%	22
NC	2.32%	17	2.88%	14	1.43%	19	1.47%	19	1.52%	19	1.70%	15	3.73%	12	3.63%	9
NH	2.40%	15	0.55%	26	1.25%	21	0.68%	23	2.10%	14	0.22%	25	0.23%	26	0.29%	26
NJ	0.30%	28	1.90%	18	0.12%	28	0.16%	27	0.24%	27	0.11%	27	0.11%	27	0.17%	27
NY	3.13%	11	1.81%	20	4.02%	9	5.10%	5	3.15%	9	0.95%	20	0.87%	21	1.14%	20
OH	15.26%	1	16.85%	1	16.62%	1	17.78%	1	16.97%	1	25.01%	1	21.77%	1	21.63%	1
PA	10.79%	2	14.91%	2	11.81%	2	15.30%	2	10.82%	2	12.86%	2	8.56%	3	12.54%	2

RI	0.08%	30	0.03%	31	0.02%	31	0.02%	32	0.02%	32	0.01%	31	0.01%	31	0.01%	31
SC	1.85%	21	2.11%	16	1.37%	20	1.17%	20	1.36%	22	1.07%	19	1.80%	17	2.06%	16
TN	2.39%	16	2.84%	15	2.29%	15	2.66%	13	2.07%	15	2.83%	12	4.06%	10	2.99%	14
TX	5.01%	6	4.52%	5	4.99%	6	4.81%	7	5.89%	6	3.26%	9	4.08%	9	3.57%	10
VA	2.50%	14	4.22%	7	1.56%	18	1.80%	17	1.44%	20	2.40%	14	5.69%	5	4.32%	7
VT	0.03%	31	0.01%	32	0.06%	29	0.02%	31	0.03%	30	0.00%	32	0.00%	32	0.00%	32
WI	2.85%	12	1.24%	21	3.19%	10	2.51%	14	2.27%	13	1.46%	16	1.22%	19	1.68%	17
WV	2.60%	13	3.59%	10	2.67%	13	3.39%	10	2.79%	12	10.02%	3	3.88%	6	6.18%	4

	MANE-VU												SESARM			
	Acadia		Brigantine		Great Gul		Lye Brook		Moosehorn		Dolly Sods		James River Face		Shenandoah	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
2018																
AL	2.22%	15	2.29%	15	1.97%	15	2.27%	14	1.75%	16	1.91%	16	2.66%	15	2.13%	16
AR	2.62%	14	2.46%	13	2.97%	12	2.64%	13	2.94%	12	2.02%	13	2.61%	16	2.19%	15
CT	0.13%	30	0.08%	29	0.03%	32	0.08%	28	0.09%	29	0.02%	30	0.02%	30	0.03%	30
DC	0.06%	32	0.13%	28	0.05%	30	0.05%	30	0.05%	31	0.04%	28	0.05%	28	0.11%	28
DE	0.29%	28	1.20%	22	0.16%	28	0.13%	27	0.23%	28	0.13%	25	0.16%	25	0.25%	25
GA	1.37%	21	1.40%	21	1.10%	21	1.08%	22	1.08%	21	1.06%	19	1.58%	18	1.38%	18
IA	1.35%	22	0.75%	23	1.47%	18	1.11%	20	1.20%	20	0.79%	21	0.93%	21	0.82%	22
IL	5.42%	7	3.83%	9	6.17%	7	4.77%	8	6.34%	6	3.95%	9	4.78%	10	4.07%	10
IN	7.46%	5	6.26%	6	8.79%	4	6.95%	4	8.06%	5	6.45%	5	7.68%	3	6.47%	6
KY	5.20%	8	6.27%	5	5.96%	8	5.81%	7	5.70%	8	6.02%	6	7.59%	5	6.05%	7
LA	2.96%	12	2.77%	11	2.62%	13	2.95%	12	2.49%	13	2.13%	12	2.82%	14	2.38%	14
MA	0.80%	26	0.25%	26	0.22%	27	0.24%	26	0.37%	26	0.09%	26	0.10%	26	0.12%	26
MD	**3.77%**	**9**	**8.89%**	**3**	**3.36%**	**11**	**3.80%**	**11**	**3.35%**	**11**	**8.39%**	**4**	**4.17%**	**11**	**7.46%**	**4**
ME	1.25%	23	0.07%	30	0.22%	25	0.05%	29	1.39%	18	0.03%	29	0.04%	29	0.04%	29
MI	6.02%	6	2.66%	12	6.44%	6	5.95%	6	6.32%	7	2.97%	10	2.83%	13	3.47%	11
MN	1.08%	24	0.46%	25	0.30%	24	1.09%	21	0.30%	27	0.56%	23	0.49%	23	0.66%	23
MO	7.50%	4	5.37%	7	8.37%	5	6.38%	5	9.04%	4	4.96%	8	6.16%	7	5.24%	8
MS	1.58%	18	1.55%	20	1.41%	19	1.60%	18	1.35%	19	1.22%	17	1.66%	17	1.37%	19
NC	2.64%	13	3.24%	10	1.74%	17	1.68%	17	1.89%	15	1.98%	14	5.02%	9	4.39%	9
NH	0.99%	25	0.20%	27	0.73%	23	0.25%	25	0.77%	24	0.08%	27	0.09%	27	0.11%	27
NJ	0.49%	27	1.83%	18	0.22%	26	0.27%	24	0.38%	25	0.18%	24	0.19%	24	0.27%	24
NY	3.35%	11	1.98%	17	3.71%	9	4.46%	10	3.37%	10	1.08%	18	1.01%	20	1.29%	20
OH	10.16%	2	10.22%	2	11.07%	2	11.33%	2	10.93%	2	13.94%	2	13.20%	1	12.82%	2
PA	11.57%	1	16.36%	1	12.27%	1	15.74%	1	10.94%	1	13.65%	3	9.50%	2	13.71%	1
RI	0.16%	29	0.05%	31	0.04%	31	0.03%	32	0.03%	32	0.02%	31	0.02%	31	0.03%	31
SC	1.47%	19	1.64%	19	1.03%	22	0.91%	23	0.98%	23	0.72%	22	1.29%	19	1.67%	17

TN	2.01%	16	2.24%	16	1.86%	16	2.19%	15	2.15%	14	2.23%	11	3.17%	12	2.38%	13
TX	9.17%	3	7.90%	4	9.00%	3	8.66%	3	10.47%	3	5.91%	7	7.61%	4	6.55%	5
VA	1.46%	20	2.35%	14	1.16%	20	1.31%	19	1.00%	22	1.96%	15	5.45%	8	2.92%	12
VT	0.07%	31	0.02%	32	0.13%	29	0.04%	31	0.07%	30	0.01%	32	0.01%	32	0.01%	32
WI	1.93%	17	0.74%	24	2.00%	14	1.69%	16	1.45%	17	0.86%	20	0.79%	22	1.13%	21
WV	3.46%	10	4.54%	8	3.45%	10	4.48%	9	3.54%	9	14.63%	1	6.32%	6	8.48%	3

CALPUFF Modeling

Following completion of the meteorologically-weighted Q/d assessment, the New Hampshire Department of Environmental Services (NHDES) in conjunction with the Vermont Department of Environmental Conservation (VTDEC) modeled air pollution transport with the CALPUFF dispersion model. CALPUFF was used to simulate sulfate and nitrate formation and transport in MANE-VU and nearby regions. The modeling effort focused on Electrical Generating Units (EGUs) and large industrial and institutional sources in the eastern and central United States.

Once the dispersion modeling with CALPUFF was completed, the CALPOST post-processor was used to extract predicted sulfate and nitrate concentrations for a set of receptors covering eleven Class I areas in and near the MANE-VU region. The CALPOST output data was imported into an Excel output processing spreadsheet created by NHDES that automatically finds the maximum 24-hour sulfate and nitrate modeling concentration for each of the eleven selected Class I areas.

A routine programmed into the Excel spreadsheet mathematically converts predicted sulfate concentrations to ammonium sulfate concentrations, and nitrate concentrations to ammonium nitrate concentrations. The spreadsheet also calculates an estimated change in light extinction for each modeled emission source based on its predicted ammonium sulfate and ammonium nitrate impacts at each Class I area. These calculations are based on FLAG guidance equations for reconstructed light extinction. Additional spreadsheet calculations include emission source relative visibility changes in deciviews for the 20% best and 20% worst visibility days for each Class I area. Average 20% best and 20% worst visibility extinction values were derived from 2011 IMPROVE data for each Class I area (note: On January 10, 2017, EPA published a final rule regarding amendments to state plans for protection of visibility (82 FR 3078). This rule incorporates a new methodology based on the 20% "most impaired" days. EPA also published an associated draft guidance for the second implementation period of the regional haze rule.

However, EPA has not finalized this draft guidance. Therefore, this 2016 CALPUFF analysis was based on the 20% "worst days" metric.). Visibility (in deciviews) was calculated with and without the modeled extinction increment and the difference between the two provided an estimate for changes in deciviews under different visibility conditions. It should be noted that the methodology of using 95th percentile emissions produces a very conservative (i.e. high bound) impact assessment representing potential impact when certain conditions combine. The modeling results are even more conservative in that the 95th percentile daily NO_x emissions and 95th percentile daily SO_2 emissions may occur on different operational days for each EGU. Yet, it is assumed in the modeling that both occur every day of the year so all meteorological conditions are considered with peak emissions.

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

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

Details on the modeling are found in the report *2016 MANE-VU Source Contribution Modeling Report – CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources (MANE-VU, April 2017)* (Appendix 4).

MANE-VU Determination of Visibility Threshold for Four-Factor Analysis

As noted in Section 2.4 above, Maryland relied on contribution assessments conducted by MANE-VU to determine which source emission categories should be considered in its long-term strategy and which facility sources should be reasonably considered for further source specific four-factor analysis.

MANE-VU concluded that in light of the flexibility of the regulations and guidance, MANE-VU set a scientifically defensible threshold of 3 Mm^{-1}. This threshold is conservative in that it brings into consideration those emissions units that are reasonably anticipated to cause or contribute to visibility at one or more of MANE-VU's Class I areas. Yet this threshold is not so onerous as to unnecessarily burden air agency staff or the regulated community by requiring them to analyze emissions units with a negligible impact on visibility. Additional documentation of the MANE-VU rationale for adopting the 3 Mm^{-1} threshold is presented in Appendix 17.

MANE-VU reviewed all the data and analysis concerning visibility impairment and determined that 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 Federal area, as identified by MANE-VU contribution analyses should perform a four-factor analysis for reasonable installation or upgrade to emission controls.

Maryland agrees with the MANE-VU approach and assessment. MANE-VU developed the threshold using scientifically defensible methods and an open forum technical advisory policy in developing the threshold.

In Maryland, the results of the MANE-VU approach and assessment is supported by the completely different approach conducted by SESARM[12]/VISTA[13]. Where MANE-VU used a process including a meteorologically-weighted emissions over distance (Q/d) methodology along with the CALPUFF/HYSPLIT model, SESARM/VISTA used CAMx[14] and PSAT[15]. The SESARM/VISTA methodology produced only one source in Maryland (Luke Paper Mill) as a facility of visibility concern; the MANE-VU methodology identified two sources (Luke Paper Mill and the H.A. Wagner Generating Facility). The results of the two disparate methods to address visibility coincide nicely, and the results substantiate each other.

[12] SESARM: Southeastern States Air Resource Managers

[13] VISTA: Visibility Improvement State and Tribal Association

[14] CAMx: Comprehensive Air Quality Model with Extensions

[15] PSAT: Particulate Matter Source Apportionment Technology

2.5 § 51.308 (f)(2)(ii) – State-to-State Consultation

The State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress.

(A) The State must demonstrate that it has included in its implementation plan all measures agreed to during state-to-state consultations or a regional planning process, or measures that will provide equivalent visibility improvement.

(B) The State must consider the emission reduction measures identified by other States for their sources as being necessary to make reasonable progress in the mandatory Class I Federal area.

(C) In any situation in which a State cannot agree with another State on the emission reduction measures necessary to make reasonable progress in a mandatory Class I Federal area, the State must describe the actions taken to resolve the disagreement. In reviewing the State's implementation plan, the Administrator will take this information into account in determining whether the plan provides for reasonable progress at each mandatory Class I Federal area that is located in the State or that may be affected by emissions from the State. All substantive interstate consultations must be documented.

In 1999, EPA and affected States/Tribes established five Regional Planning Organizations (RPOs) to facilitate interstate coordination on their SIPs. Maryland is a member of the Mid-Atlantic / Northeast Visibility Union (MANE-VU) RPO.

Table 2-3: MANE-VU Members

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

*Non-voting members

MANE-VU's work is managed by the Ozone Transport Commission (OTC) and carried out by OTC, the Mid-Atlantic Regional Air Management Association (MARAMA), and the Northeast States for Coordinated Air Quality Management (NESCAUM). The states along with federal agencies and professional staff from OTC, MARAMA, and NESCAUM are members of the various committees and workgroups.

Since its inception on July 24, 2001, MANE-VU established a committee structure that meets regularly to address both technical and non-technical issues related to regional haze. The primary committee is the Technical Support Committee (TSC). The TSC is charged with assessing the nature and magnitude of the

regional haze problem within MANE-VU, interpreting the results of technical work, and reporting on such work to MANE-VU.

Maryland consulted with other states by participation in the MANE-VU and inter-RPO processes that developed technical information necessary for development of coordinated strategies. A full documentation of this consultation is available in *MANE-VU Regional Haze Consultation Summary* (MANE-VU, July 2018) (Appendix 7).

On May 10, 2006, MANE-VU adopted the Inter-RPO State/Tribal and FLM Consultation Framework, which set forth basic principles for the consultation process (Appendix 5) for the first implementation period. On May 5, 2017, MANE-VU adopted an updated consultation plan, *MANE-VU Regional Haze Consultation Plan* (May 5, 2017) (Appendix 6), which summarized the consultation process for the second implementation period. A detailed description of the consultation process, meetings, and calls is in the *MANE- VU Regional Haze Consultation Summary* (MANE-VU, August 2018) (Appendix 7).

Table 2-4: Schedule of MANE-VU Intra- and Inter-RPO Consultation

Date	Call/Meeting	Consultation Step	Type
February 7, 2017	Air Directors Call	Introduction to Process & Planning	
February 28, 2017	TSC Call	**MANE-VU Intra-RPO Consultation #1**	Technical
March 7, 2017	Air Directors Call	Update	
March 28, 2017	TSC Call	**MANE-VU Intra-RPO Consultation #2**	Technical
April 11, 2017	TSC Meeting	**MANE-VU Intra-RPO Consultation #3**	Technical
April 21, 2017	FLM Call	**MANE-VU Intra-RPO Consultation #4**	Technical
April 25, 2017	TSC Call	**MANE-VU Intra-RPO Consultation #5**	Technical
May 9-11, 2017	Air Directors Meeting	**MANE-VU Intra-RPO Consultation #6**	Policy
May 30, 2017	TSC Call	**MANE-VU Intra-RPO Consultation #6b**	Technical
June 5, 2017	Annual Meeting Caucus	**MANE-VU Intra-RPO Consultation #7**	Policy
June 16, 2017	Air Directors Call	**MANE-VU Intra-RPO Consultation #8**	Policy
June 29, 2017	Commissioners Call	Briefing	
July 25, 2017	Commissioners Call	**MANE-VU Intra-RPO Consultation #9**	Policy
August 4, 2017	Air Directors Call	**MANE-VU Intra-RPO Consultation #10**	Policy
August 9, 2017	Air Directors Call	**MANE-VU Intra-RPO Consultation #11**	Policy

September 7, 2017	TSC Meeting	Update	
October 20, 2017	Technical/Air Directors Call	**MANE-VU Inter-RPO Consultation #1**	Technical
December 1, 2017	Technical/Air Directors/FLM Call	**MANE-VU Inter-RPO Consultation #2**	Technical
December 18, 2017	Technical/Air Directors Call	**MANE-VU Inter-RPO Consultation #3**	Technical
January 12, 2018	Technical/Air Directors Call	**MANE-VU Inter-RPO Consultation #4**	Technical
March 28, 2018	Commissioners Call	**MANE-VU Inter-RPO Consultation #5**	Policy

On August 25, 2017, MANE-VU signed a statement containing six "Asks" concerning controls and analyses that the States with Class I Federal areas in MANE-VU wanted to be addressed in the long-term strategy of any MANE-VU member (Appendix 8). Maryland participated in the inter-RPO consultation and has chosen to address the MANE-VU "Asks" in its implementation plan.

How Maryland addressed the six MANE-VU "Asks" is discussed in the following sections.

2.5.1 "Ask 1" – Running NOx and SO2 Post-Combustion Controls on Coal-Fired EGUs Year Round

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;

Tables 2-5 and 2-6 show the current status of NO_x and SO_2 controls for units in Maryland that are affected by the Effective Use of Control Technologies for EGUs "Ask".

NO_x *emissions are regulated by:*

- COMAR 26.11.27.* - *Emission Limitations for Power Plants (Maryland Healthy Air Act)* Caps NO_x emissions on an ozone season and annual basis for each coal-fired EGU in Maryland.

Table 2-5: Emissions Limitations for Power Plants

26.11.27 Emission Limitations for Power Plants				
Citation	**Title/Subject**	**State effective date**	**EPA approval date**	**Additional explanation/citation at 40 CFR 52.1100**
26.11.27.01	Definitions	7/16/2007	9/4/2008, 73 FR 51599	
26.11.27.02	Applicability and Exceptions	7/16/2007	9/4/2008, 73 FR 51599	
26.11.27.03	General Requirements	7/16/2007	9/4/2008, 73 FR 51599	Exceptions: Paragraphs .03B(7)(a)(iii) and .03D; the

				word “and” at the end of paragraph .03B(7)(a)(ii).
26.11.27.05	Monitoring and Reporting Requirements	7/16/2007	9/4/2008, 73 FR 51599	
26.11.27.06	Judicial Review of Penalty Waivers	7/16/2007	9/4/2008, 73 FR 51599	

Source: https://www.epa.gov/sips-md/epa-approved-regulations-maryland-sip

- COMAR 26.11.40.* - NO_x *Ozone Season Emission Caps for Non-trading Large* NO_x *Units* Assures optimization of post-combustion (Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR)) NO_x controls on coal-fired EGUs and sets NO_x Indicator Rates for each unit to assure optimization

Table 2-6: NOx Ozone Season Emissions Caps

26.11.40 NO_x Ozone Season Emission Caps for Non-trading Large NOx Units				
Citation	Title/Subject	State effective date	EPA approval date	Additional explanation/ citation at 40 CFR 52.1100
26.11.40.02	Applicability	4/23/2018	10/11/2018, 83 FR 51366	
26.11.40.03	NOx Ozone Season Emission Caps	4/23/2018	10/11/2018, 83 FR 51366	
26.11.40.04	Monitoring and Reporting Requirements	4/23/2018	10/11/2018, 83 FR 51366	

Source: https://www.epa.gov/sips-md/epa-approved-regulations-maryland-sip

These regulations are very effective, reducing the annual NO_x mass emissions by almost 95% from 2002 levels as can be seen by Table 2-8, Figure 2-3 and Figure 2-4. The annual rate of NO_x emissions for Maryland coal-fired EGUs with SCR or FBC is also very low with an overall average NO_x rate for all units from 2016 through 2019 of 0.063 lbs/mmBtu (see Figure 2-4). This annual rate of NO_x emissions is far below the level EPA considers to be optimized in the CSAPR Update rule (0.10 lbs NOx/mmBtu). The overall NOx percent reduction and the low annual NOx rates effectively demonstrate that the regulations ensure the most effective use of control technologies on a year-round basis.

SO_2 *emissions are regulated by:*

COMAR 26.11.27.* - *Emission Limitations for Power Plants (Maryland Healthy Air Act)* Caps SO_2 emissions on an annual basis for each coal-fired EGU in Maryland. All non-fluidized bed base load coal-fired units are equipped with Flue Gas Desulfurization (FGD) except one. H.A. Wagner Unit 3 is the only coal-fired EGU not equipped with an FGD. H.A. Wagner Unit 3 is named as a unit requiring a four-factor analysis and is analyzed further in Section 2.5.2.

SO_2 NAAQS – The SO_2 nonattainment area covered three coal-fired power-generating facilities (Brandon Shores, H.A. Wagner and C.P. Crane). The main coal-fired EGU associated with the Anne

Arundel County and Baltimore County SO_2 nonattainment area is Herbert A. Wagner Unit 3. MDE estimates a 20-45% reduction in SO_2 emissions based on AERMOD modeling and the permit limits in the federally enforceable consent order.

These regulations are also very effective, reducing the annual SO_2 mass emissions by over 95% from 2002 levels (see Table 2-7 below). The SO_2 regulations and SIP provisions are enforceable on an annual basis. The overall SO_2 percent reduction and the annual basis of the regulations and SIP provisions effectively demonstrate that the regulations ensure the most effective use of control technologies on a year-round basis.

Maryland has met the requirements for this Ask.

Table 2-7: Maryland Units Affected by Effective Use of Control Technologies for EGUs Ask – SO_2 Reductions

Table 2-7 shows the annual SO_2 emissions (tons) from each coal-fired EGU in Maryland from 2002 to 2017, the overall annual statewide SO_2 mass and the percent reduction relative to 2002.

Year	AES Warrior Run 1	Brandon Shores 1	Brandon Shores 2	C.P. Crane 1	C.P. Crane 2	Chalk Point 1	Chalk Point 2	Dickerson 1	Dickerson 2	Dickerson3	H.A. Wagner 2	H.A. Wagner 3	Morgantown 1	Morgantown 2	R. Paul Smith 3	R. Paul Smith 4	Total	Reduction from 2002 (tons)	% Reduction from 2002
2002		20,476	19,498	17,971	14,415	23,528	25,203	10,225	11,100	12,580	6,428	10,096	37,757	32,587	820	3,768	246,452	0	0.00%
2003		18,153	22,614	15,420	16,841	19,550	22,116	9,928	9,190	10,988	7,121	13,783	43,039	42,301	829	2,921	254,794	8,342	3.38%
2004		21,144	20,147	14,860	14,182	27,181	27,332	12,817	13,125	12,857	7,635	12,694	40,085	40,915	333	2,467	267,774	21,322	8.65%
2005		18,876	22,822	15,445	17,586	25,244	22,854	11,434	13,250	13,043	6,698	15,480	38,552	40,930	812	2,547	265,573	19,121	7.76%
2006		20,498	19,969	14,770	13,111	23,358	25,196	11,888	10,301	13,763	6,492	12,860	50,019	48,054	926	3,462	274,667	28,215	11.45%
2007		17,323	24,718	13,537	17,094	22,879	21,907	11,041	11,316	11,476	6,219	14,040	45,270	47,798	1,335	4,201	270,154	23,702	9.62%
2008		21,194	18,730	12,833	11,519	21,089	21,611	8,378	10,382	11,064	5,889	9,117	39,695	30,864	848	2,851	226,064	-20,388	-8.27%
2009	1,045	12,527	20,293	6,960	5,517	19,937	20,960	9,271	7,362	9,040	4,359	10,734	32,914	36,637	141	822	198,519	-47,933	-19.45%
2010	1,247	540	720	1,315	4,274	1,219	1,254	875	823	877	3,176	5,852	3,029	2,229	425	1,641	29,496	-216,956	-88.03%
2011	1,709	1,323	1,506	2,597	3,085	1,651	4,018	261	424	439	2,994	6,013	3,252	1,926	115	533	31,846	-214,606	-87.08%
2012	1,235	1,547	1,301	1,212	961	2,510	2,136	265	259	293	2,513	4,960	1,232	1,699	33	526	22,682	-223,770	-90.80%
2013	1,236	1,389	1,481	831	2,140	3,203	1,240	243	262	345	1,551	8,554	1,374	1,048			24,897	-221,555	-89.90%
2014	1,167	1,670	1,475	573	1,314	1,310	2,540	211	214	200	1,939	7,276	1,342	1,538			22,769	-223,683	-90.76%
2015	1,090	1,310	1,643	381	944	826	647	127	125	147	1,187	8,751	1,214	1,521			19,913	-226,539	-91.92%
2016	891	1,449	1,269	411	637	496	407	124	149	152	163	7,571	1,437	1,357			16,513	-229,939	-93.30%
2017	1,023	1,097	1,417	378	449	309	216	51	64	69	116	1,243	613	906			7,951	-238,501	-96.77%

Note: Emissions Data from EPA Clean Air Markets Division (CAMD)

Table 2-8: Maryland Units Affected by Effective Use of Control Technologies for EGUs Ask – NO_x Reductions

Table 2-8 shows the annual NOx emissions (tons) from each coal-fired EGU in Maryland from 2002 to 2017, the overall statewide annual NOx mass and the percent reduction relative to 2002.

Year	AES Warrior Run 1	Brandon Shores 1	Brandon Shores 2	C.P. Crane 1	C.P. Crane 2	Chalk Point 1	Chalk Point 2	Dickerson 1	Dickerson 2	Dickerson3	H.A. Wagner 2	H.A. Wagner 3	Morgantown 1	Morgantown 2	R. Paul Smith 3	R. Paul Smith 4	Total	Reduction from 2002 (tons)	% Reduction from 2002
2002	418	6,040	5,629	6,419	4,323	6,337	6,755	2,121	2,444	2,661	2,310	1,735	10,014	8,605	248	1,011	67,070	0	0.00%
2003	483	5,419	7,624	5,253	5,597	4,432	5,133	1,905	1,269	1,811	2,434	2,488	9,066	8,726	232	757	62,629	-4,442	-6.62%
2004	554	6,215	5,678	3,974	3,729	5,174	5,198	1,914	1,947	1,819	2,392	2,114	7,097	6,606	97	655	55,163	-11,907	-17.75%
2005	592	4,347	7,378	3,983	4,223	5,085	4,601	1,668	1,987	1,947	2,036	2,770	6,737	6,698	244	678	54,974	-12,097	-18.04%
2006	460	5,867	6,097	2,898	2,410	4,590	5,029	1,649	1,401	1,926	2,015	2,075	8,030	7,415	279	867	53,008	-14,062	-20.97%
2007	541	4,120	8,732	2,682	3,093	4,885	4,835	1,645	1,644	1,658	2,062	2,210	3,097	6,321	402	996	48,923	-18,147	-27.06%
2008	491	5,686	5,907	2,908	2,170	3,169	3,513	1,266	1,546	1,604	1,906	1,535	1,020	1,820	267	686	35,494	-31,576	-47.08%
2009	407	1,052	2,421	1,211	911	1,564	2,146	1,175	964	1,071	1,073	602	842	1,044	44	195	16,722	-50,348	-75.07%
2010	611	1,853	1,913	986	1,463	1,497	2,038	1,215	1,337	1,255	1,043	355	1,059	710	132	397	17,864	-49,206	-73.36%
2011	1,220	2,355	2,467	1,195	1,302	1,435	2,601	531	690	666	990	594	635	560	36	129	17,406	-49,664	-74.05%
2012	580	1,405	2,735	946	871	1,095	1,245	487	435	517	980	503	343	458	12	155	12,767	-54,303	-80.96%
2013	560	1,030	1,495	694	1,174	1,154	1,487	541	449	587	473	568	323	342			10,877	-56,194	-83.78%
2014	550	1,136	1,396	444	780	974	2,489	550	574	491	496	386	547	584			11,397	-55,674	-83.01%
2015	444	759	1,312	339	732	655	814	246	269	254	259	593	380	465			7,521	-59,549	-88.79%
2016	357	1,021	983	270	384	581	742	230	255	285	51	395	471	423			6,448	-60,623	-90.39%
2017	452	637	999	208	326	205	246	84	106	110	36	81	223	281			3,994	-63,076	-94.05%

Note: Emissions Data from EPA Clean Air Markets Division (CAMD)

Figure 2-3: NO_x and SO_2 Reductions in Maryland

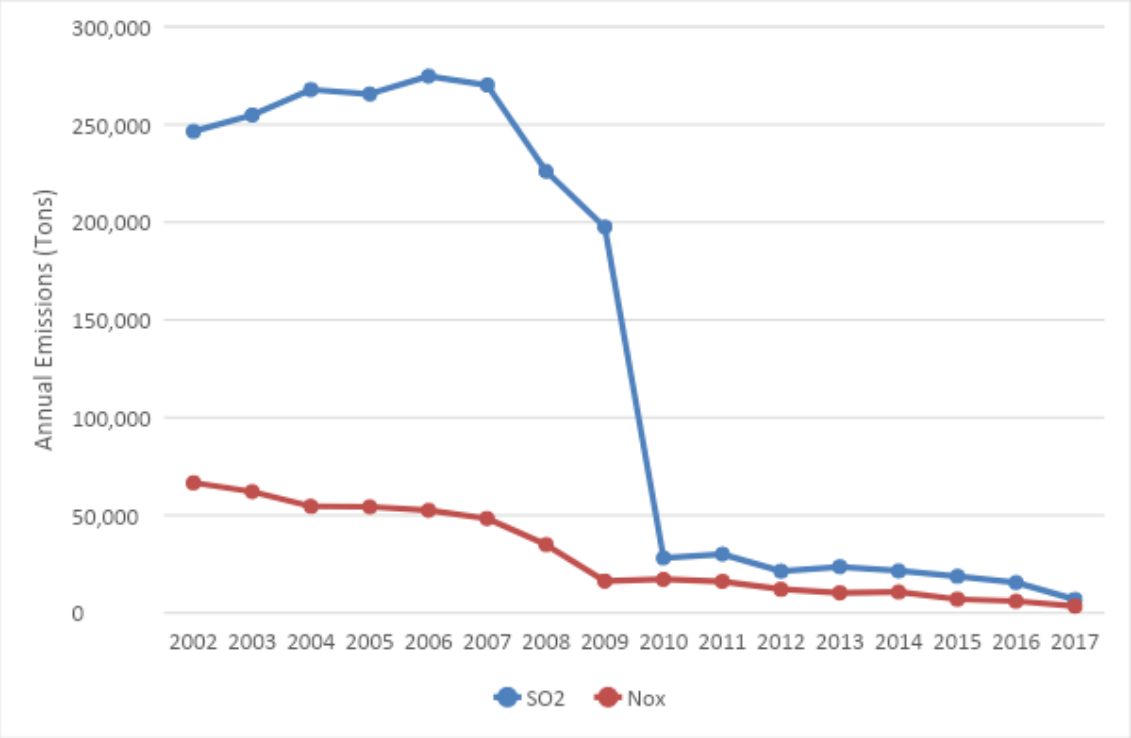


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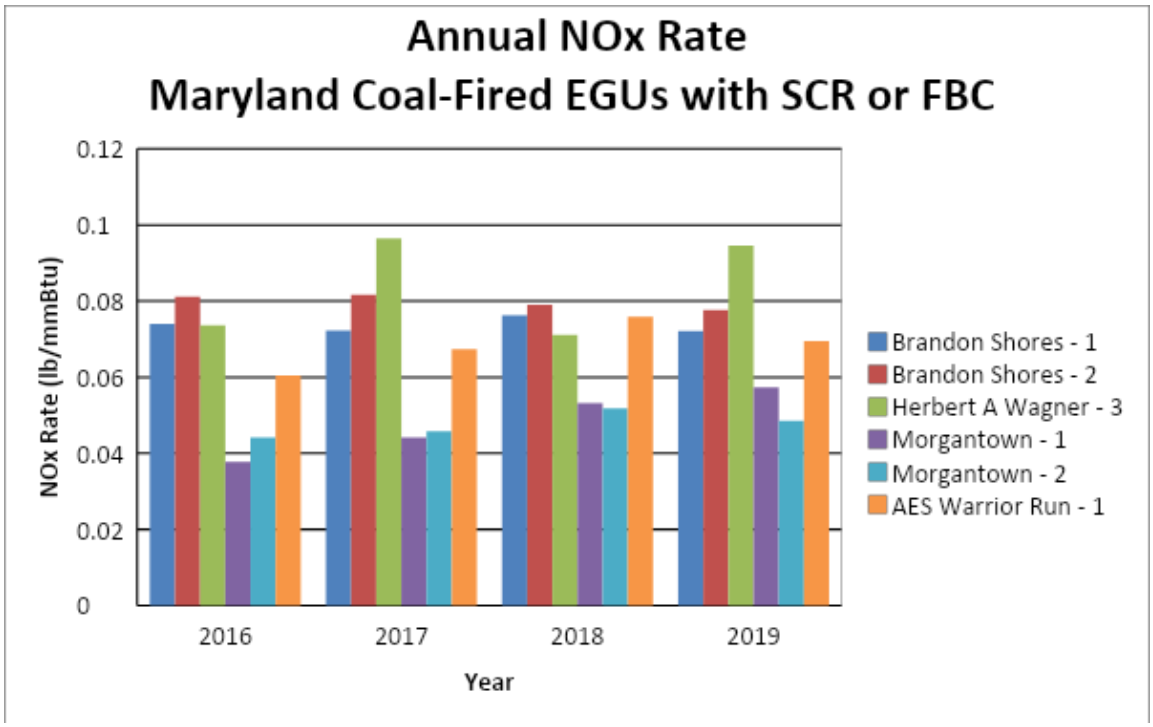
Figure 2-4: NO_x Emission Rates - Maryland Coal-Fired EGUs with SCR or FBC



SCR: Brandon Shores, H.A. Wagner, Morgantown
FBC: AES Warrior Run

Table 2-9: Emissions Controls

Facility Name	Unit ID	Unit Type	Fuel Type (Primary)	Fuel Type (Secondary)	SO_2 Control(s)	NO_x Control(s)	PM Control(s)
Brandon Shores	1	Dry bottom wall-fired boiler	Coal		Wet Lime FGD	Low NO_x Burner Technology w/ Overfire Air, Selective Catalytic Reduction	Cyclone, Baghouse
	2	Dry bottom wall-fired boiler	Coal		Wet Limestone	Low NO_x Burner Technology w/ Overfire Air, Selective Catalytic Reduction	Cyclone, Baghouse
C P Crane	1	Cyclone boiler	Coal			Overfire Air Combustion Modification/Fuel Reburning, Selective Non-catalytic Reduction	Baghouse
	2	Cyclone boiler	Coal			Overfire Air Combustion Modification/Fuel Reburning, Selective Non-catalytic Reduction	Baghouse
Chalk Point	1	Dry bottom wall-fired boiler	Coal	Pipeline Natural Gas	Wet Limestone	Low NO_x Burner Technology (Dry Bottom only), Overfire Air Selective Catalytic Reduction	Electrostatic Precipitator
	2	Dry bottom wall-fired boiler	Coal	Pipeline Natural Gas	Wet Limestone	Low NO_x Burner Technology (Dry Bottom only), Overfire Air Ammonia Injection Other	Electrostatic Precipitator
	3	Tangentially-fired	Pipeline Natural Gas	Residual Oil		Overfire Air	
	4	Tangentially-fired	Pipeline Natural Gas	Residual Oil		Overfire Air	
Dickerson	1	Tangentially-fired	Coal		Wet Limestone	Low NO_x Burner Technology w/ Separated OFA, Selective Non-catalytic Reduction	Baghouse, Electrostatic Precipitator
	2	Tangentially-fired	Coal		Wet Limestone	Low NO_x Burner Technology w/ Separated OFA, Selective Non-catalytic Reduction	Baghouse, Electrostatic Precipitator
	3	Tangentially-fired	Coal		Wet Limestone	Low NO_x Burner Technology w/ Separated OFA, Selective Non-catalytic Reduction	Baghouse, Electrostatic Precipitator
Herbert A Wagner	1	Dry bottom wall-fired boiler	Other Oil	Pipeline Natural Gas			Electrostatic Precipitator
	2	Dry bottom wall-fired boiler	Coal			Low NO_x Burner Technology (Dry Bottom only), Selective Non-catalytic Reduction	Electrostatic Precipitator
	3	Dry bottom wall-fired boiler	Coal		Dry Sorbent Injection	Low NO_x Burner Technology w/ Overfire Air, Selective Catalytic Reduction	Electrostatic Precipitator
	4	Dry bottom wall-fired boiler	Other Oil	Pipeline Natural Gas			Electrostatic Precipitator
Morgantown	1	Tangentially-fired	Coal	Residual Oil	Wet Limestone	Low NO_x Burner Technology w/ Closed-coupled/Separated OFA, Ammonia Injection, Selective Catalytic Reduction	Electrostatic Precipitator
	2	Tangentially-fired	Coal	Residual Oil	Wet Limestone	Low NO_x Burner Technology w/ Closed-coupled/Separated OFA, Ammonia Injection Selective Catalytic Reduction	Electrostatic Precipitator

2.5.2 "Ask 2" – Sources with an Impact of 3 Mm^{-1} or More on MANE-VU Class I Federal areas

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 Federal area, as identified by MANE-VU contribution analyses (see attached listing) - perform a four-factor analysis for reasonable installation or upgrade to emission controls.*

MANE-VU documents how the 3.0 Mm^{-1} threshold was established in Appendix 17. Maryland summarizes the process in Section 2.4. Maryland agrees with MANE-VU that the 3.0 Mm^{-1} threshold is reasonable.

The Herbert A. Wagner Generating Facility located in Anne Arundel County, Maryland and the Verso Luke Paper Company located in Allegany County, Maryland were identified by MANE-VU as having units with the potential for 3.0 Mm^{-1} or greater visibility impacts at any MANE-VU Class I area. The units identified are all coal-fired boilers and are specifically Wagner Unit 3 and Luke Paper Unit 001-0011-3-0018 & Unit 001-0011-3-0019.

LUKE PAPER COMPANY

The Luke Paper Company ceased operations, closed and relinquished their air permits. The information was officially sent to EPA on May 29, 2020 and included an attainment designation request letter, signed document from the company relinquishing their air permits and SO_2 monitoring data from the facility demonstrating the operations at the plant have ceased. EPA used the information to designate the area as attainment/unclassifiable under Round 4 for the 2010 1-Hour SO_2 Primary NAAQS, noting the following:

> "The primary emission source in this area, Luke Paper, has shut down and is subject to an enforceable requirement to remain shut down unless restarting is authorized by a new source permit (which would include provisions assuring continued attainment)."

No further action is necessary.

H.A. WAGNER

MDE sent a letter to the company requesting a four-factor analysis. Talen Energy Corporation, the parent company to the H.A. Wagner Generating Station, publicly announced a strategic repositioning of the facility that would eliminate the use of coal. The owners of the H.A. Wagner Generating Station have agreed and signed a legal consent order with the department to cease the combustion of coal by 2026. The Department requests that the consent agreements be incorporated by reference into the Maryland SIP. The entire SIP, including the consent agreements, will be federally enforceable upon EPA's approval. Therefore, according to the statutory factor of remaining useful life for this facility, further control is not reasonable. Talen Energy, the owner of the Herbert A. Wagner Generating Facility has publicly committed to eliminating coal use at the facility by December 31, 2025.

Maryland agrees that further control of the coal-fired Unit 3 at the H.A. Wagner Generating Station is not reasonable since the remaining useful life of the unit is approximately 4½ years.

A four-factor analysis of H.A. Wagner Unit 3 similarly concludes that no additional controls would effectively control SO_2 and NO_x emissions at this facility since the remaining useful life of the coal-fired unit is approximately 4½ years.

1. The cost of control – According to EIA[16] data, Table 9.4. Average Costs of Existing Flue Gas Desulfurization Units (Operating in Electric Power Sector 2009-2019), the average capital cost of existing flue gas desulfurization (FGD) units in the U.S. is $88,000,000 and the most recent year cost is $138,000,000 for a 305 MW unit.
2. Time necessary to install controls – The time needed to install additional controls at this facility would include the necessary engineering studies, funding resources for the controls, and construction at the site. The time constraints would be significant and likely to exceed the anticipated remaining useful life of this facility.
3. Energy and non-air quality impacts – The proposed Maryland legislation addresses reductions in greenhouse gas emissions, impacts on displaced workers, and support for the surrounding community.
4. Remaining useful life – Approximately 4½ years.

Maryland has met the requirements for this Ask.

2.5.3 "Ask 3" – Ultra Low-Sulfur Fuel Oil Regulations

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:

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

Maryland adopted amendments to COMAR 03.03.05.04, Specifications for No. 1 and No. 2 Fuel Oil in 2014. The amendments lowered the maximum allowable amount of sulfur in two stages. The first stage reduced the maximum No. 1 and No. 2 fuel oil sulfur levels from 3,000 ppm to 2,000 ppm in 2014. The second stage reduced sulfur levels further to a level of 500 ppm in 2016. The third stage reduced sulfur levels further for No. 1 and No. 2 fuel oil to the MANE-VU ASK level of 15 ppm in 2019.

The amount of #4 or #6 residual oil combusted in Maryland is minimal[17] (less than 0.2% of national consumption total) and sources that utilize residual oil are uncommon. To comply with the Ask, Maryland commits to examine the state's sulfur in residual oil standards as expeditiously as possible and address any deficiencies identified by the examination, as needed.

Maryland has met the requirements for this Ask.

2.5.4 "Ask 4" – Updating Permits at Facilities Larger than 250 MMBtu Heat Input

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*

Maryland 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

[16] https://www.eia.gov/electricity/annual/html/epa_09_04.html

[17] https://www.eia.gov/state/seds/seds-data-complete.php?sid=US#Consumption

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. COMAR 26.11.02.02 requires that a permit to construct and an approval from the Department is required before construction or modification of a source.

Maryland has met the requirements for this Ask.

2.5.5 "Ask 5" – High Electricity Demand Day Units

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:*

- *Striving to meet* NO_x *emissions standard of no greater than 25 ppm at 15% O2 for natural gas and 42 ppm at 15% O2 for fuel oil but at a minimum meet* NO_x *emissions standard of no greater than 42 ppm at 15% O2 for natural gas and 96 ppm at 15% O2 for fuel oil, or*
- *Performing a four-factor analysis for reasonable installation or upgrade to emission controls, or obtaining equivalent alternative emission reductions on high electric demand days.*

Table 2-10 shows the current status of NO_x emissions for units in Maryland that meet the definition of a HEDD unit as defined for the purposes of the "Ask". A four-factor analysis approach has been utilized to analyze potential control options. The four factors are:

- Cost of Compliance
- Time Necessary for Compliance
- Energy and Non-Air Impacts
- Remaining Useful Life at the Source

Cost of Compliance - SCR

Information on cost effectiveness of retrofitting controls on combustion turbines has been compiled from various sources. It is important to note that the values provided are estimated and actual retrofit control costs may be higher or lower depending on the utilization and size of the turbine as well as specific capital costs associated with the design. MDE referenced a report by The Brattle Group, titled "Cost of New Entry Estimates for Combustion-Turbine and Combined-Cycle Plants in PJM"[18]. Capital cost estimates as well as the fixed and variable operation and maintenance costs need to be established in order to determine an accurate cost of compliance. Due to the low annual NO_x emissions reported by these facilities, MDE focused on the fixed operation and maintenance (O & M) costs. Table 49 of the above-referenced document lists the fixed O & M costs per regional transmission organization. The O & M costs range from $6m/yr to $15.7m/yr.

The Maryland specific emissions data shown in the table below, reports that a typical combustion turbine emits an average of 5 tons per year of NO_x, with a maximum value of 10 tons per year. Assuming the lowest fixed annual O & M cost of $6m/yr., the highest NO_x annual emissions value of 10 tons per year and an SCR control efficiency[19] of 90%; the cost per ton NO_x removed :

[18] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.643.9632&rep=rep1&type=pdf

[19] https://www3.epa.gov/ttncatc1/dir1/fscr.pdf

Cost per Ton = $6,000,000/(10 x 90%) = $666,666/ton

Cost of Compliance - Water/Steam Injection

Maryland Peaking Unit Turbines

Turbine	Interest Rate:	5.50%	
Unit Type: Typical	Control Device Life	20	Years
Base Emissions:			
NOx tpy:	10	<--	2017 Emission Certification Report
Water Injection			
NOx Control Efficiency:	60%	<--	Assumed for Water/Steam Injection, AP-42 Section 3.1.4.1
NOx tpy:	4		
Total Cap Investment:	$2,240,000	<--	Vendor Estimate [1]
Annualized TCI:	$187,442	<--	Based on Interest Rate, Year and TCI
Annual O&M Costs:	$340,000	<--	Vendor Estimate [1]
Total Annual Costs:	$527,442		
Emissions Reductions:	6.00		
Cost Effectiveness:	**$87,906.95**		**$/ton removed**

[1] The most recent vendor cost estimates for installation and operation of water/steam injection obtained from New Mexico Regional Haze SIP, https://www.env.nm.gov/air-quality/wp-content/uploads/sites/2/2019/12/AI_604_Xcel-Energy_Cunningham_Four-Factor-Analysis-Report_v2.0-2019-1104.pdf

Capital recovery factor

A **capital recovery factor** is the ratio of a constant annuity to the present value of receiving that annuity for a given length of time. Using an interest rate *i*, the capital recovery factor is:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where:

n is the number of annuities received.
i is the interest rate.

Interest Rate (i)	5.5%
Compounding Periods	20
CRF =	0.08368

C**apital recovery** is the earning back of the initial funds put into an investment (capital investment). The capital recovery factor provides a way to annualize a total capital investment given a specific rate of time and at a specific interest rate. It is used to calculate equal annual amounts required to amortize an investment until the initial investment is recouped.

Time Necessary for Compliance

Approximately 30 months would be needed to budget, design, procure, and construct the equipment necessary for compliance.

Energy and Non-Air Impacts

There are several non-air environmental impacts associated with the handling and storage of the reagent used in the SCR system, typically ammonia or urea. Ammonia is a Toxic Air Pollutant (TAP) regulated under 20.2.72.502 NMAC with an occupational exposure limit (OEL) of 18 mg/m3. In both soil and water, urea is hydrolyzed quickly to ammonia and carbon dioxide by urease, an extracellular enzyme that originates from microorganisms and plant roots.[20] Short-term inhalation exposure to high levels of ammonia in humans can cause irritation and serious burns in the mouth, lungs, and eyes. Chronic exposure to airborne ammonia can increase the risk of respiratory irritation, cough, wheezing, tightness in the chest, and impaired lung function in humans. Animal studies also suggest that exposure to high levels of ammonia in air may adversely affect other organs, such as the liver, kidney, and spleen.[21] Unavoidable releases of ammonia could have significant and irreversible impacts on the living and physical environment affected. Storage and handling of urea or ammonia onsite would result in an increased risk to the health and safety of facility operators.

Remaining Useful Life at the Source

The estimated lifetime of a SCR control system or a water/steam injection system is 20 years.

Conclusion

MDE evaluated several controls, such as adding SCR or water/steam injection. Due to the high cost and low NOx reductions from these units, MDE has determined that it is not technically feasible or cost effective to implement any controls on high electricity demand day (HEDD) units at this time.

[20] U.S. EPA, EPA/635/R-10/005F, "Toxicological Report of Urea", July 2011.

[21] U.S. EPA, EPA/635/R-16/163Fc, "Toxicological Review of Ammonia Noncancer Inhalation: Executive Summary", September 2016.

Table 2-10: Maryland Units Affected by HEDD Ask

Facility Name	Facility ID	Unit ID	2011 NO_x (tons)	2011 Operating Hours	2017 NO_x (tons)	MW
Raven Power Fort Smallwood LLC	003-0468	003-0468-0007	2.673		1.4025	14
Constellation – Notch Cliff	005-0076	005-0076-9-1094	4.34	169	5.044	17
Constellation – Notch Cliff	005-0076	005-0076-9-1095	5.5145	201	9.03	17
Constellation – Notch Cliff	005-0076	005-0076-9-1096	5.12	196	8.61	17
Constellation – Notch Cliff	005-0076	005-0076-9-1097	6.04125	231	8.988	17
Constellation – Notch Cliff	005-0076	005-0076-9-1098	4.94175	199	5.4095	17
Constellation – Notch Cliff	005-0076	005-0076-9-1099	6.6395	245	8.14	17
Constellation – Notch Cliff	005-0076	005-0076-9-1100	5.5575	208	8.127	17
Constellation – Notch Cliff	005-0076	005-0076-9-1101	4.788	173	9.4725	17
C.P. Crane LLC	005-0079	005-0079-4-0089	5.411		2.3985	14
GenOn Energy, Inc.-Morgantown	017-0014	017-0014-4-0068	10.072	69	1.498	20
GenOn Energy, Inc.-Morgantown	017-0014	017-0014-4-0069	9.7425	72	1.884	20
GenOn Energy, Inc.-Dickerson	031-0019	031-0019-4-0907	1.274		1.749	18
GenOn Energy, Inc.-Chalk Point	033-0014	033-0014-4-0778	3.08	37	2.032	18
Easton Utilities - Airport Park	041-0069	041-0069-4-0101	0.6111		0.3597	4.5
Easton Utilities - Airport Park	041-0069	041-0069-4-0102	0.38285		0.14945	4.5
Constellation - Philadelphia Road	510-0265	510-0265-4-0431	5.061	85	0.558	16
Constellation - Philadelphia Road	510-0265	510-0265-4-0432	6.409	105	1.827	16
Constellation - Philadelphia Road	510-0265	510-0265-4-0433	6.165	98	2.0325	16
Constellation - Philadelphia Road	510-0265	510-0265-4-0434	7.163	116	2.002	16
AVERAGE			**5.04**		**3.92**	

Source: Maryland Department of the Environment

2.5.6 "Ask 6" – Energy Efficiency, Combined Heat and Power, and Clean Distributed Generation

> *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.*

Maryland's electricity generation sector includes emissions from Maryland's fossil fuel-burning power plants, as well as estimates of the emissions associated with electricity generated outside of Maryland but used in the state (Imported Power). The electricity generation strategy in the State's 2030 Greenhouse Gas Reduction Act (GGRA) Plan is designed to achieve 100% Clean and Renewable Electricity by 2040 by both deploying energy through the existing Renewable Portfolio Standard (RPS) and the proposed Clean and Renewable Energy Standard (CARES), and by capping and reducing emissions through RGGI.

Achieving 100% clean electricity is an essential part of the economy-wide decarbonization and electrification strategy, as it will not only reduce emissions from Maryland power plants, but also provide carbon-free energy to decarbonize the buildings and transportation sectors by replacing fossil-powered systems with electric systems that run on increasingly clean and renewable electricity.

Maryland's RPS requires Maryland electric utilities to purchase increasingly large proportions of Maryland's electricity from renewable energy sources like solar, wind, hydropower, and qualifying biomass. The current RPS goal is for 50% of Maryland's electricity to come from renewable sources by 2030 through substantial increases in solar power and deployment of new offshore wind energy off the Atlantic coast. The proposed CARES would build upon the existing RPS to achieve 100% clean electricity by 2040. It would rely on both renewable energy and additional zero- and low-carbon electricity sources to meet that goal where most cost-effective, including:

- Additional Maryland solar power beyond the current RPS requirements;
- New efficient Combined Heat and Power (CHP) systems in Maryland buildings;
- New nuclear power; and
- Natural gas or qualifying biomass power plants with carbon capture and storage (CCS).

Capping and Reducing Fossil Energy through RGGI

RGGI is a collaborative program among Eastern states to reduce CO2 emissions from power plants through a regional cap-and-invest program. Maryland has participated in RGGI since its inception 12 years ago. Through RGGI, the participating states have cut power plant emissions in half while enjoying billions of dollars of economic benefit and creating thousands of jobs.[22]

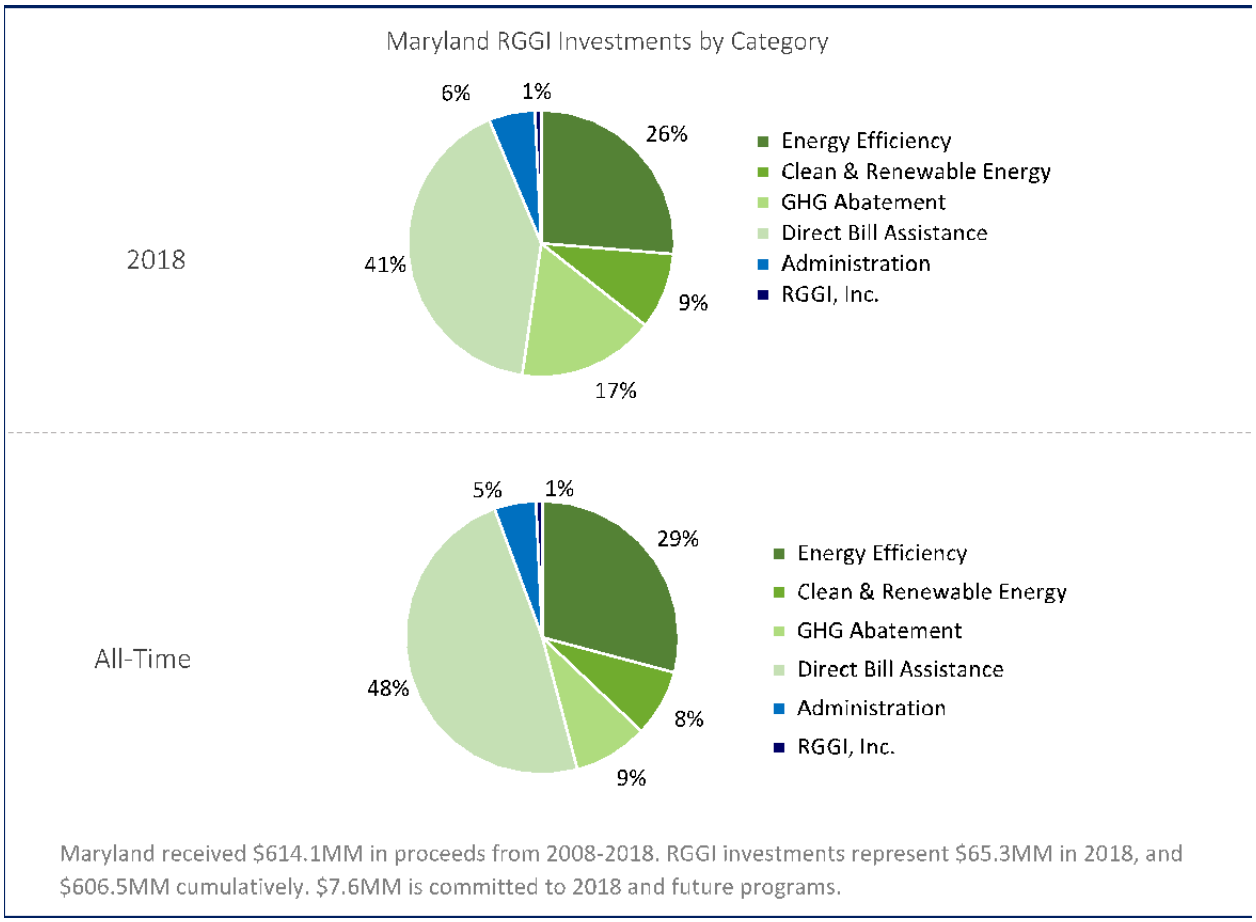
Thanks to its success, RGGI has grown substantially in recent years, with New Jersey renewing its participation in the program in 2020, Virginia joining in 2021, and Pennsylvania proposing to begin participation in 2022.

Although RGGI is designed to reduce carbon dioxide (CO_2) emissions from large electricity generating sources, significant benefits in terms of NO_x and SO_2 are realized through energy efficiency promotion. Maryland allocates proceeds from the sale of CO_2 allowances into the Strategic Energy Investment Fund, a special, non-lapsing fund administered by the Maryland Energy Administration. These funds enable

[22] https://www.rggiprojectseries.org/

programs that reduce household bills, create jobs in growing industries, increase resiliency, and promote energy independence. The programs also have significantly reduced the energy costs of Maryland's businesses. RGGI sets a binding cap on CO2 emissions from power plants in the region that reduces every year. To achieve the 100% clean electricity by 2040 goal, the 2030 GGRA Plan proposes to reduce the RGGI cap to zero by 2040, with cost controls. Maryland will bring that goal into the upcoming 2021 Program Review, where the RGGI participating states convene to establish the program's future goals. Combined with the RPS and proposed CARES program, that would eliminate CO2 from Maryland power plants and substantially reduce emissions from the power plants in nearby states that supply electricity into Maryland. For the period 2008, when Maryland joined RGGI, through 2018, the most recent year for which data have been published, the RGGI funds have been allocated as follows:

Figure 2-5: Maryland RGGI Investments by Category - 2008 - 2018 (FY)



As part of RGGI, Maryland has committed to promoting Combined Heat and Power.[23] The Combined Heat and Power (CHP) Grant Program is designed to further encourage CHP growth in the State. This first-come-first-served program targets eligible commercial, industrial, institutional, and critical infrastructure facilities (including healthcare, wastewater treatment, and essential state and local government facilities).

[23] ibid

Combined Heat and Power Program

HP systems generate electricity and useful thermal energy in a single, integrated system. CHP options combine technologies to maximize energy efficiency and reduce waste. In traditional fossil fuel power plants, two-thirds of the energy used to generate electricity is wasted in the form of heat discharged to the atmosphere as well as through electricity transmission, achieving a combined efficiency of only 33 percent. By combining electricity generation and waste heat capture, CHP systems can operate at levels as high as 80 percent efficiency.

In FY15, MEA launched this program to encourage CHP development, initially targeting healthcare and publicly owned wastewater treatment facilities because of their inherent requirement for enhanced electricity resiliency. It has since been expanded to include critical infrastructure, fuel cells, and commercial, industrial, and institutional facilities. The program also targets projects that leverage biogas or biomass as a fuel source. The commissioning of CHP systems can improve building efficiencies and reduce greenhouse gas emissions. It can also result in lower operational costs and provide resiliency to crucial facilities or other organizations that value highly reliable power supply. Seven projects awarded FY20 funding are underway. Projects awarded grant funds in FY20 are still in progress. For this reason, the program accomplishments reflect estimated project metrics and benefits associated with FY20 grants, which are subject to change.

To date, 10 CHP projects from prior fiscal years have been completed, five of which were completed at hospital locations across Maryland. A number of CHP projects receiving awards from MEA since the program's inception are in various stages of design, installation, and commissioning. CHP systems are engineering-intensive projects with long lead times, and, depending largely on complexity and installation requirements imposed by local jurisdictions and utilities, can require several years to complete.

Offshore Wind MOU - SMART-POWER

Maryland also continues to work with its regional partners, and most recently Maryland joined North Carolina and Virginia in launching the Southeast and Mid-Atlantic Regional Transformative Partnership for Offshore Wind Energy Resources (SMART-POWER). This tri-state collaborative effort to promote the Southeast and mid-Atlantic United States as a hub for offshore wind and industry. Under this initiative the three states agree to cooperatively promote, develop and expand the offshore wind industries, estimated to support up to 86,000 jobs and $57 billion in investment by 2030.

Offshore Wind Development Programs

This Offshore Wind Development Program[24] provides funds to emerging businesses, nonprofit organizations, and state, local, and municipal governments and their agencies/institutions. The Offshore Wind program includes both the OSWDF within the SEIF and the Offshore Wind Business Development Fund (OSWBDF) outside of the SEIF. Respectively, these funds are used for the development of offshore wind projects and the creation of a business supply chain in Maryland.

The OSWDF has historically been used for environmental surveys and wind resource characterization campaigns. These activities help defray the costs of an offshore wind energy developer to successfully navigate the Bureau of Ocean Energy Management's Environmental Impact Statement process, which requires submission of a Site Assessment Plan and a Construction and Operations Plan. The OSWDF is also being used to enable Maryland to participate in a national consortium funded by the U.S. Department of Energy and other participating states to focus on offshore wind technology challenges in

[24] https://energy.maryland.gov/Reports/FY20%20SEIF%20Report%20Volume%201%20Final.pdf

the United States. The OSWBDF is used to help prepare Maryland's workforce and emerging businesses, including minority-owned emerging businesses, to enter the offshore wind industry.

In FY20, the OSWBDF supported the Maryland Offshore Wind Capital Expenditure program22 (Capital Expenditure program) and the Maryland Offshore Wind Workforce Training program23 (Workforce program).

- The Capital Expenditure program provides support to emerging Maryland businesses that are interested in participating in the global offshore wind industry.
- The Workforce program provides funding to ensure Maryland has a ready and able workforce capable of contributing to the construction, installation, and operations and maintenance of an offshore wind energy project.

In FY20, the OSWDF was used for ongoing Maryland Department of Natural Resources research related to sea bass and any potential impacts of noise during turbine construction. Additionally, FY20 funds were again used for the National Offshore Wind Research and Development Consortium to provide competitive grant funding for research and development projects focused on addressing offshore wind technology advancement; wind power resource and physical site characterization; installation, operations and maintenance; and supply chain technology solutions.

In FY20, funds from OSWBDF were used to provide funding to the Business Network for Offshore Wind to continue efforts to organize Maryland businesses entering the industry. The OSWBDF also provided four additional grants in FY20; two under the Capital Expenditure program and two through the Workforce program. The Capital Expenditure program will fund a bay door expansion project that will enable an existing facility to manufacture larger boats, such as the crew transfer vessels required for the offshore wind industry, as well as to help an emerging business to purchase new metal fabrication equipment. Both of these upgrades will expand the capability of Maryland manufacturing for offshore wind, as well as manufacturing needs for other Maryland industries. The Workforce program will help fund an initiative to recruit and train individuals in welding, the fundamentals of manufacturing, or computer numerical control machining. The program will also help the Maritime Institute of Technology and Graduate Studies to become a certified training provider of the Global Wind Organization's Basic Safety Training (BST) Standard and BST Refresher Standard.

Maryland Smart Energy Communities

The Smart Energy Communities program was established in 2009, as part of MEA's Smart Energy Communities Low-to-Moderate Income Grant Program. It finances energy efficiency projects that benefit low-to-moderate income Marylanders.

An example of a success story[25] is a project at Bon Secours Property. Bon Secours is committed to providing safe, affordable housing for low- and moderate- income families, seniors, and persons with disabilities in West Baltimore. Utilizing multiple funding sources to develop and upgrade the neighborhoods and housing stock, Unity Properties targets the upstream factors contributing to health. The Maryland Energy Administration's (MEA) Smart Energy Communities Low-to-Moderate Income Grant Program (LMI) Program was able to provide funding for cost-effective energy efficiency upgrades that assisted with enhancing the physical environment of this West Baltimore housing. Unity Properties received awards in three consecutive years totaling approximately $300,000. These LMI Program funds have enhanced funding received from other sources by providing energy audits, followed by weatherizing measures and upgrades to HVAC, appliances and lighting for 90 apartments, in 45 row house residences. The weatherization efforts have resulted in an average 6-8% decrease in air

[25] https://energy.maryland.gov/Pages/default.aspx

infiltration, while making residences more energy efficient and more comfortable for residents. Residences with natural-draft appliances (such as a furnace, boiler, or water heater) were tested for combustion appliance zone safety (CAZ testing) as a part of the Building Performance Institute audit process to ensure the gas appliances were working safely.

The energy efficiency improvements made possible from the funds granted by the MEA LMI program, as well as the additional leveraged funds, not only helped to lower utility costs, but also create a healthier, brighter, and safer living environment for residents. MEA is proud to assist Bon Secours' holistic healthcare goal of "addressing the social determinants" of health for their West Baltimore neighbors.

Beneficial Siting of Renewable Energy Resources

Building sufficient renewable electricity capacity to meet Maryland's pollution reduction goals will require careful balancing of land-use impacts, particularly from solar energy. The 2030 GGRA Plan incorporates the recommendations of Governor Hogan's Task Force on Renewable Energy Development and Siting that identified several opportunities to prioritize renewable energy development in preferable locations, including degraded lands, building rooftops, and parking lot canopies.[26]

Managing a Clean and Electrified Energy System

A 100% clean electricity system will enable electrification of the transportation and building sectors, as EVs and electric heating systems use less fossil fuel fired energy. However, Maryland will have to deploy new and emerging technologies and practices to accommodate the increased electricity demand and balance an electrical grid that uses substantial amounts of intermittent renewable energy.

Building upon the Maryland Public Service Commission's (PSC) grid modernization process (PC-44), Maryland will deploy battery storage, flexible demand management, and other solutions to integrate higher levels of clean and renewable energy, and satisfy increasing demand for electricity, particularly to charge EVs.

Maryland does have time to plan for and deploy those solutions. Increased electricity demand will take decades to accumulate because of the long lifetime of vehicles and building heating systems that will be electrified at the end of their useful life, and most of the additional demand will likely come from EVs whose charging can be timed to help balance generation and load on the electrical grid.

Community Solar Programs

In FY20, program incentives went to subscriber organizations developing LMI community solar projects and a nonprofit entity providing a loan loss reserve for projects targeted to LMI subscribers. However, the ultimate beneficiaries of MEA's Community Solar program are LMI residents who are now more likely and able to participate in a community solar project enrolled in the pilot being overseen by the Maryland Public Service Commission (PSC). Description Community solar allows Maryland residents to purchase subscriptions for electricity produced from local community solar arrays, thereby gaining some of the same economic advantages as having solar modules directly on a residence while avoiding possible obstacles to participation in solar that may exist (e.g., roof age, property ownership, roof orientation, or shading). The incentives offered by MEA in FY20 were designed to help enable LMI Marylanders to

[26] https://governor.maryland.gov/energy-task-force/

participate in the larger Community Solar Pilot Program being overseen by the PSC. Both community solar arrays incentivized in FY20 are Power Purchase Agreement (PPA) projects, in which subscribers agree to purchase the electricity produced by the community solar project, rather than purchase a portion of the community solar array itself. In FY20, incentives for subscriber organizations enable them to offer terms and conditions in their community solar subscription agreement (i.e., a contract by which a customer agrees to participate in a community solar project) that would increase cost savings for LMI residents.

Clean Distributed Generation

Maryland COMAR 26.11.36.03 (effective at the State level on February 12, 2018) was updated to reflect changes in the federal regulations for stationary engines. These engines are now subject to the requirements in 40 CFR Part 63, Subpart ZZZZ, 40 CFR Part 60, Subpart IIII or JJJJ. These federal restrictions on engine use should prevent certain older, less-controlled engines from running on hot days, which should reduce the amount of ozone-forming emissions.

Maryland has two new natural gas combined cycle power plants, and two or three others are being proposed. These are very efficient, state of the art power units, and they are assuming generating capacity of less efficient

Maryland has met the requirements for this Ask.

Table 2-11: Maryland Natural Gas Combined Cycle Power Plants

Facility Name	ORIS ID	NO_x Rate (lbs/MMBtu) CAMD	SO_2 Rate (lbs/MMBtu)	Operating Time (%)	Start Date
Brandywine Power Facility	54832	0.03335	Negligible	50-90 %	1996
CPV St Charles Energy Center	56846	0.00535	Negligible	75-80%	2017
Keys Energy Center	60302	0.00587	Negligible	75-90%	2018
Wildcat Point Generation Facility	59220	0.00912	Negligible	50-60%	2018

2.6 Additional 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. Prior to the formal consultation process, MDE engaged with the FLMs to facilitate the consultation process and provide an opportunity for discussion.

2.6.1 National Park Service Source Evaluation Request

As part of the preliminary discussions, the National Park Service (NPS) sent a letter on April 12, 2018 to MANE-VU requesting that MANE-VU states consider specific individual sources in their long-term strategies (Appendix 9). NPS used an analysis of 2014 emissions divided by distance (Q/d) to estimate the impact of MANE-VU facilities on NPS Class I Federal areas - Acadia, Mammoth Cave, and Shenandoah National Parks. The letter states that the NPS used the following technique:

> *EPA's draft guidance allows use of emissions divided by distance (Q/d) as a surrogate for a modeling analysis to estimate impact. We first summed 2014 NEI* NO_x *+* PM_{10} *+* SO_2 *+* SO_4 *at a given facility and divided by distance to a specified NPS Class I Federal area. Airports and rail yards were deleted because these mobile sources are not regulated by states. For EGUs with significant Q/d values, we used 2017 CAM [sic] data to adjust for changes in emissions since 2014. We also deleted facilities that either had shut down since 2014 or had committed to shut down during the next planning period. To estimate the impact of MANE-VU facilities, we summed the Q/d values across all MANE- VU states relative to ACAD, MACA, and SHEN, ranked the Q/d values relative to each Class I Federal area, created a running total, and identified those facilities contributing to 80% of the total impact at each NPS Class I Federal area. We applied a similar process to facilities in ME relative to ACAD. We merged the resulting lists of facilities and sorted them by their states. Although the numbers of facilities identified for most states were not excessive, we observed that the totals for NY and PA could be considered burdensome. To address this problem, we suggest that a state consider those facilities comprising 80% of the Q/d total, not to exceed the 25 top ranked facilities.*

Maryland notes that the use of the metric puts states/jurisdictions that acted early and forcefully at a disadvantage and allows states with "excessive" numbers of facilities to continue to promote policies that contribute to haze. In addition to the 80% of the Q/d total/not to exceed 25 facilities threshold, some state(s) are using a metric designed to evaluate only those facilities at or above the average Q/d. Maryland would prefer the FLMs and EPA establish a consistent metric applicable to all states/jurisdictions regardless of burden. A metric, such as a visibility impact threshold, would even the regional haze playing field at the state level.

The NPS analysis identified the following facilities in Maryland as shown below.

Table 2-12: NPS Identified Facilities in Maryland

EIS ID	Facility Name	Q	Distance to Class I Area	Q/d	NPS Class I Area
7763811	Luke Paper Company	20,159	97	208.76	SHEN
6084311	Brandon Shores	4,151	146	28.42	SHEN
8200011	Lehigh Cement Company – Union Bridge	3,026	115	26.30	SHEN
7931411	Holcim (US), Inc.	2,028	95	21.33	SHEN
7717711	AES Warrior Run	1,844	91	20.23	SHEN
6011511	Morgantown	2,022	113	17.89	SHEN
6084311	Herbert A Wagner	1,566	146	10.73	SHEN
5857411	Wheelabrator Baltimore, LP	1,413	141	10.05	SHEN
6011911	Chalk Point	1,299	131	9.90	SHEN
5155011	C P Crane	1,361	164	8.29	SHEN
7719011	Montgomery County RRF	551	72	7.66	SHEN
5998011	Dickerson	549	72	7.65	SHEN
6117011	Naval Support Facility, Indian Head	387	89	4.35	SHEN
Average				29.35	

This Q/d analysis, completed by the FLMs, does not consider meteorological factors such as prevailing wind direction nor does it include any modeled visibility extinction values.

MANE-VU provided a ranking of modeled EGU stacks with 2015 95th percentile emissions that considers impacts to all seven MANE-VU Class I areas. Each stack modeled visibility extinction of 1.0 Mm^{-1} or greater. MANE-VU also provided a ranking of modeled industrial and institutional facilities with typical 2011 emissions that considers impacts to all seven MANE-VU Class I areas. Each facility modeled visibility extinction of 1.0 Mm^{-1} or greater.

The MANE-VU potential list of sources compiled to be considered for further evaluation does not include the following facilities from the FLM list:

- Lehigh Cement Company – Union Bridge
- Holcim (US), Inc.
- AES Warrior Run
- Wheelabrator Baltimore, LP
- Montgomery County RRF

Contribution assessments conducted by MANE-VU discussed in Section 2.4.3, which do consider meteorology and visibility extinction, show that two facilities in Maryland recommended for a four-factor analysis is the Luke Paper Mill and H.A. Wagner generating station.

The average Q/d for all of the named facilities is 29.35. Only one facility is at or above the average Q/d for the list compiled for Maryland. That facility is the Luke Paper Company. Using this metric conforms satisfactorily with the SESARM/VISTA and the MANE-VU efforts, as first stated in Section 2.4.3. The MANE-VU modeling and technical analysis identified two sources in Maryland, Luke Paper and H.A. Wagner Unit 3, requiring further analysis to meet the progress goals.

Luke Paper Company

The Luke Paper Company ceased operations, closed and relinquished their air permits.

Maryland's long term strategy, see Section 2.3, includes the measures necessary to achieve the reasonable progress goals established by States having Class I Federal Areas. The reasonable progress goals established by States with Class I Federal Areas also included the H.A. Wagner Generating Facility. This facility is analyzed in Section 2.5.2 with a summary provided below.

H.A. Wagner

The H.A. Wagner Generating Station has agreed to cease coal combustion at the site by 2026. MDE and Raven Power have entered into a legal consent order agreeing to the timing and cessation of coal combustion. The consent order is included as Appendix 19 to this SIP to ensure federal enforceability of the order.

Maryland also provided additional information on facilities identified by the National Park Service in an effort to demonstrate its commitment to the regional haze process and provide a good faith effort to the FLMs. This additional information goes beyond the measures necessary to achieve the reasonable progress goals established by States having Class I Federal Areas.

Brandon Shores

The Brandon Shores Generating Station has issued a joint statement with the Sierra Club to cease coal combustion at the site by 2026.

C.P. Crane

The C.P. Crane Generating Station has disabled the coal boilers and agreed via consent order to never again stockpile or burn coal at the facility. The consent order is part of the State of Maryland 1-Hour Sulfur Dioxide (SO2) National Ambient Air Quality Standard (NAAQS) State Implementation Plan for the Anne Arundel County and Baltimore County, MD ("Wagner") Nonattainment Area (SIP #20-01, January 2020). In November 2016 owner Avenue Capital Group LLC filed a deactivation notice with PJM Interconnection, announcing that it plans to stop burning coal at the plant in June 2018. The coal units are currently shut down and decommissioned. Two small natural gas turbines operating as peaking units are the only electric generating units currently at the facility.

Dickerson

The Dickerson Generating Station ceased coal operations and has closed. Per the Retired Unit Exemption form filed with the U.S. Environmental Protection Agency, Clean Air Markets Division:

> For the purpose of applying monitoring requirements under 40 CFR part 75, a unit that loses its exemption under 40 CFR 72.8 shall be treated as a new unit that commenced commercial operation on the first date on which the unit resumes operation.

Therefore, the units identified in the Retired Unit Exemption form are permanently shut down and cannot be restarted. A new owner would be required to obtain all new permits.

Chalk Point

The Chalk Point Generating Station will cease coal operations in 2021 and close. Per the Retired Unit Exemption form filed with the U.S. Environmental Protection Agency, Clean Air Markets Division:

> For the purpose of applying monitoring requirements under 40 CFR part 75, a unit that loses its exemption under 40 CFR 72.8 shall be treated as a new unit that commenced commercial operation on the first date on which the unit resumes operation.

Therefore, the units identified in the Retired Unit Exemption form are permanently shut down and cannot be restarted. A new owner would be required to obtain all new permits.

Morgantown

The FLMs asked for additional information and analysis on the Morgantown Generating Station. MDE supplied the following information:

- Description of the facility
- Current control devices/technologies for NOx, SO2 and PM
- Current monitoring devices
- Regulations that limit emissions
- Consent orders that limit emissions
- Permit conditions that limit emissions
- Analysis and documentation of historical emissions to demonstrate effectiveness of the control strategies.

The FLMs are satisfied with the information provided and don't request anything further for Morgantown.

Naval Support Facility at Indian Head

The primary emission units at the facility consisted of the Goddard Steam Plant, which included the three 208 MM Btu/hr (Coal/ No.6 fuel oil fired) boilers.

The coal-fired boilers were permanently replaced in 2014 by a decentralized (nodal) energy production system (NES) consisting of one 4.5-MW natural gas-fired combustion turbine (CT) and one 29.5 MM Btu heat recovery steam generator (HRSG). The NES replaced the capacity of the Goddard Steam Plant, which included the shutdown of the three 208 MM Btu/hr. (Coal/ No.6 fuel oil fired) boilers. Also, one 43 MM Btu/hr. auxiliary boiler and three diesel generators were removed from service.

The Combined Heat and Power Plant (CT & HRSG) portion of the NES was installed in March 2015, initial start-up in July 2015. The SNP-2 boilers were installed in March 2015 and initial startup in April 2015.

All Facilities Listed Above

The FLMs reviewed the documentation, analysis and additional information and concluded that:

> "many of the EGUs that we had originally proposed for 4-factor analyses have closed or are closing in the next few years. Some other facilities on our original list have reduced emissions significantly……. a new list of the facilities we still believe warrant further analyses--only the five facilities highlighted in yellow.
>
> …… am not suggesting that all of these facilities on this new list should undergo a rigorous 4-factor analysis. EPA Guidance allows emission units that are "effectively" controlled may be exempted. For example, Air Markets Program data indicates that the SO2 and NOx controls on both units at the Morgantown Generating Station exceed 90% efficiency and can be considered "effectively controlled."
>
> … list now consists of two cement plants, two Municipal Waste Combustors (MWCs), and one EGU (AES Warrior Run)."

MDE appreciates the FLM's removal of these six additional facilities from their list of facilities needing additional analysis.

MUNICIPAL WASTE COMBUSTORS: WHEELABRATOR, MONTGOMERY COUNTY RRF

The FLMs asked for additional information and analysis on the municipal waste combustor facilities listed above. MDE supplied the following information:

- Description of the facility
- Current control devices/technologies for NOx, SO2 and PM
- Current monitoring devices
- Regulations that limit emissions
- Consent orders that limit emissions
- Permit conditions that limit emissions
- Analysis and documentation of historical emissions to demonstrate effectiveness of the control strategies.

Comments from and response to the FLMs included:

- The NOx and SO2 limits at the Wheelabrator-Baltimore City facility are as low as we have seen.
  - MDE appreciates the acknowledgment.
- The Montgomery County RRF NOx limit is relatively low. What is the SO2 limit?
  - MDE explained that the annual SO2 emissions at the facility are typically very low (≈90 tons per year).

Analysis of Facilities to FLM Request to consider Facilities Comprising 80% of the Q/d Total

The FLM's suggest that a state consider those facilities comprising 80% of the Q/d total, not to exceed the 25 top ranked facilities. The following analysis demonstrates that MDE has met these conditions.

Table 2-13: NPS Identified Facilities in Maryland – Percent of Q/d

EIS ID	Facility Name	Q	Distance to Class I Area	Q/d	NPS Class I Area
7763811	Luke Paper Company	20,159	97	208.76	SHEN
6084311	Brandon Shores	4,151	146	28.42	SHEN
6011511	Morgantown	2,022	113	17.89	SHEN
6084311	Herbert A Wagner	1,566	146	10.73	SHEN
5857411	Wheelabrator Baltimore, LP	1,413	141	10.05	SHEN
6011911	Chalk Point	1,299	131	9.9	SHEN
5155011	C P Crane	1,361	164	8.29	SHEN
7719011	Montgomery County RRF	551	72	7.66	SHEN
5998011	Dickerson	549	72	7.65	SHEN
6117011	Naval Support Facility, Indian Head	387	89	4.35	SHEN
8200011	Lehigh Cement Company – Union Bridge	3,026	115	26.3	SHEN
7931411	Holcim (US), Inc.	2,028	95	21.33	SHEN
7717711	AES Warrior Run	1,844	91	20.23	SHEN
Average				29.35	
Total Q/d				381.56	
				Percent of Total Q/d	
Luke				54.71%	
Luke + Brandon Shores + Morgantown + Wagner + Chalk + Crane + Naval Support Facility				75.57%	
Luke + Brandon Shores + Morgantown + Wagner + Chalk + Crane + Naval Support Facility + Wheelabrator + Montgomery Co. RRF				82.22%	

The total Q/d for all of the identified sources is 381.56. Of this total the Luke Paper Company accounts for 54.71%. A sum of the Q/d for the following sources exceeds the FLM suggestion that 80% of the listed sources provide additional information.

- Luke Paper Company, Brandon Shores, Morgantown, Herbert A Wagner, Wheelabrator Baltimore, LP, Chalk Point, C P Crane, Montgomery County RRF, Dickerson, Naval Support Facility, Indian Head

The FLMs have stated that these sources are sufficiently well controlled, closed, closing soon or have fuel-switched so that further analysis is not required.

The facilities account for 82.22% of the total Q/d and thusly satisfy the FLM suggested analysis criteria.

Maryland also provided additional information on the last three facilities identified by the National Park Service in an effort to demonstrate its commitment to the regional haze process and provide a good faith effort to the FLMs. This additional information goes beyond the measures necessary to achieve the reasonable progress goals established by States having Class I Federal Areas and the FLM's metric of 80% of Q/d.

CEMENT PLANTS: ***HOLCIM; LEHIGH***

The FLMs asked for additional information and analysis on the facilities listed above. MDE supplied the following information:

- Description of the facility
- Current control devices/technologies for NOx, SO2 and PM
- Current monitoring devices
- Regulations that limit emissions
- Consent orders that limit emissions
- Permit conditions that limit emissions
- Analysis and documentation of historical emissions to demonstrate effectiveness of the control strategies.

Comments from and response to the FLMs included:

- The NOx emissions at 1.85 lb/ton of clinker for the Holcim Plant appear to be well-controlled by SNCR.
- At 2.4 lb/ton of clinker, why is Lehigh's NOx limit higher than Holcim's, even though both are pre-heater/pre-calciners with SNCR?
    - Lehigh signed a consent order with EPA in 2019 with a 30-day rolling average NOx rate of 2.1 lb/ton of clinker. The 2.4 lb/ton clinker was a typographic error.
    - Both of these facilities have agreed to consent orders with USEPA limiting NOx and SO2 emissions.
    - Holcim under an EPA consent decree to meet 1.85 lb NOx/ton clinker limit.
- Are there any SO2 controls on the Lehigh plant? If so, how efficient are they?
    - Consent Order with EPA 0.4 lbs SO2/ton clinker limit 30-day rolling average limit.
    - MDE explained that the annual SO2 emissions at the Lehigh facility are typically very low (≈25 tons per year for 2014 and 2017). The low annual emissions preclude an analysis for SO2 at the facility at this time.

MDE also considers the facilities well controlled.

ELECTRIC GENERATING UNIT: AES WARRIOR RUN

The FLMs asked for additional information and analysis on the facilities listed above. MDE supplied the following information:

- Description of the facility

- Current control devices/technologies for NOx, SO2 and PM
- Current monitoring devices
- Regulations that limit emissions
- Consent orders that limit emissions
- Permit conditions that limit emissions
- Analysis and documentation of historical emissions to demonstrate effectiveness of the control strategies.

Comments from and response to the FLMs included:

- Based upon the demonstrated very low NOx emission rate (0.08 lb/mmBtu) with SNCR, I see no need for additional analysis.
- I found 15 coal or pet-coke-fired CFBs in CAMD with an SO2 emission rate in 2019 lower than the 0.16 lb/mmBtu at Warrior Run. (Please see the attachment.) Nine of these CFBs may have added dry lime FGDs. I recommend that a 4-factor analysis be conducted to evaluate the addition of SO2 controls--especially Dry Sorbent Injection--to reduce annual emissions below the typical 1000 tpy.

MDE thanks the FLM's for the comments.

2.7 § 51.308 (f)(2)(iii) – Technical Documentation of Long-term Strategy

The State must document the technical basis, including modeling, monitoring, cost, engineering, and 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. The State may meet this requirement by relying on technical analyses developed by a regional planning process and approved by all State participants. The emissions information 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. However, if a State has made a submission for a new inventory year to meet the requirements of subpart A in the period 12 months prior to submission of the SIP, the State may use the inventory year of its prior submission.

§ 51.308(f)(2)(iii) requires Maryland to identify the baseline emission inventory on which strategies are based. The baseline inventory is used to assess progress in making emission reductions. MANE-VU and Maryland are using 2011 as the baseline year inventory. A future year inventory was developed for 2028 based on the 2011 base year. This future year emission inventory includes emissions growth due to projected increases in economic activity as well as the emissions reductions due to the implementation of control measures.

The emissions dataset discussed below is the 2011 MANE-VU Version Gamma emissions inventory. The emission inventories include carbon monoxide (CO), but it is not considered in this SIP, as it does not contribute to visibility impairment. The MANE-VU regional haze emissions inventory version Gamma, released in January 2018, was used for modeling purposes. This inventory was

developed through the Mid-Atlantic Regional Air Management Association (MARAMA), the Eastern Regional Technical Advisory Committee (ERTAC) EGU Workgroup, and EPA.

The guiding philosophy behind the development of the 2011 inventory was to rely as much as possible on the collaborative work performed by the State/Local/Tribal (S/L/T) air agencies and the EPA in developing a 2011-based Modeling Platform. More detailed information regarding the Gamma Inventory and projections can be found in *Technical Support Document: Emission Inventory Development for 2011 for the Northeastern U.S. Gamma Version* (Appendix 9).

For the 2028 inventory, the guiding philosophy was to use a combination of S/L/T data and methods for projecting emissions from stationary sources and to rely on EPA's 2028 Modeling Platform for mobile source emission projections. More detailed information regarding the Gamma Inventory and projections can be found in *Technical Support Document for the 2011 for the Northeastern U.S. Gamma Inventory* (January 2018) and *Ozone Transport Commission/Mid- Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update* (October 2018) (Appendices 10 and 11, respectively).

The MANE-VU Technical Support Committee (TSC), in conjunction with the OTC Modeling Committee, performed photochemical modeling in support of MANE-VU's Regional Haze objectives. Details are provided in the modeling Technical Support Document[27], and fulfill the technical basis requirement of 40 CFR 51.308(f)(2)(iii). Modeling to determine the RPGs for the federal Class I areas included measures documented in the Asks and documented in the Technical Support Document. Modeled RPGs are shown in Figure 2-8, 2-9, 2-10 and 2-11.

In addition to modeling 2028 visibility improvement resulting from implementation of the Asks, MANEVU evaluated health implications with the BenMap model. BenMap is the model used by EPA to evaluate heath changes resulting from proposed changes in rules and revisions to health standards. MANE-VU found that emissions changes resulted in lower PM2.5 and ozone concentrations and improved public health and a lower mortality rate in contributing states as well as MANE-VU states with Class I areas.

2.8 § 51.308 (f)(2)(iv) – Other Factors for Long-term Strategy

The State must consider the following additional factors in developing its long-term strategy:

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

(B) Measures to mitigate the impacts of construction activities,

(C) Source retirement and replacement schedules,

(D) Basic smoke management practices for prescribed fire used for agricultural and wildland vegetation management purposes and smoke management programs, and

(E) The anticipated net effect on visibility due to projected changes in point, area, and mobile source emissions over the period addressed by the long-term strategy.

27 https://otcair.org/MANEVU/Upload/Publication/Reports/OTC%20MANE-VU%202011%20Based%20Modeling%20Platform%20Support%20Document%20October%202018%20-%20Final.pdf

2.8.1 § 51.308 (f)(2)(iv)(A) – Emission Reductions Due to Ongoing Air Pollution Programs

Maryland used MANE-VU's Gamma Emissions Inventory for 2011 for the base year. The ERTAC EGU Forecast Tool was used for the 2028 projection. This method uses base year hourly AMPD data and fuel specific growth rates and other information to estimate future activity and emissions. Future emission rates are developed from base year emission rates adjusted to account for state knowledge of known future year emission controls, fuel switches, retirements, and new units.

Implementation of the federal Mercury and Air Toxics Rule is expected to reduce particle and SO_2 emissions power plants. The 2010 SO_2 NAAQS, although not a control measure, will require lowering emissions from those sites determined to be not in compliance with the standard. In Maryland, the area around the H.A. Wagner power plant was designated as nonattainment for the 2010 SO_2 NAAQS. Implementation of both the Mercury and Air Toxics Rule and the 2010 SO_2 NAAQS will reduce haze-forming emissions in the second implementation period.

Maryland-specific measures for EGUs that will reduce emissions by 2028 are:

- COMAR 26.11.27, Emission Limitations for Power Plants (Maryland Healthy Air Act)[28]
- COMAR 26.11.38, Control of NO_x Emissions from Coal-Fired Electric Generating Units[29]
- COMAR 26.11.40, NO_x Ozone Season Emission Caps for Non-trading Large NO_x Units[30]

Non-EGU Point Source Emission Reductions Expected by 2028 Due to Ongoing Air Pollution Control Programs

Maryland used MANE-VU's Gamma Emissions Inventory for 2011 as the base year. Control factors for Non-EGU Point Sources were applied to the 2028 MANE-VU Gamma inventory projections to represent the following national, regional, or state control measures:

- OTC and MANE-VU Control Measures
- State NO_x Rules and Control Requirements
- State VOC Rules and Control Requirements
- State Fuel Oil Sulfur Rules
- Facility and Unit Closures
- Boiler MACT Rules
- RICE MACT Standards
- Consent Decrees
- Regional Haze Plan Controls

[28] State Effective Date 7/16/2007; Federal Register Date 9/4/2008; Federal Register Citation 73FR51599

[29] State Effective Date 8/31/2015; Federal Register Date 5/30/2017; Federal Register Citation 82FR24546

[30] State Effective Date 4/23/2018; Federal Register Date 10/11/2018; Federal Register Citation 83FR51366

- Stand Alone Inventories

Maryland-specific measures for Non-EGU Point Sources that will reduce emissions by 2028 are:

- COMAR 26.11.29, Control of NO_x Emissions from Natural Gas Pipeline Compression Stations[31]
- COMAR 26.11.30, Control of Portland Cement Manufacturing Plants[32]

Area Sources Controls Expected by 2028 Due to Ongoing Air Pollution Control Programs

Maryland used the Gamma emissions inventory for 2011. MANE-VU applied growth and control factors to the 2011 Gamma inventory to develop 2028 projections. Control factors were applied to the 2028 inventory projections to represent the following national, regional, or state control measures:

- OTC and MANE-VU Control Measures
- State Specific NO_x Rules
- State Specific VOC Rules
- State Fuel Oil Sulfur Rules
- Portable Fuel Container Rules
- Boiler MACT Rules
- RICE MACT Rules

Maryland-specific measures for Area Sources that will reduce area source emissions in the second implementation period are:

- COMAR 26.11.09, Control of Fuel-Burning Equipment, Stationary Internal Combustion Engines and Certain Fuel-Burning Installations.[33]
- COMAR 26.11.35, Volatile Organic Compounds from Adhesives and Sealants[34]
- COMAR 26.11.32, Control of Emissions of Volatile Organic Compounds from Consumer Products[35]
- COMAR 26.11.39, Architectural and Industrial Maintenance (AIM) Coatings[36]

[31] State Effective Date 7/20/2015; Federal Register Date 3/28/2018; Federal Register Citation 83FR13192

[32] State Effective Date 7/20/2015; Federal Register Date 3/28/2018 Federal Register Citation 83FR13192

[33] State Effective Date 4/28/2014; Federal Register Date 6/9/2015; Federal Register Citation 80FR32472

[34] State Effective Date 6/1/2009; Federal Register Date 10/18/2011

[35] State Effective Date 10/9/2017; Federal Register Date 4/2/2019 Federal Register Citation 84FR12508

36 State Effective Date 4/25/2016; Federal Register Date 5/8/2017; Federal Register Citation 82FR21312

2.8.2 § 51.308 (f)(2)(iv)(B) – Measures to Mitigate the Impacts of Construction Activities

A description of MANE-VU's consideration of measures to mitigate the impacts of construction can be found in the MANE-VU Construction TSD entitled, *Technical Support Document on Measures to Mitigate the Visibility Impacts of Construction Activities in the MANE-VU Region* (MANE-VU, September 2006)[37]. The following statements summarize the main points of this technical support document:

- Although a temporary source, fugitive dust and diesel emissions from construction activities can have an effect on local air quality.
- While construction activities are responsible for a relatively large fraction of direct $PM_{2.5}$ and PM_{10} emissions in the Region, the impact on visibility is less because dust settles out of the air relatively close to the sources.
- Ambient air quality data shows that soil dust makes up only a minor fraction of the $PM_{2.5}$ measured in MANE-VU Class I areas and impacts of diesel emissions in these rural areas are also a small part of total $PM_{2.5}$.
- The use of measures such as clean fuels, retrofit technology, best available technology, specialized permits, and truck staging areas (to limit the adverse impacts of idling) can help decrease the effects of diesel emissions on local air quality.

Like 40 CFR 51.308(d)(3)(v)(B) of the RHR for the first implementation period, 40 CFR 51.308(f)(2)(iv)(B) requires each state to consider in the second implementation period measures to mitigate the impacts of construction activities on regional haze. Maryland has instituted COMAR 26.11.06.03D[38] to mitigate the visibility impacts of construction activities. This regulation states that during construction activities there must be "reasonable precautions to prevent particulate matter from becoming airborne" and lists possible control measures.

The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description (NESCAUM, August 2010) (Appendix 12) found that, from a regional haze perspective, crustal material generally continues to not play a major role in visibility impairment at MANE-VU Class I Federal areas.

The crustal material Maryland samples through $PM_{2.5}$ speciation include: Aluminum, Calcium, Magnesium, Copper, Silicon, Titanium, and Iron. Based on Positive Matrix Factorization (PMF) analysis using data from the Essex monitoring site, the crustal contribution to the total PM2.5 in Baltimore is 3.2% for 2011 and 3.8% for 2014. The main sources of the crustal species in the region comprise wind-blown dust, unpaved roads, and construction sites. Maryland's 2014 inventory shows $PM_{2.5}$ emissions from Construction Dust were 4,948.77 tons, or 15% of Maryland's $PM_{2.5}$ emissions inventory.

2.8.3 § 51.308 (f)(2)(iv)(C) –Source Retirement and Replacement Schedules

40 CFR Section 51.308(f)(2)(iv)(C) requires states to consider source retirement and replacement schedules in developing its Long-term Strategy. The point sources retired in the inventories used in the MANE-VU contribution assessment for the second implementation period are in Table 2-14.

[37] https://otcair.org/MANEVU/Upload/Publication/Reports/Construction_TSD_102006.pdf

[38] State Effective Date 11/11/2002; Federal Register Date 8/6/2003; Federal Register Citation 68FR46487

Table 2-14: Units Retired in the Regional Haze Inventories

Facility Name	ORIS ID	CAMD Unit ID	Inventory Offline Date
Perryman	1556	CT2	12/31/2016
Riverside	1559	4	6/1/2016
Riverside	1559	CT6	12/31/2014
Severstal Sparrows Point	10485	BLR1, BLR2, BLR3, BLR4	12/31/2012

2.8.4 § 51.308 (f)(2)(iv)(D) –Agricultural and Forestry Basic Smoke Management Practices (BSMP) and Smoke Management Programs

40 CFR section 51.308(f)(2)(iv)(D) requires each state to consider smoke management techniques related to agricultural and forestry management in developing the Long-term Strategy to improve visibility at Class I areas. MANE-VU's analysis of smoke management in the context of regional haze is documented in "Technical Support Document on Agricultural and Forestry Smoke Management in the MANE-VU Region, September 1, 2006." As that report notes, fires used for resource benefits are of far less significance to the total inventory of fine-particle pollutant emissions than other sources of wood smoke in the region. The largest wood smoke source categories for the MANE-VU region, with respect to $PM_{2.5}$ emissions, are residential wood combustion (73 %); open burning (15 %); and industrial, commercial, and institutional wood combustion (9 %). Unwanted fires involving buildings and wild lands are only a minor fraction of wood burning emissions and cannot be reasonably addressed in a SIP. Fires that are covered under smoke management plans, including agricultural and prescribed forest burning, constitute less than one percent of total wood smoke emissions in MANE-VU.

Wildfire emissions within MANE-VU states are also relatively small and infrequent contributors to regional PM emissions. However, MANE-VU Class 1 areas are occasionally affected by wildfire smoke emissions from other regions, such as the lightning-induced forest fires that occurred in Quebec Province in July 2002. These natural wildfire smoke emissions occasionally impair visibility but are not considered manmade or controllable but rather are part of "natural background" conditions.

Smoke Management Programs are only required when smoke impacts from fires managed for resource benefits contribute significantly to regional haze. The MANE-VU study concluded that it is "unlikely that fires for agricultural or forestry management cause large impacts on visibility in any of the Class I areas in the MANE-VU Region." Though Maryland does not need an official Smoke Management Plan, Maryland does have the legal authority to allow or prohibit burning through a formal permitting system.

The 2014 NEI shows that Maryland's $PM_{2.5}$ emissions from agricultural and prescribed burning for forestry smoke management are low. In 2014 statewide emissions from prescribed fires were 1,349.18 tons (4.13% of Maryland's overall $PM_{2.5}$ emissions inventory) and agricultural burning were 1.5 tons (<1% of Maryland's overall $PM_{2.5}$ emissions inventory). It is unlikely that fires in Maryland for agricultural or forestry management cause impacts on visibility in the MANE-VU and nearby Class I areas, including Shenandoah, Dolly Sods, Otter Creek, and James River Face.

A Smoke Management Program is a required element of a SIP only if it is necessary to make reasonable progress. Though Maryland does not need an official Smoke Management Plan,

Maryland does have the legal authority to allow or prohibit burning through a formal permitting system

2.8.5 § 51.308 (f)(2)(iv)(E) –Anticipated Net Impact on Visibility due to Projected Emissions Changes over the Long-term Strategy Period

40 CFR Section 51.308(f)(2)(iv)(E) requires Maryland to address the net effect on visibility resulting from changes projected in point, area and mobile source emissions by 2028. For the first implementation period, NESCAUM conducted modeling for MANE-VU to document the impacts of the Long-term strategies of Maryland and other states on visibility at affected Class I areas.

The starting point for judging the progress achieved by measures included in this SIP is the 2000-2004 baseline visibility at affected Class I areas, as assessed by NESCAUM. To calculate the baseline visibility NESCAUM, using 2000-2004 IMPROVE monitoring data, averaged together the deciview value for the 20 percent best days in each year, producing a single average deciview value for the best days. Similarly, NESCAUM averaged the deciview values for the 20 percent worst days in each year, producing a single average deciview value for the worst days. Calculation of best and worst days included both biogenic and anthropogenic emissions, as detailed in NESCAUM's *Baseline and Natural Background Visibility Conditions.*[39]

Initial modeling to assess the impact of potential control measures is documented in *Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update* (Appendix 11). An assessment of potential control measures identified a number of promising strategies that would yield significant visibility benefits beyond the uniform rate of progress and, in fact, significantly beyond the projected visibility conditions that would result from "on the books/on the way" air quality protection programs. These additional measures include the adoption of low sulfur heating oil, implementation of Best Available Retrofit Technology (BART) requirements, and additional electric generating unit (EGU) controls on select sources.

On January 10, 2017, US EPA published final revisions to regional haze SIPs regulations in the federal register (82 FR 3078, January 10, 2017). One aspect of the new regulations would be a change from using the "20% worst days" in terms of visibility impairment to "20% most impaired days." EPA also developed draft guidance on how to develop the "20% most impaired days." MANE-VU TSC recommended using multiple approaches to address visibility impairment, with a focus on the "20% Most Impaired Days Based on Deciviews", as detailed in *Recommendation on Approaches to Selecting the 20% Most Impaired Days (March 2, 2017)* (Appendix 18).

For the second implementation period, analyses of visibility trends are documented in *Mid-Atlantic/Northeast U.S. Visibility Data 2004-2016 (2nd RH SIP Metrics)* (MANE-VU, May 2018) (Appendix 13). Staff from the Maine Department of Environmental Protection (MEDEP) analyzed visibility data collected at IMPROVE monitoring sites, starting in the baseline period of 2000-2004 through 2012-2016, the most recent five-year period with available data.

Based on rolling five-year averages demonstrating progress since the 2000-2004 baseline period, all MANE-VU and nearby Class I area (Dolly Sods, Shenandoah, and James River Face) visibility conditions are currently better than the 2028 uniform rate of progress (URP) visibility condition for the 20 percent most impaired visibility days and below baseline conditions for the 20 percent clearest days.

[39] https://www.nescaum.org/documents/mv-natural-background-memo-01-17-07-final.pdf/

MANE-VU did not separate out individual states' impact on visibility when conducting the modeling exercise, but simply calculated 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 for both the base and control case. In the base case modeling improvements were projected on the 20% most impaired days in 2028 of 4.1, 6.29, 5.89, and 6.18 deciviews at Brigantine Wilderness, Dolly Sodds Wilderness, James River Face Wilderness, and Shenandoah National Park, respectively (See figures 2-7 – 2-10). The base case modeling also projects improvements in the 20% clearest days, meaning no degradation is expected on those days. Full documentation of the modeling is in *Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update* (Ozone Transport Commission, October 2018) (Appendix 11).

2.9 § 51.308 (f)(3)(i) – Reasonable Progress Goals

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

Maryland does not have any Class I Federal areas located within its borders and thus is not required to comply with § 51.308 (f)(3)(i).

2.10 § 51.308 (f)(3)(ii)(A) – Reasonable Progress Goals Above the Uniform Rate of Progress

If a State in which a mandatory Class I Federal area is located establishes a reasonable progress goal for the most impaired days that provides for a slower rate of improvement in visibility than the uniform rate of progress calculated under paragraph (f)(1)(vi) of this section, the State must demonstrate, based on the analysis required by paragraph (f)(2)(i) of this section, that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the State that may reasonably be anticipated to contribute to visibility impairment in the Class I Federal area that would be reasonable to include in the long-term strategy. The State must provide a robust demonstration, including documenting the criteria used to determine which sources or groups or sources were evaluated and how the four factors required by paragraph (f)(2)(i) were taken into consideration in selecting the measures for inclusion in its long- term strategy. The State must provide to the public for review as part of its implementation plan an assessment of the number of years it would take to attain natural visibility conditions if visibility improvement were to continue at the rate of progress selected by the State as reasonable for the implementation period.

Maryland does not have any Class I Federal areas located within its borders and thus is not required to comply with § 51.308 (f)(3)(ii)(A).

2.11 § 51.308 (f)(3)(II)(B) – Upwind States Impact on Reasonable Progress Goals

If a State contains sources which are reasonably anticipated to contribute to visibility impairment in a mandatory Class I Federal area in another State for which a demonstration by the other State is required under (f)(3)(ii)(A), the State must demonstrate that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the State that may reasonably be anticipated to contribute to visibility impairment in the Class I Federal area that would be reasonable to include in its own long-term strategy. The State must provide a robust demonstration, including documenting the criteria used to determine which sources or groups or sources were evaluated and how the four factors required by paragraph (f)(2)(i) were taken into consideration in selecting the measures for inclusion in its long-term strategy.

The key difference between SIPs from States with Class I areas, and those States without Class I areas but that may have sources that impact visibility on Class I areas, is the calculation of the baseline, current, and natural visibility for their Class I areas and the determination of reasonable progress goals (RPG) - expressed in deciviews - that provide for reasonable progress toward achieving natural visibility by 2064. It is the Class I States' responsibility to assess these calculations. The Class I States must also consult with those States, which may reasonably be anticipated to cause or contribute to visibility impairment in their Class I areas (40 CFR 51.308 (f)(3)(i-iv)).

EPA provided a guidance document[40], titled Guidance on Regional Haze State Implementation Plans for the Second Implementation Period. EPA recommends states without a Class I federal area conduct a uniform rate of progress (URP) glidepath check to fulfill the requirements of 40 CFR 51.308 (f)(3)(iI)(B).

If the RPG for the 20 percent most anthropogenically impaired days for the affected Class I area in another state is above the URP glidepath, the state preparing the SIP must demonstrate that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the state whose emissions may reasonably be anticipated to contribute to visibility impairment in the Class I area that would be reasonable to include in the LTS. 40 CFR 51.308(f)(3)(ii)(B) Section II.B.7 of this guidance document addresses this step.

40 https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf

MANE-VU completed the glidepath check and the results are documented in spreadsheets [41,42] on their website. The results of the glidepath checks show that the RPG for the 20 percent most anthropogenically impaired days for the affected Class I area in another state is not above the URP glidepath and the RPG for the 20 percent clearest days shows no degradation, therefore no additional analysis is necessary.

The glidepath checks fulfill EPA's guidance requirements for 40 CFR 51.308 (f)(3)(iI)(B).

2.12 § 51.308 (f)(3)(III) – Enforceability of Reasonable Progress Goals

The reasonable progress goals established by the State are not directly enforceable but will be considered by the Administrator in evaluating the adequacy of the measures in the implementation plan in providing for reasonable progress towards achieving natural visibility conditions at that area.

§ 51.308 (f)(3)(iii) applies to the Administrator when assessing SIPs rather than to States and thus is not applicable to Maryland.

2.13 § 51.308 (F)(3)(IV) – Evaluation of Reasonable Progress Goals

In determining whether the State's goal for visibility improvement provides for reasonable progress towards natural visibility conditions, the Administrator will also evaluate the demonstrations developed by the State pursuant to paragraphs (f)(2) and (f)(3)(ii)(A) of this section and the demonstrations provided by other States pursuant to paragraphs (f)(2) and (f)(3)(ii)(B) of this section.

§ 51.308 (f)(3)(iv) applies to the Administrator when assessing SIPs rather than to States and thus is not applicable to Maryland.

2.14 § 51.308 (f)(4) – Reasonably Attributable Visibility Impairment Monitoring

If the Administrator, Regional Administrator, or the affected Federal Land Manager has advised a State of a need for additional monitoring to assess reasonably attributable visibility impairment at the mandatory Class I Federal area in addition to the monitoring currently being conducted, the State must include in the plan revision an appropriate strategy for evaluating reasonably attributable visibility impairment in the mandatory Class I Federal area by visual observation or other appropriate monitoring techniques.

Maryland has not been advised by the Administrator, Regional Administrator, or any Federal Land Manager of the need to conduct additional monitoring to assess reasonably attributable visibility impairment and thus is in compliance with § 51.308 (f)(4).

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41 https://otcair.org/MANEVU/Upload/Publication/Reports/TD%20MANE-VU%202000-19%20RHII%20&%20III%20Metrics%20Trends%20Plots%2012-19-20.xlsx

42 https://otcair.org/MANEVU/Upload/Publication/Reports/TD%20MANE-VU%202000-19%20RH%20METRICS%20COMPARISON%20PLOTS%2012-19-20.xlsx

2.15 § 51.308 (f)(5) – Second Planning Period Progress Report Requirement

So that 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 (5) of this section.

However, the period to be addressed for these elements shall be the period since the most recent progress report.

Maryland demonstrates compliance with this requirement in Sections 2.16 through 2.24 of this document.

2.16 § 51.308 (f)(6) – Monitoring Strategy

Monitoring strategy and other implementation plan requirements. *The State must submit with the implementation plan a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment that is representative of all mandatory Class I Federal areas within the State. Compliance with this requirement may be met through participation in the Interagency Monitoring of Protected Visual Environments network. The implementation plan must also provide for the following:*

(i) The establishment of any additional monitoring sites or equipment needed to assess whether reasonable progress goals to address regional haze for all mandatory Class I Federal areas within the State are being achieved.

(ii) Procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I Federal areas both within and outside the State.

(iii) For a State with no mandatory Class I Federal areas, procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I Federal areas in other States.

(iv) The implementation plan must provide for the reporting of all visibility monitoring data to the Administrator at least annually for each mandatory Class I Federal area in the State. To the extent possible, the State should report visibility monitoring data electronically.

(v) A statewide inventory of emissions of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I Federal area. The inventory must include emissions for the most recent year for which data are available, and estimates of future projected emissions. The State must also include a commitment to update the inventory periodically.

(vi) Other elements, including reporting, recordkeeping, and other measures, necessary to assess and report on visibility.

Maryland does not have any Class I Federal areas located within its borders and thus is not required to comply with § 51.308 (f)(6) nor any of the subsections, excepting § 51.308(f)(6)(iii).

§ 51.308(f)(6)(iii) requires the inclusion of procedures by which monitoring data and other information are used in determining the contribution of emissions from within the state to visibility impairment at mandatory Class I Federal areas. States with Class I Federal areas must establish a monitoring program and report data to EPA that is representative of visibility at the Class I Federal areas. The IMPROVE network meets this requirement.

As a participant in MANE-VU, Maryland reviewed information about the chemical composition of baseline monitoring data at Class I Federal areas in and near MANE-VU in order to understand the sources of haze causing pollutants.

Additionally, EPA in its draft guidance on regional haze stated "EPA is not expecting that any state will need to address these requirements in a manner differently than in its SIP for the first implementation period. States with questions or concerns, or that receive public comments that raise issues related to these requirements, should consult with their EPA regional office and with the FLMs for affected Class I areas," which further supports the adequacy of the current network since it was cited in Maryland's SIP for the first planning period.[43]

Maryland commits to continuing support of ongoing visibility monitoring in Class I Federal areas. The IMPROVE network currently meets this monitoring goal, and Maryland agrees that IMPROVE is an appropriate monitoring network to track regional haze progress and will work with neighboring states and the FLMs to meet the goals of the IMPROVE program.

In the future, as required by 40 CFR 51.308 (f), Maryland will use monitoring data and procedures consistent with US EPA guidance to review progress and trends in visibility at Class I Federal areas that may be affected by emissions from Maryland both for comprehensive periodic revisions of this implementation plan and for periodic reports describing progress towards the reasonable progress goals for those areas.

2.17 Progress Report Requirements

Requirements for periodic reports describing progress towards the reasonable progress goals. Each State identified in § 51.300(b) must periodically submit a report to the Administrator evaluating progress towards the reasonable progress goal for each mandatory Class I Federal area located within the State and in each mandatory Class I Federal area located outside the State that may be affected by emissions from within the State. The first progress report is due 5 years from submittal of the initial implementation plan addressing paragraphs (d) and (e) of this section. The first progress reports must be in the form of implementation plan revisions that

[43]US EPA, "Draft Guidance on Progress Tracking Metrics, Long-Term Strategies, Reasonable Progress Goals and Other Requirements for Regional Haze State Implementation Plans for the Second Implementation Period," July 2016.

comply with the procedural requirements of § 51.102 and § 51.103. Subsequent progress reports are due by January 31, 2025, July 31, 2033, and every 10 years thereafter. Subsequent progress reports must be made available for public inspection and comment for at least 30 days prior to submission to EPA and all comments received from the public must be submitted to EPA along with the subsequent progress report, along with an explanation of any changes to the progress report made in response to these comments. Periodic progress reports must contain at a minimum the following elements…

Maryland is required to address section § 51.308 (g) due to the requirements of § 51.308 (f)(5) and shall do so in the subsequent sections.

Maryland will submit a report on reasonable progress to EPA by January 31, 2025; July 31, 2033; and every 10 years thereafter. The reports will evaluate the progress made towards the reasonable progress goals for of all Class I Federal Areas within 300 kilometers of Maryland: Brigantine Wilderness area in New Jersey, Shenandoah National Park in Virginia, the Dolly Sods and Otter Creek Wilderness Areas in West Virginia, and the James River Face Wilderness in Virginia. All requirements listed in § 51.308(g) shall be addressed in the progress report. A summary of submittal dates through July 31, 2043 is below:

Report	Due date
10-Year SIP	July 31, 2021
5-Year Progress Report	January 31, 2025
10-Year SIP	July 31, 2028
5-Year Progress Report	July 31, 2033
10-Year SIP	July 31, 2038
5-Year Progress Report	July 31, 2043

In accordance with § 51.308(h), at the time of the report submission due on January 31, 2025, Maryland will also submit a determination of the adequacy of its existing Regional Haze SIP revision.

2.18 § 51.308 (g)(1) – Status of Measure Implementation

A description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for mandatory Class I Federal areas both within and outside the State.

In the first implementation period, MANE-VU identified three major initiatives to reduce anthropogenic haze pollutants from impacting federal class I areas and achieve reasonable progress goals. These initiatives included the following and will be addressed individually after the list:

1. Identification of 167 stacks
2. BART
3. Low Sulfur Fuel Standards

"167 Ask" Measures

MANE-VU identified emissions from 167 stacks at EGU facilities as having visibility impacts in MANE-VU Class I areas that make controlling emissions from those stacks crucial to improving visibility at MANE-VU Class I areas. MANE-VU's regional approach for this source sector was to pursue a 90 percent control level on SO_2 emissions from these 167 stacks by 2018 as appropriate and necessary. MANE-VU allowed for the state to obtain the requested reduction from other units in the State. MANE-VU concluded that pursuing this level of sulfur reduction was both reasonable and cost-effective.

Table 2-15 identifies the EGU facilities and units in Maryland included in the MANE-VU list of "167 units".

Table 2-15: Maryland "Top 167" EGU Units

Plant Name	Unit(s)
Brandon Shores	1, 2
C.P. Crane	1, 2
Chalk Point	1, 2
Dickerson	1, 2, 3
H.A. Wagner	3
Morgantown	1, 2

Table 2-16 shows the SO_2 emission reductions needed to meet the 90% reduction goal for those units. The required emission reductions are based on 90% of the 2002 emissions.

Table 2-16: SO_2 Emission Reduction Target

"Ask" Emission Reduction Target	SO_2 *(TPY)*
All 12 of Maryland's "167 Units"	211,892

"167 Ask" Measures – Maryland Healthy Air Act (HAA)

Maryland's response to the "167 Ask" was the adoption in 2007 of the Maryland Healthy Air Act (HAA). The HAA was adopted in two phases; phase 1 started in 2010 with further SO2 curtailments in 2013 for phase 2. The HAA has provided substantial reductions in NO_x and SO_2. The regulation applied to all non-fluidized bed coal combustion EGUs in the state. As shown in Table 2-17, the MD HAA includes more units than the MANE-VU "167" Ask units. Table 2-18 presents the resulting annual emission tonnages (2011-2018) for affected units. Note: The R. Paul Smith facility was decommissioned in 2012.

Table 2-17: Comparison of HAA Units to MANE-VU 167 EGUs

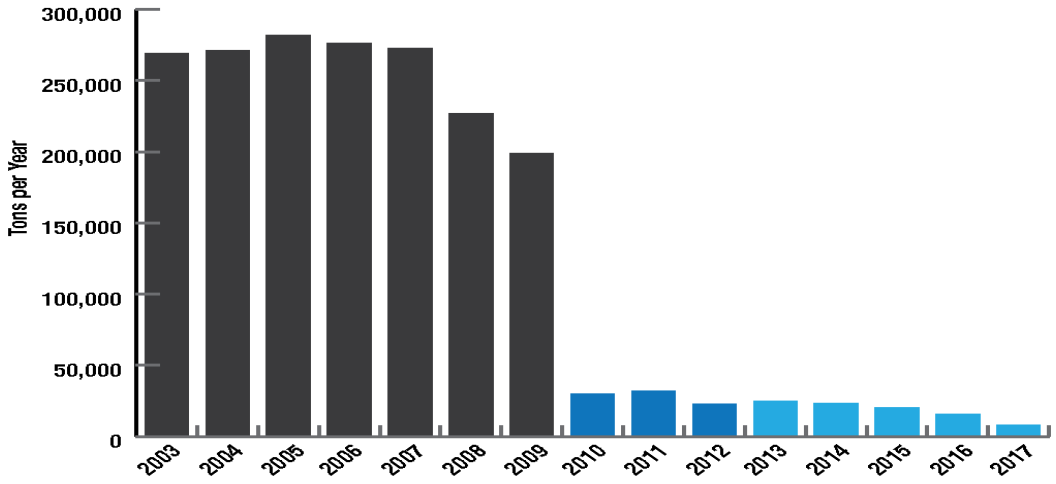
Facility	HAA Units	"167" Units
Brandon Shores	1, 2	1, 2

C.P. Crane	1, 2	1, 2
Chalk Point	1, 2	1, 2
Dickerson	1, 2, 3	1, 2, 3
H.A. Wagner	2, 3	3
Morgantown	1, 2	1, 2
R. Paul Smith	3, 4	

Table 2-18: Comparison of SO2 Emissions from MD Coal Units to the MANE-VU "167 Ask"

Year	AES Warrior Run 1	Brandon Shores 1	Brandon Shores 2	C.P. Crane 1	C.P. Crane 2	Chalk Point 1	Chalk Point 2	Dickerson 1	Dickerson 2	Dickerson3	H.A. Wagner 2	H.A. Wagner 3	Morgantown 1	Morgantown 2	R. Paul Smith 3	R. Paul Smith 4	Tot
HAA Unit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	
2002		20,476	19,498	17,971	14,415	23,528	25,203	10,225	11,100	12,580	6,428	10,096	37,757	32,587	820	3,768	246,
2003		18,153	22,614	15,420	16,841	19,550	22,116	9,928	9,190	10,988	7,121	13,783	43,039	42,301	829	2,921	254,
2004		21,144	20,147	14,860	14,182	27,181	27,332	12,817	13,125	12,857	7,635	12,694	40,085	40,915	333	2,467	267,
2005		18,876	22,822	15,445	17,586	25,244	22,854	11,434	13,250	13,043	6,698	15,480	38,552	40,930	812	2,547	265,
2006		20,498	19,969	14,770	13,111	23,358	25,196	11,888	10,301	13,763	6,492	12,860	50,019	48,054	926	3,462	274,
2007		17,323	24,718	13,537	17,094	22,879	21,907	11,041	11,316	11,476	6,219	14,040	45,270	47,798	1,335	4,201	270,
2008		21,194	18,730	12,833	11,519	21,089	21,611	8,378	10,382	11,064	5,889	9,117	39,695	30,864	848	2,851	226,
2009	1,045	12,527	20,293	6,960	5,517	19,937	20,960	9,271	7,362	9,040	4,359	10,734	32,914	36,637	141	822	198,
2010	1,247	540	720	1,315	4,274	1,219	1,254	875	823	877	3,176	5,852	3,029	2,229	425	1,641	29,
2011	1,709	1,323	1,506	2,597	3,085	1,651	4,018	261	424	439	2,994	6,013	3,252	1,926	115	533	31,
2012	1,235	1,547	1,301	1,212	961	2,510	2,136	265	259	293	2,513	4,960	1,232	1,699	33	526	22,
2013	1,236	1,389	1,481	831	2,140	3,203	1,240	243	262	345	1,551	8,554	1,374	1,048			24,
2014	1,167	1,670	1,475	573	1,314	1,310	2,540	211	214	200	1,939	7,276	1,342	1,538			22,
2015	1,090	1,310	1,643	381	944	826	647	127	125	147	1,187	8,751	1,214	1,521			19,
2016	891	1,449	1,269	411	637	496	407	124	149	152	163	7,571	1,437	1,357			16,
2017	1,023	1,097	1,417	378	449	309	216	51	64	69	116	1,243	613	906			7,
Percent Reduction 2002-2017	2.11%	94.64%	92.73%	97.90%	96.89%	98.69%	99.14%	99.50%	99.42%	99.45%	98.20%	87.69%	98.38%	97.22%	100.00 %	100.00 %	

Figure 2-6: Maryland HAA Annual SO_2 Tons per Year



As can be seen in Table 2-18 above, Maryland has met the MANE-VU "167 Ask" SO_2 reduction level of 211,892 tons from only those units named by the MANE-VU "167 Ask" every year since the activation of Phase 2 of the HAA in 2013. In 2017 the units in Maryland named by the MANE-VU "167 Ask" achieved an overall 97.11% reduction in SO_2 annual tons from 2002 levels.

The Maryland Healthy Air Act, however, went farther than the units named by MANE-VU in the "167 Ask". The HAA included all non-fluidized bed coal combustion EGUs in the state. Including all HAA units in the analysis the SO_2 reduction total yields an additional ≈10,000 tons of SO_2 reductions.

In more recent developments since 2017 and under a settlement agreement signed May 23, 2018, C.P. Crane agreed to cease the burning of coal in Units 1 and 2 by no later than June 15, 2018. Table 2-19 illustrates this retirement.

Table 2-19: C.P. Crane 2018 SO_2 and NO_x Emissions (Tons per Month)

	SO_2		NO_x	
Month	**Unit 1**	**Unit 2**	**Unit 1**	**Unit 2**
January	50.238	150.25	54.849	210.158
February	62.232	65.703	33.958	63.823
March	184.441	182.654	137.941	159.316
April	0	0	0	0
May	94.429	76.329	17.572	21.105
June	0	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0

Source: EPA Clean Air Markets Division

BART Sources

Luke/Westvaco Paper Mill

Verso Luke Paper in Luke, Maryland produces various grades of paper from wood fiber and other raw materials using the Kraft process. The facility is identified as New age/Westvaco/Luke Paper in the first implementation period Regional Haze SIP. The Verso Corporation acquired the plant on January 6, 2015. As such, MDE identifies it as Verso Luke Paper in this SIP. The facility has three boilers that use a common stack for its emissions. The installation of a control, like a scrubber, on one boiler would cause a temperature drop in the scrubbed source and create an acid dew point issue in the common emission stack. In addition, if a control device was to be installed, the older No. 24 cyclone boiler would provide greater SO_2 reduction than an equivalent expenditure on the No. 25 BART unit. Maryland considered an alternative BART compliance plan for the Verso Luke Paper Mill. Maryland's alternative for the mill involves setting alternative BART emission rates for SO_2 and NO_x for the No.24 cyclone boiler that provide greater reasonable progress than the BART limits for SO_2 and NO_x for the No. 25 boiler which were established in the first implementation period SIP.[44]

Rather than implementing BART, 40 CFR Section 51.308(e)(2), allows states to require BART sources to participate in a trading program or another alternative measure if the alternative achieves greater than reasonable progress at all sources. The alternative BART plan for the No. 25 Power Boiler at Verso Luke Paper mill provides greater SO_2 and NO_x tonnage reductions. Both units already meet the 0.07 lb./MMBtu BART limit for $PM_{2.5}$, therefore no greater reasonable progress demonstration is necessary. The company has agreed to repower the No. 24 Power Boiler from coal to natural gas as a primary fuel, use fuel oil as a secondary power source only when the natural gas supply is constrained, and apply applicable or better BART emission rates to the No. 24 Power Boiler. Coal is prohibited from being burned in the No. 24 Power Boiler.

The conversion of the No. 24 Power Boiler to natural gas allows the facility to surpass these goals as it provides 288% more NO_x benefits and 20% more SO_x benefits than what is required under BART. This plan is federally enforceable through permit condition. MDE regards the requirements of a "demonstration that the alternative BART measure will achieve greater reasonable progress than would have resulted from the installation and operation of BART at the source subject" to have been met.

Holcim Cement

Holcim (Independent/St. Lawrence) Cement Plant is located in Hagerstown, Washington County, Maryland. The facility consists of two components, the Portland cement manufacturing plant and the quarry adjacent to the plant. The site quarries limestone, operates a limestone crushing plant, a raw mill system, a cement kiln/clinker cooler system, a finish mill system, and a packaging and shipping operation. Although cement production at this location dates back to 1903, the current long dry kiln has been in operation since 1971. The maximum annual clinker production from the kiln is 693,500 tons. Holcim is a major source of criteria air pollutants and is therefore required to have a Part 70 (Title V) Operating Permit.

The BART analysis for this facility concluded that the Hagerstown cement kiln is already equipped with BART controls for NO_x, having implemented combustion optimization, low NO_x burners, the mid-kiln firing of tires and flame shape controls. No further controls are considered possible based on technological feasibility and unintended consequences of the use of wet scrubbers, i.e. production of

[44] Approval and Promulgation of Air Quality Implementation Plans; Maryland; Regional Haze Best Available Retrofit Technology Measure for Verso Luke Paper Mill, 82FR35451 (July 31, 2017)

wastewater and sludge. For PM control, BART controls have been implemented through the use of ESP on the kiln gas and baghouses on other non-kiln sources. This facility is not reasonably expected to affect MANE-VU Class I areas in the second implementation period.

At the time of the first implementation Regional Haze SIP, Holcim had the following pollution controls in place:

- PM – Multi-cyclones, baghouses and an electrostatic precipitator
- NO_x – mid-kiln tire firing with mixing air technology, upgraded kiln computer control system and low-NO_x type burner in the kiln
- SO_2 – injection of mixing air and inherent dry scrubbing (efficiency 82%-96%)

In 2015, Maryland adopted a regulation to further reduce NO_x emissions from Portland cement plants to satisfy Reasonably Available Control Technology (RACT) requirements for ozone.[45] Holcim upgraded the cement plant from a long-dry kiln to a pre-heater/pre-calciner kiln. Effective April 1, 2017, the preheater/pre-calciner kiln is required to meet a year-round NO_x limit of 2.4lbs NO_x/ton of clinker on a 30-day rolling average.

Low Sulfur Heating Oil

Maryland adopted amendments at the state level to COMAR 03.03.05.04, Specifications for No. 1 and No. 2 Fuel Oil in 2014. The amendments lowered the maximum allowable amount of sulfur in two stages. The first stage reduced the maximum No. 1 and No. 2 fuel oil sulfur levels from 3,000 ppm to 2,000 ppm in 2014. The second stage reduced sulfur levels further to a level of 500 ppm in 2016.

2.19 § 51.308 (g)(2) – Emission Reductions from Measure Implementation

A summary of the emissions reductions achieved throughout the State through implementation of the measures described in paragraph (g)(1) of this section.

The measures, SIP revisions and regulations described above in response to the "167 Ask", BART and Low Sulfur Heating Oil and the corresponding emission reductions listed in the tables above have been achieved by Maryland and are needed for upwind Class I Federal areas to achieve their reasonable progress goals.

2.20 § 51.308 (g)(3) – Assessment of Reasonable Progress Goals

For each mandatory Class I Federal area within the State, the State must assess the following visibility conditions and changes, with values for most impaired, least impaired and/or clearest days as applicable expressed in terms of 5-year averages of these annual values. The period for calculating current visibility conditions is the most recent 5-year period preceding the required date of the progress report for which data are available as of a date 6 months preceding the required date of the progress report.

[45] COMAR 26.11.30 – Control of Portland Cement Manufacturing Plants. Effective date: July 20, 2015 (42:Md. R. 884). http://www.dsd.state.md.us/comar/SubtitleSearch.aspx?search=26.11.30.* Approved by EPA 3/28/2018, 83 FR 13192

Maryland does not have any Class I Federal areas located within its borders and thus is not required to comply with § 51.308 (g)(iii).

2.21 § 51.308 (g)(4) – Emissions Analysis

An analysis tracking the change over the period since the period addressed in the most recent plan required under paragraph (f) of this section in emissions of pollutants contributing to visibility impairment from all sources and activities within the State.

Emissions changes should be identified by type of source or activity. With respect to all sources and activities, the analysis must extend at least through 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 as of a date 6 months preceding the required date of the progress report. 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. The State is not required to backcast previously reported emissions to be consistent with more recent emissions estimation procedures, and may draw attention to actual or possible inconsistencies created by changes in estimation procedures.

Maryland has provided a summary of emissions of visibility-impairing pollutants from all sources and activities within the state for the time period from 2002 to 2017. 2017 is the most recent year for which Maryland has submitted emissions estimates to fulfill the requirements of 40 CFR 51 Subpart A (also known as the Air Emissions Reporting Requirements, or AERR). In this section, Maryland has provided estimates for nitrogen oxides (NO_x), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), volatile organic compounds (VOC), and ammonia (NH_3), all of which have the potential to contribute to regional haze formation. Data categories include point sources, nonpoint sources, non-road mobile sources, and on-road mobile sources. A brief description of each of these categories is provided below:

- Point sources are discrete facilities that generally report their emissions directly via state and/or Federal permitting and reporting programs. Point sources usually represent larger facilities such as electric generating units (EGUs), factories, and heating plants for large schools and universities. In the tables and charts that follow, point source NO_x and SO_2 are further broken down into Air Markets Program Division (AMPD) sources and non-AMPD sources. The majority of sources that report to one or more of EPA's AMPD programs are EGUs. Therefore, the AMPD point category is a reasonable representation of emissions from EGUs.
- Nonpoint sources are those emissions categories that are too small, widespread, or numerous to be inventoried individually. Emissions are estimated for these categories using aggregate activity data such as population, employment, and statewide fuel use (after accounting for the fuel used by point sources). There is a wide range of nonpoint categories, but examples include residential fuel combustion and commercial & consumer solvent use.
- Non-road mobile sources represent vehicles and equipment that are not designed to operate on roadways. Examples include aircraft, ships, locomotives, construction equipment, recreational vehicles, and lawn & garden equipment. Beginning in 2008, emissions from airports and some large rail yards are inventoried as point sources because these emissions occur at discrete

locations. Emissions from other locomotive activities and commercial marine vessels are inventoried as nonpoint sources.

- On-road mobile sources represent vehicles that operate on roadways, including cars, trucks, buses, and motorcycles.

The summary data were downloaded from EPA's National Emissions Inventory (NEI).[46] Under the AERR, states are required to submit estimates for all emissions categories to EPA on a three-year cycle. The state submittals are combined with EPA's own estimates to form the NEI. 2005 was a limited effort NEI, so that year is not shown. A brief discussion of emissions trends is provided in the section for each pollutant. Inconsistencies due to changes in estimation procedures 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." Therefore, Maryland has also provided a summary of NO_x and SO_2 emissions for AMPD sources for the years 2016 through 2019.

In addition to the Maryland-specific data, 2002 – 2017 summaries of emissions from all sectors, as well as summaries of 2016 through 2019, NO_x and SO_2 emissions for AMPD sources are provided for the MANE-VU states. Similar summaries are also shown for the states listed in the MANE-VU Inter-RPO Ask 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), Ohio (OH), Tennessee (TN), Texas (TX), Virginia (VA), and West Virginia (WV). This group of states is referred to hereinafter as the "Ask states". MANE-VU also developed a list of major regulations affecting Regional Haze emissions inventories from 2002-2017: MANE-VU Emissions Inventory Trends Template (Regulation List Supplemental). The data is available on MANE-VU's website: https://otcair.org/manevu/document.asp?fview=Reports.

In this summary, Maryland has provided estimates for NO_x, PM_{10}, $PM_{2.5}$, SO_2, and ammonia (NH_3), all of which have the potential to contribute to regional haze formation.

2.21.1 Nitrogen Oxides

Table 2-20 shows a summary of Maryland's NO_x emissions from all data categories – point, nonpoint, non-road and on-road – for 2002 to 2017.

NO_x emissions have shown a dramatic decline in Maryland over the period from 2002 to 2017, particularly in the AMPD, non-road and on-road mobile sectors. NO_x emissions from all source categories were reduced by over 60 percent in the 15-year period. Reductions in AMPD emissions are due to the successful implementation of Maryland's Healthy Air Act (2007)[47], fuel switching to lower emitting fuels, and adoption of COMAR 26.11.38, Control of NO_x Emissions from Coal-Fired Electric Generating Units.[48]

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

[47] Annotated Code of Maryland Environment Title 2 Ambient Air Quality Control Subtitle 10 Health Air Act Sections 2-1001 - 2-1005

[48] https://www.google.com/url?q=http://www.dsd.state.md.us/COMAR/SubtitleSearch.aspx?search%3D26.11.38.*&sa=D&source=editors&ust=1615996245133000&usg=AOvVaw31tE_1ufw6a4vVnfEL52GW

NO_x reductions in the non-road sector are due to a wide range of federal rules that apply to vehicles and equipment. A few examples of regulatory programs that have reduced, and/or will continue to reduce, emissions from non-road vehicles and equipment include Control of Emissions of Air Pollution from Non-road Diesel Engines and Fuel[49], Control of Emissions from Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters Per Cylinder[50], and Control of Emissions from Non-road Spark-Ignition Engines and Equipment[51].

On-road NO_x reductions are largely due to the federal Tier 2 motor vehicle emissions standards[52]. It should also be noted that federal requirements for on-road vehicles and fuels were being strengthened with the implementation of the Tier 3 requirements[53] (beginning with the model year 2017). More information on programs to control emissions from mobile sources can be found on EPA's Transportation, Air Pollution, and Climate Change website[54]. For both non-road and on-road mobile sources, NO_x emissions are expected to continue to decrease as fleets turn over and older more polluting vehicles and equipment are replaced.

[49] https://www.gpo.gov/fdsys/pkg/FR-2004-06-29/pdf/04-11293.pdf

[50] https://www.gpo.gov/fdsys/pkg/FR-2008-06-30/pdf/R8-7999.pdf

[51] https://www.gpo.gov/fdsys/pkg/FR-2008-10-08/pdf/E8-21093.pdf

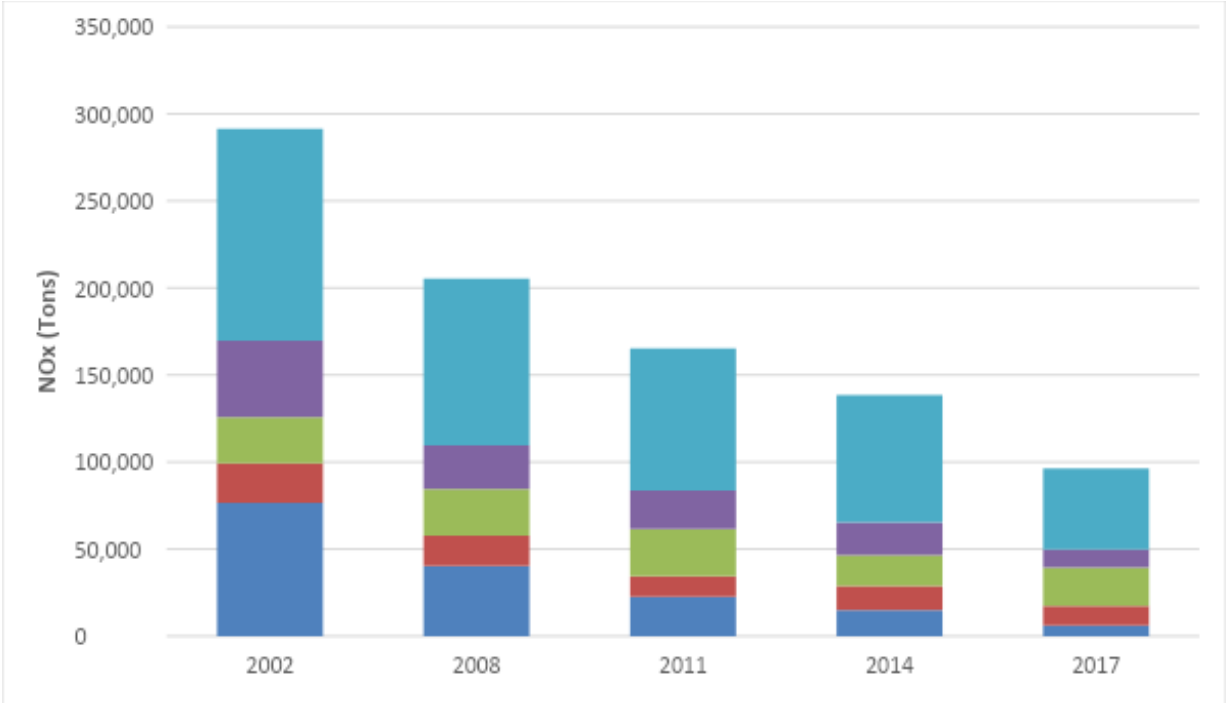
[52] Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements, Final Rule (https://www.gpo.gov/fdsys/pkg/FR-2000-02-10/pdf/00-19.pdf)

[53] Tier 3 Motor Vehicle Emission and Fuel Standards, Final Rule (https://www.gpo.gov/fdsys/pkg/FR-2014-04-28/pdf/2014-06954.pdf)

[54] https://www.epa.gov/air-pollution-transportation

Table 2-20: NOx Emissions in Maryland

NO_x Emissions in Maryland for all Data Categories, 2002 – 2017



Reductions in Maryland's NO_x Emissions 2002 -2017

Category	Tons	Percent Reduction
AMPD Point	-70,393	-92%
Non-AMPD Point	-11,557	-51%
Nonpoint	-4,462	-17%
Nonroad	-33,534	-76%
Onroad	-75,043	-62%
Total	194,989	-67%

NO_x Emissions from AMPD Sources in Maryland, 2016 – 2019 (Tons)

2016	2017	2018	2019
9,405	6,127	8,431	4,019

Table 2-21 shows total NO_x emissions from all source categories for the MANE-VU states for the period from 2002 to 2017. There has been a steady decline in NO_x emissions from 2002 to 2017 for the MANE-VU states and the 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).

Table 2-21: NO_x Emissions from MANE-VU States

State	Reduction (2002 – 2017)	Percent Reduction (2002 – 2017)
CT	-68,438	-60%
DE	-34,462	-60%
DC	-10,390	-68%
ME	-36,104	-42%
MD	**-194,989**	**-67%**
MA	-181,216	-63%
NH	-40,503	-59%
NJ	-193,408	-59%
NY	-297,101	-55%
PA	-396,361	-55%
RI	-15,052	-50%
VT	-13,453	-47%
Total	-1,481,477	-58%

NO_x Emissions in MANE-VU States for all Data Categories, 2002 – 2017

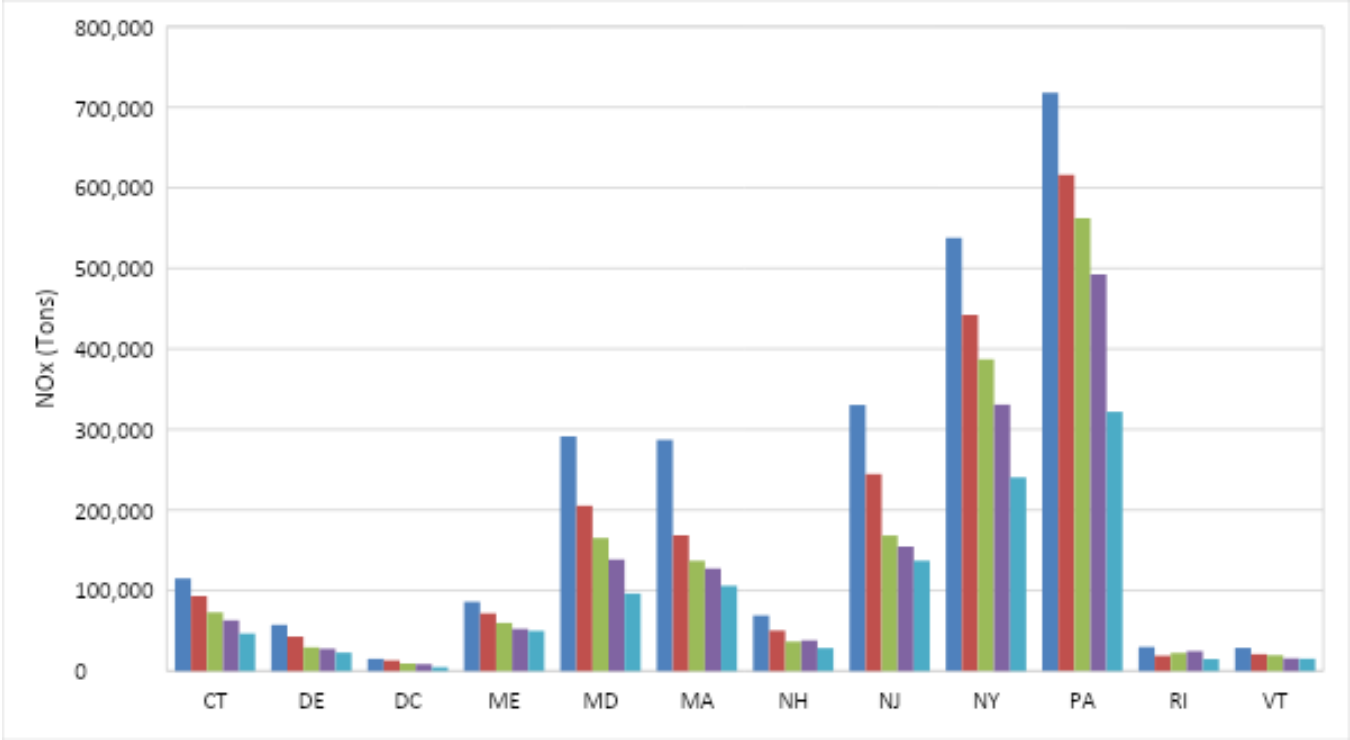


Table 2-22: NOx Emissions from AMPD Sources in MANE-VU, 2016 – 2019 (Tons)

State	Reduction (Tons)	Percent Reduction
CT	-257	-24%
DC	8	12%
DE	-812	-62%
MA	-1,876	-65%
MD	**-5,386**	**-57%**
ME	-150	-52%
NH	-317	-24%
NJ	-1,433	-33%
NY	-8,378	-52%
PA	-46,317	-58%
RI	5	1%
VT	-34	-20%
Total	**-64,948**	**-56%**

NO_x Emissions from AMPD Sources in MANE-VU, 2016 – 2019 (Tons)

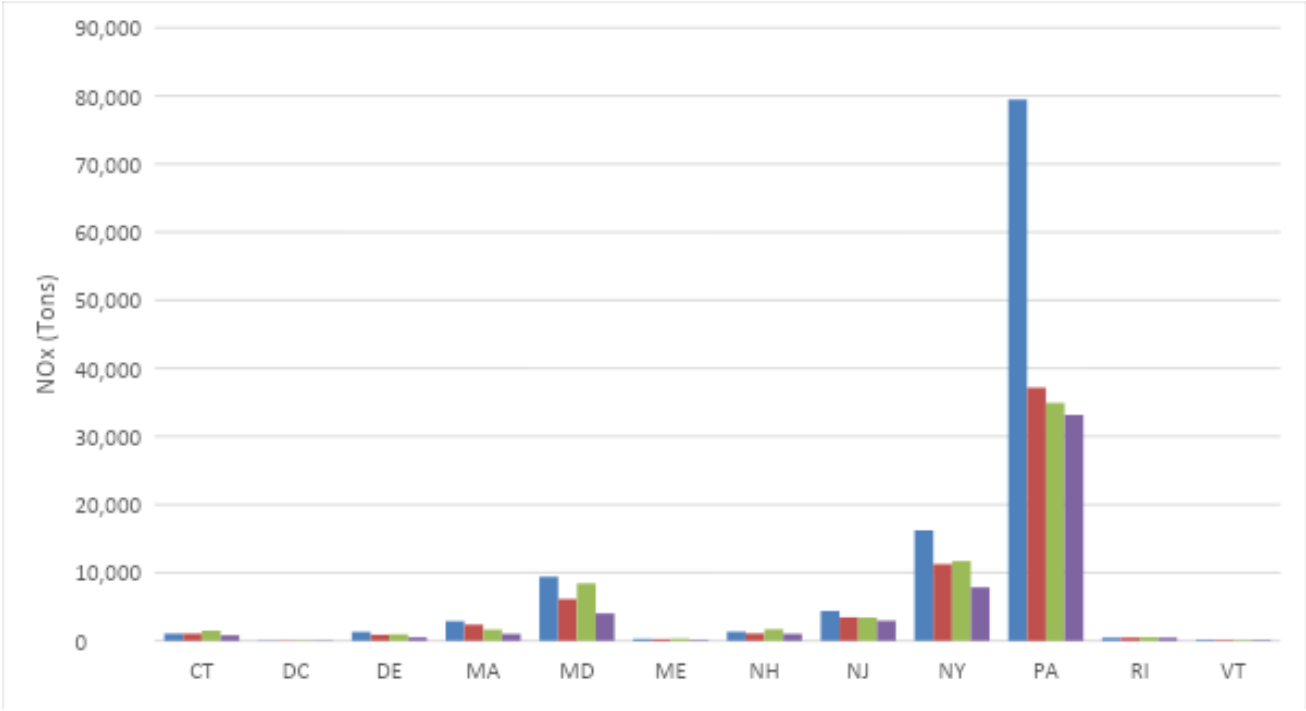


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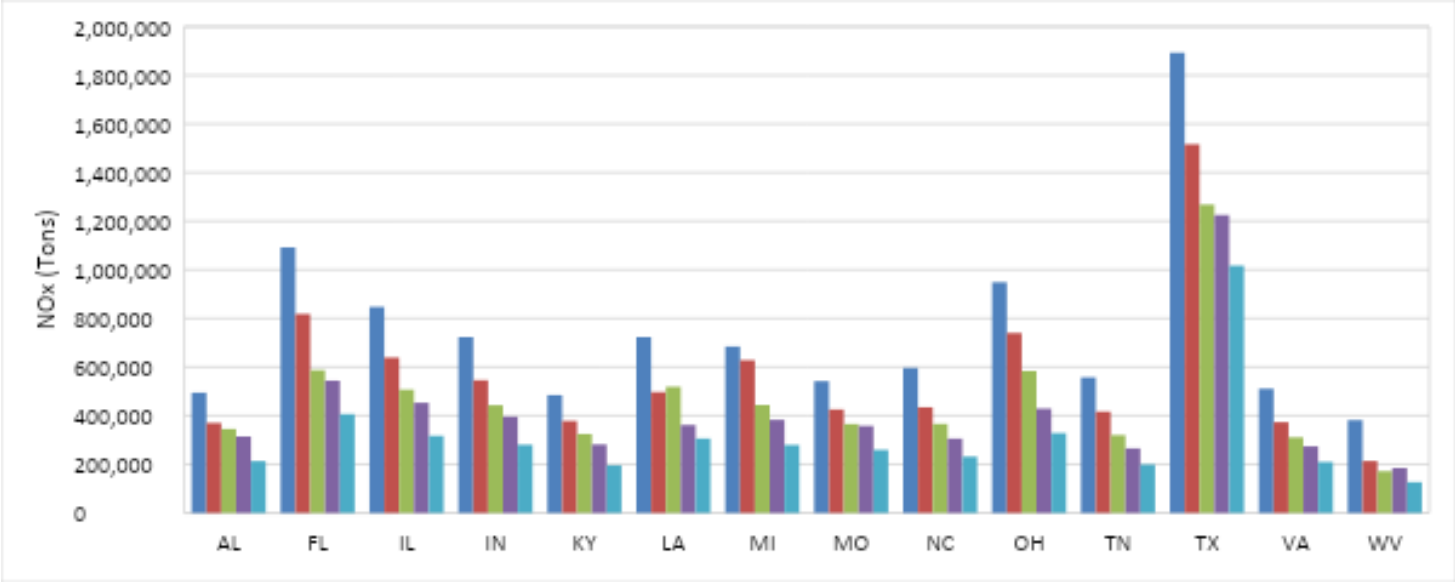
*Table 2-23: NO_x Emissions from Contributing States**

NO_x Emissions in Contributing States for all Data Categories, 2002 – 2017

State	Reduction (Tons)	Percent Reduction
AL	-281,564	-57%
FL	-685,753	-63%
IL	-530,325	-63%
IN	-442,886	-61%
KY	-288,604	-60%
LA	-417,136	-58%
MI	-405,124	-59%
MO	-282,652	-52%
NC	-365,002	-61%
OH	-620,682	-65%
TN	-358,269	-64%
TX	-876,865	-46%
VA	-301,379	-59%
WV	-255,129	-67%
Total	**-6,111,367**	**-58%**

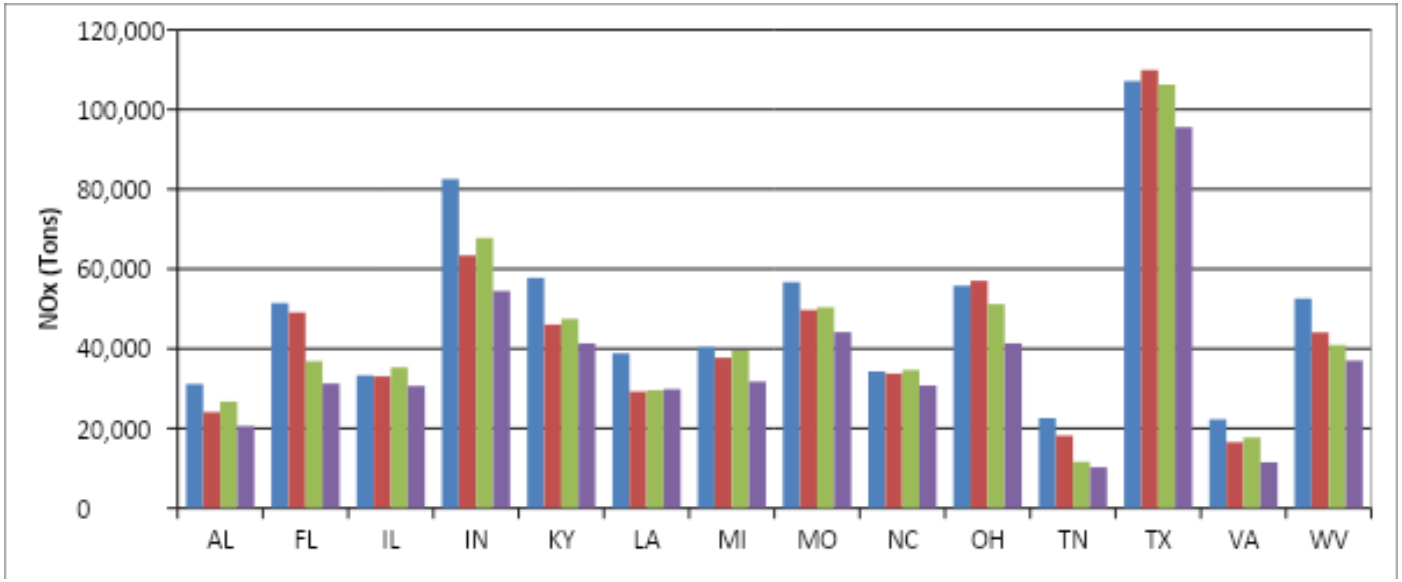


* States outside of MANE-VU that contribute to Visibility Degradation within MANE-VU

Table 2-24: NOx Emissions from AMPD Sources in Contributing States, 2016 – 2019 (Tons)

NO_x Emissions from AMPD Sources in Contributing States, 2016 – 2019 (Tons)*

State	Reduction (Tons)	Percent Reduction
AL	-10,556	-51%
FL	-20,191	-65%
IL	-2,643	-9%
IN	-28,151	-52%
KY	-16,426	-40%
LA	-8,988	-30%
MI	-8,625	-27%
MO	-12,527	-28%
NC	-3,539	-12%
OH	-14,406	-35%
TN	-12,347	-120%
TX	-11,596	-12%
VA	-10,774	-94%
WV	-15,571	-42%
Total	**-176,341**	**-35%**



* States outside of MANE-VU that contribute to Visibility Degradation within MANE-VU

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

Table 2-25 shows a summary of Maryland's PM_{10} emissions from all data categories – point, nonpoint, non-road and on-road – from 2002 to 2017. It should be noted that the variability in PM_{10} nonpoint emissions between the 2011 and 2014 inventories is primarily due to a change in inventory methodologies for nonpoint emissions.

Table 2-25: PM_{10} Emissions in Maryland for All Data Categories, 2002 – 2017 (Tons)

Category	Tons	Percent Reduction
Point	-13,320	-61%
Nonpoint	-747	-85%
Nonroad	-45,398	-97%
Onroad	44,186	72%
Total	-15,279	-12%

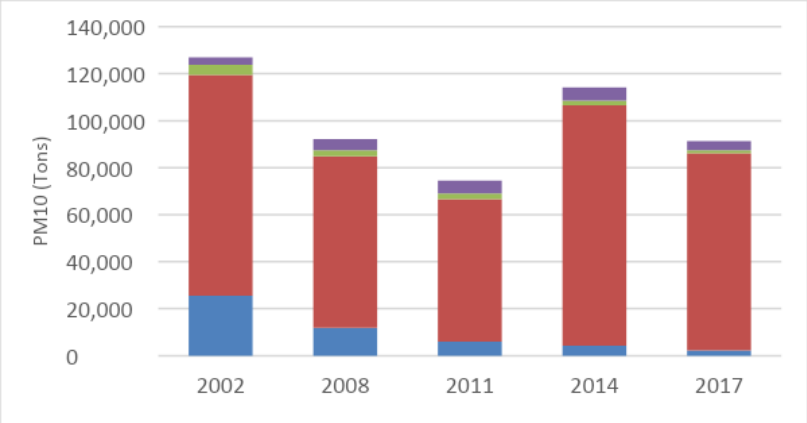


Table 2-17 shows total PM_{10} emissions from all data categories in the MANE-VU states. Similarly, Table 2-18 shows total PM_{10} emissions from all data categories in the Ask states. PM_{10} emissions in the MANE-VU and Ask states show no particular pattern over the 2002 to 2017 period. Some of the large declines in PM_{10} emissions from 2002 to subsequent years, as well as some of the increases in 2014, could be due to changes in estimation methodologies for categories such as yard waste burning, paved and unpaved road dust, and residential wood combustion

Table 2-26: PM_{10} Emissions in MANE-VU for All Data Categories, 2002 – 2017 (Tons)

State	Reduction	Percent Reduction
CT	-24,209	-45%
DE	48	0%
DC	-3,067	-45%
ME	-9,197	-13%
MD	-35,619	-28%
MA	-143,154	-68%
NH	-25,409	-55%
NJ	-33,236	-43%
NY	-191,240	-49%
PA	-272,321	-59%
RI	-1,955	-21%
VT	-12,319	-22%
Total	-751,678	-49%

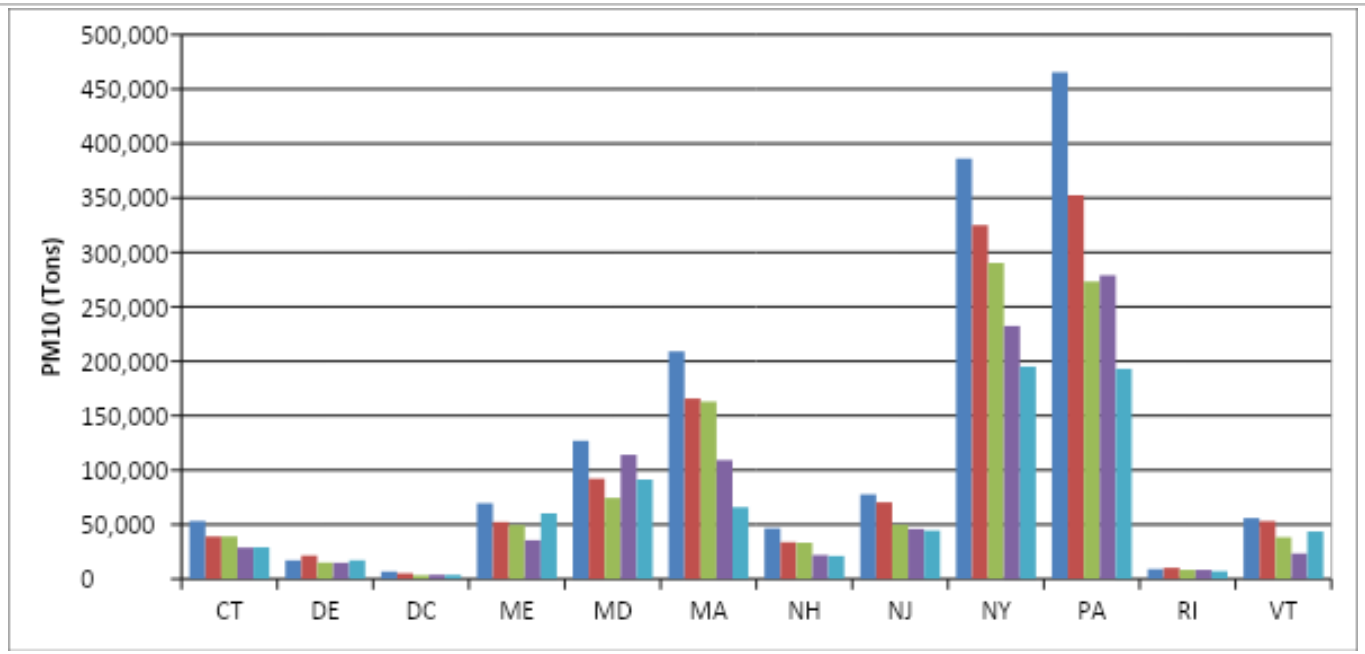
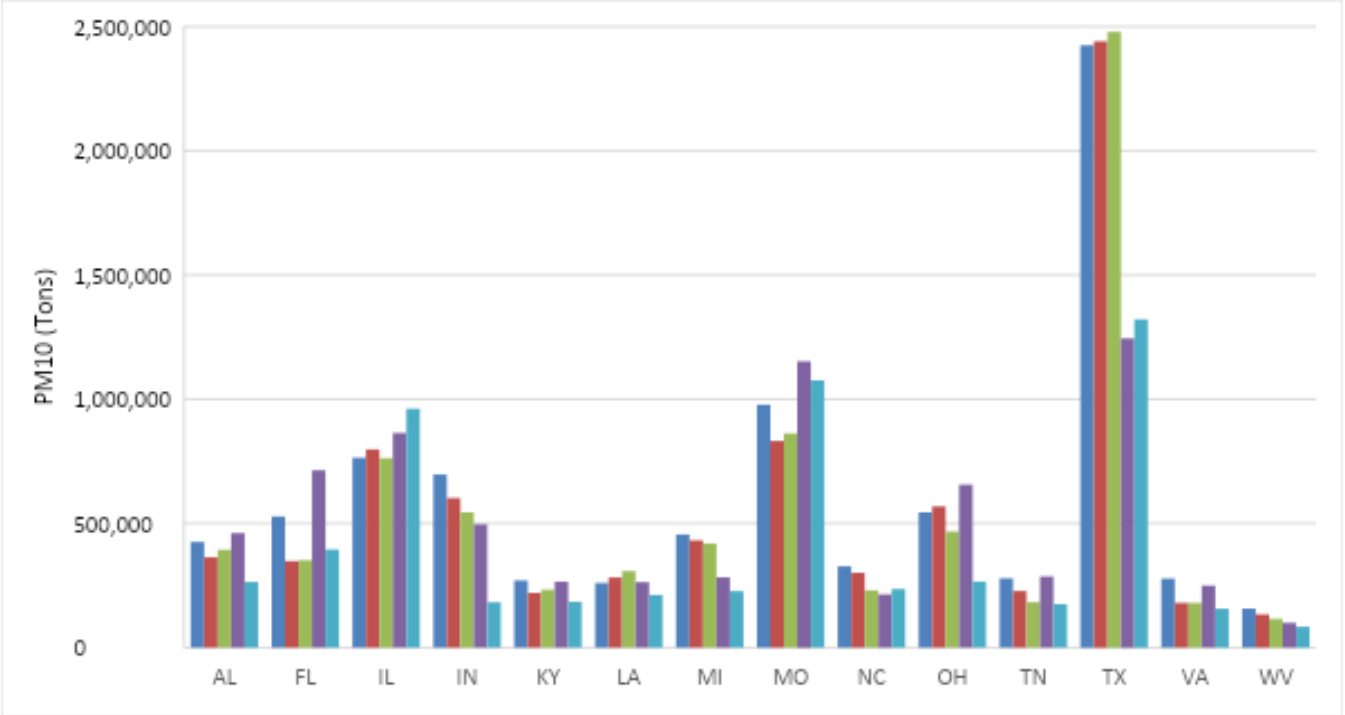


Table 2-27: PM_{10} Emissions in Contributing States for All Data Categories, 2002 – 2017 (Tons)*

State	Reduction (Tons)	Percent Reduction
AL	-161,181	-38%
FL	-133,232	-25%
IL	197,392	26%
IN	-514,452	-74%
KY	-85,775	-32%
LA	-48,083	-19%
MI	-228,370	-50%
MO	97,724	10%
NC	-91,421	-28%
OH	-278,620	-51%
TN	-104,145	-37%
TX	-1,104,530	-46%
VA	-121,497	-44%
WV	-73,001	-47%
Total	**-2,649,190**	**-32%**



* States outside of MANE-VU that contribute to Visibility Degradation within MANE-VU

2.21.3 Sulfur Dioxide

Table 2-28 shows SO_2 emissions in Maryland for all data categories for the period from 2002 to 2017. SO_2 emissions have shown a large decline in Maryland from 2002 to 2017, largely owing to the successful implementation of the Healthy Air Act, fuel switching from coal to natural gas, and the use of low-sulfur home heating and motor fuels. SO_2 emissions from AMPD sources in Maryland declined by nearly 50 percent from 2016 to 2017.

Tables 2-29 and 2-30 show total SO_2 emissions from all data categories in the MANE-VU states for 2002 to 2017. A steady decrease in SO_2 emissions can be seen for each MANE-VU state over this time period. Some of these decreases are attributable to the low sulfur fuel strategy and the 90% or greater reduction in SO_2 emissions at 167 EGU stacks (both inside and outside of MANE-VU) requested in the MANE-VU "Ask" for states within MANE-VU for the first regional haze planning period[55]. Maryland, Connecticut, Delaware, Maine, Massachusetts, New Jersey, New York, Pennsylvania, and Vermont adopted rules to implement the strategy. SO_2 emissions reductions are expected to continue beyond 2017. Other SO_2 emissions decreases are due to source shutdowns and fuel switching from high sulfur fuel oils to natural gas[56] due to favorable economic conditions in recent years.

Tables 2-31 and 2-32 shows total SO_2 emissions from all data categories in the Contributing States for 2002 to 2017. These contributing states also reduced SO_2 emissions. For applicable states, some of the SO_2 reduction for AMPD sources is attributable to CSAPR[57] (formerly CAIR), which requires NO_x and/or SO_2 emissions reductions from EGUs in 27 states in the eastern and central US.

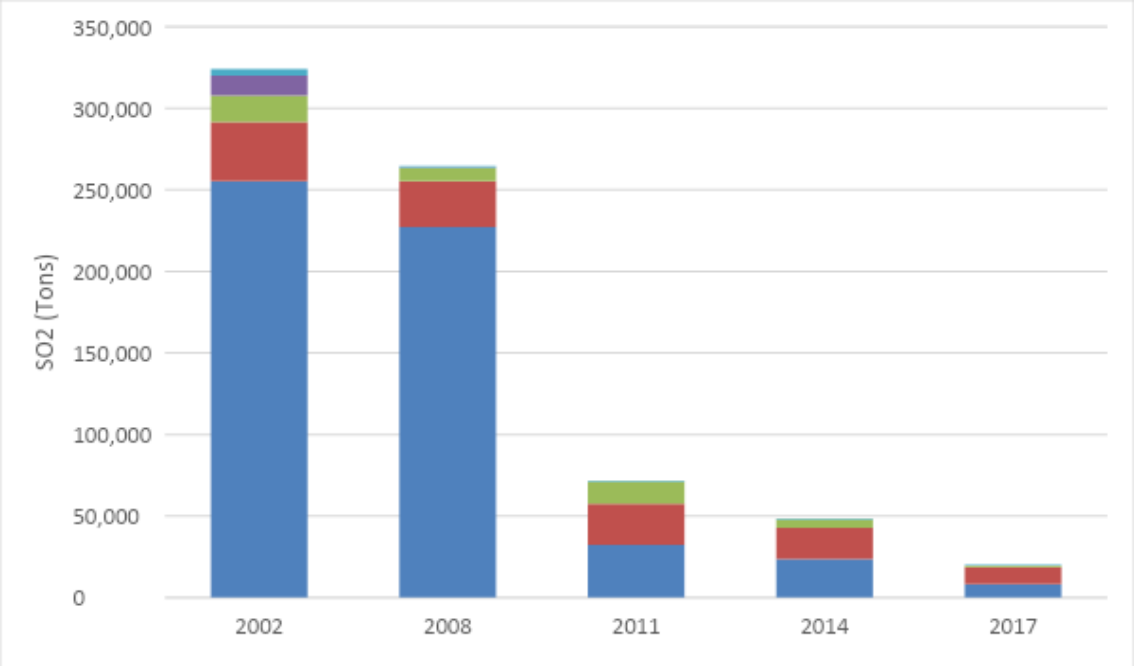
[55] Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU Toward Assuring Reasonable Progress (http://otcair.org/MANEVU/Upload/Publication/Formal%20Actions/Statement%20on%20Controls%20in%20MV_072007.pdf)

[56] AP-42, Appendix A: Miscellaneous Data and Conversion Factors, p.A-5 Typical Parameters of Various Fuels (https://www3.epa.gov/ttn/chief/ap42/appendix/appa.pdf). Natural gas contains a negligible amount of sulfur by weight.

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

Table 2-28: SO_2 Emissions in Maryland from all Data Categories, 2002 – 2017 (Tons)

Category	Reduction (Tons)	Percent Reduction
AMPD Point	-247,239	-97%
Non-AMPD Point	-25,637	-71%
Nonpoint	-15,337	-94%
Nonroad	-12,278	-99.8%
Onroad	-3,395	-86%
Total	**-303,885**	**-94%**



SO_2 Emissions from AMPD Sources in Maryland, 2016 – 2019 (Tons)

2016	2017	2018	2019
16,754	8,121	11,325	5,572

Table 2-29: SO_2 Emissions in the MANE-VU States, 2002 - 2017

SO_2 Emissions in MANE-VU States for all Data Categories, 2002 – 2017

State	Reduction (Tons)	Percent Reduction
CT	-35,410	-93%
DE	-85,552	-98%
DC	-3,961	-98%
ME	-27,823	-83%
MD	**-303,885**	**-94%**
MA	-150,523	-96%
NH	-49,274	-89%
NJ	-92,483	-95%
NY	-300,460	-92%
PA	-919,469	-91%
RI	-7,342	-90%
VT	-4,245	-85%
Total	-1,980,427	-92%

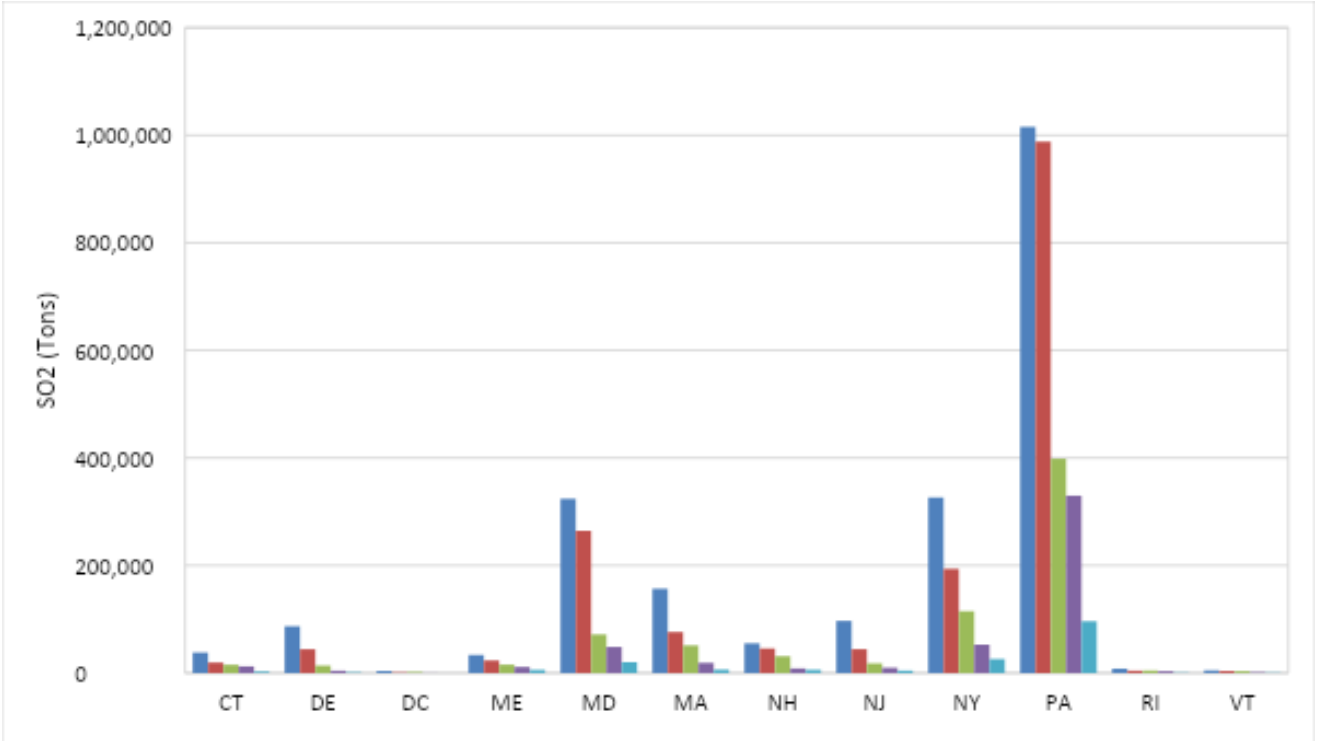


Table 2-30: SO_2 Emissions from AMPD Sources in MANE-VU

SO_2 Emissions from AMPD Sources in MANE-VU, 2016 – 2019 (Tons)

State	Reduction (Tons)	Percent Reduction
CT	-229.71	-64%
DC		
DE	-233.67	-46%
MA	-1,523.54	-89%
MD	**-11,181.13**	**-67%**
ME	-318.98	-87%
NH	-155.99	-27%
NJ	-475.57	-28%
NY	-2,560.91	-56%
PA	-45,612.08	-47%
RI	1.66	11%
VT	-0.24	-17%
Total	-62,290.16	-50%

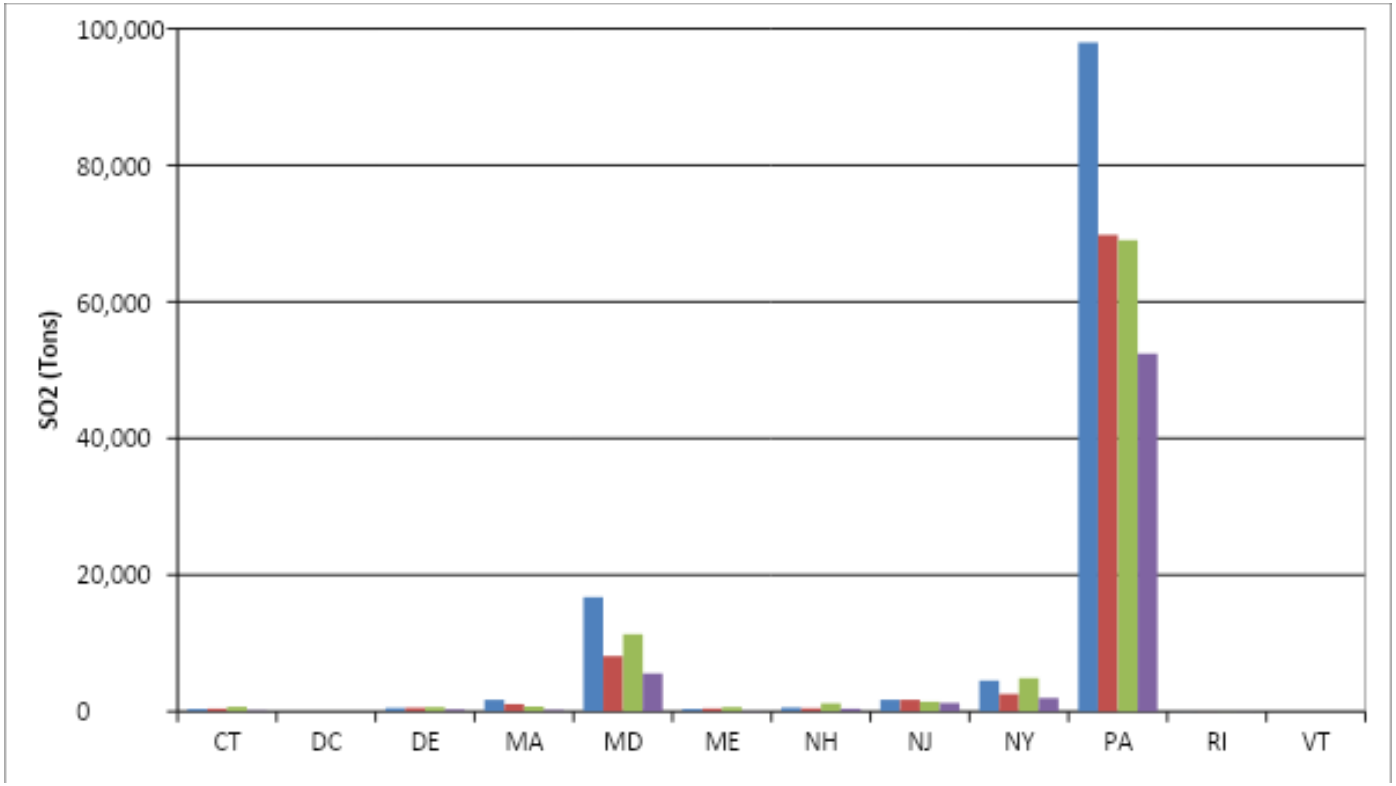
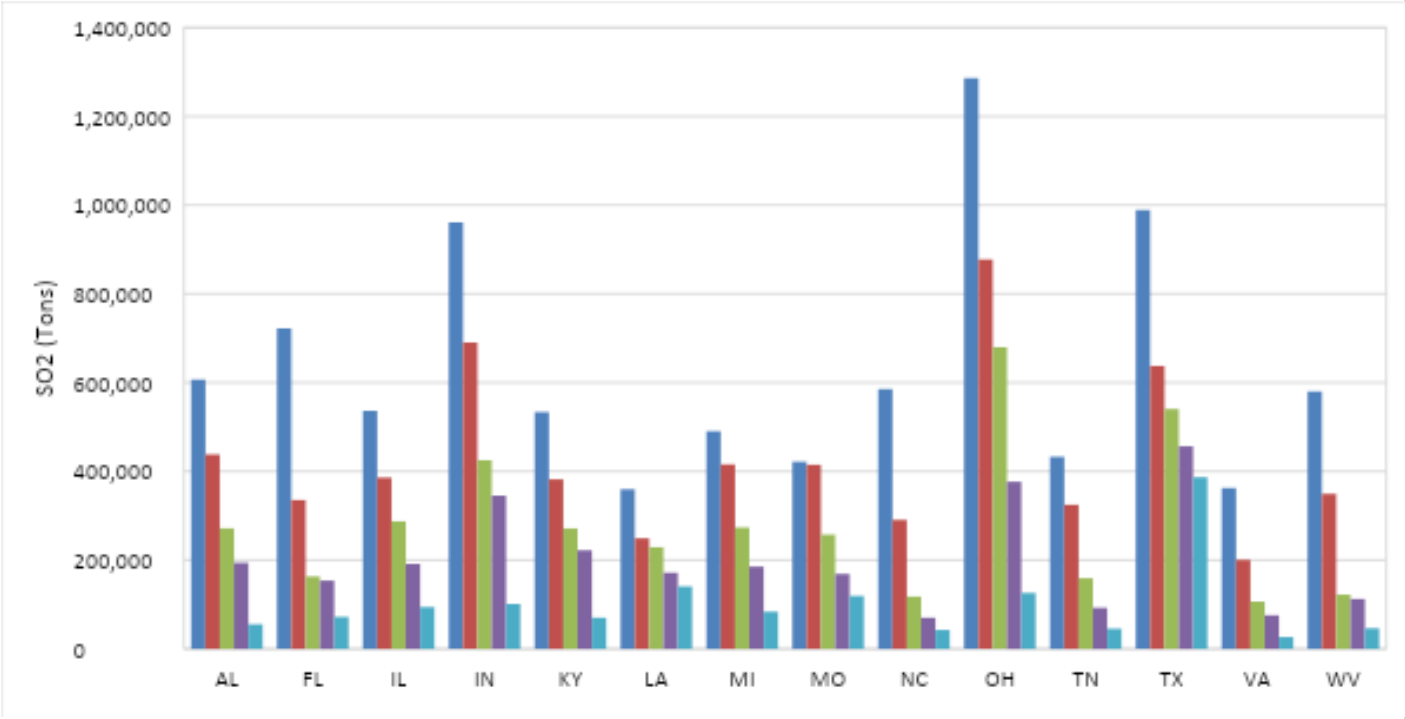


Table 2-31: SO_2 Emissions in the Contributing States, 2002 - 2017*

SO_2 Emissions in the Contributing States for all Data Categories, 2002 – 2017

State	Reduction (Tons)	Percent Reduction
AL	-551,379	-91%
FL	-649,830	-90%
IL	-442,535	-82%
IN	-859,447	-89%
KY	-463,488	-87%
LA	-219,010	-61%
MI	-406,768	-83%
MO	-302,456	-72%
NC	-542,914	-93%
OH	-1,160,102	-90%
TN	-387,463	-90%
TX	-602,410	-61%
VA	-335,961	-93%
WV	-533,682	-92%
Total	**-7,457,447**	**-84%**



* States outside of MANE-VU that contribute to Visibility Degradation within MANE-VU

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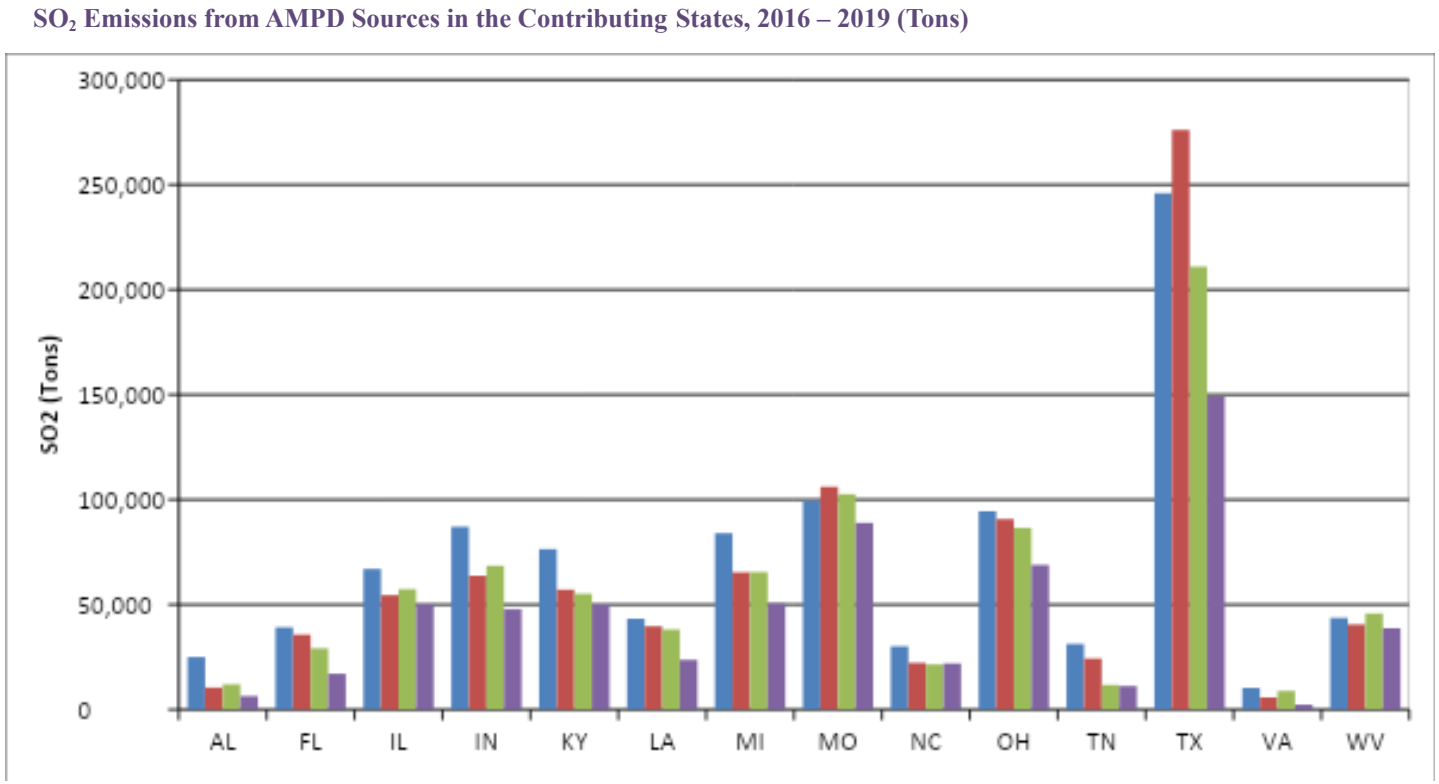
Table 2-32: SO_2 Emissions from AMPD Sources in the Contributing States 2016-2019*

State	Reduction (Tons)	Percent Reduction
AL	-18,615	-74%
FL	-22,111	-56%
IL	-16,856	-25%
IN	-39,303	-45%
KY	-26,475	-35%
LA	-19,640	-45%
MI	-33,465	-40%
MO	-10,535	-11%
NC	-8,158	-27%
OH	-25,581	-27%
TN	-20,045	-64%
TX	-96,664	-39%
VA	-7,973	-77%
WV	-4,952	-11%
Total	**-350,373**	**-36%**



* States outside of MANE-VU that contribute to Visibility Degradation within MANE-VU

2.21.4 Ammonia

Table 2-334 shows NH_3 emissions for all data categories in Maryland from 2002 to 2017. It should be noted that the decrease in Nonpoint ammonia between the 2008 and 2011 inventories is due to changes in inventory estimation methodologies. While ammonia emissions grew slightly between the 2002 and 2008 inventories, there has been a decrease in ammonia emissions from 2011 to 2017. Emissions from livestock operations account for the largest share of estimated ammonia emissions in Maryland.

Table 2-34 shows total NH_3 emissions for all data categories for the MANE-VU states. Again, some year to year variability in ammonia emissions can be seen. With the exception of New Jersey, NH_3 emissions for 2014 are lower than they were for earlier years.

Total ammonia emissions for all data categories for the Contributing states are shown in Table 2-35. Again, some year-to-year variability in NH_3 emissions can be seen. In most of the Ask states, 2014 emissions are lower than they were for previous years. For every Ask state, 2014 emissions are lower than they were for at least one of the earlier years.

Table 2-33: NH3 Emissions in Maryland from all Data Categories, 2002 – 2017 (Tons)

Category	Reduction (Tons)	Percent Reduction
Point	-200	-41%
Nonpoint	-21,076	-84%
Nonroad	-5	-18%
Onroad	-3,889	-70%
Total	-25,170	-80%

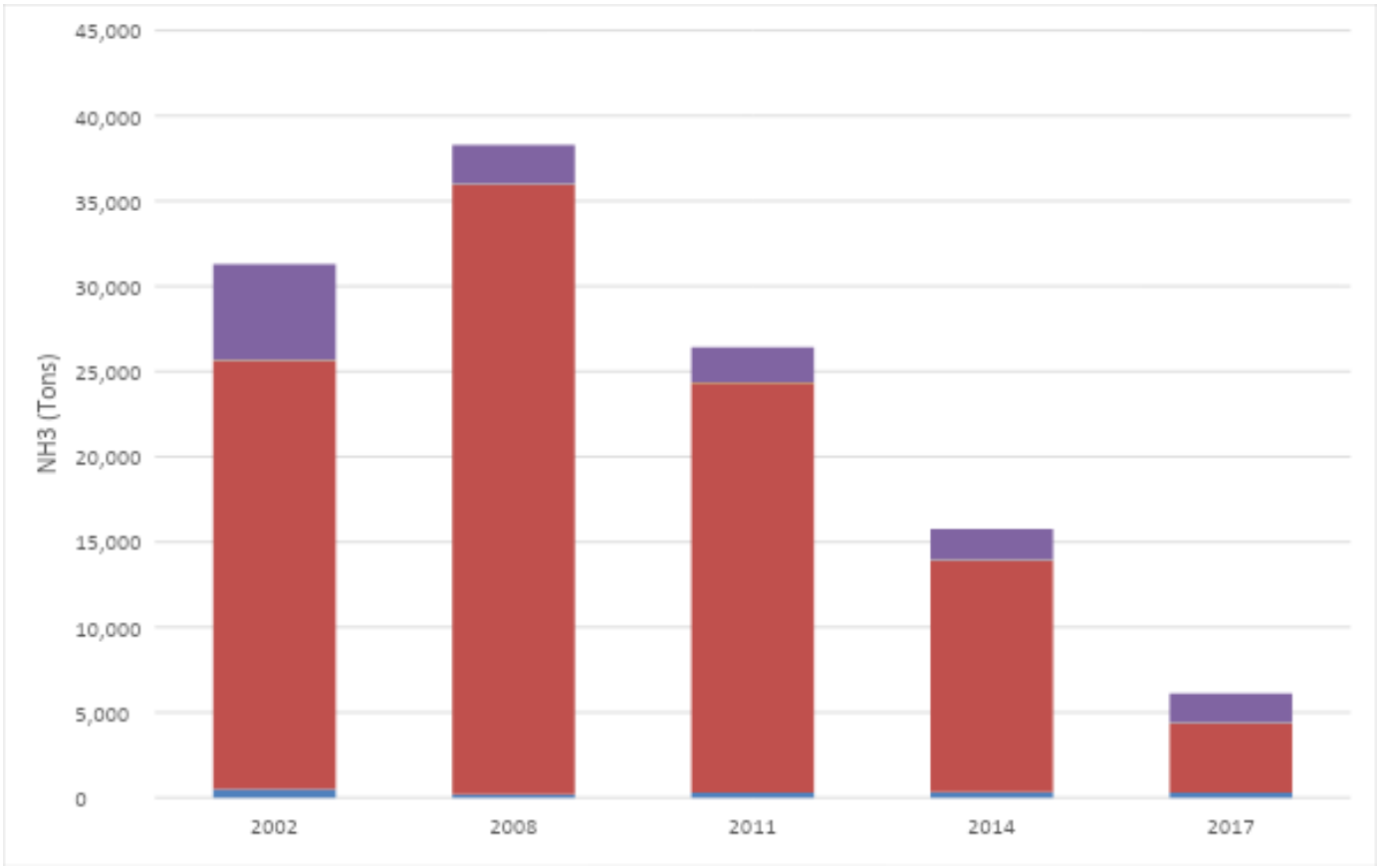


Table 2-34: NH3 Emissions in the MANE-VU States from all Data Categories, 2002 – 2017 (Tons)

State	Reduction (Tons)	Percent Reduction
CT	-2,898	-35%
DE	-6,567	-47%
DC	-158	-37%
ME	-3,792	-40%
MD	**-25,170**	**-80%**
MA	3,698	34%
NH	-1,445	-41%
NJ	169	1%
NY	-25,356	-37%
PA	-22,080	-25%
RI	-329	-27%
VT	-3,320	-34%
Total	**-87,248**	**-33%**

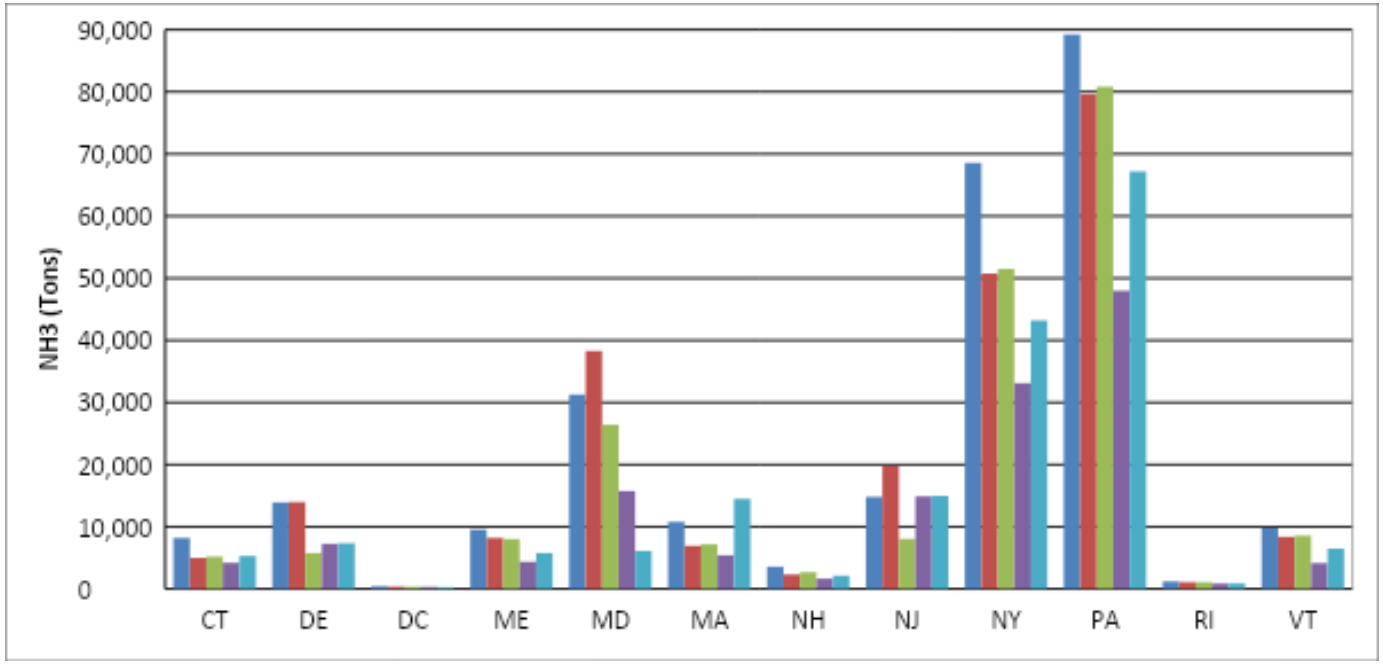
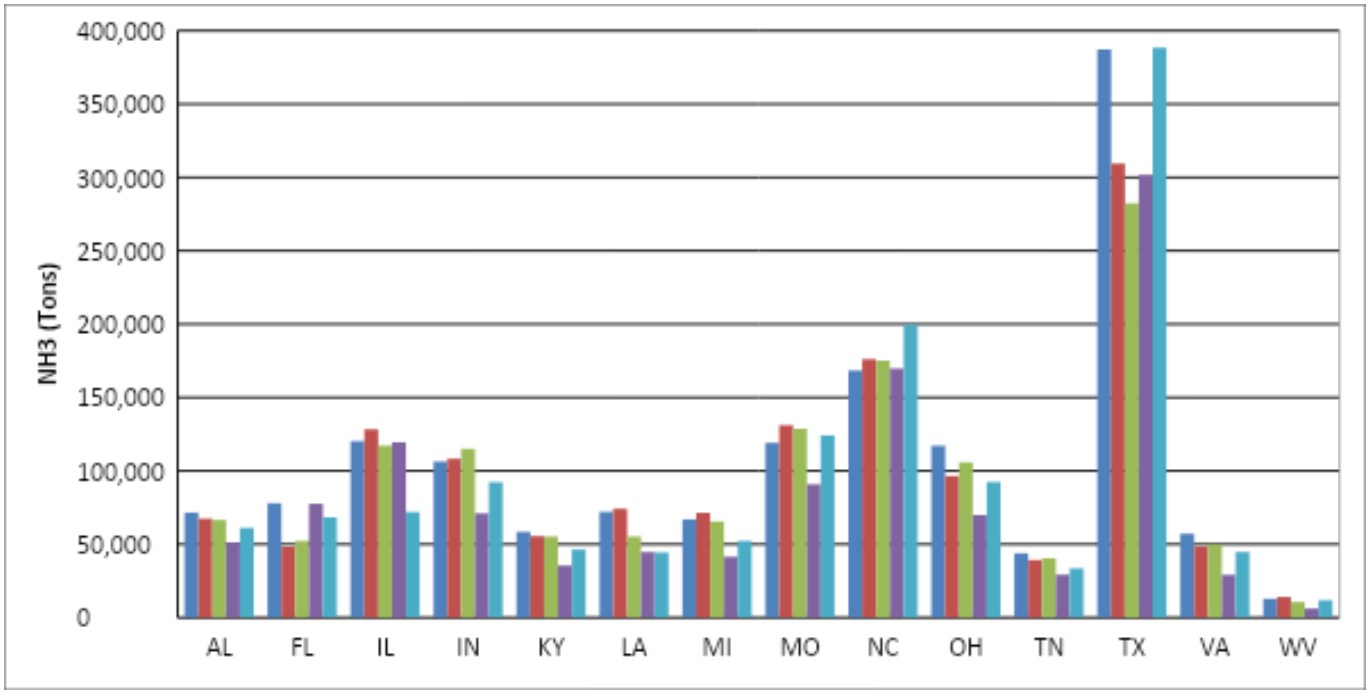


Table 2-35: NH_3 Emissions in the Contributing States from all Data Categories, 2002 – 2017 (Tons)*

State	Reduction (Tons)	Percent Reduction
AL	-20,298	-28%
FL	-322	0%
IL	-740	-1%
IN	-35,319	-33%
KY	-22,930	-39%
LA	-27,391	-38%
MI	-25,454	-38%
MO	-28,248	-24%
NC	1,379	1%
OH	-47,299	-40%
TN	-14,594	-33%
TX	-85,456	-22%
VA	-27,999	-49%
WV	-6,670	-52%
Total	**-341,340**	**-23%**



* States outside of MANE-VU that contribute to Visibility Degradation within MANE-VU

2.22 § 51.308 (g)(5) – Assessment of Significant Emissions Changes

An assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred since the period addressed in the most recent plan required under paragraph (f) of this section including whether or not these changes in anthropogenic emissions were anticipated in that most recent plan and whether they have limited or impeded progress in reducing pollutant emissions and improving visibility.

In general, anthropogenic haze-causing pollutant emissions in Maryland and throughout the MANE-VU region have continued to decrease during the second five-year period. The analysis and summaries in Section 2.20 include all relevant significant emission sources and show that none have limited or impeded progress for the regional haze program during the reporting period.

2.23 § 51.308 (g)(6) – Assessment of Adequacy of Strategies to Ensure Reasonable Progress Goals

An assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Class I Federal areas affected by emissions from the State, to meet all established reasonable progress goals for the period covered by the most recent plan required under paragraph (f) of this section.

Figure 2-8 through Figure 2-11 taken the report *Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics)* (MANE-VU, December 2018) (Appendix 13), show the progress made at the four Class I Federal areas with IMPROVE monitors that are within 300 km of Maryland. It is challenging to compare exactly how progress has been made towards the 2018 Reasonable Progress Goals for these four Class I areas because the algorithm used in calculating the metrics has changed substantially between the first and second planning periods. However, it is clear that the 5-year rolling deciview average on both the 20% most impaired days and the 20% clearest days is well below the Uniform Rate of Progress and that one-year deciview values are at or near to what was modeled in MANE-VU modeling for 2028. Maryland assesses that the Class I Federal areas that were considered during the first planning period are adequately meeting their Reasonable Progress Goals.

Figure 2-7: Visibility Metrics Levels at Brigantine Wilderness Area

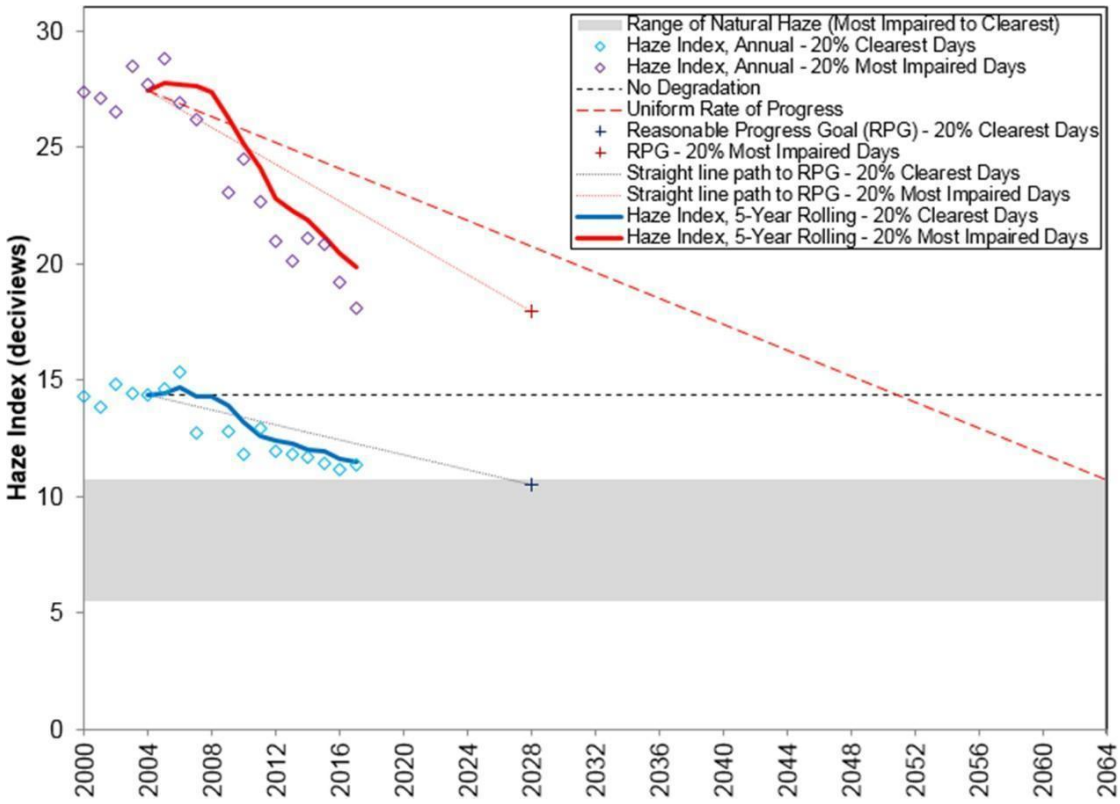


Figure 2-8: Visibility Metrics Levels at Dolly Sods Wilderness Area

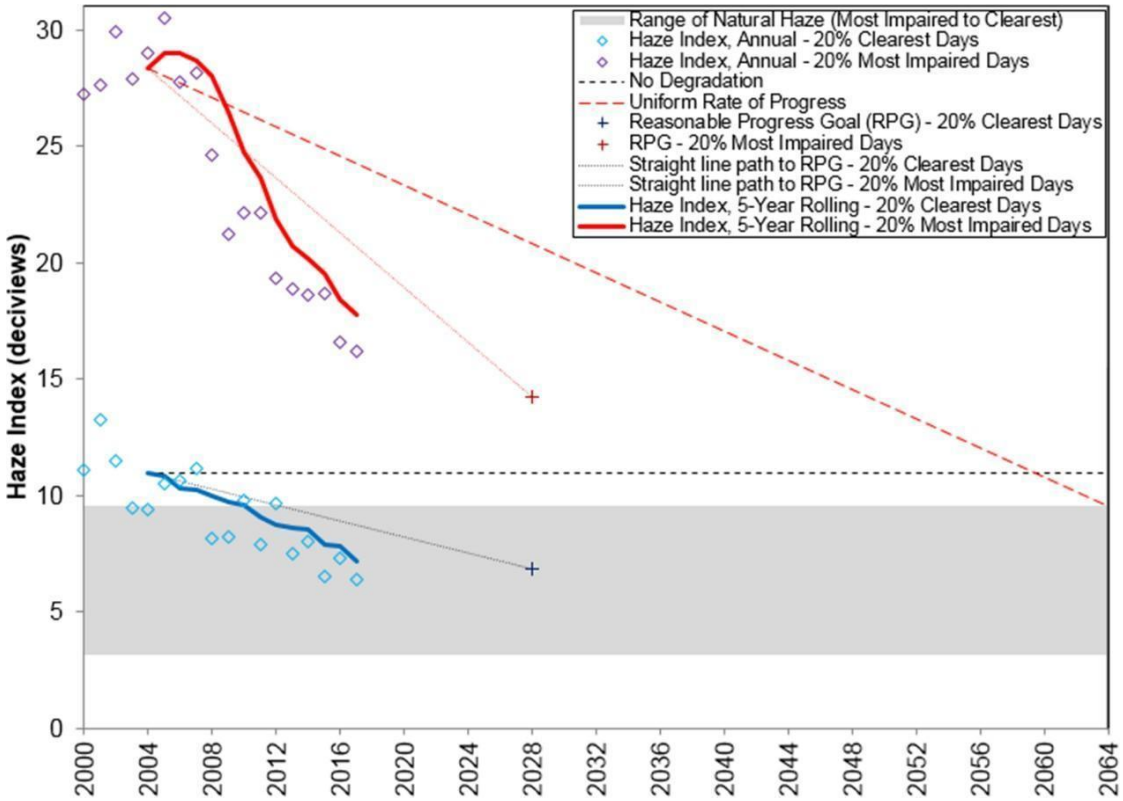


Figure 2-9: Visibility Metrics Levels at Shenandoah National Park

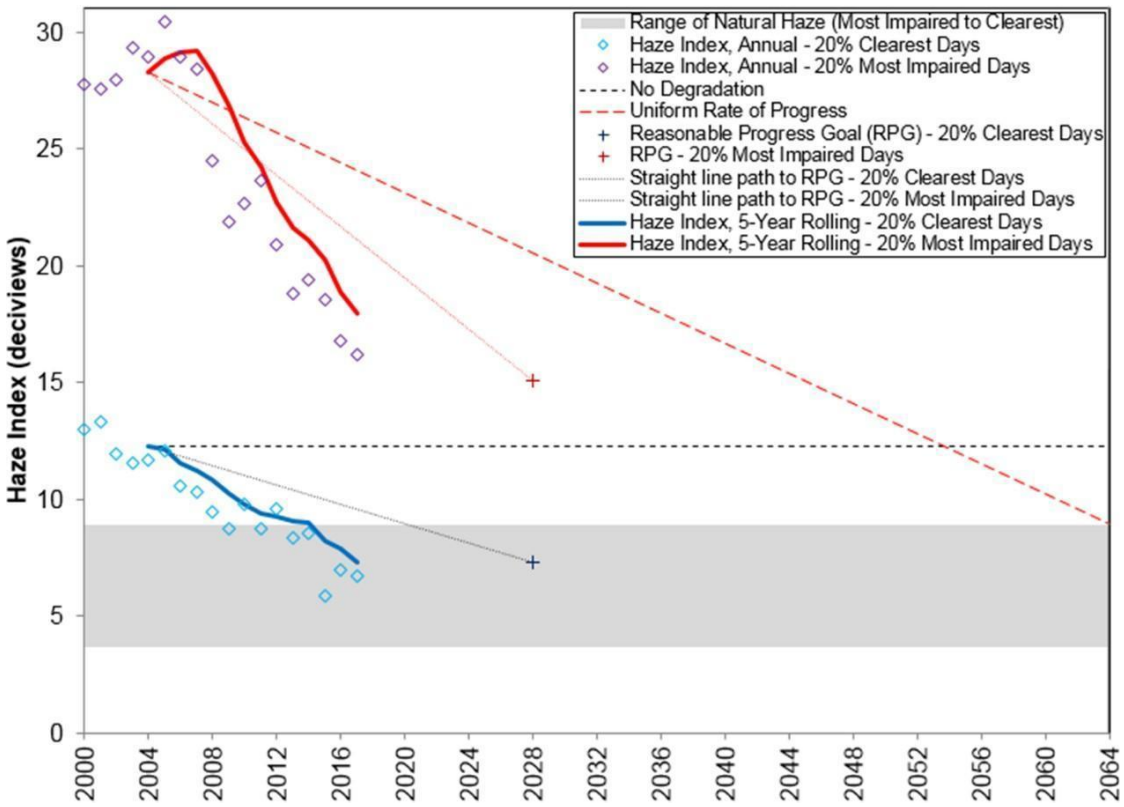
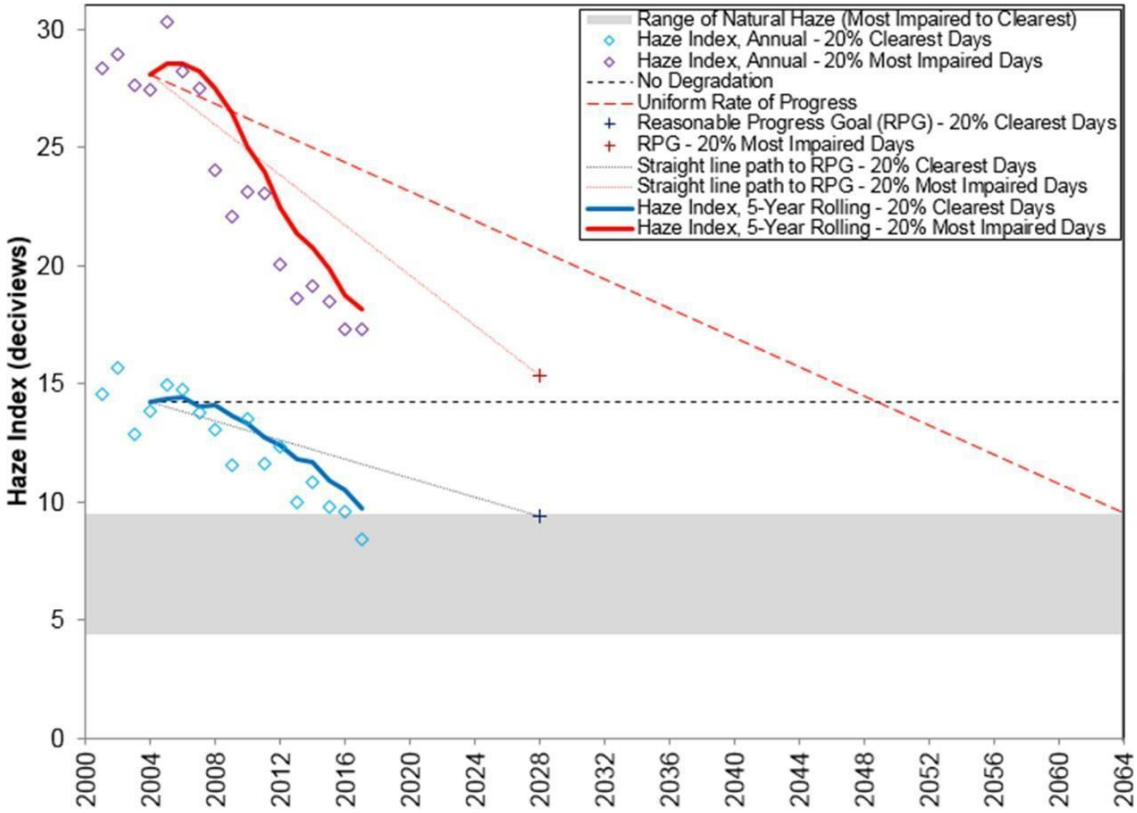


Figure 2-10: Visibility Metrics Levels at James River Face Wilderness



2.24 § 51.308 (g)(7) – Review of Monitoring Strategy

For progress reports for the first implementation period only, a review of the State's visibility monitoring strategy and any modifications to the strategy as necessary.

Maryland does not have a visibility monitoring strategy because there are no Class I Federal areas within the jurisdiction.

2.25 § 51.308 (g)(8) – Review of Smoke Management Plan

For a state with a long-term strategy that includes a smoke management program for prescribed fires on wildland that conducts a periodic program assessment, a summary of the most recent periodic assessment of the smoke management program including conclusions if any that were reached in the assessment as to whether the program is meeting its goals regarding improving ecosystem health and reducing the damaging effects of catastrophic wildfires.

MANE-VU's analysis of smoke management in the context of regional haze is documented in "Technical Support Document on Agricultural and Forestry Smoke Management in the MANE-VU Region, September 1, 2006." As that report notes, fires used for resource benefits are of far less significance to the total inventory of fine-particle pollutant emissions than other sources of wood smoke in the region. The largest wood smoke source categories for the MANE-VU region, with

respect to $PM_{2.5}$ emissions, are residential wood combustion (73 %); open burning (15 %); and industrial, commercial, and institutional wood combustion (9 %). Unwanted fires involving buildings and wild lands are only a minor fraction of wood burning emissions and cannot be reasonably addressed in a SIP. Fires that are covered under smoke management plans, including agricultural and prescribed forest burning, constitute less than one percent of total wood smoke emissions in MANE-VU.

Wildfire emissions within MANE-VU states are also relatively small and infrequent contributors to regional PM emissions. However, MANE-VU Class 1 areas are occasionally affected by wildfire smoke emissions from other regions, such as the lightning-induced forest fires that occurred in Quebec Province in July 2002. These natural wildfire smoke emissions occasionally impair visibility but are not considered manmade or controllable but rather are part of "natural background" conditions.

Smoke Management Programs are only required when smoke impacts from fires managed for resource benefits contribute significantly to regional haze. The MANE-VU study concluded that it is "unlikely that fires for agricultural or forestry management cause large impacts on visibility in any of the Class I areas in the MANE-VU Region." Though Maryland does not need an official Smoke Management Plan, Maryland does have the legal authority to allow or prohibit burning through a formal permitting system.

The 2014 NEI shows that Maryland's $PM_{2.5}$ emissions from agricultural and prescribed burning for forestry smoke management are low. In 2014 statewide emissions from prescribed fires were 1,349.18 tons (4.13% of Maryland's overall $PM_{2.5}$ emissions inventory) and agricultural burning were 1.5 tons (<1% of Maryland's overall $PM_{2.5}$ emissions inventory). It is unlikely that fires in Maryland for agricultural or forestry management cause impacts on visibility in the MANE-VU and nearby Class I areas, including Shenandoah, Dolly Sods, Otter Creek, and James River Face.

Maryland is not required to have a Smoke Management Plan, however current state legal authority and guidelines regarding fires/open burning are adequate to meet the requirements in this section.

2.26 § 51.308 (h) – Adequacy Determination

Determination of the adequacy of existing implementation plan. At the same time the State is required to submit any progress report to EPA in accordance with paragraph (g) of this section, the State must also take one of the following actions based upon the information presented in the progress report:

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

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

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

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

Based on the analyses presented in Section 2.16 through Section 2.24, Maryland determines that the existing SIP, as approved by EPA, is adequate for continued reasonable progress towards natural conditions by 2064 in all mandatory Class I Federal areas within 300 km of its borders.

Maryland has no further information indicating that emissions from Maryland impact any specific Class I Federal area. Maryland finds that no substantive SIP revisions are required to meet established visibility goals; therefore no implementation plan revision is needed.

2.27 § 51.308 (i)(2) – Federal Land Manager Consultation

The State must provide the Federal Land Manager with an opportunity for consultation, in person at a point early enough in the State's policy analyses of its long-term strategy emission reduction obligation so that information and recommendations provided by the Federal Land Manager can meaningfully inform the State's decisions on the long-term strategy. The opportunity for consultation will be deemed to have been early enough if the consultation has taken place at least 120 days prior to holding any public hearing or other public comment opportunity on an implementation plan (or plan revision) for regional haze required by this subpart. The opportunity for consultation on an implementation plan (or plan revision) or on a progress report must be provided no less than 60 days prior to said public hearing or public comment opportunity. This consultation must include the opportunity for the affected Federal Land Managers to discuss their:

(i) Assessment of impairment of visibility in any mandatory Class I Federal area; and

(ii) Recommendations on the development and implementation of strategies to address visibility impairment.

During the MANE-VU consultation process discussed in Section 2.5, opportunities were provided by MANE-VU for FLMs to review and comment on each of the technical documents developed by MANE-VU and included in this SIP. Maryland has provided agency contacts to the FLMs as required. In the development of this SIP, the FLMs were consulted in accordance with the provisions of 51.308(i)(2). Maryland has provided the FLMs an opportunity for consultation, in person at least 60 days prior to holding any public hearing on this SIP. This draft SIP was sent to the FLMs on September 2nd, 2021 for their review and comment. FLMs were asked to respond within 90 days by December 1st, 2021.

Maryland will consult with the FLMs on the status of the following implementation items:

1. Implementation of emissions strategies identified in the SIP as contributing to achieving improvement in the most impaired day visibility;
2. Summary of major new source permits issued;
3. Status of State actions to meet commitments for completing any future assessments or rulemakings on sources identified as likely contributors to visibility impairment, but not directly addressed in the most recent SIP revision;
4. Any changes to the monitoring strategy or monitoring stations status that may affect tracking of reasonable progress;
5. Work underway for preparing the 5-year reviews and/or 10-year revisions;

6. Items for FLMs to consider or provide support for, in preparation for any visibility protection SIP revisions (based on a 5-year review or the 10-year revision schedule under the Regional Haze Rule); and
7. Summary of the topics for discussion covered in ongoing communications (meetings, emails, other records) between the State and FLMs regarding implementation of the visibility program.

The consultation will be coordinated with the designated visibility protection program coordinators for the National Park Service, U.S. Fish and Wildlife Service, and the U.S. Forest Service.

Maryland will provide FLMs with an opportunity to provide comments on future SIP revisions as required by § 51.308(f).

2.28 § 51.308 (i)(3) – Comments from Federal Land Manager Consultation

In developing any implementation plan (or plan revision) or progress report, the State must include a description of how it addressed any comments provided by the Federal Land Managers.

Maryland received comments from the National Park Service prior to the publication of the proposed SIP similar to the letter received by MANE-VU and this was considered in the analysis in Section 2.5.7.

Comments were received by the U.S. Forest Service and National Park Service during the FLM comment period. The comments and responses are in Appendix 20.

2.29 § 51.308 (i)(4) – Procedures for Continuing Consultation

The plan (or plan revision) must provide procedures for continuing consultation between the State and Federal Land Manager on the implementation of the visibility protection program required by this subpart, including development and review of implementation plan revisions and progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibility in mandatory Class I Federal areas.

§ 51.308(i)(4) requires procedures for continuing consultation between States and FLMs on the implementation of the visibility protection program. Maryland commits to providing the progress report due on January 31, 2025 to the FLMs as part of continuing consultation and will consult with the FLMs if requested during the next planning period.

2.30 Appendix V to CFR Part 51 – Legal Authority to Adopt and Implement SIP

Maryland's statutory provisions for enforcement are in §§2-601—614 of the Environment Article of the Annotated Code of Maryland. In addition to the enforcement provisions in §§2-601—614 of the Environment Article, Annotated Code of Maryland, in §2-1005 of the Environment Article, Annotated Code of Maryland, are the enforcement provisions pertaining specifically to the requirements of the

Maryland Healthy Air Act ("HAA"). Among other elements, the HAA contains SO_2 , NO_x, $PM_{2.5}$, and Mercury emissions limits for certain electric generating units.

3 CONCLUSION

This SIP update represents the culmination of years' worth of technical work performed in partnership with member states, tribes, EPA and the federal land managers (FLMs). Maryland has documented its long-term strategy to assure reasonable progress toward visibility goals in nearby Class I areas and assessed its progress in reducing emissions of visibility impairing pollutants. Maryland consulted with, and incorporated, the elements of the Ask that Class I states requested be included in affecting states' regional haze plans.

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

Maryland's existing implementation plan requires no further revision at this time in order to achieve established goals for visibility improvement at nearby Class I areas. Therefore, no revision to the existing plan is needed at this time.