Maryland
Department of
the Environment

Regional Haze 5-Year Progress Report

Assessment of Reasonable Progress Goals and Adequacy of the Existing State Implementation Plan

SIP Number 17-04

July 17, 2017

Prepared for:
U.S. Environmental Protection Agency

Prepared by:
Maryland Department of the Environment

Maryland Department of the Environment
Regional Haze Progress Report

Air and Radiation Management Administration
1800 Washington Boulevard, Suite 730
Baltimore, Maryland 21230
Phone 410.537.3255 • Fax 410.537.4223

Executive Summary

Regional haze is the degradation of visibility due to air pollution from both natural and anthropogenic sources. Haze causing pollutants are transported over regional areas and thereby have a degrading effect on the visibility in many of our national parks and wilderness areas.

Section 169A of the Clean Air Act (CAA) requires states to protect visibility in national parks and wilderness areas designated as Class I Federal areas. CAA section 169A also requires the U.S. Environmental Protection Agency (EPA) to set regulations for the protection of the Class I areas. In 1999, the EPA finalized the Regional Haze Rule (64 FR 35714, 40 Code of Federal Regulations (CFR) 51.300 et seq.). The rule requires states to develop plans (State Implementation Plans or SIPs) to protect and improve visibility, in collaboration with Federal Land Managers. The original SIPs were due December 17, 2007. States are also required to revise and submit a revised SIP by July 31, 2018 and every ten years after. Additionally, every five years from the SIP submission, states are required to submit a progress report to evaluate the SIP's adequacy in meeting the ten year goals of the SIP. This progress report is hereafter known as the "five-year look back". Maryland Department of the Environment (MDE) submitted the Regional Haze SIP on February 13, 2012, and EPA approved the SIP on July 6, 2012 (77 FR 39938).

This report is the five-year look back, as required by 40 CFR 51.308(g). The purpose of this five-year look back is to review the adequacy of Maryland's Regional Haze SIP for meeting the ten-year visibility goals.

The enclosed report includes:

- Timely implementation of the alternative Best Available Retrofit Technology (BART) program;
- A review of implemented control measures including a reduction in the sulfur content of fuel oil;
- A summary of continuing evaluation of other measures such as energy efficiency, alternative clean fuels, and measures to reduce emissions from wood and coal combustion;
- Emissions trends analysis; and
- Visibility trends analysis.

The visibility improvements in the region's Class I areas have exceeded the necessary rate of progress to meet the ten-year visibility goals. *Maryland has satisfied all of the control strategy commitments in the Regional Haze SIP*. Maryland's Healthy Air Act and alternative BART program for the Luke Westvaco Paper Mill was fully implemented prior to this SIP submission. The first phase of the low sulfur fuel program became effective July 1, 2014. The reductions already achieved from the implementation of the Healthy Air Act and alternative BART program have surpassed the 2018 goals. Specifically, between 2002 and 2014 the Maryland Healthy Air sources have reduced sulfur dioxide (SO_2) emissions by 91% and nitrogen oxide (NO_x) emissions by 84%. The alternative BART program for the Luke Westvaco Paper Mill is expected to reduce their SO_2 emissions by 60% and NO_x emissions by 37% between 2002 and 2016. The visibility improvements have been even greater than the rate of progress needed to achieve 2018 goals.

This report concludes that Maryland's Regional Haze SIP is sufficient and meets the requirements of EPA's Regional Haze Rule. Thereby, MDE submits the following review for a negative declaration. As defined by 40 CFR 51.308(h), a negative declaration indicates the existing implementation plan requires no further substantive revision at this time to achieve established goals for visibility improvement and emissions reductions
.

TABLE OF CONTENTS

List of Tables

List of Figures

1.0 Introduction

Section 169A of the Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to set regulations for the protection of visibility in national parks and wilderness areas that are designated as Class I areas. In 1999, the EPA finalized the Regional Haze Rule (RHR)[1]. The RHR requires states to develop plans (State Implementation Plans or SIPs) to protect and improve visibility in collaboration with Federal Land Managers (FLM). The Maryland Department of the Environment (MDE) submitted the Regional Haze SIP on February 13, 2012, and EPA approved the SIP on July 6, 2012 (77 FR 39938).

This report is a five-year look back and is intended to review the status of the measures included in the SIP, emissions trends and the visibility trends, to determine if the SIP is adequate to meet the ten-year goals.

This introductory section describes: the purpose of this document; the background and authority of the RHR; the requirements for this periodic progress report; and the commitments to be reviewed in this report in and outside of Maryland for the region to achieve the reasonable progress goals (RPGs).

1.1 Purpose

MDE has prepared this report in fulfillment of 40 Code of Federal Regulations (CFR) section 51.308. MDE has determined that no further SIP revisions are needed to meet the 2018 goal and is therefore, submitting a negative declaration.

Table 1-1 outlines the requirements of 40 CFR sections 51.308 (g)-(h) and is included for the determination of completeness of this report.

[1] 64 FR 35714, 40 CFR 51.300 et seq.

Table 1-1: Five Year Progress Report Submittal Checklist

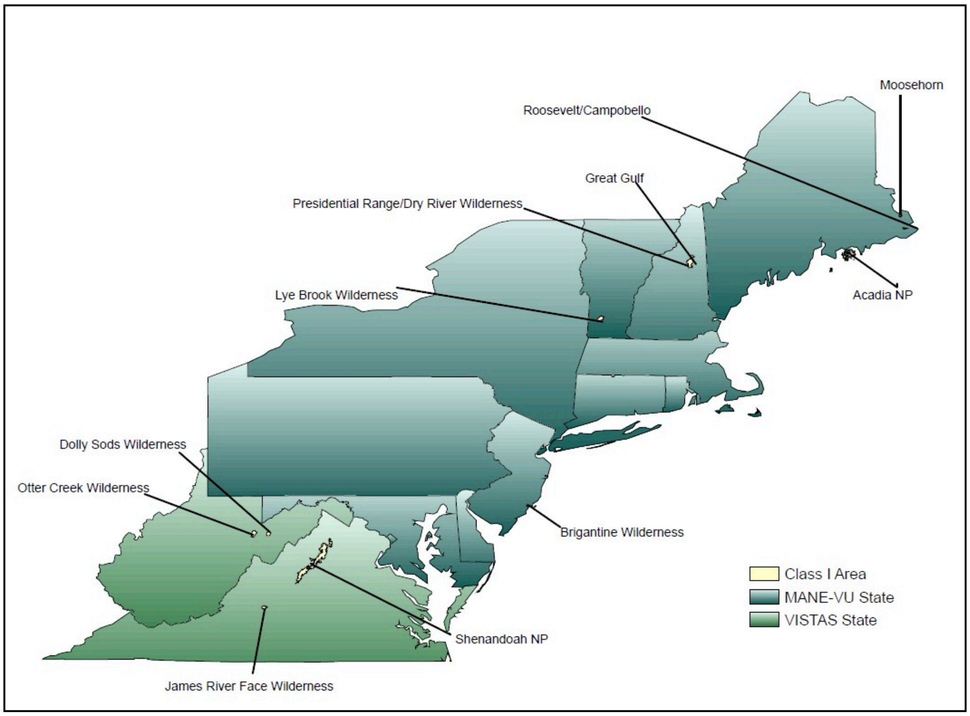
Included in This Report	Regulation Citation	Regulation Summary (not verbatim)	Location in five-year progress report or reasoning for not including in this report
Y	51.308(g)(1)	Status of Control Strategies in the Regional Haze SIP: Does the report include a list of measures the state relied upon?	Section 2: Status of Maryland Implementation Measures. Section 3: Status of Controls Outside of Maryland
Y	51.308(g)(2)	Emissions Reductions from Regional Haze SIP Strategies: Does the report include estimated reduction estimates for these measures?	Section 4: Emissions Inventory Trends
Y	51.308(g)(3)	Visibility Progress: Does the report include the summaries of monitored visibility data as required by the Regional Haze Rule? (states with Class I areas only)	Section 5: Changes in Visibility for each Mandatory Federal Class I Area in and near MANE-VU Maryland has no Class I areas. Included for full picture of the region's visibility status.
Y	51.308(g)(4)	Emissions Progress: Does the report provide emissions trends across the entire inventory for a 5-year period as required by the Regional Haze Rule? (all states)	Section 4: Emissions Inventory Trends
Y	51.308(g)(5)	Assessment of Changes Impeding Progress: Does the report include an explicit statement of whether there are anthropogenic emissions changes impeding progress? (all states)	
Y	51.308(g)(6)	Assessment of Current Strategy: Does the report include an assessment of whether the state's haze plan is on track to meet RPGs? (all states)	Section 3-4: Assessment of Implementation of Strategies Outside of Maryland Section 7: Determination of Adequacy of Current Regional Haze SIP
N	51.308(g)(7)	Review of Monitoring Strategy: Does the report review the monitoring plan including any non-IMPROVE monitors the state is using? (states with Class I areas only)	This section is a requirement for states with Class I areas and is, therefore, not applicable for Maryland.
Y	51.308(h)	Determination of Adequacy	Section 7: Determination of Adequacy of Current Regional Haze SIP

1.2 Background

The CAA requires the protection of air quality in national parks and wilderness areas. Specifically, CAA Section 169A requires the "prevention of any future, and the remedying of any existing impairment of visibility in Class I areas which impairment results from manmade air pollution."

CAA section 169A defines Class I areas as: national parks exceeding 6,000 acres; wilderness areas and national memorial parks exceeding 5,000 acres; and all international parks in existence on August 7, 1977. There are 156 Class I areas in the United States. Eleven Class I areas are in or near the Mid-Atlantic and Northeast Region (Figure 1.1).

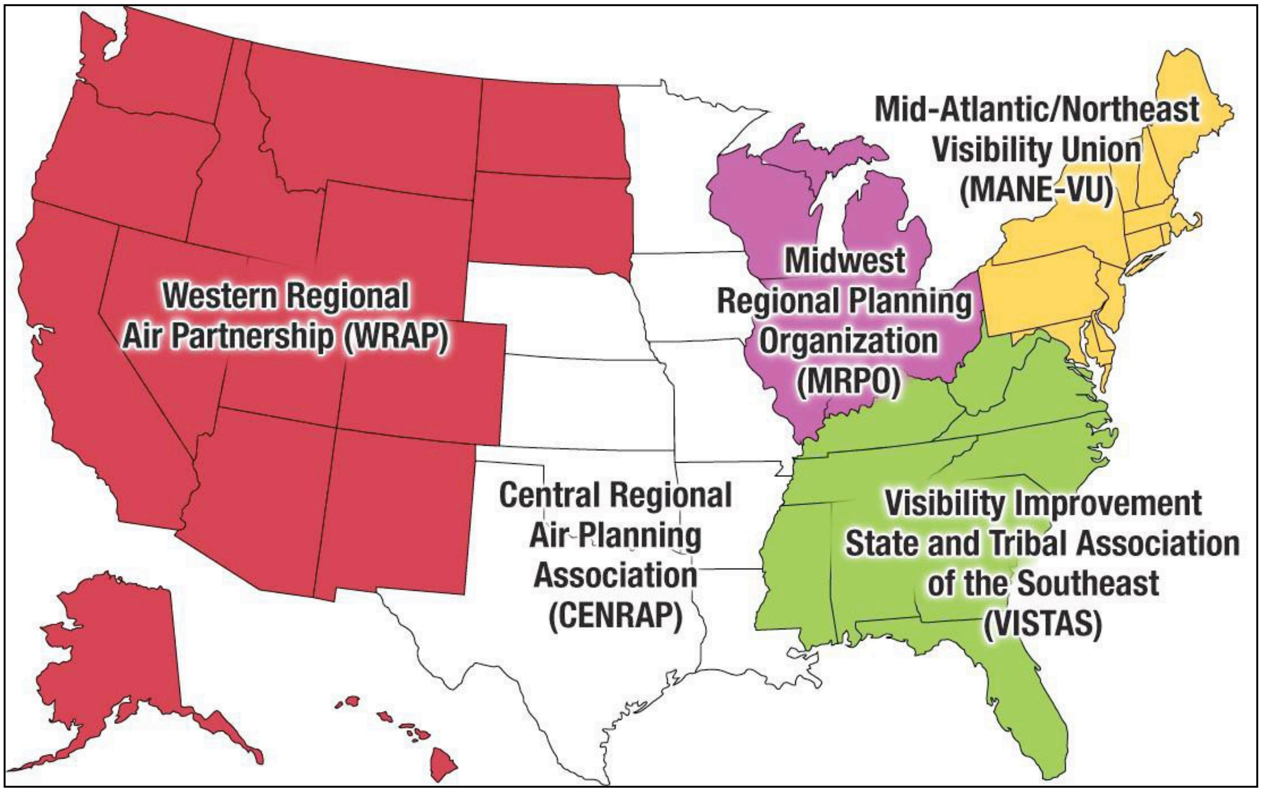
Figure 1-1: Nearby Class I Areas



The RHR is codified in 40 CFR sections 51.300-308. One of the RHR's requirements is that state, tribal and federal agencies work together to improve visibility.

EPA designated five Regional Planning Organizations (RPOs) to establish the platform to collaboratively address the visibility issue (Figure 1.2). Maryland is a member of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) RPO.

Figure 1-2: Map of U.S. Regional Planning Organizations



In 2006 MANE-VU conducted a contribution assessment study to evaluate the most effective approach for remedying the haze problem. The study determined that the predominant cause of haze pollution in MANE-VU's Class I areas is sulfate particles. These particles originate as sulfur dioxide emissions primarily from burning coal and oil to provide heat and power. Other haze contributing pollutants are emitted by power plants, boilers, furnaces, motor vehicles, other fuel-burning equipment, forest fires and other wood combustion.[2] Using these conclusions from the contribution assessment study, MANE-VU members, neighboring states, FLMs and EPA collaborated on the development of strategies to reduce haze that obscures the Class I area vistas.

Additionally, the RHR requires states to develop and implement SIPs to reduce the pollution that causes the visibility impairment. These plans establish RPGs and the emission reduction strategies needed to meet said goals. As noted above, these emissions reductions strategies were developed in a collaborative process with key stakeholders. The strategies were then adopted and implemented into Maryland's Regional Haze SIP.

1.3 Summary of the Requirements for Periodic Progress Reports

This five-year progress report for the first planning period is a SIP revision that fulfills the requirements of 40 CFR Part 51 sections 308(g)-(i) and 40 CFR Part 51 sections 102 and 103. The following paragraphs summarize those requirements. The primary purpose of this report is to provide an update on the status of MDE's efforts to implement the measures in the Regional Haze SIP and determine their

[2] See Contributions to Regional Haze in the Northeast and Mid-Atlantic States, NESCAUM, 2006.

adequacy to meet the RPGs.

1.3.1 General and Procedural Requirements

The RHR requires the five-year progress report for the first planning period to be in the form of a SIP revision and comply with CAA procedural requirements. Maryland's initial regional haze SIP was submitted on February 13, 2012[3], establishing a 2017 submission date for this five-year report. The periodic report must address the following requirements:

1. 40 CFR section 51.102 - public hearings;
2. 40 CFR section 51.103 - EPA submittal requirements;
3. 40 CFR section 51.308(g) - evaluate progress towards the RPGs established in the initial SIP for each mandatory Class I Federal area located within the State and each mandatory Class I Federal area located outside the State which may be affected by emissions from within the State;
4. 40 CFR section 51.308(h) - determine the adequacy of the existing implementation plan; and
5. 40 CFR section 51.308(i) - provide continued coordination with other states with Class I areas impacted by Maryland as well as consult with FLMs and EPA in order to maintain and improve the visibility in the Class I area.

1.3.2 Required Elements of the Progress Report SIP

According to 40 CFR Section 51. 308(g), a five-year progress report must contain the following elements:

1. A description of the status of implementation of all measures included in Maryland's Regional Haze SIP for achieving RPGs for mandatory Class I Federal areas.
2. A summary of the emissions reductions achieved throughout the State through implementation of the measures.
3. For states with Class I areas, a detailed assessment of visibility changes that must be made. This requirement does not apply to Maryland because there are no Class I areas in Maryland. Maryland has included MANE-VU's assessment of the neighboring Class I areas and review of the visibility trends observed at Maryland's IMPROVE monitoring site.
4. An analysis tracking the change over the past five years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity.
5. An assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past five years that have limited or impeded progress in reducing pollutant emissions and improving visibility.
6. An assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Federal Class I areas affected by emissions from the State, to meet all established RPGs.

---

[3] https://www.federalregister.gov/documents/2012/07/06/2012-16417/approval-and-promulgation-of-air-quality-implementation-plans-maryland-regional-haze-state

7. A review of the State's visibility monitoring strategy and any modifications to the strategy as necessary. This requirement is not applicable to Maryland, as the state does not have any Class I areas. However, Maryland does intend to maintain the Interagency Monitoring of Protected Visual Environments (IMPROVE) site at Frostburg Reservoir.

Each of these required elements with the exception of the states monitoring strategy, as it is not applicable to states like Maryland without a Class I area, is addressed in subsequent sections of this progress report.

1.4 Summary of MANE-VU Commitments

The RPGs adopted by the MANE-VU Class I States are based on the implementation of the regional course of action set forth by MANE-VU on June 20, 2007 in the following documents:

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

These documents are known collectively as the MANE-VU Ask and are summarized in this section. The MANE-VU Ask is the set of strategies that resulted from the collaborative process described in Section 1.2 of this report. Also noted in Section 1.2, the contribution assessment by the region determined that the primary cause of haze in MANE-VU Class I areas was sulfate particles.[4] This contribution assessment concluded that, during the baseline period, sulfate alone accounted for anywhere from one-half to two-thirds of total fine particle mass on the 20 % haziest days at MANE-VU Class I sites. Even on the 20 percent clearest days, sulfate generally accounted for the largest fraction (40 % or more) of total fine particle mass in the region. Sulfate has an even larger effect when one considers the differential visibility impacts of different particle constituents. Sulfate accounted for 70 to 82 % of estimated particle-induced light extinction at northeastern and mid-Atlantic Class I sites.

The MANE-VU Contribution Assessment also indicates that sulfur dioxide (SO_2) emissions from within MANE-VU in 2002 were responsible for approximately 25% of the sulfate at MANE-VU Class I Areas. Sources in the Midwest and Southeast regions were responsible for about 15 to 25 percent each. Point sources dominated the inventory of SO_2 emissions. The largest source category responsible for SO_2 emissions within the point sources was determined to be electric generating units (EGUs). EPA's Clean Air Interstate Rule (CAIR) was expected to reduce emissions from EGUs by 2018. Therefore, MANE-VU's long-term strategy included additional measures to control sources of SO_2 both within the MANE-VU region and in other states that were determined to contribute to regional haze at MANE-VU Class I Areas. In addition, a special focus was given to EGUs.

[4] Contributions to Regional Haze in the Northeast and Mid-Atlantic United States. NESCAUM, 2006

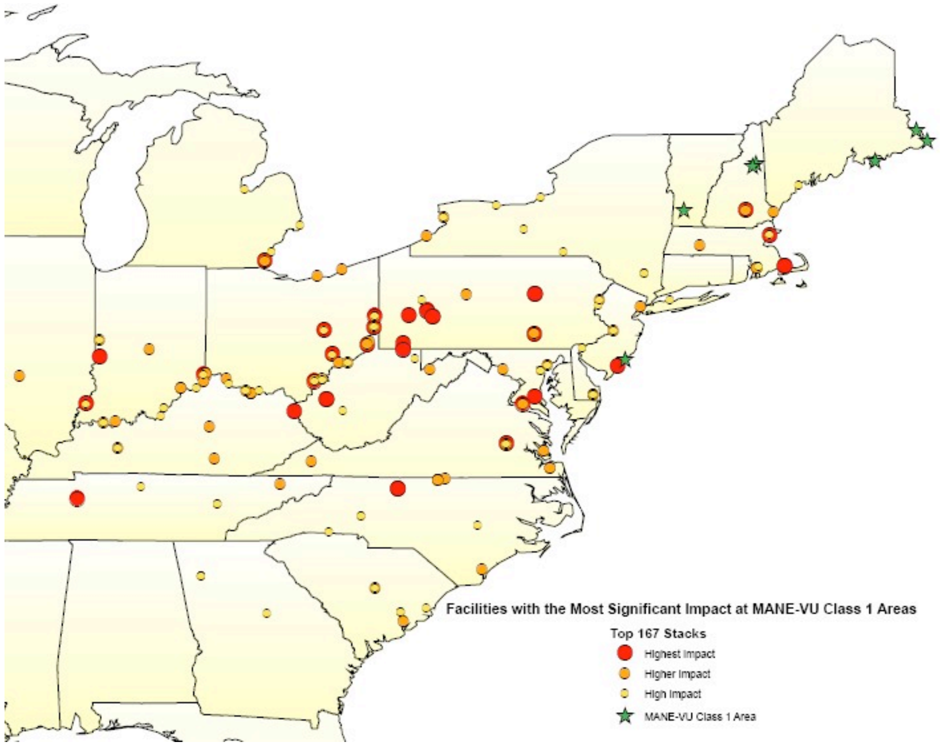
MANE-VU modeling demonstrated that the control strategies described below, in addition to on-the-books/on-the-way (OTB/OTW) measures would enable all MANE-VU Class I areas to meet their reasonable progress targets in 2018. The actions taken in response to the MANE-VU Ask are outlined in Section 2 and Section 3.

1.4.1 Requested Action within MANE-VU

On June 20, 2007, the Mid-Atlantic and Northeast States agreed to pursue a coordinated course of action designed to assure reasonable progress toward remedying the existing impairment and preventing the future degradation of visibility in mandatory Class I areas within MANE-VU. This approach would also leverage the multi-pollutant benefits that such measures may provide for the protection of public health and the environment. This course of action includes pursuing the adoption and implementation of the following emissions reduction strategies by MANE-VU states, as appropriate and necessary:

- Timely implementation of Best Available Retrofit Technology (BART) requirements; and
- A low sulfur fuel oil strategy in the inner zone States (New Jersey, New York, Delaware, and Pennsylvania, or portions thereof) to reduce the sulfur content: of distillate oil to 0.05% sulfur by weight (500 ppm) by no later than 2012, of #4 residual oil to 0.25% sulfur by weight by no later than 2012, of #6 residual oil to 0.3 – 0.5% sulfur by weight by no later than 2012, and to further reduce the sulfur content of distillate oil to 15 ppm by 2016; and
- A low sulfur fuel oil strategy in the outer zone States (the remainder of the MANE-VU region, including Maryland) to reduce the sulfur content of distillate oil to 0.05% sulfur by weight (500 ppm) by no later than 2014, of #4 residual oil to 0.25 – 0.5% sulfur by weight by no later than 2018, and of #6 residual oil to no greater than 0.5% sulfur by weight by no later than 2018, and to further reduce the sulfur content of distillate oil to 15 ppm by 2018, depending on supply availability; and
- A 90% or greater reduction in SO_2 emissions from each of the electric generating unit (EGU) stacks identified by MANE-VU (Appendix B) – comprising a total of 167 stacks as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region (see Figure 1.3). If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and
- Continued evaluation of other control measures including energy efficiency, alternative clean fuels, and other measures to reduce SO_2 and nitrogen oxides (NO_x) emissions from all coal-burning facilities by 2018 and new source performance standards for wood combustion. These measures and other measures identified will be evaluated during the consultation process to determine if they are reasonable and cost-effective.

Figure 1-3: "167 Stacks" - EGUs with Most Significant Impact at MANE-VU Class I Areas



1.4.2 Requested Action Outside MANE-VU

On June 20, 2007, the MANE-VU states adopted a statement requesting that states outside of the MANE-VU region, which modeling identified as contributing to visibility impairment in the MANE-VU Class I areas, pursue a course of action to assure reasonable progress toward improvement of visibility in the MANE-VU Class I areas. This requested course of action included pursuing the adoption and implementation of the following control strategies by states outside of MANE-VU and the EPA:

- Timely implementation of BART requirements,
- A 90% or greater reduction in SO_2 emissions from each of the EGU stacks identified by MANE-VU (Appendix B) – comprising a total of 167 stacks as reasonably anticipated to cause or contribute to impairment of visibility in each mandatory Class I Federal area in the MANE-VU region (refer to Figure 1.3 for stack locations). If it is infeasible to achieve that level of reduction from a unit, alternative measures will be pursued in such State; and
- The application of reasonable controls on non-EGU sources resulting in a 28% reduction in non-EGU SO_2 emissions. This is equivalent to the projected reductions MANE-VU will achieve through its low sulfur fuel oil strategy,[5]

[5] The 28 % emission reduction from non-EGU sources outside MANE-VU was intended to represent a similar emission reduction as the MANE-VU Low Sulfur Fuel Oil strategy in the areas inside MANE-VU. This strategy intentionally did not define a specific control measure. It was the intention of the MANE-VU states to enable contributing states to define how they would achieve this additional reduction in a way that is most reasonable for the sources in their state. Based on MANE-VU's initial analysis of available projection inventories for 2018, these targets were estimated at 151,000 and 308,000 tons per year

- States continued evaluation of other measures to reduce SO_2 and NO_x emissions from all coal-burning facilities by 2018; and
- EPA's assessment of new source performance standards for wood combustion.

1.5 Summary of Maryland's Regional Haze SIP Submittal

On February 13, 2012, Maryland submitted its Regional Haze SIP, which EPA approved (effective August 6, 2012).[6] Maryland's Regional Haze SIP submittal consisted of the following commitments:

- The demonstration of BART equivalency achieved through existing controls.
- All BART eligible and NO_x Budget/CAIR program sources would meet the recommended residual oil content or use lower sulfur content residual oil than specified in MANE-VU's low- sulfur fuel oil strategy.
- Implement sulfur limits on distillate oil for heating and off-road diesel.
- The continued evaluation of other control measures including energy efficiency and alternative clean fuels to reduce SO_2 and NO_x emissions from coal-burning facilities by 2018.
- The collaborative work with other states and FLMs to maintain the IMPROVE network, including the Frostburg Reservoir sites, to the extent that resources are available.

Maryland identified seven units that qualified as BART eligible. The Regional Haze SIP submission and associated analyses determined that Maryland's Healthy Air Act regulations (COMAR 26.11.27) and the 10 units subject to these regulations had realized greater emissions reductions than what BART would have achieved (see Section 4.2 for the demonstration of the achieved emissions reductions). Therefore, these regulatory measures were submitted as Maryland's alternative to BART.

As noted above, MDE committed to adopt a low-sulfur fuel strategy. The strategy is implemented in two phases.[7] The first phase began in 2014 and limited the sulfur content in distillate oil #1 and #2 to 0.05% and restricted the sale of residual oil #4, #5 and #6 sulfur content to 1.0%. The second phase, beginning in 2018, will further reduce the sulfur content of residual oil to 0.3% and distillate oil further to 0.0015%.

The resulting emissions reductions and changes in visibility are noted in Section 5 and summarized in Figure 5.1a-g.

---

reduction in non-EGU SO_2 emissions from the Midwest RPO and VISTAS RPO respectively. MANE-VU reached a consensus with the Midwest RPO during the consultation process that 131,6000 tons per year was a more accurate estimate of the magnitude of a 28 % reduction relative to their projected 2018 non-EGU SO_2 emissions of 470,000 tons per year.

[6] https://www.federalregister.gov/documents/2012/07/06/2012-16417/approval-and-promulgation-of-air-quality-implementation-plans-maryland-regional-haze-state

[7] COMAR 03.03.05.04

2.0 Status of Maryland Implementation Measures

The Regional Haze SIP included the commitments to implement BART, compliance with a 90% reduction in SO_2 from the MANE-VU "167" stacks and the enactment of a low sulfur fuel oil strategy. Maryland has achieved compliance with a 90% reduction in SO_2 from the MANE-VU "167" Stacks by implementing the HAA. Maryland has implemented a Low Sulfur Fuel Strategy by updating COMAR03.03.05.04 to reduce the maximum sulfur level of Nos. 1 and 2 fuel oil to 500 ppm no later than July 1, 2016. Maryland's BART approach was approved by EPA on July 6, 2012 (77 Fed. Reg. 39938). MDE has met all implementation obligations and achieved the associated emissions reductions. This section of the report describes the implementation of the measures.

2.1 Status of 90% Reduction from MD "Top 167" EGU Units

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 agreed regional approach for this source sector is to pursue a 90 percent control level on SO_2 emissions from these 167 stacks by 2018 as appropriate and necessary. MANE-VU has concluded that pursuing this level of sulfur reduction is both reasonable and cost-effective. Table 2-1 identifies the EGU facilities and units in Maryland included in the MANE-VU list of "167 units".

Table 2-1: Maryland's 12 EGU Units identified in the MANE-VU list of "167 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

MANE-VU identified 167 stacks at EGU facilities that had the highest emissions in the eastern U.S. These had highest visibility impacts on MANE-VU Class I areas. Thus, controlling emissions from those stacks is crucial to improving visibility. Therefore, to meet the reasonable progress goals, SO_2 emissions from those units (or those units plus other sources[8]) must be reduced by at least 90%. Table 2-3 shows the SO_2 emission reductions needed to meet the 90% RPG for those units. The required emission reductions are based on 90% of the 2002 emissions.

[8] The MANE-VU Resolutions state that, "If it is infeasible to achieve that level of reduction from a 167 unit, alternative measures will be pursued in such State, which could include other point sources"

Table 2-2: RPG SO_2 Emission Reduction Target

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

2.1.1 Healthy Air Act (COMAR 26.11.27)

Maryland's response to the "167 Ask" was the adoption in 2007 of the Maryland Healthy Air Act (HAA). The HAA has provided substantial reductions in NO_x and SO_2 . These reductions come from all coal-fired EGUs, including the older BART-eligible units. As shown in the Table 2-3, the MD HAA includes more units than the MANE-VU "167" Ask units or the EGU BART units. Table 2-4 and 2-5 presents the HAA annual tonnage limits and 2015 emissions for affected units. Note: The R. Paul Smith facility was decommissioned in 2012.

Table 2-3: Comparison of HAA, BART and MANE-VU 167 EGUs

Facility	HAA Units	BART Units	"167" Units
Brandon Shores	1, 2		1, 2
C.P. Crane	1, 2	2	1, 2
Chalk Point	1, 2	1, 2, 3	1, 2
Dickerson	1, 2, 3		1, 2, 3
H.A. Wagner	2, 3	3	3
Morgantown	1, 2	1, 2	1, 2
R. Paul Smith	3, 4		

Table 2-4: Maryland HAA Annual SO_2 Tonnage Limitations

Affected Unit	HAA SO_2 Limits	2015 SO_2 Emissions
Brandon Shores Unit 1	5,392	1,310
Brandon Shores Unit 2	5,627	1,643
C.P. Crane Unit 1	1,532	381
C.P. Crane Unit 2	1,646	944
Chalk Point Unit 1	2,606	826
Chalk Point Unit 2	2,733	647
Dickerson Unit 1	1,238	127
Dickerson Unit 2	1,355	125
Dickerson Unit 3	1,285	147
H.A. Wagner Unit 2	1,239	1,187
H.A. Wagner Unit 3	2,490	8,751
Morgantown Unit 1	4,678	1,214
Morgantown Unit 2	4,646	1,521
R. Paul Smith Unit 3	124	0
R. Paul Smith Unit 4	644	0

Total	**37,235**	**18,823**

Table 2-5: Maryland HAA Annual NO_x Tonnage Limitations

Affected Unit	HAA NO_X Limits	2015 NO_X Emissions
Brandon Shores Unit 1	2,414	759
Brandon Shores Unit 2	2,519	1,312
C.P. Crane Unit 1	686	339
C.P. Crane Unit 2	737	732
Chalk Point Unit 1	1,166	655
Chalk Point Unit 2	1,223	814
Dickerson Unit 1	554	246
Dickerson Unit 2	607	269
Dickerson Unit 3	575	254
H.A. Wagner Unit 2	555	259
H.A. Wagner Unit 3	1,115	593
Morgantown Unit 1	2,094	380
Morgantown Unit 2	2,079	465
R. Paul Smith Unit 3	55	0
R. Paul Smith Unit 4	288	0
Total	**16,667**	**7,077**

The HAA is resulting in greater emissions reductions than would be achieved under BART. The BART rule ensures that high efficiency controls were installed at large units that had an impact on any Class I area. Maryland strongly believes that excellent controls are indeed being installed at these facilities in a faster timeframe than actually required by the haze rule.

2.1.1.1 HAA SO_2 Reductions

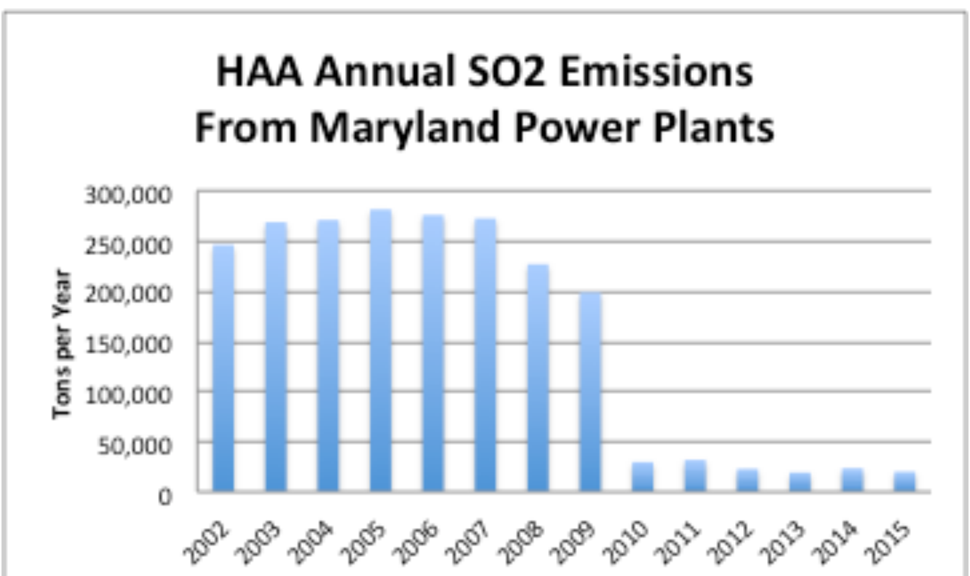
Maryland will reduce SO_2 emissions by 269,444 tons per year from the 2002 baseline and yield a surplus of 57,552 tons per year beyond that of the 2018 RPG target. The following table illustrates the expected SO_2 emission reductions achievable by the HAA) The reductions are based on the predicted 2018 emissions and the HAA caps.

Table 2-6: 2018 Maryland Healthy Air Act SO_2 Reduction Potential

2018 Reductions Based on HAA	SO_2 **(TPY)**
HAA Reductions on the twelve MD "167 Units" [9]	*257,741*
HAA Reductions from remaining EGU Units in Maryland	11,703
Total Maryland Reductions	**269,444**
2018 RPG Target	**211,892**
"*Surplus*" *(Maryland reductions minus RPG* ***269,444 – 211,892***	**57,552**

Figure 2.1 illustrates the total annual SO_2 emissions from Maryland power plants per year reported to the EPA Clean Air Markets Division (CAMD). The HAA implemented annual SO_2 caps in two phases beginning in 2010. The second and last phase of the regulation went into effect starting on January 1, 2013. *Reductions from the HAA more than satisfy Reasonable Progress Goals. Maryland already fulfills its share of emission reductions under the RPG "ask" for EGUs. Furthermore, these control measures will be achieved well before the time frame requested by the BART Rule and the Reasonable Progress Goals.*

Figure 2-1: Annual SO_2 Emissions from Maryland Power Plants



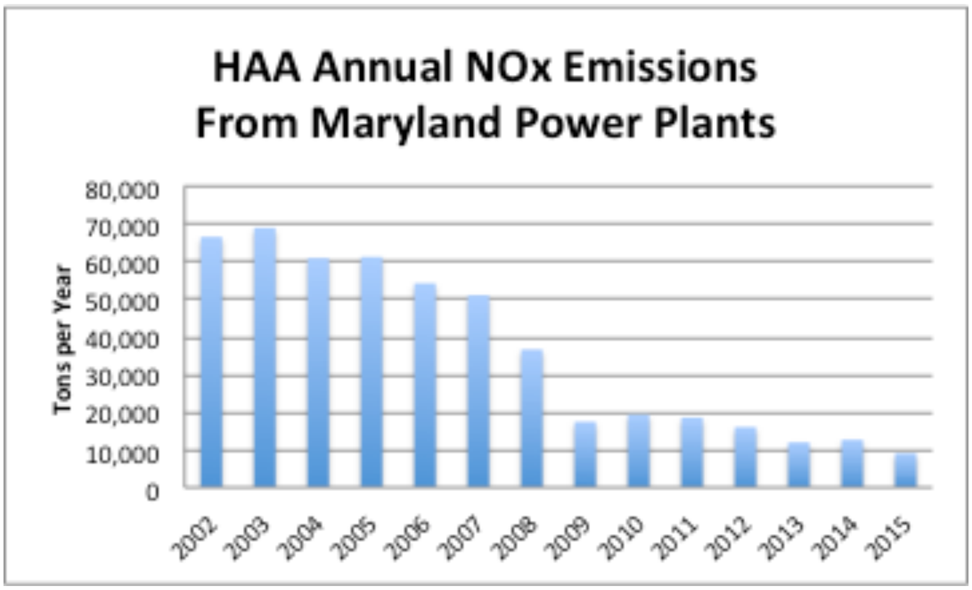
9 Based on the projected 2018 emissions from the Maryland "167 Units".

2.1.1.2 *HAA NO_x Reductions*

The HAA capped and reduced NO_x emissions from all coal-fired EGUs in Maryland. Because NO_x is also a pollutant of concern for regional haze, MDE is including it here to show the additional benefits of the program.

Figure 2.2 illustrates the total annual NO_x emissions from Maryland power plants reported to the EPA Clean Air Markets Division. The HAA implemented annual NO_x caps in two phases beginning in 2009. The second and last phase of the regulation went into effect starting on January 1, 2012. Overall, in 2015, NO_x emissions were reduced by 89% (over 65,700 tons) from a 2002 base.

Figure 2-2: Annual NO_x Emissions from Maryland Power Plants



2.2 Status of Non-EGU BART

2.2.1 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 Page/Westvaco/Luke Paper in the February 13, 2012 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 revision submittal.

The facility has three boilers that use a common stack for their 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. Therefore, Maryland has considered an alternative BART compliance plan for the Verso Luke Paper Mill. Maryland's proposed 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 SIP.

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[10] 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 will allow the facility to surpass these goals as it provides 288% more NO_x benefits[11] and 20% more SO_x benefits[12] than what is required under BART. This plan is federally enforceable through permit condition. The Maryland Department of the Environment 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 be met.

2.2.2 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, mid-kiln firing of tires and flame shape controls. Regarding 2, no further controls are considered possible based on technological feasibility and unintended consequences of the use of wet scrubbers, i.e. production of 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. Lastly, in regards to MANE-VU Class I areas, impacts of the facility are not expected to be significant.

At the time of the 2008 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 kiln
- SO_2 – injection of mixing air and inherent dry scrubbing (efficiency 82%-96%)

[10] State of Maryland Regional Haze State Implementation Plan Revision: Alternative BART for the Verso Luke Paper Mill. SIP # 16-14, September 26, 2016
[11] See Alternative BART for the VERSO Luke Paper Mill SIP Revision for technical analysis.
[12] See Alternative BART for the VERSO Luke Paper Mill SIP Revision for technical analysis.

In 2015, Maryland adopted a regulation[13] to further reduce NO_x emissions from Portland cement plants to satisfy Reasonably Available Control Technology (RACT) requirements for ozone. Holcim upgraded the cement plant from a long-dry kiln to a pre-heater/pre-calciner kiln. Effective April 1, 2017, the pre-heater/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. MDE expects a 40 to 50% reduction in NO_x from the upgrade to the facility.

2.2.3 Mettiki Coal

Mettiki Coal is included here because it was in the 2008 Regional Haze SIP. Mettiki Coal is not technically a BART-eligible source because it began operation in 1978, not within the BART timeframe of 1962-1977.

Table 2-7: Non-EGU BART Source Emissions (Tons per Year)

Facility	Facility Id	County	Pollutant	2002	2006	2011	2014	2015
Verso Luke Paper	001-0011	Allegany	SO_x	19,770.60	20,936.75	22,669.89	16,999.39	14,097.04
			NO_x	425.41	3,951.35	3,617.00	2,695.78	1,887.18
			PM	650.00	664.64	211.78	123.33	105.75
Holcim	043-0008	Washington	SO_x	301.14	1,146.00	537.06	723.00	756.19
			NO_x	1,973.54	2,092.43	1,614.05	1,173.03	1,226.87
			PM	154.42	284.75	211.28	222.06	244.59
Mettiki Coal	023-0042	Garrett	SO_x	67.63	40.51	62.58	49.07	37.96
			NO_x	163.64	185.09	212.08	125.01	143.54
			PM	62.65	0.00	21.72	16.36	18.84

The increases in SO_2 emissions at the Verso Luke Paper facility in 2006 and 2011 were due to increased production. SO_2 emissions at this facility are expected to decline as the primary fuel is switched from coal to natural gas. SO_2 emissions at Holcim increased unexpectedly as the facility implemented a mid-kiln used tire burning technology to reduce NO_x emissions. In 2014, Holcim applied and obtained the permit and approval to convert its long-dry kiln to a pre-heater/pre-calciner kiln. The new kiln is currently under a series of emission performance testing. From a preliminary test report, both NO_x and SO_2 emissions have been reduced significantly.

2.3 Status of Low Sulfur Fuel Oil Standard

The assumption underlying the MANE-VU low-sulfur fuel oil strategy is that refiners will be able, by 2018, to produce home heating and fuel oils that contain 50% less sulfur for the heavier grades (#4 and #6 residual), and a minimum of 75% and maximum of 99.25% less sulfur in #2 fuel oil (also known as home heating oil, distillate, or diesel fuel) with only a small increase in price to end users. As much as 75% of the total sulfur reductions achieved by this strategy result from use of low-sulfur #2 distillate for space heating in the residential and commercial sectors.

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. MDE will continue to work with the Maryland Comptroller of the Treasury to pursue additional SO_2 reductions. These regulations, which

[13] COMAR 26.11.30

are proposed and promulgated by the Comptroller's Office will be submitted for SIP approval.

2.4 Evaluation and Implementation of Other Control Methods to Reduce SO_2 and NO_x from Coal-fired EGUs by 2018

In 2015, Maryland adopted amendments to COMAR 26.11.38 – Control of NO_x emissions from Coal-Fired Electric Generating Units. The regulation is designed first and foremost as an ozone measure. The regulations apply to the following 13 coal-fired EGUs currently operating in Maryland, which account for most of the State's power plant NO_x emissions:

- Brandon Shores Generating Station (Units 1 and 2);
- C.P. Crane Generating Station (Units 1 and 2);
- H.A. Wagner Generating Station (Units 2 and 3);
- Chalk Point Generating Station (Units 1 and 2);
- Morgantown Generating Station (Units 1 and 2); and
- Dickerson Generating Station (Units 1, 2 and 3).

The regulation established a system-wide emissions rate of 0.15 pounds per million British thermal units (lbs./MmBtu) on a 30-day rolling average for coal-burning EGUs during the ozone season. System-wide emissions are an aggregation of NO_x emissions from all coal-fired EGUs owned, operated, or controlled by the same company. Continuous emissions monitoring (CEM) systems already installed on these units as a requirement of previous federal and state programs, will be used to track system-wide emissions and to determine compliance with the 30-day rolling average emissions limit. The 0.15 lb./MmBtu emission rate does not apply to C.P. Crane and AES Warrior Run, as they are not a part of a system.

To demonstrate compliance with the requirement to optimize controls, MDE established 24-hour block emissions levels for each coal-burning EGU based on historical emissions data. During the ozone season, EGU owners are required to provide a daily report for any unit that exceeds its 24-hour emissions level. The report requires specific operating data and an explanation of any exceedances of the 24-hour level. A detailed discussion of the requirements of regulation COMAR 26.11.38 may be found in the EPA technical support document (TSD) prepared in support of this proposed rulemaking, which is available in the docket for this rulemaking action and online at *www.regulations.gov.*

The 14 affected units at the seven plants that are subject to COMAR 26.11.38 have all installed controls as a result of programs requiring NO_x reductions by previous regulatory requirements such as the NO_X SIP Call (65 FR 57356, October 27, 1998), the Clean Air Interstate Rule (CAIR) (70 FR 25162, May 12, 2005), the Cross State Air Pollution Rule (CSAPR) (76 FR 48208, August 8, 2011), and Maryland's Healthy Air Act (HAA). All of the affected units have either selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), or selective alternative catalytic reduction (SACR).

This initial phase of the regulation was submitted to EPA for approval on November 20, 2015. The second phase of implementation continues to build on the success of the Healthy Air Act beyond 2015 by requiring the owners or operators of specific coal-fired electric generating units - C.P. Crane Units 1 and 2, Chalk Point Unit 2, Dickerson Units 1, 2, and 3 and H.A. Wagner Unit 2 to select and implement one of the following compliance options:

1. Install an SCR on the unit by June 1, 2020
2. Permanently retire the unit by June 1, 2020
3. Permanently switch fuel from coal to natural gas by June 1, 2020
4. Achieve a system-wide NO_x 24-hour block average or NO_x mass cap be met by June 1, 2020 and ozone season NO_x reductions in 2016, 2018 and 2020. The rate and the cap in this option are consistent with levels assuming SCR controls on all units. The emission rates are in Table 2-6.

Table 2-8: COMAR 26.11.38 24-Hour Block Average Emission Rates

Affected Unit	24-Hour Block Average NO_X Emissions (lbs./MmBtu)
Brandon Shores	
Unit 1	0.08
Unit 2 <650 MWg ≥650 MWg	 0.07 0.15
C.P. Crane	
Unit 1	0.30
Unit 2	0.28
Chalk Point	
Unit 1 only	0.07
Unit 2 only	0.33
Units 1 and 2 combined	0.20
Dickerson	
Unit 1 only	0.24
Unit 2 only	0.24
Unit 3 only	0.24
Two or more units combined	0.24
H.A. Wagner	
Unit 2	0.34
Unit 3	0.07
Morgantown	
Unit 1	0.07
Unit 2	0.07

Although not specifically designed to reduce Regional Haze impacts, MDE believes that this regulation will benefit nearby Class I areas.

2.5 Agricultural and Forestry Smoke Management

40 CFR section 51.308(d)(3)(v)(E) requires each state to consider smoke management techniques related to agricultural and forestry management in developing the long-term strategy to improve visibility at Class I areas. MANE-VU's analysis of smoke management in the context of regional haze is documented in "Technical Support Document on Agricultural and Forestry Smoke Management in the MANE-VU Region, September 1, 2006." As that report notes, fires used for resource benefits are of far less significance to the total inventory of fine-particle pollutant emissions than other sources of wood smoke in the region. The largest 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 make up 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.

Wild fire emissions within MANE-VU states are also relatively small and infrequent contributors to regional PM emissions. However, MANE-VU Class 1 areas are occasionally impacted by wild fire smoke emissions from other regions, such as the lightning-induced forest fires that occurred in Quebec Province in July 2002. These natural wild fire 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.

2.6 Measures to Mitigate Impacts of Construction Activities

40 CFR 51.308(d)(3)(v)(B) requires each state to consider measures to mitigate the impacts of construction activities on regional haze. MANE-VU's Contribution Assessment found that particulate emissions from construction activities were a small portion of the inventory and that these emissions made up a minor fraction of fine particulates in Class I areas. While acknowledging that control strategies could decrease the effects on local air quality, it was determined that further mitigation efforts were not needed for the improvement of regional haze in Class I areas and existing rules were sufficient.

Maryland has instituted COMAR 26.11.06.03D 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.

2.7 Prevention of Significant Deterioration (PSD)

Prevention of Significant Deterioration (PSD) [14] applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the National Ambient Air Quality Standards (NAAQS). PSD protects visibility in Class I areas by recognizing the role of Federal Land Managers in determining the impacts of Maryland sources on Class I areas and advocating on behalf of affected Class I areas in the permitting process.

Maryland's PSD program is consistent with EPA's regulations and guidelines. The Maryland PSD program requires installation of Best Available Control Technology (BACT), an air quality analysis, an additional impacts analysis and public involvement. Maryland commits to ensuring PSD permitting activity and will ensure that such activity supports Maryland's Regional Haze SIP commitments.

2.8 Enforceability

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 reductions for certain electric generating units.

[14] COMAR 26.11.06.14 Control of PSD Sources

2.9 Status of Controls on Non-EGU Point Sources

2.9.1 MACT STANDARDS

In 2014, MDE adopted biomass boiler regulations in response to a MACT issued in 2013. The new standards for biomass fuel-burning equipment are under COMAR 26.11.09.12 Standards for Biomass Fuel burning Equipment greater than or Equal to 350,000 Btu. New biomass fuel-burning equipment under 10 MmBtu/hr. is required to meet emission standards which will necessitate control technology, whereas federal requirements did not establish standards for biomass fuel-burning equipment under 10 MmBtu/hr.

Installing biomass fuel-burning equipment is a choice over conventional fuels, such as fuel oil. Exact quantification of air quality benefits depends on the type and number of units installed and cannot be quantified at this time. A farm or a school may choose a small biomass boiler for heating needs. The additional NO_x and standards established by the regulation will help to ensure that new biomass boilers installed in the state will have less emissions of pollutants than under the federal program, which will help reduce the state's burden in meeting federal ozone and fine particle standards. Utilizing poultry litter as fuel can possibly remove ammonia emissions that contribute to fine particulate matter formation.

2.9.2 MATS STANDARD – POTENTIAL SO_2 BENEFIT

With scrubbers at Brandon, Dickerson, Morgantown and Chalk Point no additional mercury controls had to be added for the MATS rule. Wagner units 2 and 3 use Carbon injection. Crane has never had a mercury problem due to nature of boiler Loss on Ignition coal which soaks up mercury.

SO_2 is not regulated for the MATS rule. It is used as a surrogate for HCL at Morgantown Chalk Point and Dickerson. The Fort Smallwood plants do quarterly stack testing for HCL and or HCL CEMS (Wagner 3 only so far) to show compliance with HCL

2.9.3 CEMENT KILNS

Maryland adopted regulations applicable to Portland Cement Plants that became effective July 20, 2015. These regulations

- Combined existing regulations .01, .06 and .02 into a new chapter, COMAR 26.11.30;
- Established more stringent NO_x limits based upon recommendations from the Ozone Transport Commission. The older limits in COMAR 26.11.09.08 were repealed; and
- Established a new method for continuous monitoring of particulate matter emissions for cement kilns and clinker coolers required by the 2013 National Emission Standards for Hazardous Air Pollutants for the Portland Cement Manufacturing Industry and Standards of Performance for Portland Cement Plants.

Of the three Portland Cement facilities that were included in the 2002 base year inventory for the Regional Haze SIP, two are currently operating: Lehigh and Holcim. Essroc shut down in 2008. Both Lehigh and Holcim are in compliance with Maryland permit requirements.

As a result of this regulation, Holcim will reduce annual NO_x emissions by about 33% or 510 tons based on 2012/2013 production. Holcim currently is a 600,000 ton per year clinker plant.

Calculating from the existing emission rate times the average tons/ year of clinker used at a plant results in 33% reduction:
at 5.1 lbs. NO_x /ton clinker = 1,530 tons NO_x per year
at 3.4 lbs. NO_x /ton clinker = 1,020 tons NO_x per year
Reduction of 510 tons of NO_x per year

2.10 Controls on Area Sources Expected by 2018

2.10.1 Low-Sulfur Fuel Regulations

Maryland approached sulfur reductions 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 before July 1, 2014. The second stage reduced sulfur levels further to a level of 500 ppm before July 1, 2015. Section 2.3 of this document describes Maryland's sulfur limits in fuels.

2.10.2 Mobile Sources

The Maryland Clean Cars Program (2007)[15] adopts California's stricter vehicle emission standards. These standards, known as California Low Emission Vehicle Standards II (Cal LEV II), became effective in Maryland for model year 2011 vehicles, significantly reducing a number of emissions including volatile organic compounds (VOCs) and NO_x . The VOC reduction achieved from this program was expected to be 3.4 tons/days greater than the existing Federal standards and the NO_x reduction was expected to be 2.9 tons/day greater than the existing Federal Tier 2 standards that were in place at the time of its adoption. VOCs and NO_x emissions contribute to Maryland's ozone problems.

Maryland revised the Clean Car Program in 2012 to incorporate California's stricter tailpipe and greenhouse gas standards. The program takes effect in model years 2015-2025 and sets all new emissions standards for criteria pollutants as well as greenhouse gasses. By 2025, vehicles will emit 75% less smog-forming pollutants and 34% less greenhouse gas emissions.

In August 2012, EPA and NHTSA finalized a second round of fuel economy standards that were designed to mirror California's LEV III GHG standards. The fuel economy standards are set to increase the industry's fleet average to an equivalent of about 54.5 MPG by 2025, if achieved solely through fuel economy improvements. This program was broadly supported throughout the industry as it aligns the Federal program with California's and eases compliance.

In April, 2014 EPA finalized Tier 3 emission standards for light-duty vehicles. These tighter emission standards will affect all new vehicles sold beginning with the 2017 model year. The Tier 3 program reduces the fleet average emissions manufacturers must meet while also reducing the sulfur content of gasoline. The reduced sulfur content will allow for more stringent vehicle emission standards and will make emission control systems more effective. Reducing the sulfur content will also help older cars (Pre-Tier 3 standards) reduce their emissions by allowing their emission control devices to run more effectively. The Tier 3 standards will closely align with California's LEV III standards providing emission benefits to the entire nation as well as helping

[15] COMAR 26.11.34

to improve Maryland's air quality even more.

2.10.3 Assessment of Controls

40 CFR section 51.308(g)(1) requires states to review the status of controls addressed in the state implementation plans. Maryland included the following strategies:

- Healthy Air Act
- Low-sulfur Fuel Requirements
- Clean Cars Program

These regulations and associated emissions limit and caps have been implemented in the timeframe described in the SIP commitment. Furthermore, as explained in Section 1 of this report, the emissions have decreased in a manner adequate under the RPGs.

3.0 Status of Controls Outside of Maryland

The regional nature of haze causing pollutants and the required collaboration of the regional haze process suggests that a review of the control strategy implementation beyond Maryland's borders is an important component of this report. Therefore, this section describes that status, of the strategies committed to within MANE-VU; outside MANE-VU and federal strategies that have and will reduce haze causing pollutants.

3.1 MANE-VU States

As mentioned previously, the primary strategy employed by MANE-VU was the reduction of SO_2 emissions by targeting the largest sources (i.e. EGUs) and implementing a low sulfur fuel strategy. Table 3.1 summarizes the implementation of EGU emission controls in MANE-VU states other than Maryland. State implementation of the low sulfur fuel strategy, also a key for the MANE-VU RPGs, is summarized in Table 3.2.

Table 3-1: Status of EGU Control Measures in MANE-VU States

Measure	Effective Date
Delaware	
Reg. 1144, Control of Stationary Generator Emissions, requiring emission controls for SO_2 , PM, VOC, and NO_x state-wide.	January 2006
Reg. 1146, Electric Generating Unit (EGU) Multi-Pollutant Regulation, requiring SO_2 and NO_x emission controls state-wide.	December 2007
Reg. 1148, Control of Stationary Combustion Turbine Electric Generating Unit Emissions, requiring SO_2 , NO_x , and $PM_{2.5}$ emission controls state-wide.	January 2007
Maine	
Chapter 145, NO_x *Control Program*, limits the NO_x emission rate to 0.22 lb./MmBtu for fossil-fuel-fired units greater than 25 MW built before 1995 with a heat input capacity between 250 and 750 MmBtu MmBtu/hr., and also limits the NO_x emission rate to 0.15 lb./MmBtu for fossil-fuel-fired units greater than 25 MW built before 1995 with a heat input capacity greater than 750 MmBtu/hr.	2007

Measure	Effective Date
Massachusetts	
Based on the Massachusetts Department of Environmental Protection's 310 CMR 7.29, *Emissions Standards for Power Plants,* adopted in 2001, six of the largest fossil-fuel-fired power plants in Massachusetts must comply with emissions limitations for NO_x , SO_2 , Hg, and CO_2. These regulations will achieve an approximately 50-percent reduction in NO_x emissions and a 50- to 75-percent reduction in SO_2 emissions. Depending on the compliance paths selected, the affected facilities will meet the output-based NO_x and SO_2 standards between 2004 and 2008. This regulation also limits the six grandfathered EGUs to a CO_2 emission rate of 1,800 lb./MWh.	Between 2004 and 2008 depending on compliance path.
New Hampshire	
Chapter Env-A 2900, Sulfur Dioxide and Nitrogen Oxides Annual Budget Trading and Banking Program, capping NO_x emissions at 3,644 tons per year and SO_2 emissions at 7,289 tons per year for all existing fossil-fuel fired steam units.	October 1, 2011
Chapter Env-A 3200, NO_x *Budget Trading Program*, limiting ozone season NO_x emissions on all fossil-fuel-fired EGUs greater than 15 MW to 0.15 lb./MmBtu.	November 2, 2007
New Jersey	
The New Jersey settlement agreement with PSEG required the following actions for specific EGUs:	
Bergen Unit #2: Repower to combined cycle by December 31, 2002.	December 31, 2002
Hudson Unit #2: Install dry FGD or approved alternative technology by Dec. 31, 2006, to control SO_2 emissions and operate the control technology at all times the unit operates to limit SO_2 emissions to 0.15 lb./MmBtu; install SCR or approved alternative technology by May 1, 2007, to control NO_x emissions and operate the control technology year-round to limit NO_x emissions to 0.1 lb./MmBtu; and install a baghouse or approved alternative technology by May 1, 2007, to control and limit PM emissions to 0.015 lb. PM/MmBtu.	May 1, 2007
Mercer Unit #1: Install dry FGD or approved alternative technology by Dec. 31, 2010, to control SO_2 emissions and operate the control technology at all times the unit operates to limit SO_2 emissions to 0.15 lb./MmBtu; and install SCR or approved alternative technology by 2005 to control NO_x emissions and operate the control technology during ozone season only in 2005 and year-round by May 1, 2006, to limit NO_x emissions to 0.13 lb./MmBtu.	2005, 2006, 2010
Mercer Unit #2: Install dry FGD or approved alternative technology by Dec. 31, 2012, to control SO_2 emissions and operate the control technology at all times the unit operates to limit SO_2 emissions to 0.15 lb./MmBtu; and install SCR or approved alternative technology by 2004 to control NO_x emissions and operate the control technology during ozone season only in 2004 and year-round by May 1, 2006, to limit NO_x emissions to 0.13 lb./MmBtu.	2004, 2006, 2010

The New Jersey settlement also requires that units operating an FGD use coal having a monthly average sulfur content no greater than 2 percent.	2004, 2006, 2010

Measure	Effective Date
New York	
Title 6 NYCRR Parts 237, Acid Deposition Reduction NO_x *Budget Trading Program*, limits NO_x emissions on all fossil-fuel-fired EGUs greater than 25 MW to a non- ozone season cap of 39,908 tons in 2007.	2007
Title 6 NYCRR Parts 238, Acid Deposition Reduction SO_2 *Budget Trading Program*, limits SO_2 emissions from all fossil-fuel-fired EGUs greater than 25 MW to an annual cap of 197,046 tons per year starting in 2007 and an annual cap of 131,364 tons per year starting in 2008.	2007, 2008

Table 3-2: Current State Sulfur Fuel Limits

Limits Adopted as reported by MANE-VU in 2013		
State	**#2 Distillate Oil**	**#4 / #6 Residual Oil**
Connecticut	500 ppm by 2014, 15 ppm by 2018	0.3% by 2018
Delaware	15 ppm by 2016	0.5% by 2016
Maine	0.005% by weight by July 2016 0.0015% by weight by January 2018	0.5% by 2018
Massachusetts	500 ppm by 7/1/2014 15 ppm by 7/1/2018	1% by 7/1/2014 (0.5% for power plants) 0.5% by 7/1/2018
New Jersey	500 ppm by 2014 15 ppm by 2016	3000-5000 ppm by 2014 depending on county
New York	15 ppm by 2012 - heating oil 15 ppm by 2014 - other sources	0.3% in NYC 0.37% in Nassau, Rockland, and Westchester Counties 0.5% in the rest of the state (Purchase date 7/1/14, Use date 7/1/16
Pennsylvania	500 ppm by 2016	0.25% by weight (#4 oil) by 2016 0.5% by weight (#5, #6 oil) by 2016
Vermont	0.05% by weight by 7/1/2014 0.0015% by weight by 7/1/2018	0.25% by weight (#4 oil) by 7/1/2018 0.5% by weight (#5, #6 oil) by 7/1/2018

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

Since states submitted Regional Haze SIPs, MANE-VU states have implemented additional strategies for emissions reductions in area, on-road and off-road sources. Table 3.3 is the summary of the MANE-VU on-road and off-road implementation strategies.

Table 3-3: Status of MANE-VU On-Road and Off-Road Strategies*

State	Measure	Status
Delaware	DE Regulation 1140, Delaware's Low Emission Vehicle Program	Amended: December, 1, 2010
New Jersey	N.J.A.C. 7:27-14.2, 14.4, and 14.6 N.J.A.C. 7:27B-4.5 Air Test Method 4: Testing Procedures for Diesel-Powered Motor Vehicles	Adopted: April, 3, 2009
Rhode Island	RI A.P.C.R. 37 Rhode Island's Low-Emission Vehicle Program	Amended: July, 17, 2013

* Maine, Massachusetts, New York and Vermont also participate in LEVII; implementation was completed prior to the last SIP submittal.

3.2 Status of Controls at 167 EGU Sources

In addition, MANE-VU identified 167 EGU sources whose 2002 emissions contributed to visibility impairment in MANE-VU Class I areas. The location of these sources is shown in Figure 1.3. The MANE-VU Long Term Strategy called for a 90% reduction in SO_2 emissions at these sources, or, if it was infeasible to achieve that level of reduction from a unit, alternative measures as determined by the State.

In 2002, emissions from the 167 key stacks were nearly 4.6 million tons per year. 2014 data from EPA's Air Markets Program Data (AMPD) indicates these emissions had dropped to 883 tons per year, an 81% reduction. Table 3.4 presents the data.

Table 3-4: SO_2 Emissions from 167 Key EGU Stacks, 2002 and 2014[16]

			Unit					Statewide				
State Name	ORIS ID	Plant Name	CEMS Unit	2002 CAMD SO_2 TPY stack-level	2014 CAMD SO_2 TPY stack-level	% Change 2002/2014 stack-level	Achieved Goal (Unit)	Total 2002 state SO_2 TPY from listed 167 stacks	90% requested SO_2 TPY total reduction based on Ask	Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide SO_2 % reduction relative to Ask amount	Achieved Goal (State)
Delaware	593	Edge Moor	D005935	2,132	10	-100%	Y					
	594	Indian River	D005944	7,491	753	-90%	Y					
			D005943	4,682	0	-100%	Y					
			D005942	3,833	0	-100%	Y					
			D005941	3,950	0	-100%	Y	22,088	-19,879	-31,430	158.10%	Y
Georgia	703	Bowen	D007032LR	37,778	1,518	-96%	Y					
			D007034LR	41,014	2,166	-95%	Y					
			D007033LR	43,696	2,207	-95%	Y					
			D007031LR	38,186	1,313	-97%	Y					
	709	Harllee Branch	D00709C02	47,746	21,064	-56%	N	208,419	-187,577	-448,220	239.00%	Y
Illinois	861	Coffeen	D00861C01	42,331	32	-100%	Y	42,331	-38,098	-231,257	607.00%	Y
Indiana	983	Clifty Creek	D00983C01	20,016	1,373	-93%	Y					
			D00983C02	18,182	2,358	-87%	N					
	988	Tanners	D00988U4	46,485	12,113	-74%	N					

[16] Source: Spreadsheet summarizing the SO_2 Emissions status of the "167 EGU stacks" identified in the MANE-VU Ask as of 2012. (Appendix B) This is a "point in time" snap shot, not a determination of whether a state achieved the MANE-VU "Ask."

State Name	ORIS ID	Plant Name	CEMS Unit	Unit: 2002 CAMD SO_2 TPY stack-level	Unit: 2014 CAMD SO_2 TPY stack-level	Unit: % Change 2002/2014 stack-level	Unit: Achieved Goal (Unit)	Statewide: Total 2002 state SO_2 TPY from listed 167 stacks	Statewide: 90% requested SO_2 TPY total reduction based on Ask	Statewide: Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide: Statewide SO_2 % reduction relative to Ask amount	Statewide: Achieved Goal (State)
		Creek	D00988C03	16,047	5,978	-63%	N					
	990	Elmer W Stout	D0099070	30,896	3,482	-89%	N					
	1001	Cayuga	D010011	29,379	1,902	-94%	Y					
			D010012	26,237	1,546	-94%	Y					
	1008	R Gallagher	D01008C01	23,994	1,768	-93%	Y					
			D01008C02	23,773	1,757	-93%	Y					
	1010	Wabash River	D01010C05	60,901	26,828	-56%	N					
	6113	Gibson	D06113C03	71,817	4,694	-93%	Y					
			D06113C04	37,600	5,268	-86%	N					
	6166	Rockport	D06166C02	53,196	54,979	3%	N					
	6705	Warrick	D067054	41,049	1,894	-95%	Y					
			D06705C02	28,691	1,695	-94%	Y	528,263	-475,437	-488,184	102.70%	Y
Kentucky	1353	Big Sandy	D01353C02	41,899	32,834	-22%	N					
	1355	E W Brown	D01355C03	38,490	1,732	-95%	Y					
	1356	Ghent	D01356C02	25,782	6,159	-76%	N					
	1364	Mill Creek	D013644	7,212	7,504	4%	N					
	1378	Paradise	D013783	47,558	5,001	-89%	N					
			D013782	20,889	8,084	-61%	N					
	1384	Cooper	D01384CS1	22,713	4,324	-81%	N					
	6018	East Bend	D060182	12,918	2,103	-84%	N					

State Name	ORIS ID	Plant Name	CEMS Unit	2002 CAMD SO_2 TPY stack-level	2014 CAMD SO_2 TPY stack-level	% Change 2002/2014 stack-level	Achieved Goal (Unit)	Total 2002 state SO_2 TPY from listed 167 stacks	90% requested SO_2 TPY total reduction based on Ask	Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide SO_2 % reduction relative to Ask amount	Achieved Goal (State)
			Unit					Statewide				
	6041	H L Spurlock	D060411	19,032	909	-95%	Y					
			D060412	21,478	1,742	-92%	Y	257,971	-232,174	-280,613	120.90%	Y
Maine	1507	William F Wyman	D015074	1,159	689	-41%	N	1,159	-1,043	-1,166	111.80%	Y
Maryland	602	Brandon Shores	D006022	19,498	1,475	-92%	Y					
			D006021	20,476	1,670	-92%	Y					
	1552	C.P. Crane	D015521	17,971	573	-97%	Y					
			D015522	14,415	1,314	-91%	Y					
	1554	H.A. Wagner	D015543	10,096	7,276	-28%	N					
	1571	Chalk Point	D01571CE2	48,731	3,850	-92%	Y					
	1572	Dickerson	D01572C23	33,905	625	-98%	Y					
	1573	Morgantown	D015732	32,587	1,538	-95%	Y					
			D015731	37,757	1,342	-96%	Y	235,435	-211,892	-233,080	110.00%	Y
Massachusetts	1599	Canal	D015991	13,066	541	-96%	Y					
			D015992	8,948	159	-98%	Y					
	1606	Mount Tom	D016061	5,282	9	-100%	Y					
	1613	Somerset	D016138	4,399	0	-100%	Y					
	1619	Brayton Point	D016193	19,450	405	-98%	Y					
			D016192	8,853	495	-94%	Y					
			D016191	9,254	407	-96%	Y					

State Name	ORIS ID	Plant Name	Unit: CEMS Unit	Unit: 2002 CAMD SO_2 TPY stack-level	Unit: 2014 CAMD SO_2 TPY stack-level	Unit: % Change 2002/2014 stack-level	Unit: Achieved Goal (Unit)	Statewide: Total 2002 state SO_2 TPY from listed 167 stacks	Statewide: 90% requested SO_2 TPY total reduction based on Ask	Statewide: Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide: Statewide SO_2 % reduction relative to Ask amount	Statewide: Achieved Goal (State)
	1626	Salem Harbor	D016264	2,886	169	-94%	Y					
			D016263	4,999	1,329	-73%	N					
			D016261	3,425	0	-100%	Y	80,562	-72,506	-86,056	118.70%	Y
Michigan	1702	Dan E Karn	D01702C09	4,589	35	-99%	Y					
	1733	Monroe	D01733C34	43,228	1,250	-97%	Y					
			D01733C12	48,676	5,036	-90%	Y					
	1743	St Clair	D017437	15,980	9,245	-42%	N					
	1745	Trenton Channel	D017459A	19,237	12,300	-36%	N	131,709	-118,538	-191,519	161.60%	Y
New Hampshire	2364	Merrimack	D023641	9,754	293	-97%	Y					
			D023642	20,902	751	-96%	Y					
	8002	Newington	D080021	5,226	312	-94%	Y	35,883	-32,294	-41,310	127.90%	Y
New Jersey	2378	B L England	D023781	10,080	0	-100%	Y					
	2403	Hudson	D024032	18,899	192	-99%	Y					
	2408	Mercer	D024082	5,954	88	-99%	Y					
			D024081	8,308	51	-99%	Y	43,241	-38,917	-47,575	122.20%	Y
New York	2480	Danskammer	D024804	8,330	0	-100%	Y					
	2516	Northport	D025163	7,407	522	-93%	Y					
	2526	Goudey	D02526C03	15,071	0	-100%	Y					
	2527	Greenidge	D025276	13,370	0	-100%	Y					
	2549	C R Huntley	D02549C01	26,689	3,192	-88%	N					

			Unit					Statewide				
State Name	ORIS ID	Plant Name	CEMS Unit	2002 CAMD SO_2 TPY stack-level	2014 CAMD SO_2 TPY stack-level	% Change 2002/2014 stack-level	Achieved Goal (Unit)	Total 2002 state SO_2 TPY from listed 167 stacks	90% requested SO_2 TPY total reduction based on Ask	Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide SO_2 % reduction relative to Ask amount	Achieved Goal (State)
			D02549C02	12,309	0	-100%	Y					
	2554	Dunkirk	D02554C03	32,141	0	-100%	Y					
	2594	Oswego	D025945	1,746	136	-92%	Y					
	2642	Rochester 7	D02642CS2	14,726	0	-100%	Y					
	8006	Roseton	D080062	2,996	322	-89%	N					
			D080061	3,825	286	-93%	Y	138,609	-124,748	-215,906	173.10%	Y
North Carolina	2709	Lee	D027093	9,459	0	-100%	Y					
	2712	Roxboro	D02712C03	30,610	4,009	-87%	N					
			D027122	29,718	3,661	-88%	N					
			D027121	12,028	2,599	-78%	N					
			D02712C04	23,254	5,379	-77%	N					
	2713	L V Sutton	D027133	14,492	0	-100%	Y					
	2721	Cliffside	D027215	19,429	338	-98%	Y					
	2727	Marshall	D027274	27,323	945	-97%	Y					
			D027273	26,381	2,789	-89%	N					
	6250	Mayo	D06250C05	27,410	3,491	-87%	N					
	8042	Belews Creek	D080421	57,849	4,092	-93%	Y					
			D080422	45,236	2,940	-94%	Y	323,190	-290,871	-426,486	146.60%	Y
Ohio	2828	Cardinal	D028281	37,832	3,455	-91%	Y					
			D028282	21,367	4,516	-79%	N					

			Unit					Statewide				
State Name	**ORIS ID**	**Plant Name**	**CEMS Unit**	**2002 CAMD SO_2 TPY stack-level**	**2014 CAMD SO_2 TPY stack-level**	**% Change 2002/2014 stack-level**	**Achieved Goal (Unit)**	**Total 2002 state SO_2 TPY from listed 167 stacks**	**90% requested SO_2 TPY total reduction based on Ask**	**Total CAMD SO_2 TPY achieved reduction 2002-2014**	**Statewide SO_2 % reduction relative to Ask amount**	**Achieved Goal (State)**
			D028283	15,552	2,687	-83%	N					
	2830	Walter C Beckjord	D028306	30,511	23,486	-23%	N					
	2832	Miami Fort	D028327	46,563	4,686	-90%	Y					
			D02832C06	23,573	18,865	-20%	N					
	2836	Avon Lake	D0283612	41,840	33,113	-21%	N					
	2837	Eastlake	D028375	37,474	0	-100%	Y					
	2840	Conesville	D028404	87,590	2,311	-97%	Y					
			D02840C02	23,655	0	-100%	Y					
	2850	J M Stuart	D028501	31,836	2,383	-93%	Y					
			D028503	28,225	2,411	-91%	Y					
			D028502	29,710	3,663	-88%	N					
			D028504	27,778	2,395	-91%	Y					
	2864	R E Burger	D02864C01	35,454	0	-100%	Y					
	2866	W H Sammis	D028667	33,995	1,377	-96%	Y					
			D028665	19,990	582	-97%	Y					
			D02866C02	26,425	3,528	-87%	N					
			D02866M6A	39,937	1,644	-96%	Y					
			D02866C01	24,766	3,132	-87%	N					
	2872	Muskingum River	D02872C04	85,125	18,299	-79%	N					
			D028725	30,401	31,276	3%	N					

			Unit					Statewide				
State Name	ORIS ID	Plant Name	CEMS Unit	2002 CAMD SO_2 TPY stack-level	2014 CAMD SO_2 TPY stack-level	% Change 2002/2014 stack-level	Achieved Goal (Unit)	Total 2002 state SO_2 TPY from listed 167 stacks	90% requested SO_2 TPY total reduction based on Ask	Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide SO_2 % reduction relative to Ask amount	Achieved Goal (State)
	2876	Kyger Creek	D02876C01	74,452	13,748	-82%	N					
	6019	W H Zimmer	D060191	21,492	13,498	-37%	N					
	6031	Killen Station	D060312	19,664	13,096	-33%	N					
	7253	Richard Gorsuch	D07253C01	31,006	0	-100%	Y					
	8102	Gen J M Gavin	D081021	18,856	16,679	-12%	N					
			D081022	13,524	20,193	49%	N	958,593	-862,734	-841,717	97.60%	Y
Pennsylvania	3113	Portland	D031132	14,569	0	-100%	Y					
			D031131	9,741	3,180	-67%	N					
	3122	Homer City	D031221	45,759	63,713	39%	N					
			D031222	55,358	54,733	-1%	N					
	3131	Shawville	D03131CS1	22,252	20,603	-7%	N					
	3136	Keystone	D031361	87,714	13,136	-85%	N					
			D031362	62,906	15,002	-76%	N					
	3140	Brunner Island	D031403	39,266	4,713	-88%	N					
			D03140C12	29,666	5,102	-83%	N					
	3148	Martins Creek	D03148C12	17,134	0	-100%	Y					
	3149	Montour	D031492	50,441	6,201	-88%	N					
			D031491	61,005	4,779	-92%	N					

			Unit					Statewide				
State Name	**ORIS ID**	**Plant Name**	**CEMS Unit**	**2002 CAMD SO_2 TPY stack-level**	**2014 CAMD SO_2 TPY stack-level**	**% Change 2002/2014 stack-level**	**Achieved Goal (Unit)**	**Total 2002 state SO_2 TPY from listed 167 stacks**	**90% requested SO_2 TPY total reduction based on Ask**	**Total CAMD SO_2 TPY achieved reduction 2002-2014**	**Statewide SO_2 % reduction relative to Ask amount**	**Achieved Goal (State)**
	3178	Armstrong	D031782	16,741	0	-100%	Y					
	3179	Hatfield's Ferry	D03179C01	82,123	0	-100%	Y					
	8226	Cheswick	D082261	42,018	4,445	-89%	N	636,693	-573,023	-627,604	109.50%	Y
South Carolina	3297	Wateree	D03297WT1	18,125	3,237	-82%	N					
			D03297WT2	18,253	3,311	-82%	N					
	3298	Williams	D03298WL1	25,544	1,933	-92%	Y					
	3319	Jefferies	D033194	12,169	0	-100%	Y					
			D033193	11,394	0	-100%	Y					
	6249	Winyah	D062491	18,028	280	-98%	Y	103,514	-93,162	-173,127	185.80%	Y
Tennessee	3403	Gallatin	D03403C34	20,226	9,484	-53%	N					
	3405	John Sevier	D03405C34	19,666	0	-100%	Y					
	3406	Johnsonville	D03406C10	108,788	17,517	-84%	N					
	3407	Kingston	D03407C15	38,076	827	-98%	Y					
			D03407C69	39,495	904	-98%	Y	226,251	-203,626	-278,587	136.80%	Y
Virginia	3775	Clinch River	D03775C02	17,658	2,087	-88%	N					
	3797	Chesterfield	D037976	40,924	1,189	-97%	Y					
			D037975	20,270	649	-97%	Y					
			D037974	9,476	280	-97%	Y					

			Unit					Statewide				
State Name	ORIS ID	Plant Name	CEMS Unit	2002 CAMD SO_2 TPY stack-level	2014 CAMD SO_2 TPY stack-level	% Change 2002/2014 stack-level	Achieved Goal (Unit)	Total 2002 state SO_2 TPY from listed 167 stacks	90% requested SO_2 TPY total reduction based on Ask	Total CAMD SO_2 TPY achieved reduction 2002-2014	Statewide SO_2 % reduction relative to Ask amount	Achieved Goal (State)
	3803	Chesapeake	D038033	9,558	3,321	-65%	N					
			D038034	10,974	3,893	-65%	N					
	3809	Yorktown	D03809CS0	22,464	8,845	-61%	N					
			D038093	10,567	909	-91%	Y	141,890	-127,701	-198,761	155.60%	Y
West Virginia	3935	John E Amos	D03935C02	63,884	4,375	-93%	Y					
			D039353	43,734	1,797	-96%	Y					
	3936	Kanawha River	D03936C02	15,862	10,715	-32%	N					
	3938	Philip Sporn	D0393851	13,037	0	-100%	Y					
			D03938C04	27,209	10,650	-61%	N					
	3942	Albright	D039423	10,136	0	-100%	Y					
	3943	Fort Martin	D039432	45,891	2,644	-94%	Y					
			D039431	45,229	1,942	-96%	Y					
	3947	Kammer	D03947C03	39,096	14,781	-62%	N					
	3948	Mitchell	D03948C02	56,009	4,458	-92%	Y					
	3954	Mt Storm	D03954CS0	20,426	2,664	-87%	N					
	6004	Pleasants	D060041	21,667	6,953	-68%	N					
			D060042	20,242	6,784	-66%	N					
	6264	Mountaineer	D062641	43,224	4,410	-90%	Y	465,647	-419,083	-415,838	99.20%	Y

3.3 Federal Control Strategies

In addition to Maryland's and MANE-VU's efforts, EPA has since promulgated federal rules that upon implementation will impact the regional haze progress. CAIR and CAIR's replacement CSAPR are the federal rules with the greatest significance to the regional haze program.
On May 12, 2005, the EPA promulgated the CAIR, which required reductions in emissions of NO_x and SO_2 from large fossil fuel-fired EGUs. Expected emission reductions were included as part of the MANE- VU 2018 modeling effort. The U.S. Court of Appeals for the D.C. Circuit ruled on petitions for review of CAIR and CAIR Federal Implementation Plans, including their provisions establishing the CAIR NO_x annual and ozone season and SO_2 trading programs. On July 11, 2008, the Court issued an opinion vacating and remanding these rules. However, parties to the litigation requested rehearing of aspects of the Court's decision. The resulting December 23, 2008 ruling left CAIR in place until EPA issued a new rule to replace CAIR in accordance with the July 11, 2008 decision.

On July 6, 2011, EPA finalized the CSAPR. EPA intended for this rule to replace CAIR beginning 2012. CSAPR was estimated to reduce EGU emissions in 28 states from 2005 levels by 6,500,000 tons of SO_2 annually and 1,400,000 tons of NO_x annually. These estimates represented a 71 % reduction in SO_2 and a 52 percent reduction in NO_x from 2005 levels.

On December 30, 2011, the U.S. Court of Appeals for the D.C. Circuit issued a ruling to stay CSAPR pending judicial review. On August 17, 2012, the D.C. Circuit Court of Appeals vacated CSAPR. On October 5, 2012, EPA requested a rehearing *en banc* of the CSAPR vacatur. The court denied this request on January 24, 2013. The Supreme Court reversed the decision of the D.C. Circuit and sent the case back to the court to resolve the outstanding substantive issues. In response on June 26, 2014, EPA filed a motion requesting that the court lift the stay on CSAPR.

On October, 23, 2014, the U.S Court of Appeals granted EPA's motion and the stay on CSAPR was lifted. CSAPR is scheduled to be effective January 1, 2015. EPA issued a ministerial rule to align the CSAPR dates as ordered by the court (November 21, 2014).

Additionally, EPA has finalized new source performance standards (NSPS) for residential wood heaters and new residential hydronic heaters and forced air furnaces. These new standards will complete the "MANE-VU" ask list. The rule is effective May 15, 2015. [17]

EPA has also implemented three on-road and off-road mobile programs that have and will continue to reduce haze causing emissions. One of EPA's on-road programs that has and will result in significant emissions reductions is the "Tier 2 Vehicle and Gasoline Sulfur Program." [18, 19] The EPA's Tier 2 fleet averaging program for on-road vehicles, modeled after the California LEV II standards, became effective in the 2005 model year. The Tier 2 program allows manufacturers to produce vehicles with a range of emissions levels as long as the mix of vehicles

[17] 80 FR 13671
[18] 40 CFR Part 80, Subpart H; 40 CFR Part 85; 40 CFR Part 86
[19] In addition, EPA has finalized Tier 3, which will implement stricter vehicle emissions standards for on-road vehicles and lower the sulfur content of gasoline.

that a manufacturer sells each year has average NO_x emissions below a specified value. Mobile emissions continue to benefit from this program as motorists replace older, more polluting vehicles with cleaner vehicles.

The "Heavy-Duty Diesel Engine Emission Standards for Trucks and Buses," is another on-road emissions reduction program EPA has employed that will greatly benefit regional haze improvements. EPA set a PM emissions standard of 0.01 grams per brake-horsepower-hour (g/bhp-hr) for new heavy-duty diesel engines in trucks and buses, to take full effect in the 2007 model year. This rule also includes standards for NO_x and non-methane hydrocarbons (NMHC) of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These NO_x and NMHC standards were phased in together between 2007 and 2010. Lowering sulfur in diesel fuel enables modern pollution control technology to be effective on the trucks and buses that use this fuel. EPA required a 97 % reduction in the sulfur content of highway diesel fuel from its previous level of 500 parts per million (low-sulfur diesel) to 15 parts per million (ultra-low sulfur diesel).

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

3.4 Assessment of Implementation of Strategies Outside of Maryland

40 CFR section 51.308(g)(6) of the RHR requires an assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Federal Class I areas affected by emissions from the State, to meet all established RPGs.

Based on the information summarized in this report, MDE determines that the existing Regional Haze SIP is sufficient to meet our RPGs. Maryland is on track for meeting the long term goals laid out in the Regional Haze SIP, as all of the strategies committed to have been implemented and emissions reductions have exceeded expectations (see Section 4). All of the Class I areas in the region have already met the said 2018 goals (see Section 5).

4.0 Emissions Inventory Trends

The control strategies of the regional haze SIP, described in Sections 2 and 3, are intended to reduce the emissions of haze causing pollutants. To assure success and adequacy of the SIP an analysis of emissions trends is provided in this section.

4.1 Requirements Addressed

This section addresses the requirements of 40 CFR sections 51.308(g)(2), 51.308(g)(4), and 51.308(g)(5).

40 CFR section 51.308(g)(2) requires that the progress report summarize the emissions reductions achieved throughout the State through implementation of the measures included in the State's SIP for achieving reasonable progress at Class I areas (as described in the previous sections). This is addressed specifically in section 4.2 of this report.

40 CFR section 51.308(g)(4) requires each state to analyze and track changes over the most recent five years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes are to be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.

40 CFR section 51.308(g)(5) requires an assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past five years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

The following emissions inventories are a compilation of three sources. First, the National Emissions Inventory (NEI) provides a comprehensive estimate of air emissions for criteria and hazardous air pollutants at the facility level. Second, Maryland's Periodic Emissions Inventory (PEI) is similar to NEI but includes emissions of more sources and at a unit level. Both the NEI and the PEI provide data for all the years needed under the requirements of the look back guidance (two years at five years apart). Third, MANE-VU collected a regional inventory for the years 2002, 2007 and projected 2018.

4.2 Maryland Emissions Inventory Trends

The MANE-VU Ask was designed to achieve reductions in SO_2 emissions, as SO_2 is the driving primary pollutant for the production of sulfate, and sulfate is the most significant pollutant impacting regional haze in MANE-VU Class I areas. This approach was successful as evidenced by the visibility improvements reviewed in Table 5-1 and in the emissions trends described below.

Table 4-1: Maryland Emissions by Sector[20]

	NO_x Emissions (1,000 TPY)					SO_2 Emissions (1,000 TPY)				
Sector	**2002**	**2008**	**2011**	**2014**	**2018**	**2002**	**2008**	**2011**	**2014**	**2018**
Point	104.56	53.85	33.71	27.00	33.45	320.76	254.86	59.08	49.43	75.85
Non-Road	58.35	44.01	37.27	31.13	24.18	16.65	4.03	6.19	4.47	0.58
On-Road	167.38	95.78	81.57	61.64	28.10	4.96	0.63	0.55	0.52	0.66
Area	12.79	11.59	12.64	12.64	17.82	11.12	4.96	5.94	5.94	9.12
Total	**343.08**	**205.23**	**165.19**	**132.41**	**103.56**	**353.49**	**264.48**	**71.76**	**60.36**	**86.20**
	VOC Emissions (1,000 TPY)					**$PM_{2.5}$ Emissions (1,000 TPY)**				
Sector	**2002**	**2008**	**2011**	**2014**	**2018**	**2002**	**2008**	**2011**	**2014**	**2018**
Point	12.54	4.79	4.11	4.11	6.85	30.16	13.39	10.90	10.90	9.93
Non-Road	56.73	39.53	30.37	27.61	37.96	4.54	3.26	3.02	2.58	3.30
On-Road	65.77	40.82	36.72	30.27	29.91	5.79	3.62	2.81	2.15	1.03
Area	120.08	60.00	47.10	47.10	104.62	16.48	12.68	11.77	11.77	30.16
Total	**255.12**	**145.14**	**118.30**	**109.09**	**179.35**	**56.97**	**32.95**	**28.50**	**27.40**	**44.42**

Table 4.1 shows a downward trend in emissions for all sectors for NO_x , SO_2 , VOCs, and $PM_{2.5}$ from 2002 through 2014. The State of Maryland did experience slight increases in area source NO_x and SO_2 emissions between 2008 and 2011 and a minimal increase in non-road SO_2 emissions between 2008 and 2011. SO_2 , VOC and $PM_{2.5}$ emissions are significantly below the projected 2018 totals. NO_x emissions have steeply declined between 2002 and 2014 but are slightly higher than the 2018 projection. The overall reductions and downward trends far outweigh the minimal increases in these sectors and do not inhibit Maryland's ability to improve visibility and continue to make progress toward the overall regional haze goals.

As discussed in Section 2 of this report, the Maryland Healthy Air Act has played an important role in reduction SO_2 and NO_x emissions from coal-fired EGUs. SO_2 emissions decreased by 92% between 2002 and 2015. NO_x emissions decreased by 86% for the same time frame. Maryland anticipates increased NO_x reductions from the implementation of COMAR 26.11.38 Control of NO_x Emissions from Coal-Fired Electric Generating Units.

[20] 2018 Projections from MARAMA's Emissions Trends Analysis for MANE-VU – Rev. 4 (January 30, 2014) p.45

Figure 4-1: Annual SO_2 Emissions from Maryland Power Plants

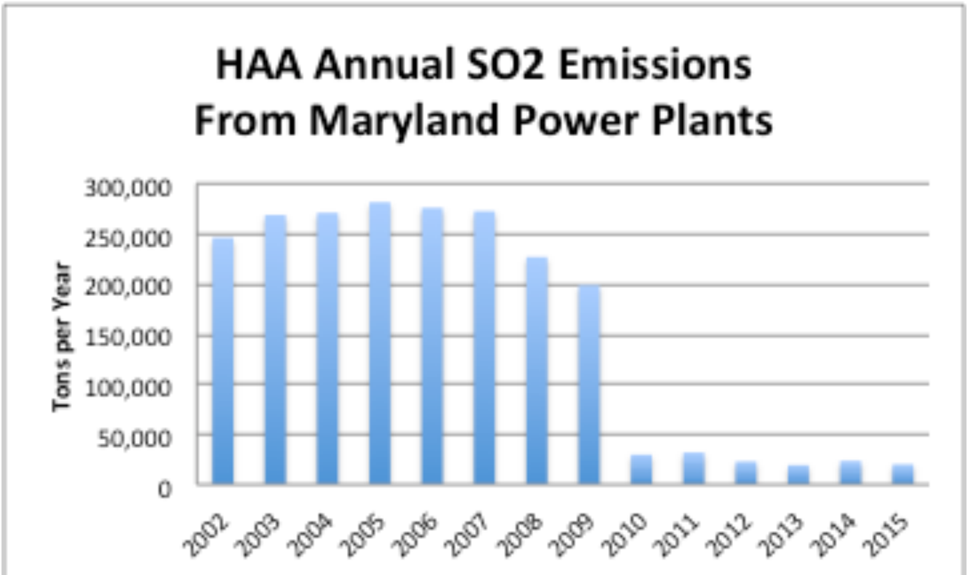
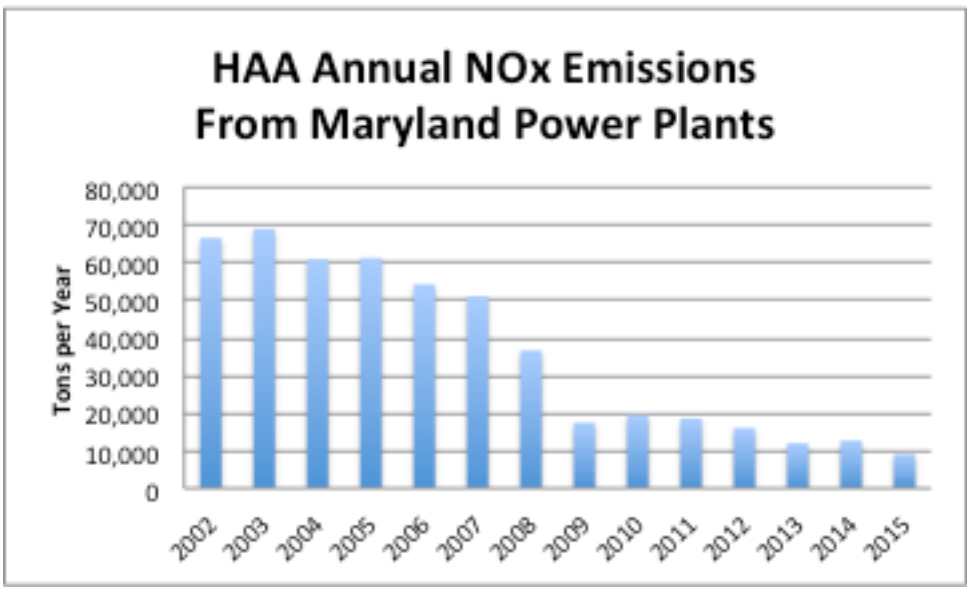


Figure 4-2: Annual NO_x **Emissions from Maryland Power Plants**



4.3 Emissions Inventory Outside of Maryland Borders

As discussed in the above sections the strategy was targeted at reducing SO_2 as it was the primary pollutant causing visibility impairment at the Class I areas. MANE-VU as a whole was successful in implementing the strategies set in the collaboration process. This success is evident in the reduction of SO_2 emissions from point sources for each of the MANE-VU states. Figure 4-2 displays the point source SO_2 emissions from 1990 – 2014.

Table 4-2: SO_2 Point Source Emissions from MANE-VU States

	1990	1996	2002	2008	2011	2014
Connecticut	67,724	42,344	15,950	5,495	1,509	2,065
District of Columbia	3,727	1,075	1,866	85	739	9
Delaware	91,911	90,212	77,376	41,111	11,488	2,942
Massachusetts	291,980	153,583	102,626	51,615	26,714	8,517
Maryland	373,473	272,837	320,759	254,861	59,081	49,425
Maine	68,149	26,469	21,726	13,133	6,295	6,600
New Hampshire	118,032	142,718	46,766	38,663	25,775	3,971
New Jersey	188,205	151,871	61,350	28,910	7,428	3,243
New York	739,010	505,987	350,168	135,928	73,866	50,516
Pennsylvania	1,371,523	1,150,859	1,009,464	938,659	374,457	307,984
Rhode Island	3,607	2,598	1,265	754	800	597
Vermont	5,370	7,934	3,096	1,223	1,196	1,194
Total	**3,324,701**	**2,550,483**	**2,014,414**	**1,512,445**	**591,359**	**439,077**

The MANE-VU region also made significant reductions in the NO_x emissions from point sources, specifically the region saw a reduction of 49% (see Table 4-3). A summary of sector emissions reductions for $PM_{2.5}$, VOC, NO_x and SO_2 of the MANE-VU states is displayed in Table 4-4. (For the entirety of the NEI reported emissions see appendix D). These reductions achieved even for most of the non-targeted pollutants in the region are only further evidence that the region is collectively making great strides in reducing the emissions impacts on regional haze and ensuring that future emissions will not impede progress. The next section shows that the overall reductions overwhelm these few increases and that such minor increases do not inhibit the region's ability to improve visibility and continue to make progress toward the 2018 goals.

Table 4-3: NO_x Point Source Emissions from MANE-VU States

	2002	2008	2011	2014
Connecticut	12,661	8,335	7,851	8,269
District of Columbia	850	351	464	218
Delaware	18,189	14,484	6,208	3,805
Massachusetts	58,196	21,900	15,725	13,876
Maryland	104,562	53,853	33,710	27,004
Maine	19,835	16,910	13,539	12,253
New Hampshire	15,629	7,581	6,293	4,658
New Jersey	51,074	25,923	15,299	11,633
New York	136,351	91,308	65,984	57,860
Pennsylvania	310,287	268,373	250,067	222,886
Rhode Island	2,045	1,129	4,711	4,526
Vermont	1,462	1,457	2,336	2,198
Total	**733,143**	**513,612**	**424,198**	**371,200**

Table 4-4: MANE-VU States Emissions Reductions (NEI 2002 & 2014)

2014 Percent Reduction from 2002[21]													
Sector	**Pollutant**	**CT**	**DC**	**DE**	**MA**	**MD**	**ME**	**NH**	**NJ**	**NY**	**PA**	**RI**	**VT**
Point	NO_x	35%	74%	79%	76%	74%	38%	70%	77%	58%	28%	-121%	-50%
	$PM_{2.5}$	-28%	45%	48%	68%	64%	13%	57%	27%	44%	47%	-37%	30%
	SO_2	87%	100%	96%	92%	85%	70%	92%	95%	86%	69%	53%	61%
	VOC	88%	-4%	53%	64%	67%	58%	13%	59%	82%	41%	37%	56%
Non-Road	NO_x	39%	41%	57%	58%	47%	14%	32%	52%	27%	50%	50%	15%
	$PM_{2.5}$	33%	41%	48%	57%	43%	31%	29%	52%	32%	37%	48%	23%
	SO_2	59%	98%	88%	86%	73%	75%	61%	84%	79%	70%	79%	93%
	VOC	53%	43%	46%	44%	51%	24%	38%	53%	37%	35%	48%	23%
On-Road	NO_x	69%	67%	63%	69%	63%	61%	66%	63%	63%	56%	45%	68%
	$PM_{2.5}$	68%	57%	63%	64%	63%	56%	58%	54%	47%	57%	48%	58%
	SO_2	87%	87%	87%	86%	90%	90%	87%	83%	85%	89%	85%	89%
	VOC	62%	62%	57%	53%	54%	45%	50%	58%	50%	46%	27%	63%
Area	NO_x	17%	20%	18%	12%	1%	39%	21%	13%	28%	26%	29%	15%
	$PM_{2.5}$	9%	-31%	-32%	10%	29%	28%	3%	-4%	17%	-14%	-109%	-33%
	SO_2	33%	41%	84%	29%	47%	27%	32%	47%	52%	65%	32%	33%
	VOC	61%	-8%	50%	59%	61%	76%	69%	41%	62%	38%	41%	31%

[21] Highlighted rows indicate the pollutant targeted for strategies to meet reasonable progress goals. Positive values indicate decreases in emissions.

Table 4-5: MANE-VU Actual and Projected Emissions

Pollutant[22]	Data Source(1)	(1) 2002 2002 V3	(2) 2007 2007 V3	(3) 2017 2007 V3	(4) 2018 2002 V3	(5) 2020 2007 V3
NO_x	**Area(4)**	266,747	207,054	194,832	263,954	194,868
	Nonroad MAR(4)	137,733	173,855	127,391	111,425	118,025
	Nonroad NMIM(4)	289,392	263,931	153,553	158,843	135,962
	Onroad Mobile(4)	1,308,235	1,175,916	---	303,956	471,558
	Point EGU(2)	453,395	338,488	---	168,268	---
	Point non-EGU(3)	213,414	174,043	169,188	174,218	169,668
	Total	2,668,916	2,333,286	---	1,180,664	---
Direct $PM_{2.5}$	**Area(4)**	332,676	259,938	262,887	339,518	264,959
	Nonroad MAR(4)	7,929	7,430	3,906	7,927	3,503
	Nonroad NMIM(4)	27,922	24,701	16,536	15,952	14,421
	Onroad Mobile(4)	22,108	45,616	---	9,189	28,365
	Point EGU(2)	20,670	44,921	---	51,109	---
	Point non-EGU(3)	33,948	29,881	29,659	38,393	29,868
	Total	445,253	412,486	---	462,087	---
	Area(4)	316,287	212,471	119,215	190,437	116,511
	Nonroad MAR(4)	32,123	30,318	4,870	8,172	4,183

[22] Reference: "Regional Emissions Trends Analysis for MANE-VU States: Technical Support Document, Revision 4,"

(1) This trend is built from three sources:

2002 V3 with future projection to 2018 (Columns 1 and 4)

2007 V3 with a projection to 2017 and 2020 (Columns 2, 3 and 5)

(2) Data meets or exceeds target of 90% complete across all years for most states. Units with incomplete data for one or more years have been completed by states or have been removed so that a consistent set of data is presented across years. Therefore totals are not identical to modeled inventory or TSD.

(3) Data identical to modeled inventory and TSD for most states. No revision to correct inconsistent methodology. Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

(4) Data identical to modeled inventory and TSD for most states. No revision to correct inconsistent methodology. Nonroad MAR – includes commercial marine vessels, airports, and railroad locomotives Nonroad NMIM – includes equipment included in USEPA's NMIM/NONROAD model

Pollutant[22]	Data Source(1)	(1) 2002 2002 V3	(2) 2007 2007 V3	(3) 2017 2007 V3	(4) 2018 2002 V3	(5) 2020 2007 V3
SO_2	**Nonroad NMIM(4)**	24,774	14,167	420	466	443
	Onroad Mobile(4)	40,092	8,974	---	8,756	7,202
	Point EGU(2)	1,670,176	1,546,335	---	365,024	---
	Point non-EGU(3)	239,400	129,615	112,784	201,478	112,828
	Total	2,322,851	1,941,879	---	774,333	---
Volatile Organic Compounds (VOCs)	**Area(4)**	1,366,735	784,233	702,289	1,334,175	696,125
	Nonroad MAR(4)	14,026	19,066	17,057	14,962	16,962
	Nonroad NMIM(4)	557,536	412,890	244,126	364,980	222,226
	Onroad Mobile(4)	789,560	600,638	---	269,979	269,647
	Point EGU(2)	11,943	4,975	---	4,344	---
	Point non-EGU(3)	92,562	68,003	68,099	103,727	68,005
	Total	2,832,364	1,889,805	---	2,092,168	---

4.4 Assessment

40 CFR section 51.308(g)(2) requires that the progress report summarize the emissions reductions achieved throughout the State through implementation of the measures included in the State's SIP for achieving reasonable progress at Class I areas (as described in the previous sections). Section 4.2 outlines the success of the programs in terms of emissions reductions for the alternative BART program and the anticipated success of the low sulfur fuel statute. The reductions already achieved through the alternative BART program and the timely implementation of the low sulfur fuel regulations and statutes have met and will continue to meet the goals set in the original SIP submission.

40 CFR section 51.308(g)(4) requires each state to analyze and track changes over the past five years in emissions of pollutants contributing to visibility impairment from all sources and activities within the state. Emissions changes outlined in sections 4.2 and 4.3 are evidence of a successful program within Maryland and the region. Table 4-4 summarizes emissions reductions in Maryland from the State Average Annual Emissions Trend, 2014.

Table 4-6: Emissions Reductions in Maryland

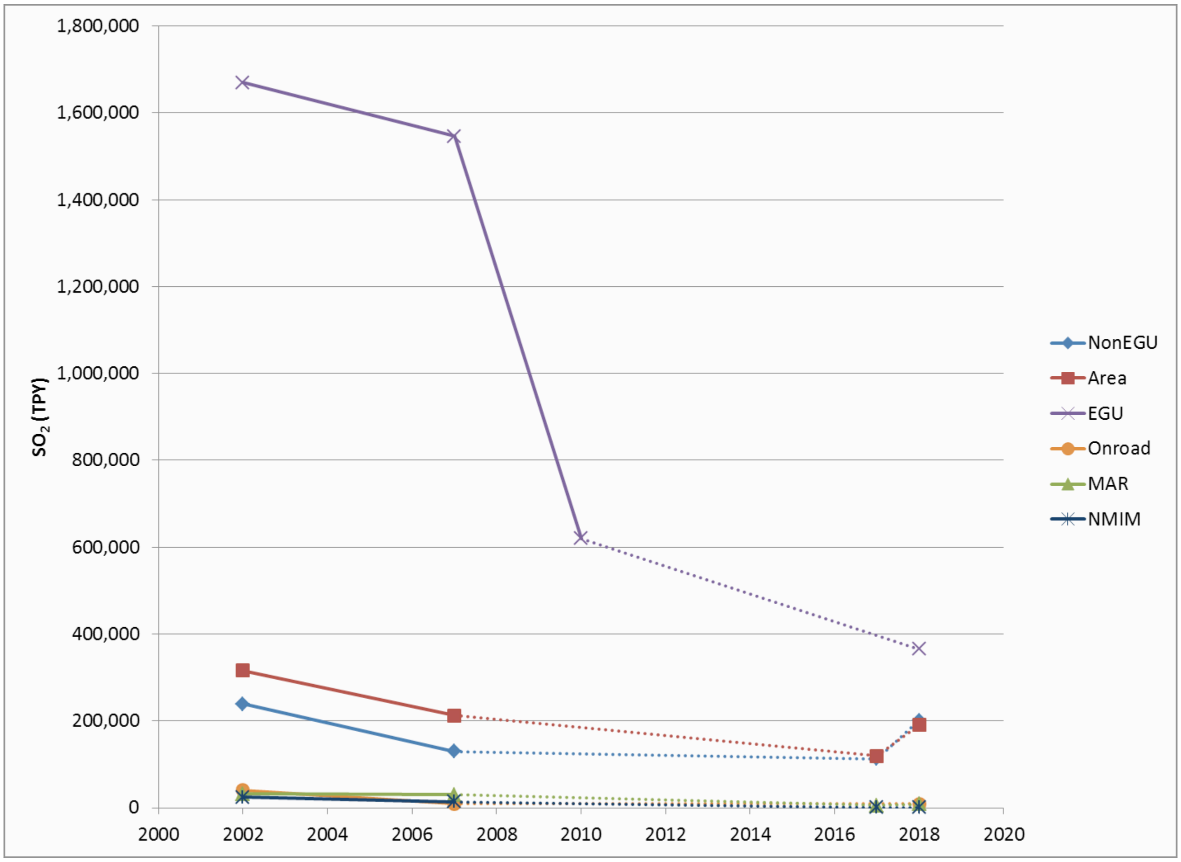
Sector	Pollutant	2002 (tpy)	2014 (tpy)	Percent Reductions
Point	NO_x	104.56	27.00	74%
	$PM_{2.5}$	30.16	10.90	64%
	SO_2	320.76	49.43	85%
	VOC	12.54	4.11	67%
Non-Road	NO_x	58.35	31.13	47%
	$PM_{2.5}$	4.54	2.58	43%
	SO_2	16.65	4.47	73%
	VOC	56.73	27.61	51%
On-Road	NO_x	167.38	61.64	63%
	$PM_{2.5}$	5.79	2.15	63%
	SO_2	4.96	0.52	90%
	VOC	65.77	30.27	54%
Area	NO_x	12.79	12.64	1%
	$PM_{2.5}$	16.48	11.77	29%
	SO_2	11.12	5.94	47%
	VOC	120.08	47.10	61%

Although VOCs, and $PM_{2.5}$ were not deemed of importance to improving visibility in Class I areas and thereby were not the target of regional haze strategies, Maryland's emissions trends specific to these pollutants also show decreases.

40 CFR section 51.308(g)(5) of the RHR requires an assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past five years that have limited or impeded progress in reducing pollutant emissions and improving visibility.
EPA has indicated a significant change that can limit or impede progress could be either
a significant unexpected increase in anthropogenic emissions that occurred over the five-year period (that is, an increase that was not projected in the analysis of the SIP), or
a significant expected reduction in anthropogenic emissions that did not occur (that is, a projected decrease in emissions in the analyses for the SIP that was not realized).

In general, haze-causing emissions in MANE-VU region have declined and are projected to continue to decline. (See Tables 4-2, 4-3 and 4-4). In addition, the general decline for pollutants in the region, results in the conclusion that changes in anthropogenic emissions have not and will not impede progress for improving visibility.

Figure 4-3: Regional SO_2 Emission Trends by Sector, MARAMA Projections[23]



[23] For the full details of the modeling used for the projections noted above see: *Technical Support Document for the Development of the 2013/2017/2020 Emission Inventories for Regional Air Quality Modeling in the Northeast / Mid- Atlantic Region Version 3_3*. January 23, 2012

5.0 Changes in Visibility for each Mandatory Federal Class I Area In and Near MANE-VU

Ultimately, the purpose of the regional haze program and the associated SIPs is to improve visibility in Class I areas. This section reviews the most recent visibility data and compares it to the RPGs set for each Class I area in the region to determine if the current SIP is adequate to meet the RPGs in 2018. The analysis provided in this section reveal that each of the Class I areas have already attained their RPGs.

5.1 Reasonable Progress Goals

The goal of the RHR is to restore natural visibility conditions to each of the 156 Class I areas identified in the Clean Air Act. Section 51.301(q) defines natural conditions "as naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration." Regional Haze SIPs must contain measures that make "reasonable progress" toward this goal by reducing anthropogenic emissions that cause haze.

Each MANE-VU State with one or more Class I areas adopted a Regional Haze SIP identifying baseline visibility for the five-year period from 2000 through 2004 and establishing goals that provide for reasonable progress in improving visibility at Class I areas in the state by 2018. Baseline visibility and RPGs were established for the 20% of days with the worst visibility and the 20% clearest days.

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

Table 5-1: Reasonable Progress Goals in Approved Regional Haze Plans

Class 1 Area	Baseline Visibility 2002-2004	Reasonable Progress 2018	Natural Visibility
20% Haziest Days – deciviews			
Acadia National Park	22.9	19.4	12.4
Brigantine Wilderness	29.0	25.1	12.2
Great Gulf / Presidential Range-Dry River Wilderness	22.8	19.1	12.0
Lye Brook Wilderness	24.4	20.9	11.7
Moosehorn Wilderness / Roosevelt Campobello International Park	21.7	19.0	12.0
Dolly Sods Wilderness	29.5	21.7	10.4
Shenandoah National Park	29.3	21.9	11.4
20% Clearest Days - deciviews			
Acadia National Park	8.8	8.3	4.7
Brigantine Wilderness	14.3	14.3	5.5
Great Gulf / Presidential Range-Dry River Wilderness	7.7	7.2	3.7
Lye Brook Wilderness	6.4	5.5	2.8
Moosehorn Wilderness / Roosevelt Campobello International Park	9.2	8.6	5.0
Dolly Sods Wilderness	12.3	11.1	3.6
Shenandoah National Park	10.9	8.7	3.1

*200-2011 data from LYBR1 site and 2012-2013 data from LYEB1 site.
Source: *Tracking Visibility Progress: 2004-2011,* NESCAUM, April 30, 2013 (Revised May 24, 2013) Units: Visibility in deciviews.

5.2 Requirements to Track Changes in Visibility

40 CFR section 51.308(g)(3), the Regional Haze Rule requires states with Class I areas to assess the current visibility conditions for the five years of most recent visibility data, compare that to baseline visibility conditions for the 2000-2004 period, and assess the change in visibility impairment over the past five years. To mitigate the impacts of year-to-year variability in determining progress towards the RPGs, the RHR mandates the use of five-year-averaged values of both the annual mean 20% best and 20% worst days determined for each site.

Maryland has no Class I areas within its borders, but provides the following information to show that progress is being made in improving visibility at Class I areas in and near MANE-VU in support of the State's determination of the adequacy of its regional haze SIP.

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

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

Progress in improving visibility at Class I areas within MANE-VU is measured via the IMPROVE monitoring network. A coalition composed of the National Park Service (NPS), the Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM), the Forest Service (FS) and the USEPA established the Interagency Monitoring of Protected Visual Environments (IMPROVE) program in response to the 1977 amendments to the Clean Air Act. This monitoring network has collected speciated fine aerosol and related visibility data in or near Federal Class 1 areas in the United States since 1988.

5.3 Review of Recent Improve Data

Maryland has no Class I areas within its borders, therefore the analysis and interpretation of the Class I areas below is supplied by MANE-VU.

In 2013 NESCAUM prepared the report Tracking Visibility Progress: 2004-2011. The report analyzes visibility data from the 2000-2004 baseline through the most recent 5-year period with available data – 2007-2011. The results of this analysis showed the following:

- There are definite downward trends in overall haze levels at the Class I areas in and adjacent to the MANE-VU region.
- Based on rolling-five year averages demonstrating progress since the 2000-2004 baseline period, the MANE-VU Class I areas appear to be on track to meet their 2018 RPGs (RPGs) for both best and worst visibility days.
- The trends are mainly driven by large reductions in sulfate light extinction, and to a lesser extent, nitrate light extinction.
- Levels of organic carbon mass (OCM) and light absorbing carbon (LAC) appear to be approaching natural background levels at most of the MANE-VU Class I areas.
- In some cases, the levels set by 2018 RPGs have already been met, and progress beyond those goals appears achievable.
- Though the Brigantine Wilderness Area is on track to meet its 2018 RPGs, challenges remain. Sulfate light extinction levels are higher at this site than at others across the region. Additional sulfate reductions would be a significant driver in reducing overall haze levels at Brigantine.

Table 5.2 and Figure 5.1a-g below provide the most recent quality assured data (through 2013) for the Class I area(s) in and near MANE-VU in comparison to the baseline visibility measured for 2000-2004. Visibility at all MANE-VU Class I areas has improved, and all areas are expected to meet 2018 RPGs. Table 5.2 also shows progress at nearby Class I areas. As required, visibility is reported as a five-year average in deciviews. (See Appendix E for a discussion of how deciviews are calculated.)

In Figure 5.1a-g, the “Uniform Rate of Progress” line indicates the rate of progress needed to achieve natural visibility by 2064 (the target set by the Clean Air Act). If the reasonable progress goal (RPG) for a Class I area for 2018 is below the Uniform Rate of Progress line, it indicates a faster rate of progress by 2018 than necessary to achieve the uniform rate of progress. None of the MANE-VU states established RPGs for 2018 that provided for a slower rate of improvement than the uniform rate.

Table 5-2: Visibility Improvements through 2015 at Class I Areas in and Near MANE-VU

Class 1 Area	Baseline Visibility 2002-2004	Visibility 2009-2013	Visibility 2011-2015	Change in Visibility
	20% Haziest Days - deciviews			
Acadia National Park	22.89	17.93	17.38	5.51
Brigantine Wilderness	29.01	23.75	22.62	6.39
Great Gulf / Presidential Range-Dry River Wilderness	22.82	16.66	16.42	6.40
Lye Brook Wilderness	24.45	18.76	17.96	6.49
Moosehorn Wilderness / Roosevelt Campobello International Park	21.72	16.84	16.34	5.38
Dolly Sods Wilderness	29.05	22.40	21.24	7.81
Shenandoah National Park	29.31	21.82	20.67	8.64
	20% Clearest Days - deciviews			
Acadia National Park	8.78	7.02	6.91	1.87
Brigantine Wilderness	14.33	12.25	11.95	2.38
Great Gulf / Presidential Range-Dry River Wilderness	7.66	5.86	5.70	1.96
Lye Brook Wilderness	6.37	4.90	5.27	1.10
Moosehorn Wilderness / Roosevelt Campobello International Park	9.16	6.71	6.87	2.29
Dolly Sods Wilderness	12.28	9.03	8.22	4.06
Shenandoah National Park	10.93	8.60	7.90	3.03

Units: Visibility in deciviews

*2000-2011 data from LYBR1 site and 2013-2015 data from LYEB1

Figure 5-1: Charts of MANE-VU Class 1 Area Visibility 2000 - 2013, Compared to RPGs for 2018

Figure 5.1.a. Acadia National Park

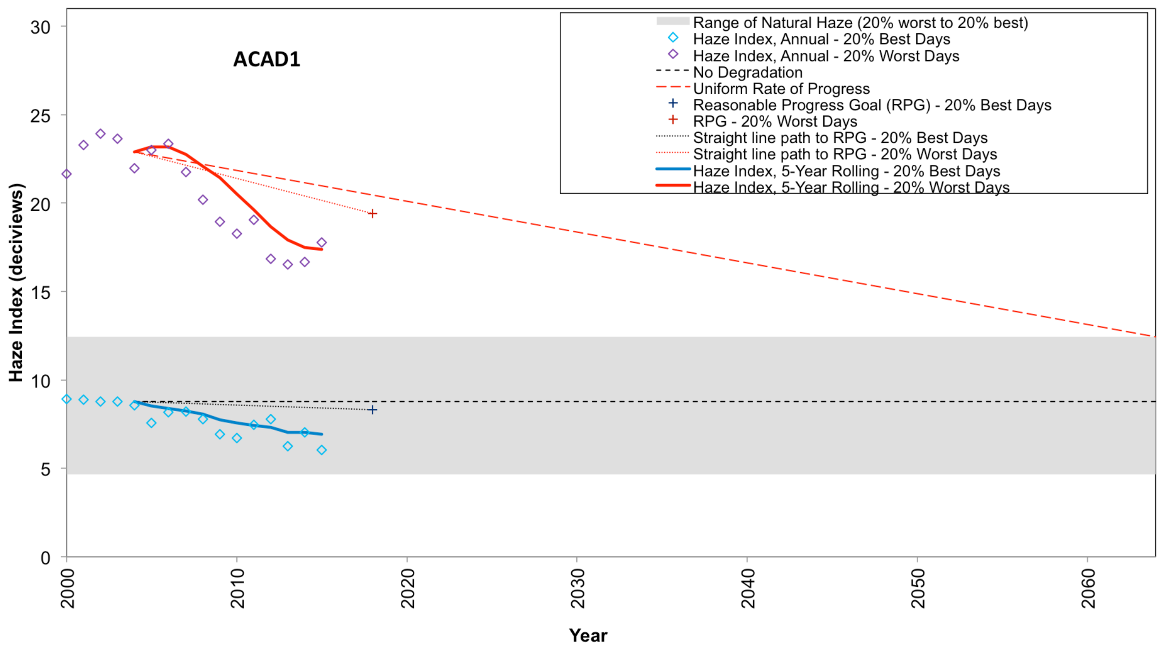


Figure 5.1.b. Brigantine Wilderness

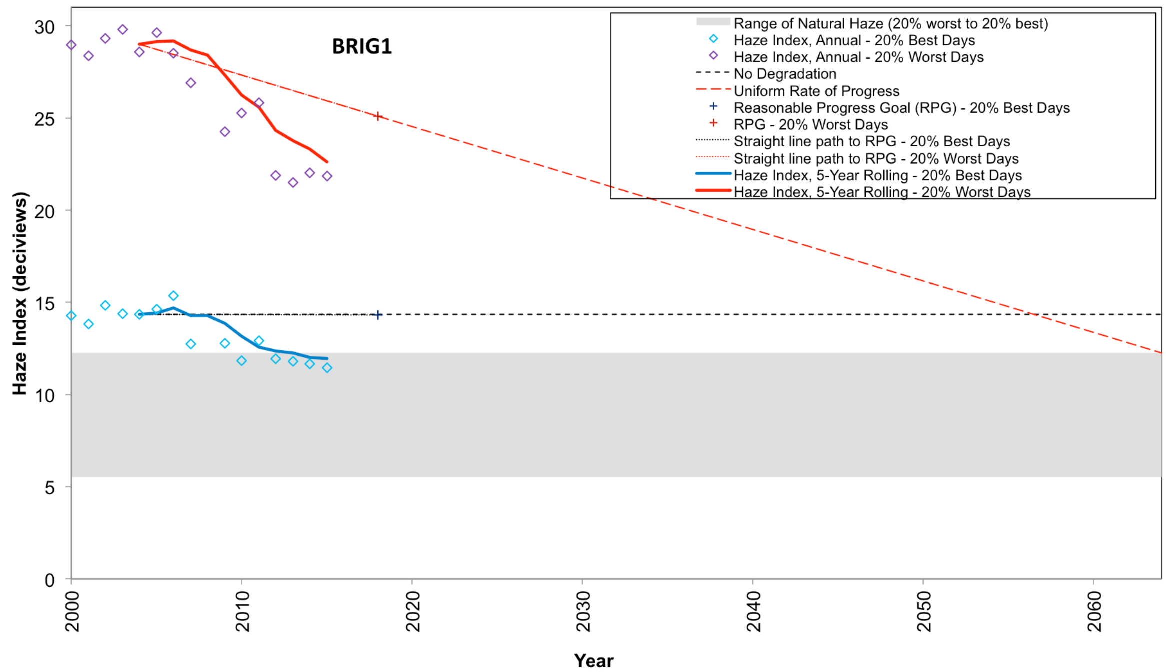


Figure 5.1.c. Great Gulf Wilderness

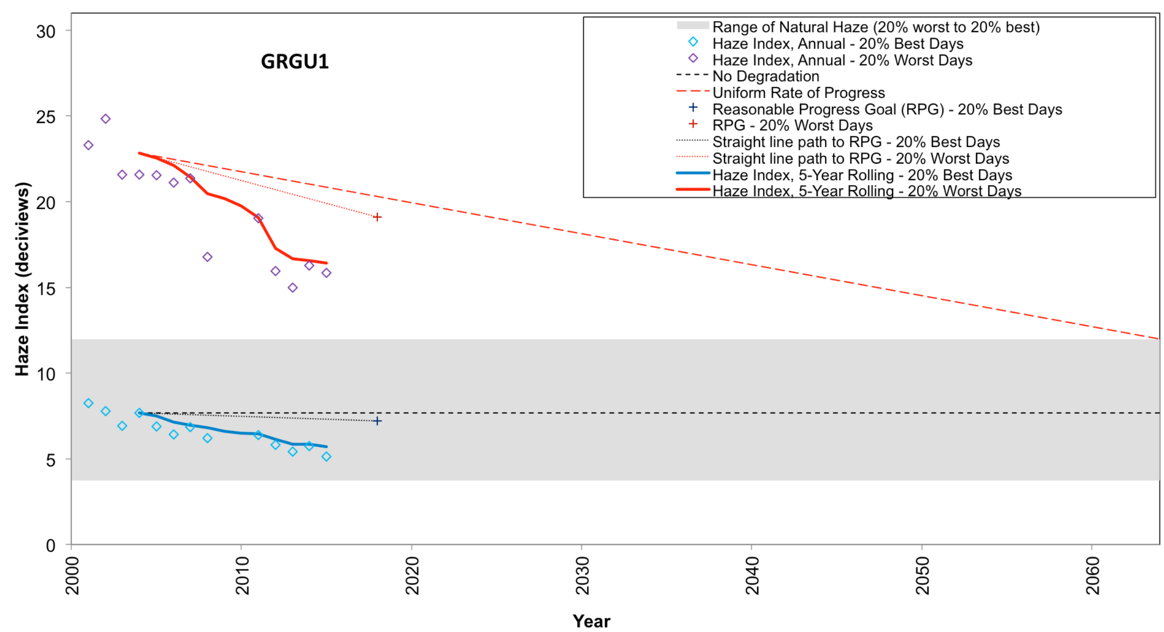


Figure 5.1.d. Lye Brook Wilderness

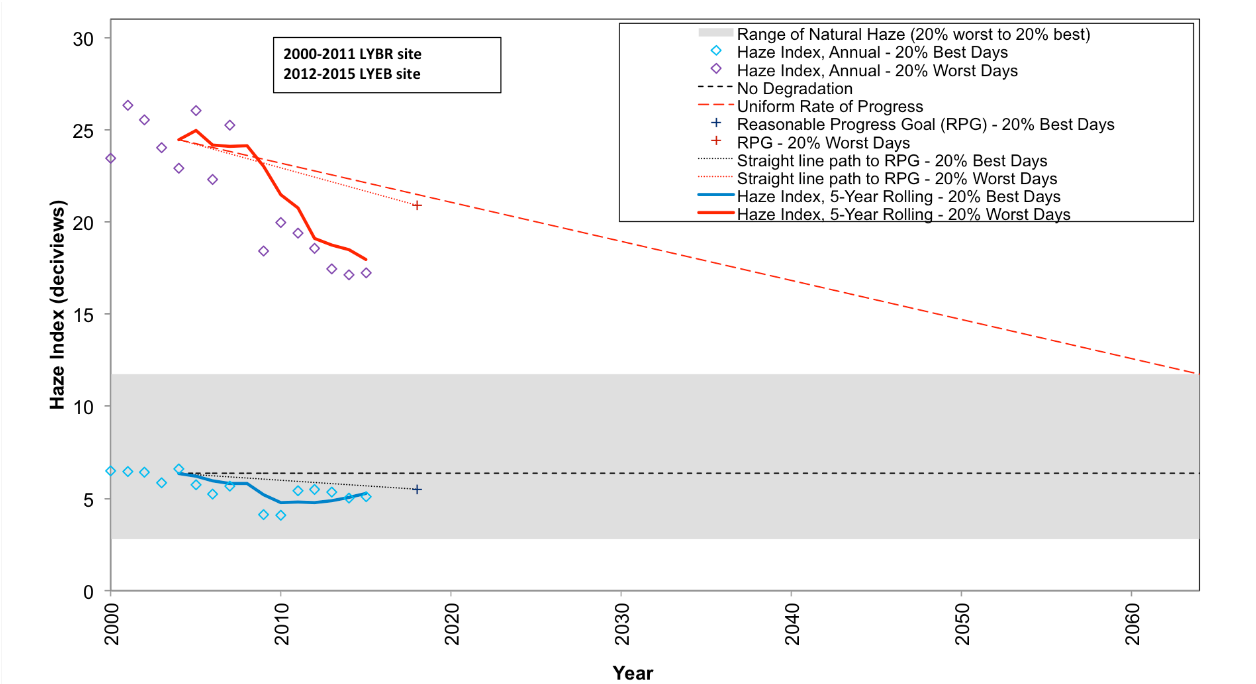


Figure 5.1.e. Moosehorn Wilderness

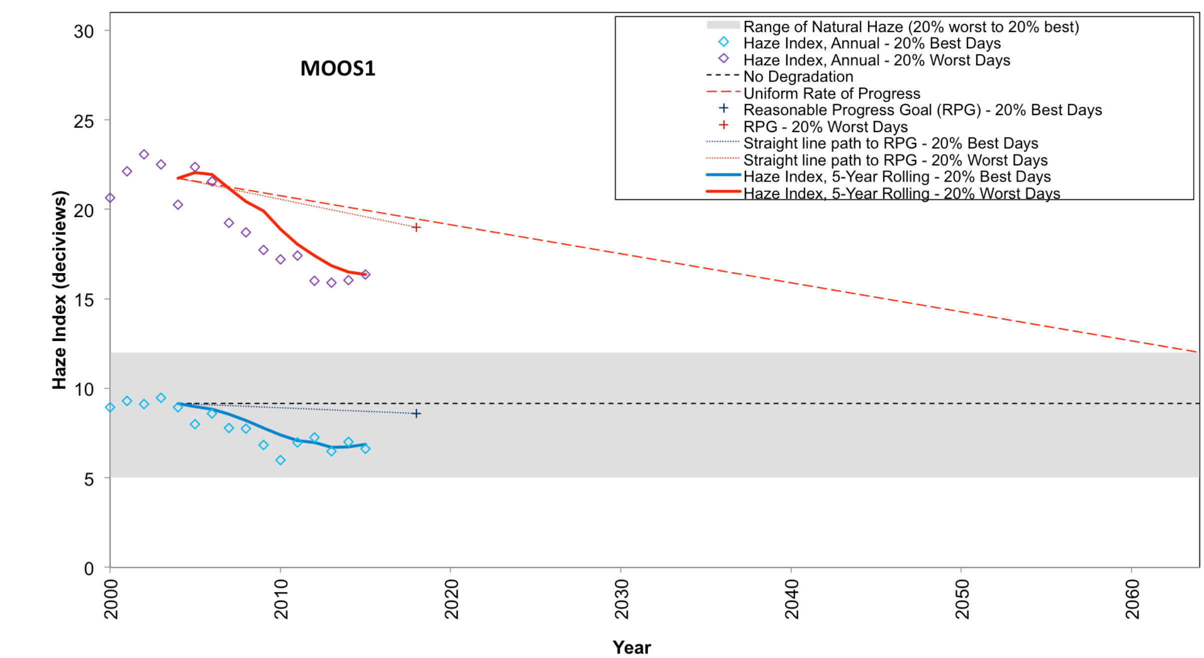


Figure 5.1.f. Dolly Sodds Wilderness

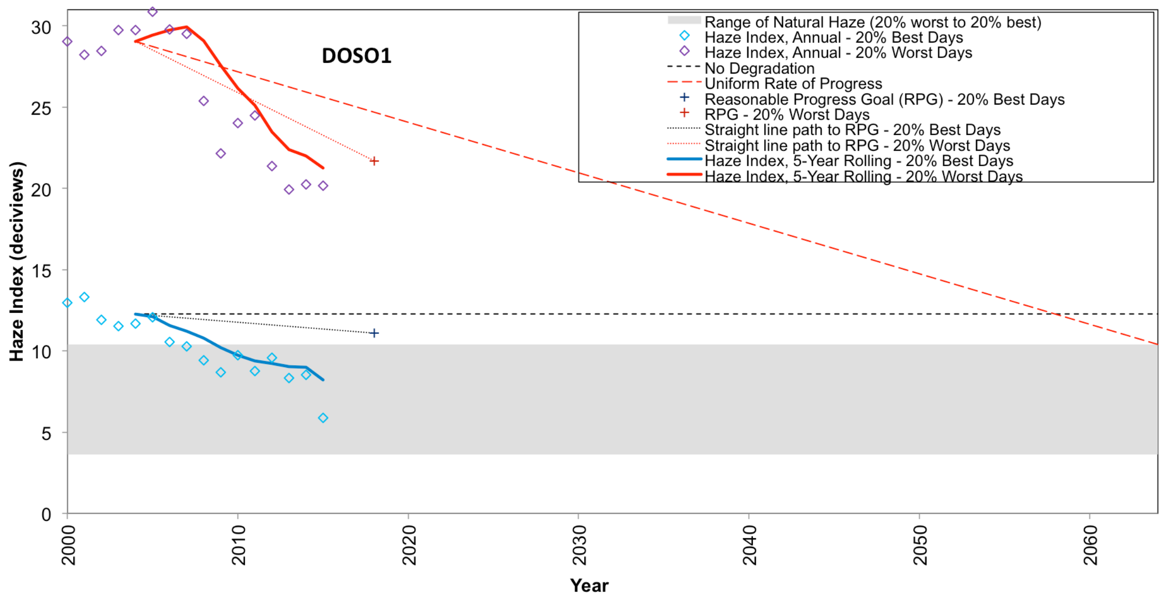
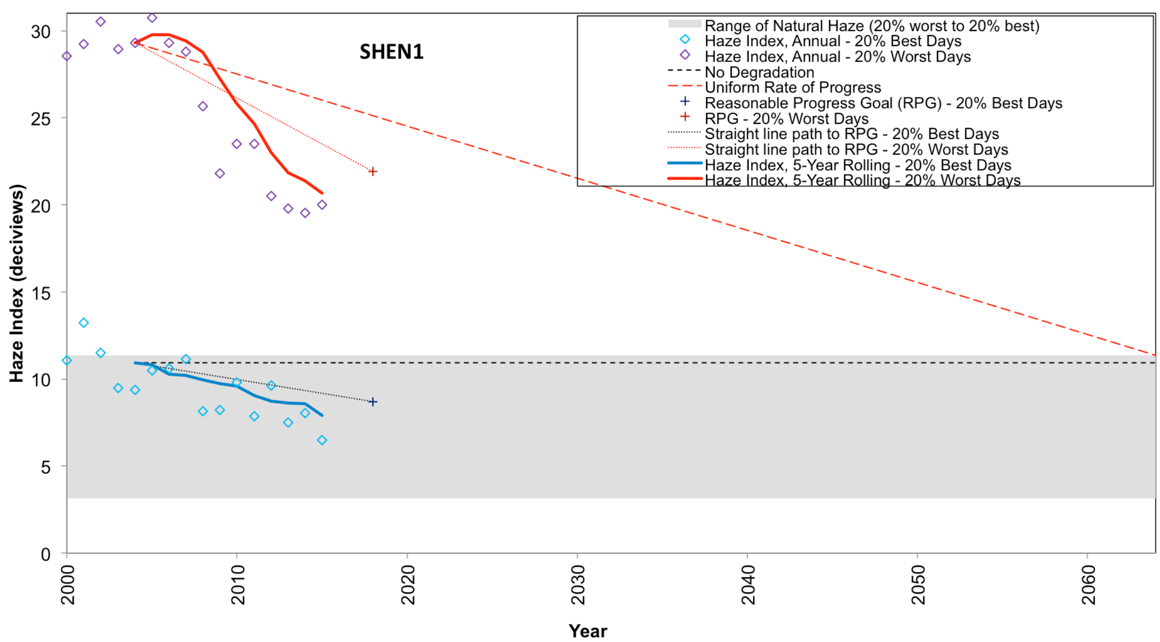


Figure 5.1.g. Shenandoah Valley National Park



In addition to the success demonstrated in the figures above of the Class I area IMPROVE sites, Maryland has seen significant improvements at the Frostburg Reservoir IMPROVE site (FRRE1) in Frostburg, Maryland. The chart in Figure 5-2 display the change in the total $PM_{2.5}$ concentration and the speciation of the annual averages. The total $PM_{2.5}$ concentration at the Frostburg Reservoir

IMPROVE site has seen a decrease of 53%. Figure 5-3 shows the haze index reduction from 2004-2014 at the Frostburg Reservoir IMPROVE site.

Figure 5-2: Frostburg Reservoir IMPROVE Data

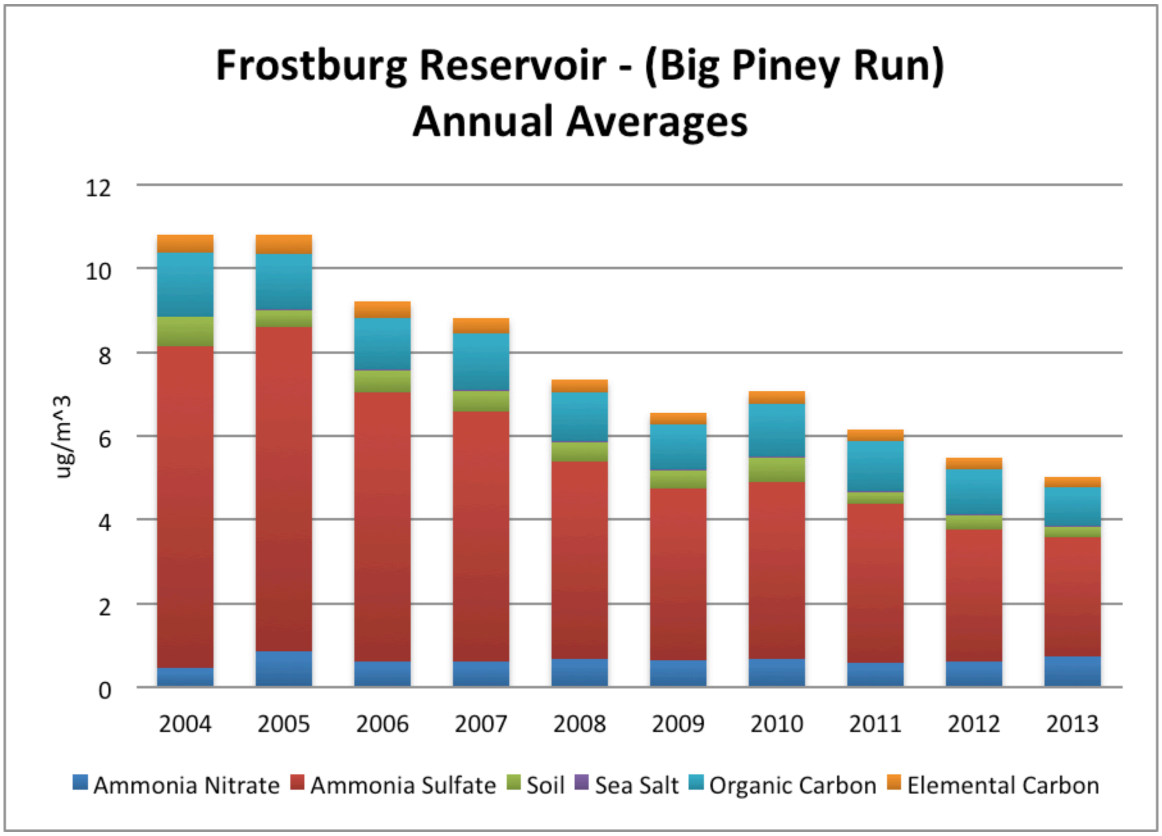
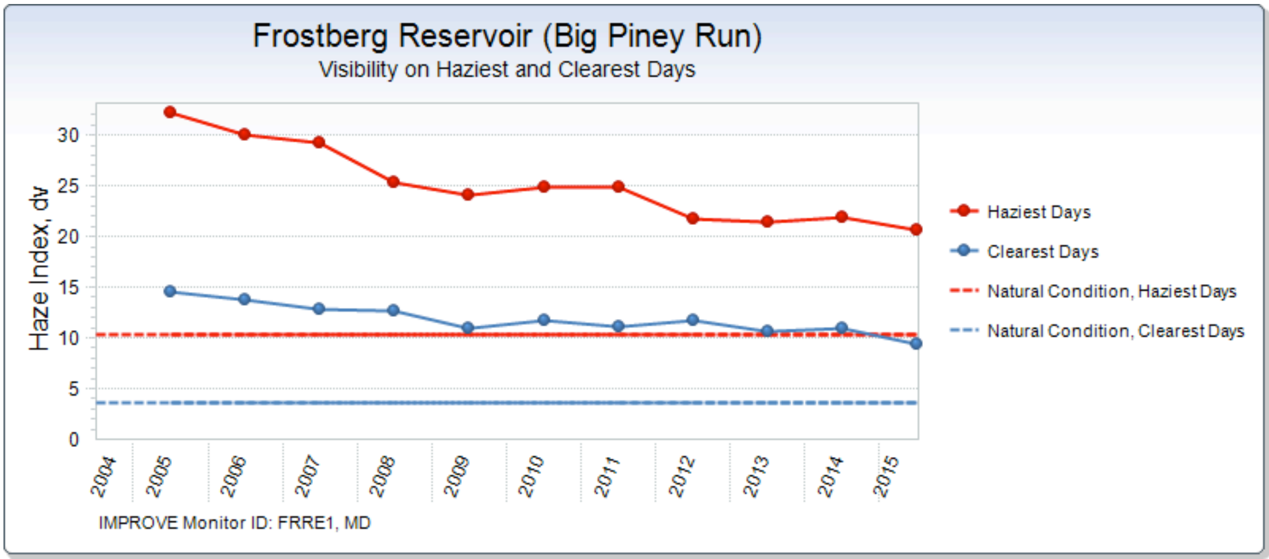


Figure 5-3: Maryland Frostburg Reservoir IMPROVE Site Haze Index Trends



5.4 Tracking Visibility Progress – National Evaluation

In addition to NESCAUM's analysis, a national report also documented progress in visibility improvement through 2009. The 2011 IMPROVE Report V: *Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States*, reported on five-year average reconstructed light extinction (the regional haze tracking metric) at IMPROVE sites for the baseline 2000- 2004 period as well as for the next five-year period, 2005-2009. [24] These five-year averages include total light extinction as well as the extinction contributed by separate pollutant species for the haziest 20% of days and for the clearest 20% of days for each of these 5-year periods.

Visibility at all MANE-VU Class I Area IMPROVE sites improved for the 2005-2009 period compared to the 2000-2004 baseline period. These improvements occurred for both the haziest 20% days (which are required to get gradually cleaner over time) as well as for the cleanest 20% days (which are required to get no worse over time).[25] Improvements in total light extinction on both the haziest and the cleanest days resulted from reductions in light extinction from all four of the major visibility-impairing pollutant species: sulfates, nitrates, particulate organic matter, and elemental carbon.

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

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

25 For more details, see Chapter 9 and Appendix G of the IMPROVE Report V.

2013. IMPROVE 2010-13 data downloaded from the FED database and updated to current 5-year (2009-13) regional haze conditions were calculated using the same procedures in the IMPROVE Report V. The visibility index used is based on inverse megameters (Mm^{-1}), a measure of light extinction, and the deciview (dv) scale, a logarithmic transformation of light extinction, which for the Regional Haze Rule is derived from IMPROVE aerosol composition data (as described in Appendix E).

Figure 5.4 and Figure 5.5 present trends in visibility at Class I sites in the MANE-VU region from the baseline (2000-04) to the most recent current (2009-13) 5-year period.

Figure 5-4: Visibility Improvements through 2015 by Particle Constituents on Haziest 20% Days in MANE-VU Class I Areas

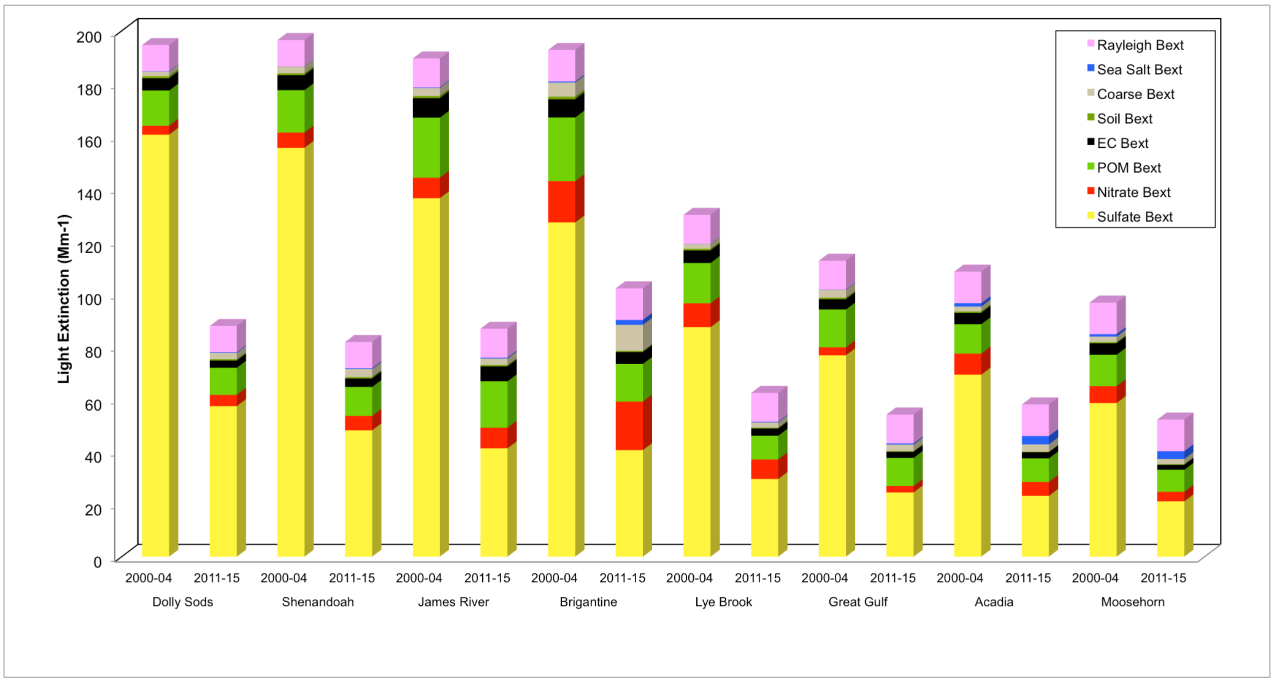
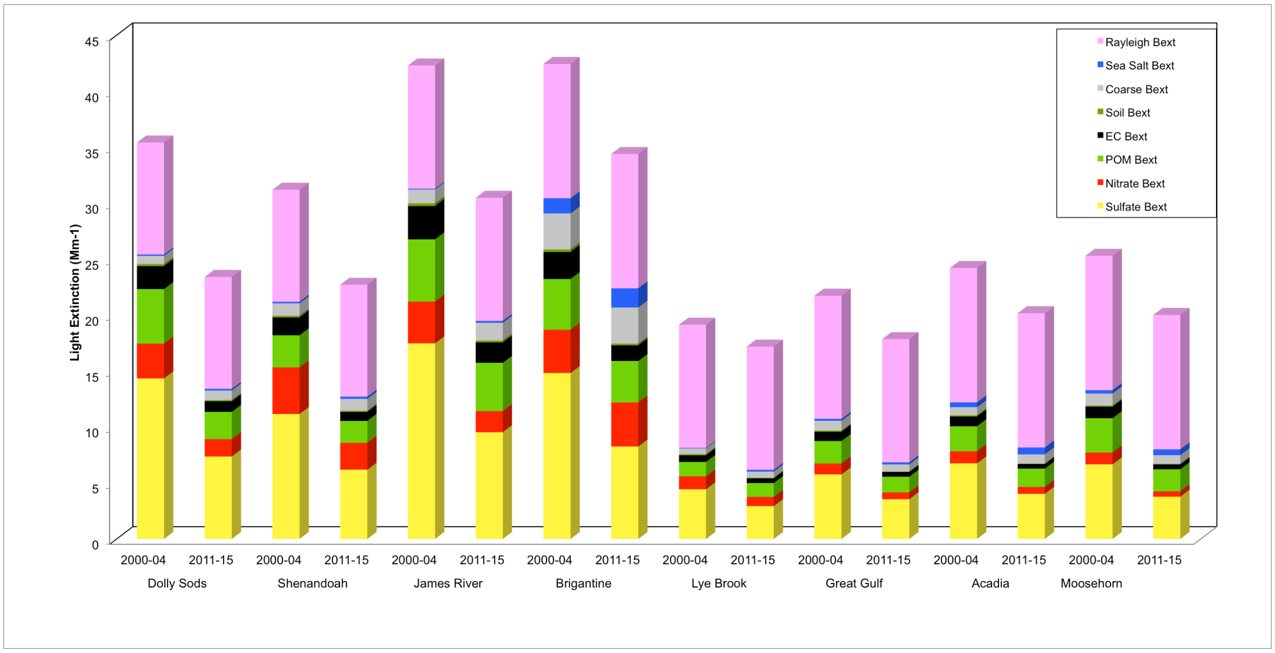


Figure 5-5: Visibility Improvements through 2015 by Particle Constituents on Clearest 20% Days in MANE-VU Class I Areas



5.5 Assessment of Visibility

Maryland has no Class I areas, thus MDE is not required by 40 CFR section 51.308(g)(3) to review the visibility improvements.

During the original collaborative process MANE-VU set uniform rates of progress and RPGs for improving visibility on both the 20% best visibility days and the 20% worst visibility days. The MANE- VU analysis above shows that the visibility in all MANE-VU Class I areas and those just outside the region that were at the time affected by Maryland and/or other MANE-VU states have surpassed all the reasonable progress and uniform progress goals. Currently, at the half way point to the 2018 deadline, the visibility is on average 20% clearer on both the worst and best visibility days than the start of the regional haze strategies, see Table 5.2.

6.0 Consultation with Federal Land Managers

The Regional Haze Rule at 40 CFR 51.308(i) requires that the state provide the Federal Land Managers (FLMs) responsible for Class I areas affected by emissions from within the state an opportunity for consultation, in person and at least 60 days before holding any public hearing on this progress report SIP.

There is no specific requirement to consult with other states about the 5-year progress report unless the Class I State determines that other states are not adequately implementing their SIPs or controlling emissions to enable reasonable progress in improving visibility at the State's Class I area(s). However, MDE still included the neighboring states to maintain consistency in the process and to provide the opportunity for comment.

Maryland sent the draft SIP revision to the FLMs on February 21, 2017. Maryland will notify FLMs of public hearing dates if requested. Maryland has considered the FLMs comments on the proposed SIP revision, along with other comments (included as Appendix F). Maryland will continue to coordinate and consult with the FLMs on future SIP revisions, including progress reports, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas.

7.0 Determination of Adequacy of Current Regional Haze SIP

Section 40 CFR 51.308(h) of the Regional Haze Rule requires the State to determine the adequacy of its regional haze SIP based upon information presented in its progress report.

Based on the analyses conducted for this report, MDE determines that the existing SIP is adequate for continued reasonable progress towards natural conditions in all mandatory Class I Areas impacted by emissions from Maryland.

8.0 Appendices

Appendix A – Acronyms

BART	Best Available Retrofit Technology
CAA	Clean Air Act
CENRAP	Central Regional Air Planning Association
CenSARA	Central States Air Resource Agencies
EGU	Electricity Generating Unit
EPA	Environmental Protection Agency
FIP	Federal Implementation Plan
FLM	Federal Land Manager
FY	Fiscal Year
IMPROVE	Interagency Monitoring of Protected Visual Environments
LADCO	Lake Michigan Air Directors Consortium
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association
METRO4	Southeastern Local Air Pollution Control Agencies
MJO	Multi-Jurisdictional Organization
MOA	Memorandum of Agreement
MRPO	Midwest Regional Planning Organization
NAAQS	National Ambient Air Quality Standards
NESCAUM	Northeast States for Coordinated Air Use Management
NESHAP	National Emission Standards for Hazardous Air Pollutant
NO_x	Nitrogen oxides
NPS	National Park Service
NSPS	New Source Performance Standards
OAQPS	Office of Air Quality Planning and Standards
OAR	Office of Air and Radiation
OTC	Ozone Transport Commission
PM	Particulate matter
$PM_{2.5}$	Particulate matter of diameter of 2.5 micrometers of less
RAVI	Reasonably Attributable Visibility Impairment
RPO	Regional Planning Organization
SESARM	Southeastern States Air Resource Managers
SAMI	Southern Appalachian Mountains Initiative
SIP	State Implementation Plan
SO_2	Sulfur dioxide
URP	Uniform Rate of Progress
VIEWS	Visibility Information Exchange Web System
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
WESTAR	Western States Air Resource Council
WRAP	Western Regional Air Partnership

Appendix B: Status of Emissions from 167 Key Stacks

Status of Controls at the Top 167 Electric Generating Units (EGUs) that Contribute to Visibility Impairment at MANE-VU Class I Areas

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

DRAFT July 25, 2016

The Mid-Atlantic/Northeast Visibility Union (MANE-VU) identified 167 Electric Generating Units (EGUs) as sources that most affect visibility in the MANE-VU Class I areas. In establishing the reasonable progress goal for regional haze, MANE-VU Class I areas relied in part on implementation of emission reductions at the 167 EGU sources by 2018. These 167 EGU sources are located both within and outside MANE-VU.

The MANE-VU "Ask" requested a 90% or greater reduction in SO_2 emissions from 2002 levels at each of the 167 stacks identified by MANE-VU as contributing to visibility impairment at the MANE-VU Class I areas. If it is infeasible to achieve this level of reduction from a unit, the state could obtain the requested reduction from other units in the State.

The attached worksheets provide a summary of the status of controls at the 167 EGU units. New Jersey worked off of a previous analysis carried out by Maine to update the status of the controls at the units. Steps taken to update the worksheets are described as follows:

Step 1

The worksheet was updated with EGU control status from the National Electric Energy Data System (NEEDS) v5.14, and later NEEDS v5.1526. The worksheet previously had control status information from NEEDS v4.10. The worksheet was also updated with Environmental Protection Agency's (EPA) 2011 and 2015 Clean Air Markets Division (CAMD) Air Markets Program Data (AMPD),27 updates from States (Georgia, Indiana, Massachusetts, Maryland, Maine, Michigan, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, and Virginia) and information from state SIPS (Ohio Regional Haze 5-Year Progress Report (January 2016)). "0" was assigned to units that had no values for SO_2 emissions in 2015 CAMD AMPD. Data from the Eastern Regional Technical Advisory Committee (ERTAC) was also reviewed to ensure consistency and accuracy.

Units with SO_2 permit rates greater than 0.4lbs/mmBtu are highlighted in grey in the tables throughout the analysis. Note that some of the SO_2 permit rates could be the permit rates at the units before controls were installed. For some of the units with SO_2 permit rates greater than 0.4lbs/mmBtu, the actual amounts of SO_2 emitted were less than 0.4lb/mmBtu. It is recommended that units with actual SO_2 emissions greater than 0.4lbs/mmBtu be revisited in the future as resources allow.

Based on the information from the sources mentioned above, 46 out of the 167 units have been shut down, retired or decommissioned. The units eliminated are highlighted in grey in the tab "Retired_Shutdown_Decommissioned" in the spreadsheet "167 EGU Stacks that Impact MANE-VU Class I Areas" in Appendix X. These 46 units were eliminated in this step leaving 121 units.

Shawville is temporarily shut down to install equipment for burning natural gas. SO_2 emissions are expected to be well below the 90% reduction expected at the Shawville units when they start

26 http://www.epa.gov/airmarkets/power-sector-modeling-platform-v515 (Accessed February 22, 2016)
27 http://ampd.epa.gov/ampd/ (Accessed February 25, 2016)

burning natural gas. Shawville has retained its rights to burn coal, however, a federal regulation requires the installation of scrubbers before they can burn coal. The enforceability of the controls on these units should be investigated in the future as resources allow.

The 46 units that were eliminated in this step are listed in Table 1.

Table 1: Shut Down, Retired or Decommissioned Units (46 Units)

STATE	ORIS ID	PLANT NAME	UNIT ID
DELAWARE	594	INDIAN RIVER	1
			2
			3
GEORGIA	709	HARLLEE BRANCH	3,4
INDIANA	988	TANNER'S CREEK	U1,U2,U3
			4*
	1010	WABASH RIVER	2*,3*,4*,5*,6*
MASSACHUSETTS	1606	MOUNT TOM	1
	1613	SOMERSET	8
	1626	SALEM HARBOR	1
			3
			4
NEW JERSEY	2378	B L ENGLAND	1
NEW YORK	2526	GOUDEY	11,12,13
	2527	GREENIDGE	6
	2549	C R HUNTLEY	67*,68*
			63,64,65,66
	2554	DUNKIRK	3,4
	2594	OSWEGO	5
	2642	ROCHESTER 7	3,4
NORTH CAROLINA	2709	LEE	3
	2713	L V SUTTON	3
OHIO	2830	WALTER C BECKJORD	6
	2832	MIAMI FORT	5-1,5-2,6
	2837	EASTLAKE	5
	2840	CONESVILLE	1,2
	2864	R E BURGER	5 THRU 8
	2872	MUSKINGUM RIVER	1,2,3,4
			5*
	7253	RICHARD GORSUCH	1,2,3,4
PENNSYLVANIA	3113	PORTLAND	1
			2
	3149	MARTINS CREEK	1,2
	3178	ARMSTRONG	2
	2179	HATFIELD'S FERRY	1,2

STATE	ORIS ID	PLANT NAME	UNIT ID
	3131	SHAWVILLE	3,4
SOUTH CAROLINA	3319	JEFFERIES	3
			4
TENNESSEE	3405	JOHN SEVIER	3,4
VIRGINIA	3803	CHESAPEAKE	3
			4
WEST VIRGINIA	3936	KANAWHA RIVER	1,2
	3938	PHILIP SPORN	51
			11,21,31,41
	3942	ALBRIGHT	3
	3947	KAMMER	1,2,3

Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.

* Units with actual amount of SO_2 emitted greater than 0.4lbs/mmBtu.

Step 2

The remaining 121 units were reviewed for units that have 90% or greater SO_2 emission reductions from 2002 total SO_2 stack level emissions. The emission reduction was based on emissions reported as 2015 CAMD AMPD SO_2 stack level data. These units met the MANE-VU Ask at the stack level for a 90% or greater reduction. 83 units met this criterion, and were eliminated, leaving 38 units. The units eliminated are highlighted in light green in the tab “90%+Reduction” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. The 83 units that were eliminated are listed in Table 2.

Table 2: Units with 90% or Greater SO_2 Emission Reductions (2002-2015) (83 Units)

STATE	ORIS ID	PLANT NAME	UNIT ID
DELAWARE	593	EDGE MOOR	5
	594	INDIAN RIVER	4
GEORGIA	703	BOWEN	1BLR
			2BLR
			3BLR
			4BLR
ILLINOIS	861	COFFEEN	1,2
INDIANA	990	ELMER W STOUT	70
	1001	CAYUGA	1
			2
	1008	R GALLAGHER	1,2*
			3,4*
	6113	GIBSON	1,2
	6705	WARRICK	1,2
			4
KENTUCKY	1355	E W BROWN	2,3
	1378	PARADISE	3
	1384	COOPER	1,2*

STATE	ORIS ID	PLANT NAME	UNIT ID
	6041	H L SPURLOCK	1
			2
MARYLAND	602	BRANDON SHORES	1
			2
	1552	C P CRANE	1
			2
	1571	CHALK POINT	1,2*
	1572	DICKERSON	1,2,3
	1573	MORGANTOWN	1
			2
MASSACHUSETTS	1599	CANAL	1
			2
	1619	BRAYTON POINT	1
			2
			3
MICHIGAN	1702	DAN E KARN	3*,4*
	1733	MONROE	1,2
			3,4
NEW HAMPSHIRE	2364	MERRIMACK	1
			2
	8002	NEWINGTON	1
NEW JERSEY	2403	HUDSON	2
	2408	MERCER	1
			2
NEW YORK	2480	DANSKAMMER	4
	2516	NORTHPORT	3
	8006	ROSETON	1
NORTH CAROLINA	2712	ROXBORO	3A*,3B*
	2721	CLIFFSIDE	5
	2727	MARSHALL	3
			4
	6250	MAYO	1A,1B
	8042	BELEWS CREEK	1
			2
OHIO	2828	CARDINAL	3
	2832	MIAMI FORT	7
	2840	CONESVILLE	4
	2850	J M STUART	1
			2
			3
			4
	2866	W H SAMMIS	1*,2*
			3,4
			5

STATE	ORIS ID	PLANT NAME	UNIT ID
			6
			7
	2876	KYGER CREEK	1*,2*,3*,4*,5*
PENNSYLVANIA	3149	MONTOUR	1
	8226	CHESWICK	1
SOUTH CAROLINA	3297	WATEREE	WAT1
			WAT2
	3298	WILLIAMS	WIL1
	6249	WINYAH	1
TENNESSEE	3407	KINGSTON	1,2,3,4*,5
			6,7,8,9
VIRGINIA	3775	CLINCH RIVER	1,2
	3797	CHESTERFIELD	4
			5
			6
WEST VIRGINIA	3935	JOHN E AMOS	1*,2*
			3
	3943	FORT MARTIN	1
			2
	3948	MITCHELL	1,2
	6264	MOUNTAINEER	1

Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.

* Units with actual amount of SO_2 emitted greater than 0.4lbs/mmBtu.

Step 3

The remaining 38 units were further reviewed for units that have scrubbers with at least 90% scrubber control efficiency. This was done on a case by case basis. SO_2 emission reductions at these units were between 85 and 89% in 2015 compared to 2002 levels. Some of these units had over 90% SO_2 emission reductions in 2014 but could have differed because of variations in amount of the unit's operation between later years and the 2002 base year. Units with wet scrubbers that were installed prior to 2002 were also eliminated even though some of them have emission reductions less than 85% when the wet scrubbers reported scrubber control efficiency of well over 90%. This could be as a result of how the scrubber was used; scrubber shut downs or inactivity, or emission reductions that may have already taken place before 2002. It could also be due to meteorological changes. In this step, 13 Units were eliminated, leaving 25. The units eliminated are highlighted in purple in the tab "Scrubber90%+" in the spreadsheet "167 EGU Stacks that Impact MANE-VU Class I Areas" in Appendix X. The 13 units that were eliminated are listed in Table 3.

Table 3: Units with Scrubbers with 90% or Higher Scrubber Efficiency
SO_2 **Emission Reductions: 85%-89% (2002-2015) (13 Units)**

STATE	ORIS ID	PLANT NAME	UNIT ID
INDIANA	983	CLIFTY CREEK	1*,2*,3*
			4*,5,6*
	6113	GIBSON	3,4
KENTUCKY	1364	MILL CREEK	4
	6018	EAST BEND	2
NORTH CAROLINA	2712	ROXBORO	1
			2
			4A*,4B*
OHIO	2828	CARDINAL	1
PENNSYLVANIA	3136	KEYSTONE	1*
	3140	BRUNNER ISLAND	1*,2*
			3
	3149	MONTOUR	2

Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.
* Units with actual amount of SO_2 emitted greater than 0.4lbs/mmBtu.

Step 4

In this step, the remaining 25 units were reviewed for units that have scrubbers (both wet and dry) installed. Dry scrubbers are believed to be less efficient than wet ones (generally below 80% emission reduction), but according to a USEPA Air Pollution Control Technology fact sheet,28 newer dry scrubbers are capable of higher control efficiencies, on the order of 90%. Some of the units that were eliminated in this step had scrubbers with 90% or higher efficiency but SO_2 emission reductions at these units in 2015 were less than 85% compared with 2002 levels. 14 units were eliminated in this step, leaving 11. 11 of these 14 units had wet scrubbers, while 3 had dry scrubbers. The units eliminated are highlighted in blue (wet scrubbers) and light blue (dry scrubbers) in the tab “Scrubbers” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. The 14 units that were eliminated are listed in Table 4.

Table 4: Units with Scrubbers (Wet and Dry)
SO_2 **Emission Reductions: < 85% (2002-2015) (14 Units)**

Units with Wet Scrubbers			
STATE	**ORIS ID**	**PLANT NAME**	**UNIT ID**
KENTUCKY	1356	GHENT	3,4
	1378	PARADISE	2
OHIO	2828	CARDINAL	2
	2866	W H ZIMMER	1
	6031	KILLEN STATION	2

28 http://www3.epa.gov/ttncatc1/dir1/ffdg.pdf (Accessed March 3, 2016)

Units with Wet Scrubbers			
STATE	**ORIS ID**	**PLANT NAME**	**UNIT ID**
	8102	GEN J M GAVIN	1
			2
PENNSYLVANIA	3136	KEYSTONE	2*
WEST VIRGINIA	3954	MT STORM	1,2
	6004	PLEASANTS	1
			2
Units with Dry Scrubbers			
STATE	**ORIS ID**	**PLANT NAME**	**UNIT ID***
PENNSYLVANIA	3122	HOMER CITY	1*
			2*
TENNESSEE	3403	GALLATIN	3*,4*

Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.

* Units with actual amount of SO_2 emitted greater than 0.4lbs/mmBtu.

It is recommended that the units in Table 4 be revisited to determine why their emissions are lower than expected.

Step 5

Units that have plans to retire or install newer controls by 2018 were eliminated in this step. Determinations were made based on updates from states and information from NEEDS v5.15. Six out of the remaining 11 units were eliminated, leaving 5 that will not meet the MANE-VU "Ask" by 2018. It is recommended that these units are reviewed again in the future to ensure that they either retired or installed controls. The units that were eliminated are highlighted in orange in the tab "Plans to Retire_Control" in the spreadsheet "167 EGU Stacks that Impact MANE-VU Class I Areas" in Appendix X. The 6 units that were eliminated in this step are listed in Table 5.

Table 5: Units with Plans to Retire or Install Newer Controls by 2018 (6 Units)

STATE	ORIS ID	PLANT NAME	UNIT ID
INDIANA	6166	ROCKPORT	MB1*,MB2*
KENTUCKY	1353	BIG SANDY	BSU1*, BSU2*
MAINE	1507	WILLIAM F WYMAN	4*
OHIO	2836	AVON LAKE	12*
TENNESSEE	3406	JOHNSONVILLE	1 THRU 10. 1*,2*,3*,4*
VIRGINIA	3809	YORKTOWN	1*,2

Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.

* Units with actual amount of SO_2 emitted greater than 0.4lbs/mmBtu.

Step 6

The remaining 5 units were further reviewed for the quantity of SO_2 in pounds (lbs.) burned per Heat Input in MMBtu. This analysis was done using 2015 CAMD AMPD data. 0.1 – 0.4 was chosen as the acceptable rate. 1 unit was eliminated, leaving 4 units having higher SO_2 emissions than others. The unit that was eliminated is highlighted in brown in the tab "Heat Input" in the spreadsheet "167 EGU Stacks that Impact MANE-VU Class I Areas" in Appendix X. The unit that was eliminated is listed in Table 6.

Table 6: Units with SO_2 (lbs) Burned per Heat Input (MMBtu) Between 0.1-0.4 (1 Unit)

STATE	ORIS ID	PLANT NAME	UNIT ID
NEW YORK	8006	ROSETON	2

Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.

Step 7

The remaining 4 units were ranked from highest to lowest based on total stack level SO_2 emissions using 2015 CAMD AMPD. These units do not seem to have sufficient SO_2 controls installed. These 7 units are listed in the tab "Rank" in the spreadsheet "167 EGU Stacks that Impact MANE-VU Class I Areas" in Appendix X, and are also listed in Table 7.

Table 7: Units with Insufficient SO_2 Controls (4 Units)

Plant	State	UNIT ID	ORIS ID	2015 CAMD SO_2 (tpy)	2002 CAMD SO_2 (tpy)	% Change 2002-2015
Trenton Channel	MI	9A*	1745	11,656	19,237	-39%
St. Clair	MI	7*	1743	8,938	15,980	-44%
Herbert A Wagner	MD	3*	1554	8,751	10,096	-13%
Yorktown	VA	3*	3809	2,070	10,567	-80%

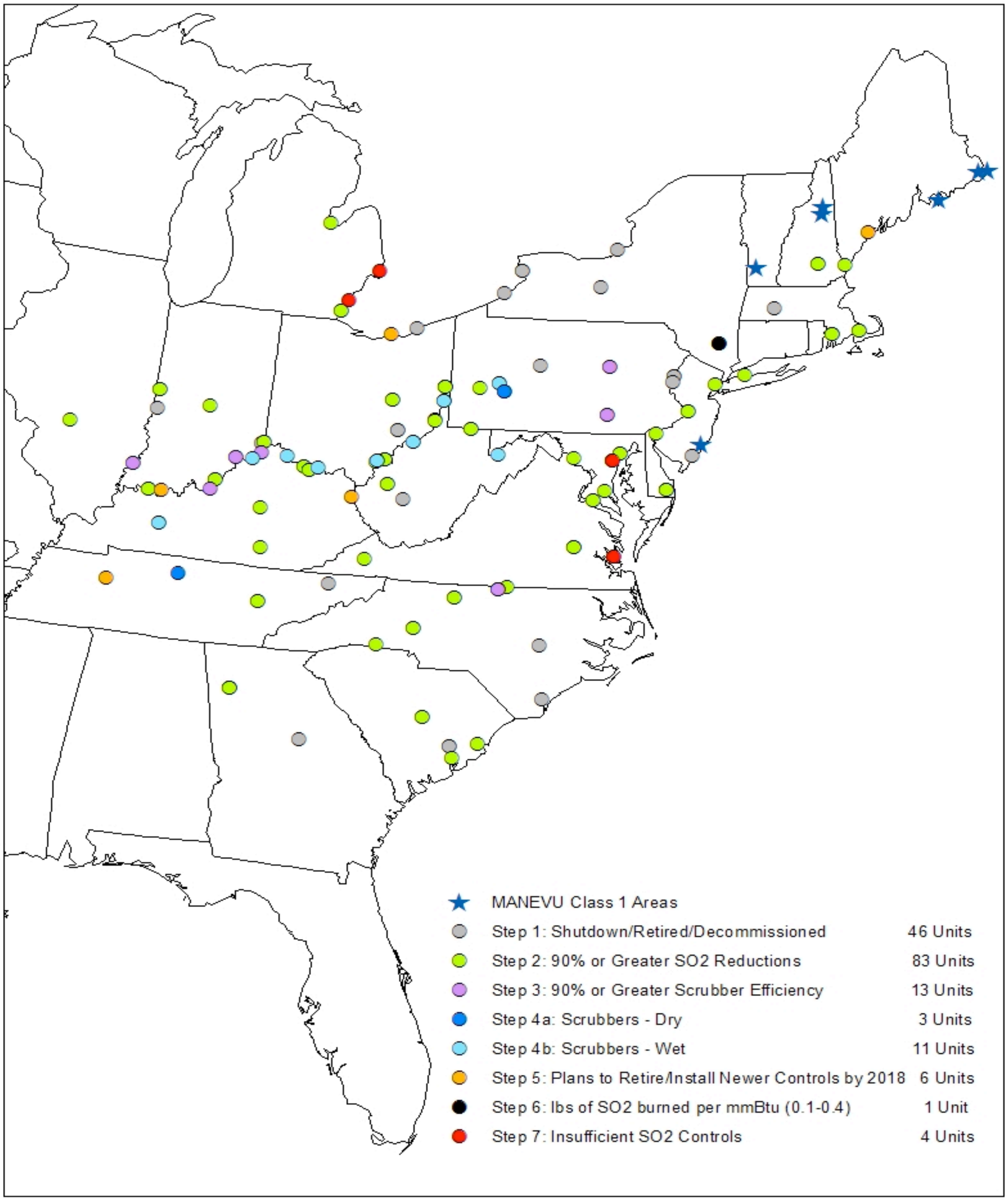
Note: Units with SO_2 permit rate greater than 0.4lbs/mmBtu are highlighted.

* Units with actual amount of SO_2 emitted greater than 0.4lbs/mmBtu.

SO_2 emissions at Yorktown, Unit 3 has reduced in the past few years because utilization of the unit was reduced a lot. In addition, the unit falls under the Mercury and Air Toxics Standard (MATS) rule and is utilizing the annual capacity factor threshold in the MATS rule to comply. Yorktown, unit 3 does not have any scrubbers.

A map showing the locations of the 167 EGU units and their status is shown in Figure 1.

<u>Figure 1</u>: Status of Controls at Top 167 EGUs:
Contribution to Visibility Impairment
at MANE-VU Class I Areas



Appendix C: Maryland Alternative BART Analysis

Maryland's alternative BART applies to the Luke/Westvaco/VERSO Paper Mill. The analysis of the alternative BART for the facility is addressed in a separate SIP submission.

Please see Maryland SIP # 16-14, "*State of Maryland Regional Haze State Implementation Plan Revision Alternative BART for the VERSO Luke Paper Mill*" for the alternative BART analysis.

The alternative BART SIP can be found here:

http://mde.maryland.gov/programs/Air/AirQualityPlanning/Documents/RegionalHazeSIP/SIP16-14.pdf

Appendix D: National Emissions Inventory for MANE-VU States

<for more information see attached spreadsheet titled
"State_Tier1_2002_2011_2014_Emissions Inventory Summary MANEVU Region">

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values				
		CT			DC		
TierType	pollutant_code	Sum of emissions02	Sum of emissions11	Sum of emissions14	Sum of emissions02	Sum of emissions11	Sum of emissions14
Area	NO_x	12.76086638	10.60540481	10.60540481	2.018478899	1.61225843	1.61225843
	PM25	11.96536249	10.8535002	10.8535002	0.587521233	0.770453256	0.770453256
	SO_2	18.53142573	12.43013941	12.43013941	1.750121554	1.036208095	1.036208095
	VOC	103.180292	40.19202922	40.19202922	4.103900798	4.451908116	4.451908116
Area Total		**146.4379466**	**74.08107364**	**74.08107364**	**8.460022484**	**7.870827898**	**7.870827898**
Non-Road	NO_x	22.83918564	17.71221238	13.97310842	3.594978908	2.58771179	2.136704362
	PM25	1.872270902	1.459364318	1.24804544	0.297529476	0.210932562	0.174633817
	SO_2	2.373294183	1.113364	0.973551481	0.383411443	0.009390405	0.007522367
	VOC	33.17198623	17.08017009	15.63499087	1.940387585	1.261386383	1.103666605
Non-Road Total		**60.25673696**	**37.36511079**	**31.82969621**	**6.216307412**	**4.069421139**	**3.42252715**
On-Road	NO_x	93.91585759	36.65919119	28.94390809	11.45598727	4.739468438	3.827792992
	PM25	2.999596717	1.142869659	0.945683687	0.415531902	0.206861665	0.176606129
	SO_2	2.07194497	0.281514835	0.267474492	0.33518074	0.044790894	0.042452386
	VOC	44.70940155	21.66896811	16.8990925	4.691807515	2.146330968	1.788466669
On-Road Total		**143.6968008**	**59.7525438**	**47.05615877**	**16.89850743**	**7.137451964**	**5.835318176**
Point	NO_x	12.66092624	7.85136789	8.2691461	0.849739163	0.463539695	0.218257495
	PM25	2.405852928	3.089699059	3.089699059	0.315059113	0.172536049	0.172536049
	SO_2	15.95027014	1.508886921	2.065039563	1.865930934	0.738750163	0.009131943
	VOC	7.527311099	0.868015035	0.868015035	0.08638139	0.090105219	0.090105219
Point Total		**38.5443604**	**13.31796891**	**14.29189976**	**3.117110601**	**1.464931127**	**0.490030707**
Grand Total		**388.9358447**	**184.5166971**	**167.2588284**	**34.69194793**	**20.54263213**	**17.61870393**

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values				
		DE			MA		
TierType	pollutant_code	Sum of emissions02	Sum of emissions11	Sum of emissions14	Sum of emissions02	Sum of emissions11	Sum of emissions14
Area	NO_x	1.910933517	1.562468915	1.562468915	24.13053152	21.28403565	21.28403565
	PM25	2.26106155	2.976472669	2.976472669	29.91620489	26.98721416	26.98721416
	SO_2	2.92942919	0.465528237	0.465528237	28.60026877	20.33062399	20.33062399
	VOC	18.47964793	9.299977481	9.299977481	171.960522	71.22850117	71.22850117
Area Total		**25.58107218**	**14.3044473**	**14.3044473**	**254.6075272**	**139.830375**	**139.830375**
Non-Road	NO_x	16.26886422	8.223928702	7.047483168	76.39067478	39.06395011	32.38837805
	PM25	1.028674031	0.666644873	0.534167483	5.78967866	2.926807221	2.511022735
	SO_2	10.42186581	1.844091697	1.224981287	22.69178408	3.768146932	3.28924659
	VOC	9.159666679	5.802948204	4.965360418	55.36381888	35.75458596	31.15478158
Non-Road Total		**60.25673696**	**36.87907074**	**16.53761348**	**13.77199236**	**160.2359564**	**81.51349022**
On-Road	NO_x	27.29227523	13.44140553	10.14455359	154.6130341	60.81886353	48.67977436
	PM25	0.839017694	0.40762401	0.311339725	6.16993271	2.615758241	2.230341412
	SO_2	0.611284834	0.085055397	0.080141232	3.761127775	0.524450003	0.527581003
	VOC	12.73487758	6.91630941	5.50713315	59.2043307	34.31139638	27.61962389
On-Road Total		**41.47745534**	**20.85039435**	**16.04316769**	**223.7484253**	**98.27046816**	**79.05732066**
Point	NO_x	18.18923724	6.208133312	3.805442017	58.19622203	15.72485761	13.87606231
	PM25	2.903481431	1.498678488	1.498678488	16.49511187	5.240090068	5.240090068
	SO_2	77.37635497	11.48806065	2.942001926	102.6263448	26.71429925	8.516936447
	VOC	1.73810738	0.811179838	0.811179838	13.41333382	4.773126945	4.773126945
Point Total		**100.207181**	**20.00605229**	**9.057302269**	**190.7310125**	**52.45237387**	**32.40621577**
Grand Total		**204.1447793**	**71.69850742**	**53.17690962**	**829.3229214**	**372.0667072**	**320.6373404**

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values				
		MD			ME		
TierType	pollutant_code	Sum of emissions02	Sum of emissions11	Sum of emissions14	Sum of emissions02	Sum of emissions11	Sum of emissions14
Area	NO_x	12.78964838	12.63731952	12.63731952	7.670391983	4.645096858	4.645096858
	PM25	16.48342187	11.77287113	11.77287113	16.8014211	12.03245979	12.03245979
	SO_2	11.11929781	5.939384864	5.939384864	11.15711502	8.150769819	8.150769819
	VOC	120.0784362	47.10407997	47.10407997	85.48300217	20.26776506	20.26776506
Area Total		**160.4708042**	**77.45365548**	**77.45365548**	**121.1119303**	**45.09609153**	**45.09609153**
Non-Road	NO_x	58.34829585	37.26599877	31.12753811	13.54388256	13.3939476	11.60658619
	PM25	4.535679854	3.018614663	2.575673292	1.648541631	1.30019108	1.138745649
	SO_2	16.65213039	6.185480286	4.473523929	3.357015549	0.952390781	0.843500793
	VOC	56.72947573	30.37409997	27.60589489	30.39058822	26.45967084	23.24492445
Non-Road Total		**60.25673696**	**136.2655818**	**76.84419369**	**65.78263022**	**48.94002796**	**42.1062003**
On-Road	NO_x	167.3754805	81.57187413	61.64322551	58.65761333	28.20672084	23.04087643
	PM25	5.786734029	2.810777502	2.146197028	1.98623141	1.036243238	0.864070629
	SO_2	4.964026132	0.54548803	0.519341652	1.255683618	0.129032504	0.131486791
	VOC	65.77086654	36.71894481	30.27033094	21.81825497	13.91651693	11.92275516
On-Road Total		**243.8971072**	**121.6470845**	**94.57909513**	**83.71778333**	**43.28851351**	**35.959189**
Point	NO_x	104.5619928	33.70960785	27.00353645	19.83461339	13.53934787	12.25265845
	PM25	30.15952275	10.8962998	10.8962998	5.391623347	4.676444706	4.676444706
	SO_2	320.7586053	59.08053509	49.42537276	21.72645735	6.296116766	6.599760902
	VOC	12.53709338	4.112062654	4.112062654	8.189996196	3.442016761	3.442016761
Point Total		**468.0172142**	**107.7985054**	**91.43727166**	**55.14269029**	**27.95392611**	**26.97088082**
Grand Total		**1008.650707**	**383.743439**	**329.2526525**	**308.9124318**	**158.4447314**	**144.8599184**

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values				
		NH			NJ		
TierType	pollutant_code	Sum of emissions02	Sum of emissions11	Sum of emissions14	Sum of emissions02	Sum of emissions11	Sum of emissions14
Area	NO_x	5.392238146	4.23561462	4.23561462	26.6943	23.32150616	23.32150616
	PM25	10.34499248	10.04094751	10.04094751	11.94839975	12.3814036	12.3814036
	SO_2	7.220968226	4.928647509	4.928647509	10.60147804	5.643485868	5.643485868
	VOC	61.16253713	18.90389817	18.90389817	152.6981631	90.08900663	90.08900663
Area Total		**84.12073598**	**38.10910781**	**38.10910781**	**201.9423409**	**131.4354023**	**131.4354023**
Non-Road	NO_x	9.715011428	7.649108091	6.594391678	90.41282238	48.9772775	43.56173201
	PM25	0.970694144	0.79848424	0.693835688	6.494779204	3.628621667	3.14968996
	SO_2	0.777508307	0.429001601	0.301724559	21.32652015	4.096081181	3.446832081
	VOC	21.94968791	15.22187585	13.67708294	80.86692095	40.25136868	37.68697654
Non-Road Total		**60.25673696**	**33.41290179**	**24.09846978**	**21.26703486**	**199.1010427**	**96.95334903**
On-Road	NO_x	47.58477292	18.38845598	16.04373622	188.599281	80.69887178	69.4796205
	PM25	1.613118535	0.784462397	0.67765029	6.480678722	3.220130743	2.962243646
	SO_2	1.015813829	0.12357197	0.127044102	4.239932075	0.739626641	0.731293446
	VOC	17.41451828	10.09182911	8.715204196	85.76939279	41.29430846	36.00779483
On-Road Total		**67.62822356**	**29.38831946**	**25.56363481**	**285.0892846**	**125.9529376**	**109.1809524**
Point	NO_x	15.62857963	6.292590344	4.657616843	51.07410352	15.2991316	11.6334634
	PM25	7.201730871	3.086358767	3.086358767	8.98729534	6.554846831	6.554846831
	SO_2	46.76573555	25.77531702	3.97110387	61.35018011	7.427734765	3.242631765
	VOC	1.917919883	1.666302897	1.666302897	13.0662252	5.408773809	5.408773809
Point Total		**71.51396593**	**36.82056902**	**13.38138238**	**134.4778042**	**34.690487**	**26.8397158**
Grand Total		**256.6758273**	**128.4164661**	**98.32115985**	**820.6104723**	**389.0321759**	**355.3013011**

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values				
		NY			PA		
TierType	pollutant_code	Sum of emissions02	Sum of emissions11	Sum of emissions14	Sum of emissions02	Sum of emissions11	Sum of emissions14
Area	NO_x	73.82971541	52.93636906	52.93636906	42.32453385	31.38986095	31.38986095
	PM25	68.11223441	56.82793722	56.82793722	46.27141021	52.64859814	52.64859814
	SO_2	72.50479438	35.04047273	35.04047273	54.74713619	19.17270856	19.17270856
	VOC	513.7784681	196.35981	196.35981	259.8843986	162.4011665	162.4011665
Area Total		**728.2252123**	**341.164589**	**341.164589**	**403.2274789**	**265.6123342**	**265.6123342**
Non-Road	NO_x	124.681712	107.733754	90.98125859	123.0393216	76.39804058	62.09138952
	PM25	9.959965883	7.864277209	6.740533476	8.07053337	6.011439616	5.123555922
	SO_2	20.07141494	4.631597134	4.126024554	11.36616974	3.928704945	3.461137482
	VOC	153.8179884	110.6533657	96.28861997	99.22392172	73.25572264	64.6131567
Non-Road Total		**60.25673696**	**308.5310812**	**230.882994**	**198.1364366**	**241.6999464**	**159.5939078**
On-Road	NO_x	324.1704339	160.6076176	118.6381787	357.2550801	204.073056	157.0569634
	PM25	12.02796722	7.529980093	6.390734363	11.78945909	6.488197463	5.122943362
	SO_2	8.789140509	1.402046356	1.346252869	8.620165006	0.938518525	0.907671872
	VOC	153.4766684	91.87895048	76.22933763	152.6617842	101.1063673	82.66121188
On-Road Total		**498.46421**	**261.4185946**	**202.6045036**	**530.3264884**	**312.6061393**	**245.7487905**
Point	NO_x	136.3505334	65.98424902	57.86026841	310.2869169	250.0672133	222.8856317
	PM25	38.13541628	21.38914218	21.38914218	82.23157172	43.59962788	43.59962788
	SO_2	350.1681862	73.86610565	50.51614499	1009.464442	374.4568168	307.9844926
	VOC	102.2950195	18.02242528	18.02242528	59.84354103	35.37142714	35.37142714
Point Total		**626.9491554**	**179.2619221**	**147.7879809**	**1461.826471**	**703.4950851**	**609.8411793**
Grand Total		**2162.169659**	**1012.7281**	**889.69351**	**2637.080385**	**1441.307466**	**1256.491544**

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values				
		RI			VT		
TierType	pollutant_code	Sum of emissions02	Sum of emissions11	Sum of emissions14	Sum of emissions02	Sum of emissions11	Sum of emissions14
Area	NO_x	3.690577498	2.614106814	2.614106814	2.765266903	2.341709302	2.341709302
	PM25	1.091690125	2.280917746	2.280917746	8.187171457	10.90688279	10.90688279
	SO_2	4.766419246	3.261957426	3.261957426	3.200513937	2.154735729	2.154735729
	VOC	17.69776099	10.39571989	10.39571989	18.69839351	12.8527872	12.8527872
Area Total		**27.24644786**	**18.55270188**	**18.55270188**	**32.8513458**	**28.25611502**	**28.25611502**
Non-Road	NO_x	8.218161883	4.961580162	4.116363085	4.180350753	4.14990748	3.565888581
	PM25	0.602232704	0.366634872	0.312339482	0.511158663	0.449622768	0.391223498
	SO_2	2.268876477	0.549284361	0.487393293	0.370731517	0.029003084	0.026913579
	VOC	8.652850131	5.272917313	4.527464231	10.49935005	9.153642909	8.063894772
Non-Road Total		**60.25673696**	**19.7421212**	**11.15041671**	**9.443560091**	**15.56159099**	**13.78217624**
On-Road	NO_x	15.43900457	10.20214569	8.496884919	29.33553146	10.80753872	9.354687658
	PM25	0.619063172	0.369593522	0.321236889	0.923624198	0.404831131	0.388576849
	SO_2	0.506557723	0.077414995	0.078085683	0.708774618	0.065444575	0.079435953
	VOC	8.38590492	6.821761607	6.09822154	13.74109152	5.304601289	5.077900469
On-Road Total		**24.95053039**	**17.47091582**	**14.99442903**	**44.7090218**	**16.58241571**	**14.90060093**
Point	NO_x	2.044683304	4.711013488	4.525610988	1.462345885	2.335595119	2.198215919
	PM25	0.679967493	0.932315582	0.932315582	2.277778226	1.589606081	1.589606081
	SO_2	1.264535921	0.800032306	0.597295806	3.095801843	1.196026143	1.193960281
	VOC	1.108907707	0.695751356	0.695751356	1.28281967	0.558193064	0.558193064
Point Total		**5.098094425**	**7.139112732**	**6.750973732**	**8.118745623**	**5.679420407**	**5.539975345**
Grand Total		**77.03719386**	**54.31314713**	**49.74166473**	**101.2407042**	**64.30012738**	**60.74461172**

NATIONAL EMISSIONS INVENTORY SUMMARY FOR MANE-VU STATES

		STATE_ABBR	Values	
		Total Sum of emissions02	Total Sum of emissions11	Total Sum of emissions14
TierType	**pollutant_code**			
Area	NO_x	215.9774825	169.1857511	169.1857511
	PM25	223.9708916	210.4796582	210.4796582
	SO_2	227.1289681	118.5546622	118.5546622
	VOC	1527.205522	683.5466494	683.5466494
Area Total		**2194.282865**	**1181.766721**	**1181.766721**
Non-Road	NO_x	551.233262	368.1174171	309.1908218
	PM25	41.78173852	28.70163509	24.59346644
	SO_2	112.0607226	27.53653641	22.66235199
	VOC	561.7666425	370.5417545	328.566814
Non-Road Total		**60.25673696**	**1266.842366**	**794.8973431**
On-Road	NO_x	1475.694352	710.2152095	555.3502024
	PM25	51.6509554	27.01732966	22.53762401
	SO_2	36.87963183	4.956954725	4.838261478
	VOC	640.378899	372.1762848	308.7970728
On-Road Total		**2204.603838**	**1114.365779**	**891.5231607**
Point	NO_x	731.1398935	422.1866471	369.1859101
	PM25	197.1844114	102.7256455	102.7256455
	SO_2	2012.412845	589.3486815	437.0638729
	VOC	223.0066563	75.81938	75.81938
Point Total		**3163.743806**	**1190.080354**	**984.7948084**
Grand Total		**8829.472874**	**4281.110197**	**3743.098144**

Appendix E: Regional Haze Rule Metric

IMPROVE aerosol sampling and filter analysis at MANE-VU Class 1 sites are conducted according to procedures described in "*IMPROVE Standard Operating Protocols: Particle Monitoring Network*". (http://vista.cira.colostate.edu/improve/Publications/IMPROVE_SOPs.htm). Data are available from the Federal Land Manager Database: http://views.cira.colostate.edu/fed/QueryWizard/Default.aspx .

The haze-relevant aerosol measurements include PM_{10} mass and $PM_{2.5}$ mass (from which coarse mass is calculated), fine sulfate and nitrate ions (from which ammonium sulfate and ammonium nitrate are calculated), fine organic carbon (from which particulate organic matter is calculated), fine elemental carbon, fine elemental chlorine and chloride ion (from which sea salt mass is calculated), and fine crustal elements (Si, Al, Fe, Ca, Ti – from which fine soil is calculated). The calculated aerosol species concentrations are then combined with estimated dry light extinction efficiencies and enhanced by hygroscopic growth functions (for sulfate nitrate & sea salt) using climatologically derived monthly relative humidity and f(RH) growth functions. This "aerosol light extinction is added to Rayleigh Scattering from natural gaseous air molecules.

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

$$
\begin{aligned}
B_{ext} \approx\ & 2.2 \text{ x } f_S(RH) \text{ x } [\text{Small } (NH_4)_2SO_4] + 4.8 \text{ x } f_L(RH) \text{ x } [\text{Large } (NH_4)_2SO_4] \\
& + 2.4 \text{ x } f_S(RH) \text{ x } [\text{Small } NH_4NO_3] + 5.1 \text{ x } f_L(RH) \text{ x } [\text{Large } NH_4NO_3] \\
& + 2.8 \text{ x } [\text{Small Organic Mass}] + 6.1 \text{ x } [\text{Large Organic Mass}] \\
& + 10 \text{ x } [\text{Elemental Carbon}] + 1 \text{ x } [\text{Fine Soil Mass}] \\
& + 1.7 \text{ x } f_{SS}(RH) \text{ x } [\text{Sea Salt Mass}] + 0.6 \text{ x } [\text{Coarse Mass}] \\
& + \text{Rayleigh Scattering (Site Specific)} + 0.33 \text{ x } [NO_2 \text{ (ppb)}]
\end{aligned}
$$

Where:

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

f_S (RH) and f_L (RH) = Humidity factor associated with small and large mode mass size distributions of $(NH_4)_2SO_4$ and NH_4NO_3,

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

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

Apportionment of the total concentrations of ammonium sulfate ($(NH_4)_2SO4$) into the concentrations of small and large size fractions is accomplished using the following equations:

[Large $(NH_4)_2SO_4$] = [Total $(NH_4)_2SO_4$]/20 x [Total

$(NH_4)_2SO_4$] [Small $(NH_4)_2SO_4$] = [Total $(NH_4)_2SO_4$] -

[Large $(NH_4)_2SO_4$]

Similar equations are used to apportion total ammonium nitrate (NH_4NO_3) and total particulate organic mass (POM = 1.8 x OC) concentrations into the small and large size fractions.

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

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

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

For each year meeting data completeness requirements, averages are calculated, in deciviews, for the 20% haziest days and for the 20% clearest days at each site. These annual means are aggregated into 5-year averages for a "baseline" period (2000-2004) and for later 5-year periods.

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

Annual Uniform Improvement = (Baseline – Natural

Background) / 60 For each 5-year period, uniform progress would be

maintained if:

5-year Uniform Improvement = (Baseline – Natural Background) / 12

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

Appendix F: FLM Consultation and Public Hearing Comments

United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

TRANSMITTED VIA ELECTRONIC MAIL - NO HARDCOPY TO FOLLOW

N3615 (2350)

April 6, 2017

Mary Jane Rutkowski
Air and Radiation Management
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Dear Ms. Rutkowski:

Thank you for the opportunity to review and comment on Maryland's draft Regional Haze 5-Year Progress Report. Maryland Department of Environment (MDE) has prepared a very comprehensive and well documented draft report that we believe meets the requirements for the regional haze periodic progress report as outlined in 40 CFR 51.308(g) and (h). No Class I areas are located in Maryland. MDE demonstrated that visibility at Class I areas in the MANE-VU states for the period 2009-2013 is better than the 2018 visibility goals set by these states. MDE has discussed the emissions controls implemented in Maryland between 2002 and 2014, emissions inventories for Maryland and the MANE-VU states, and relevant state and federal emission control programs. With the recommendations below, we would agree that Maryland is meeting its commitment to the MANE-VU states and that substantive revision of the current regional haze state implementation plan is not necessary at this time.

We have a few recommendations:

- Section 2.2 Best Available Retrofit Technology (BART): In discussions of controls required for Luke Paper and Holcim Cement, please include the year that the controls will be fully operational.
- Section 4.0 Emissions Inventory: Please add to Table 4-1 the emissions projected for Maryland in the 2018 MANE-VU inventory. Are 2014 emissions in Maryland below the emission levels in the 2018 regional air quality modeling and used by Class I states to set 2018 reasonable progress goals? If so, this information further supports MDE's determination that additional action is not needed at this time.
- Section 5: Visibility: IMPROVE data is available through 2015. We recommend that Table 5-2 and Figures 5-3 to 5-5 be updated to reflect the most recent (2011-2015) data.
- Figures 5-4 and 5-5 are intended to illustrate IMPROVE data for the 20% best and 20% worst days, but currently appear to be identical data.

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

Sincerely,

Pat Brewer

Pat Brewer

Cc: Irene Shandruk, EPA Region 3

USDA United States Department of Agriculture | Forest Service | Monongahela National Forest | 200 Sycamore Street
Elkins, WV 26241
304-636-1800

File Code: 2580
Date: April 19, 2017

Mary Jane Rutkowski
Natural Resources Planner
Air and Radiation Management Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, Maryland 21230

Dear Ms. Rutkowski:

The USDA Forest Service completed our review of the Maryland Department of the Environment's (MDE) "Regional Haze 5-Year Progress Report, Assessment of Reasonable Progress Goals and Adequacy of the Existing State Implementation Plan," which we received on February 21, 2017. We appreciate the opportunity to review and comment on this progress report. As part of our review, we have attached a one page enclosure with our comments.

I concur with the MDE determination that the existing Maryland Regional Haze State Implementation Plan (RH SIP) is adequate for continued reasonable progress towards natural conditions in all mandatory Class I areas impacted by emissions from Maryland. Further revisions of the Maryland RH SIP are not needed at this time. I am pleased to note that Maryland plans to maintain the Interagency Monitoring of Protected Visual Environments station at Frostburg Reservoir, and that Maryland has enacted a low sulfur fuel oil strategy.

We look forward to our continued close cooperation toward the national goal of no "man-made" visibility impairment to the Class I areas in our region by 2064. If you have any questions regarding the enclosure, please contact Ralph Perron rperron@fs.fed.us , Air Resource Specialist, at (802) 222-1444.

Sincerely,

Clyde Thompson

CLYDE THOMPSON
Forest Supervisor

cc: Bret Anderson, Scott Copeland, Judi Henry, Ralph Perron, Kent Karriker, Chuck Sams

Enclosure for April 18, 2017 letter

Subject: USDA Forest Service review of the Maryland Department of the Environment's "Regional Haze 5-Year Progress Report, Assessment of Reasonable Progress Goals and Adequacy of the Existing State Implementation Plan."

- Page 42, 2nd paragraph, "The MANE-VU region also made significant reductions in the NO_x emissions from point sources, specifically the region saw a reduction of 78% (see Figure 4-3)."

  Figure 4-3 is titled "Regional SO_2 Emission Trends..." This does not match the statement immediately above.

  Table 4-3 is titled "NO_x Point Source Emissions..." The total reductions in *Table* 4-3 show a reduction in regional NO_x emissions from point sources to be approximately 50%, which differs from the statement immediately above, regarding a 78% reduction, from 2002 to 2014. Please clarify this information.

- Page 42, 2nd paragraph, "A summary of sector emissions reductions for $PM_{2.5}$, VOC, NO_x and SO_2 of the MANE-VU states is displayed in Table 4-3."

  Table *4-3* is titled "NO_x Point Source Emissions..." It appears the text in the statement immediately above, should reference Table *4-4*.

- Figure 5-5 is titled "Visibility Improvements through 2013 by Particle Constituents on Clearest 20% of Days..."

  The information in this figure appears to show haziest 20% of days. Please clarify the information presented in this figure.