MISSISSIPPI
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF POLLUTION CONTROL

STATE IMPLEMENTATION PLAN (SIP) REVISION
REGARDING FEDERAL REGIONAL HAZE PROGRAM REQUIREMENTS
INCLUDING THE SIP NARRATIVE
ADDRESSING VISIBILITY IMPROVEMENT
IN FEDERAL CLASS I AREAS

(PREHEARING PLAN – June 19, 2023)
Adopted [Insert DATE]

Appendix ID	Description
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B-1b	Conversion of Task 2A 2028 Point Source Modeling Files for Emissions Processing with SMOKE (Task 3A) September 22, 2020
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E-2b	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project 2011el CAMx Version 6.32 and 6.40 Comparison Report Task 6 Benchmark Report Number #2 Covering Benchmark Run #3 August 17, 2020
E-2c	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project 2011el CAMx Version 6.40 12km VISTAS and EPA 12km Continental Grid Comparison Report Benchmark Report Task 6 Benchmark Report #3 Covering Benchmark Run #5 August 17, 2020
E-2d	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project 2028 CAMx Version 6.32 and 6.40 Comparison Report Task 6 Benchmark Report #4 Covering Benchmark Run #4 August 17, 2020

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E-4	Deposition Model Performance Evaluation Southeaster VISTAS II Regional Haze Analysis Project (Task 8.1) August 17, 2020
E-5	Model Performance Evaluation for Ozone of the CAMx 6.40 Modeling System and the VISTAS II 2011 Updated Modeling Platform (Task 8.0) August 17, 2020
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Acronym/Abbreviation	Meaning
AERR	Air Emission Reporting Rule
AFWA	Air Force Weather Agency
AIRMon	Atmospheric Integrated Research Monitoring Network (AIRMon)
AMoN	Ammonia Monitoring Network
AoI	Area of Influence
AQS	Air Quality System network
ARW	Advanced Research WRF model
BART	best available retrofit technology
BEIS	Biogenic Emission Inventory System
BELD	Biogenic Emissions Land Use Database
b_{ext}	visibility impairment as extinction, Mm^{-1}
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CAMx	Comprehensive Air Quality Model with Extensions
CASTNet	Clean Air Status and Trends Network
CENRAP	Central Regional Air Planning Association
CEM	continuous emissions monitoring
CM	course particle mass
CO	carbon monoxide
CONUS	continental U.S.
CoST	Control Strategy Tool
CPP	Clean Power Plan
CSA	North Carolina Clean Smokestacks Act
CSAPR	Cross State Air Pollution Rule
CTG	control technique guideline
CWT	concentration weighted trajectory
d	distance (kilometers)
dv	deciview
E_CM	extinction from coarse matter
EC	elemental carbon
EGU	Electricity generating unit
EIA	Energy Information Administration
EIS	Emissions Inventory System
EPA	United States Environmental Protection Agency
ERTAC	Eastern Regional Technical Advisory Committee
EWRT	extinction-weighted residence time
FAA	Federal Aviation Administration
FCCS	Fuel Characteristic Classification System
FDDA	four dimensional data assimilation
FFA	four-factor analysis
FGD	flue gas desulfurization

Acronym/Abbreviation	Meaning
FIA	Forest Inventory and Analysis
FLM	federal land manager
FS	Forest Service
FSL	Forecast Systems Laboratory
FWS	Fish and Wildlife Service
g/bhp-hr	grams per brake horsepower-hour
HAP	hazardous air pollutant
HC	hydrocarbons
H_2SO_4	hydrogen sulfate
HMP	Hazard Mapping System
HNH_4SO_4	ammonium bisulfate
HYSPLIT	Hybrid Single Particle Lagrangian Integration Trajectory Model
ICI	industrial/commercial/institutional
IMPROVE	Interagency Monitoring of Protected Visual Environments
I/O API	Input/Output Applications Programming Interface
IPM	Integrated Planning Model
km	kilometer
kW	kilowatts
LAC	light absorbing carbon
LADCO	Lake Michigan Air Directors Consortium
lb/MMBtu	pounds per million British thermal units
LDEQ	Louisiana Department of Environmental Quality
LEV	California Low Emission Vehicle Standards
m	meters
m^2g^{-1}	meter squared per gram
MACT	maximum achievable control technology
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MATS	Mercury and Air Toxics Standard
MB	mean bias
MDA8	maximum daily 8-hour average
MDEQ	Mississippi Department of Environmental Quality
mb	millibar
MJO	multi-jurisdictional organizations
Mm^{-1}	Inverse Megameters
MMBtu/hr	million British thermal units per hour
MOVES	Motor Vehicle Emission Simulator
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NaCl	sodium chloride, sea salt
NADP	National Acid Deposition Program
NAICS	North American Industry Classification System
NCAR	National Center for Atmospheric Research
NCEP	National Centers for Environmental Prediction

Acronym/Abbreviation	**Meaning**
NEI	National Emissions Inventory
NEEDS	National Electric Energy Database Systems
NH_3	ammonia
NH_4^+	ammonium ion
NH_4NO_3	ammonium nitrate
$(NH_4)_2SO_4$	ammonium sulfate
NLCD	National Land Cover Database
NMB	normalized mean bias
NME	normalized mean error
NMHC	non-methane hydrocarbons
NMIM	National Mobile Inventory Model
NTN	National Trends Network
NO	nitric oxide
NO_3^-	nitrate ion
NOAA	National Oceanic and Atmospheric Administration
NODA	notice of data availability
NO_X	nitrogen oxides
NPS	National Park Service
NSPS	New Source Performance Standards
PM	particulate matter
PM_{10}	coarse particulate matter
$PM_{2.5}$	fine particles with a diameter smaller than 2.5 µg
POM	particulate organic matter
ppb	parts per billion
ppm	parts per million
ppmvd	parts per million volume dry
PSD	Prevention of Significant Deterioration
PSAT	Particulate Matter Source Apportionment Technology
PTE	potential to emit
Q	emissions, tons per year
RAAP	Radford Army Arsenal Plant
RACT	reasonably available control technology
RFG	refinery fuel gas
RPG	reasonable progress goal
RPO	regional planning organization
RRF	relative reduction factor
RT	residence time
SAP	sulfuric acid plant
SOAP	secondary organic aerosol partitioning
SCC	source category code
SCR	selective catalytic reduction
SIP	state implementation plan
SMAT-CE	EPA Software for Model Attainment Test – Community Edition

Acronym/Abbreviation	**Meaning**
SMOKE	Sparse Matrix Operator Kernel Emissions model
SNCR	selective noncatalytic reduction
SO_2	sulfur dioxide
SO_4^{-2}	sulfate ion
TAF	Terminal Area Forecast System
TECO	Tampa Electric Company
tpOS	tons per ozone season
tpy	tons per year
URP	uniform rate of progress
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Forest Service
VEPCO	Virginia Electric and Power Company
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VMT	vehicle miles traveled
VOC	volatile organic compound
WRF	Weather Research and Forecasting
µm	micrometer
$\mu g/m^3$	microgram per cubic meter

1. INTRODUCTION

1.1. What Is Regional Haze?

Regional haze is defined as visibility impairment that is caused by atmosphere-entrained air pollutants emitted from numerous anthropogenic and natural sources located over a wide geographic area. These emissions are often transported long distances. Haze is caused when sunlight is absorbed or scattered by airborne particles which, in turn, reduce the clarity, contrast, color, and viewing distance of what is seen. Regional haze refers to haze that impairs visibility in all directions uniformly.

Pollution from particulate matter (PM) is the major cause of reduced visibility (haze) in the United States, including many of our national parks, forests, and wilderness areas (including 156 mandatory federal Class I areas as defined in 40 CFR Part 81.400). PM affects visibility through the scattering and absorption of light, and fine particles – particles similar in size to the wavelength of light – are most efficient, per unit of mass, at reducing visibility. Fine particles are produced by a variety of natural and manmade sources. Fine particles may either be emitted directly or formed from emissions of precursors, the most significant of which are sulfur oxides such as sulfur dioxide (SO_2) and nitrogen oxides (NO_X). Reducing fine particles in the atmosphere is generally considered to be an effective method of reducing regional haze and thus improving visibility. Fine particles also adversely impact human health, especially respiratory and cardiovascular systems. The United States Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for daily and annual levels of fine particles with a diameter smaller than 2.5 micrometers (μm) ($PM_{2.5}$). In the southeast, the most important sources of $PM_{2.5}$ and its precursors are coal-fired power plants, industrial boilers, process heaters, and other stationary combustion sources. Other significant contributors to $PM_{2.5}$ and visibility impairment include the following source categories: mobile, onroad, and non-road engine emissions; stationary non-combustion emissions (area sources); wildfires and prescribed burning emission; and wind-blown dust.

1.2. What Are The Requirements Under The Clean Air Act For Addressing Regional Haze?

In Section 169A of the 1977 Amendments to the Clean Air Act (CAA), Congress set forth a program for protecting visibility in Class I areas that calls for the "prevention of any future, and the remedying of any existing, impairment of visibility caused by anthropogenic (manmade) air pollution." On December 2, 1980, the EPA promulgated regulations to address visibility impairment (45 FR 80084) that is "reasonably attributable" to a single source or small groups of sources. These regulations represented the first phase in addressing visibility impairment and deferred action on regional haze that emanates from a variety of sources until monitoring, modeling, and scientific knowledge about the relationships between pollutants and visibility impairment improved.

In the 1990 Amendments to the CAA, Congress added section 169B and called on EPA to issue regional haze rules. The regional haze rule that EPA promulgated on July 1, 1999, (64 FR 35713) revised the existing visibility regulations to integrate provisions addressing regional haze impairment and established a comprehensive visibility protection program for mandatory federal Class I areas.[1] Each state was required to submit a state implementation plan (SIP) to the EPA by December 17, 2007, which set out that state's plan for complying with the regional haze rule for the first planning period from 2007 to 2018. Each state was required to consult and coordinate with other states and with Federal Land Managers (FLMs) in developing its SIP. Paragraph 40 CFR 51.308(f) of the 1999 rule required states to submit periodic comprehensive revisions of their regional haze plans by July 31, 2018, and every ten years thereafter. However, on January 10, 2017, EPA revised, among other things, paragraph 40 CFR 51.308(f) of the regional haze rule to change the deadlines for submitting revisions and updates to regional haze plans to July 31, 2021, July 31, 2028, and every 10 years thereafter. This SIP was prepared for the second planning period, which includes years 2019 to 2028.

The regional haze rule addressed the combined visibility effects of various pollution sources over a wide geographic region. This wide-reaching pollution net meant that many states – even those without mandatory federal Class I areas – would be required to participate in haze reduction efforts. Five regional planning organizations (RPOs) were formed to assist with the coordination and cooperation needed to address the visibility issue. These five RPOs are illustrated in Figure 1-1.[2] The Southeastern States Air Resource Managers, Inc. (SESARM) has been designated by EPA as the entity responsible for coordinating regional haze evaluations for the ten Southeastern states (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia), local air pollution control agencies, and tribal authorities. These parties collaborated through the organization known as Visibility Improvement - State and Tribal Association of the Southeast (VISTAS) to prepare the technical analyses and planning activities associated with visibility and related regional air quality issues supporting development of regional haze SIPs for the first and second planning periods. For the second planning period, local air pollution control agencies were represented by the Knox County, Tennessee local air pollution control agency and tribal authorities were represented by the Eastern Band of Cherokee Indians.

[1] The regional haze regulations were amended on July 6, 2005 (70 FR 39104), October 13, 2006 (71 FR 60612), June 7, 2012 (77 FR 33642), and January 10, 2017 (82 FR 3078).
[2] URL: https://www.epa.gov/visibility/visibility-regional-planning-organizations

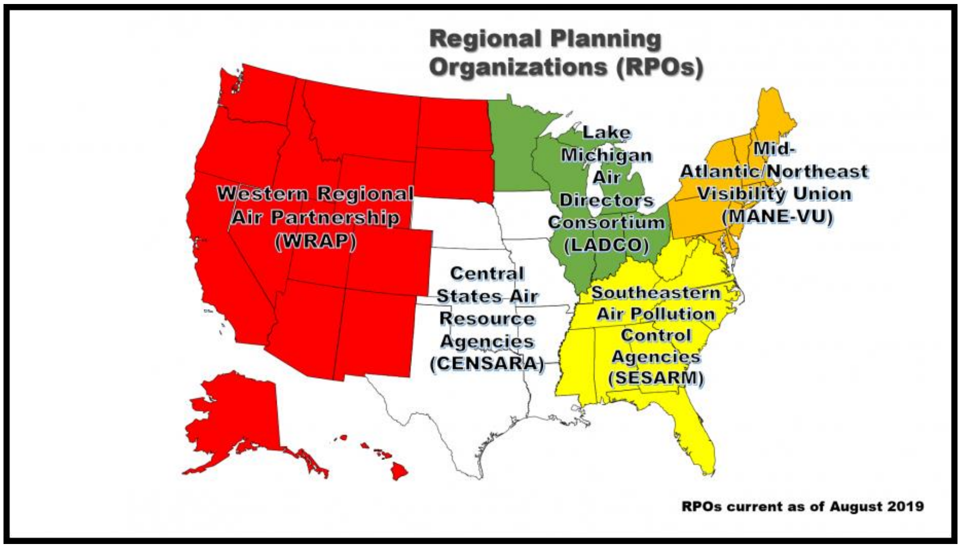


Figure 1-1: Geographical Areas of Regional Planning Organizations

1.3. General Overview of Regional Haze SIP Requirements

The regional haze rule at 40 CFR 51.308(d) requires all states to submit a SIP for regional haze. Paragraph 51.308(f) of the regional haze rule requires each state to periodically revise and submit revisions to its regional haze SIP. Generally, regional haze SIPs must include the following (requirements for states without Class I areas differ as noted):

- Reasonable progress goals (RPGs) for each mandatory federal Class I area located within the state; *(not required for states without Class I areas)*
- Natural, baseline, and current visibility conditions for each mandatory federal Class I area within the state; *(not required for states without Class I areas)*
- A long-term strategy to address visibility for each mandatory federal Class I area within the state and for each mandatory federal Class I area located outside the state that may be affected by emissions from the state;
- A monitoring strategy for measuring, characterizing, and reporting data that is representative of all mandatory federal Class I areas within the state and for states with no Class I areas, those states must have a monitoring strategy determining the contribution of emissions from within the state to regional haze visibility impairment at Class I areas in other states; and
- Other requirements and analyses.

The regional haze rule requires states with Class I areas to establish RPGs, expressed in deciviews (dv), for the end of each implementation period (approximately ten years) that reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period as a result of enforceable measures required by the regional haze rule and other requirements of the CAA (40 CFR 51.308(f)(3)). The goals must provide for reasonable progress towards achieving natural visibility conditions by providing for improvement in visibility for the most impaired days and ensuring no degradation in visibility for the clearest days over each ten-year period.

The regional haze rule requires states with Class I areas to compute natural visibility conditions for both the 20% most impaired days and the 20% clearest days (40 CFR 51.308(f)(1)). For the 20% most impaired days, the regional haze rule directs each state with a Class I area to determine the uniform rate of progress (URP or "glide path") that would need to be maintained during each implementation period to attain natural visibility conditions for the Class I area by 2064. Data from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network are used to establish baseline and natural visibility metrics.[3] States are to establish baseline visibility conditions using a five-year average of monitoring data for 2000-2004 and natural visibility conditions for 2064. A line is drawn between the two data points to determine the URP for the most impaired days. Days with the lowest 20% annual values of the daily haze index are used to represent the clearest days. The requirement of the regional haze rule for 20% clearest days is to ensure that no degradation from the baseline (2000-2004) occurs. For 20% clearest days, the regulatory requirements do not rely on a comparison to the estimated 2064 natural background conditions.

For this second planning period, regional haze SIPs for states with Class I areas must include the current visibility conditions for the most impaired and clearest days, the actual progress made towards natural visibility since the baseline period, and the actual progress made during the previous implementation period. The period for calculating current visibility conditions is the most recent five-year period for which data are available. The period for evaluating actual progress made is from the baseline period (2000 to 2004) up to and including the five-year period for calculating current visibility conditions (40 CFR 51.308(f)(1)(iii)-(iv)).

The 2028 RPGs for each Class I area are met through measures contained in the state's long-term strategy, any contributing states' measures agreed upon in the consultation process, and CAA control programs which take effect during the period. The long-term strategy must address regional haze visibility impairment for each mandatory federal Class I area within the state and for each mandatory federal Class I area located outside the state that may be affected by emissions from the state. The long-term strategy must include enforceable emissions limitations, compliance schedules, and other measures as necessary to make reasonable progress. Section 169B of the CAA requires a state to consider the four statutory factors (cost of compliance, time necessary for compliance, energy and non-air quality environmental impacts, and remaining

[3] URL: http://vista.cira.colostate.edu/Improve/

useful life) when developing the long-term strategy. States are also required to consider the following additional factors in developing their long-term strategies: ongoing air pollution control programs; measures to mitigate the impact of construction activities; source retirement and replacement schedules; smoke management programs for agriculture and forestry; and the anticipated net effect of visibility due to projected changes in point, area, and mobile source emissions over the period addressed by the long-term strategy (40 CFR 51.308(f)(2)).

States must include a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment data that is representative of all mandatory federal Class I areas within the state. For a state with no Class I areas, the state must provide for procedures by which monitoring data and other information are used in determining the contribution of emissions from within the state to regional haze visibility impairment at Class I areas in other states. The regional haze rule states that compliance with this requirement may be met through participation in the IMPROVE network (40 CFR 51.308(f)(6)).

The regional haze SIPs for this second planning period cover long-term strategies for visibility improvement from 2019 to the end of the second planning period (2028). States are required to evaluate progress toward meeting RPGs every five years to assure that emissions controls are on track with emissions reduction forecasts in each SIP. On January 10, 2017, EPA amended 40 CFR 51.308(f) so that the plan revision for the second planning period will also serve as a progress report and thus address the periodic report requirement specified in 40 CFR 51.308(g)(1) through (5). The next progress report will be due to EPA by January 31, 2025. If emissions controls are not on track to ensure reasonable progress, then states would need to take action to assure emissions controls by 2028 will be consistent with the SIP or to revise the SIP to be consistent with the revised emissions forecast (40 CFR 51.308(f) and 40 CFR 51.308(g)).

The EPA provided several guidance documents listed below to assist the states in implementation of the regional haze rule requirements, including documents that specifically address the second implementation period.

- Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule (EPA-454/B-03-005, September 2003)

- General Principles for 5-year Regional Haze Progress Reports for the Initial Regional Haze State Implementation Plans (Intended to Assist States and EPA Regional Offices in Development and Review of the Progress Reports) (EPA, April 2013)

- Technical Guidance for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program (EPA, December 20, 2018)

- Guidance on Regional Haze State Implementation Plans for the Second Implementation Period (EPA, August 20, 2019)

- Technical Support Document for EPA's 2028 Regional Haze Modeling (EPA, September 19, 2019)
- Recommendation for the Use of Patched and Substituted Data and Clarification of Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program (EPA, June 3, 2020)
- Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period (EPA Memorandum, July 8, 2021)

1.4. Mandatory Federal Class I Areas in VISTAS

Mississippi has no mandatory Class I areas within its borders. Nevertheless, the Mississippi Department of Environmental Quality (MDEQ) is responsible for developing the regional haze SIP for Mississippi and submitting it to the EPA.

As required by the regional haze rule, MDEQ has considered the impacts of emission sources within Mississippi that may affect visibility at Class I areas in neighboring states. Through VISTAS, the southeastern states worked together to assess state-by-state contributions to visibility impairment in specific Class I areas, including those affected by emissions from Mississippi. This technical work is discussed further in Sections 5, 6, 7, and 8 below. Consultations to date between Mississippi and other states are summarized in Section 10.

1.5. Regional Planning and Coordination

Successful implementation of a regional haze program involves long-term regional coordination among states. SESARM formed VISTAS in 2001 to coordinate technical work and long-range planning for addressing visibility impairment in each of the eighteen mandatory federal Class I areas in the VISTAS region (see Figure 1-2 and Table 1-1). Mississippi participated as a member state in VISTAS during the first and second planning periods. The objectives of VISTAS are as follows:

- To coordinate and document natural, baseline, and current conditions for each Class I area in the Southeast;
- To develop base year and future year emission inventories to support air quality modeling;
- To develop methodologies for screening sources and groups of sources for reasonable progress analysis;

- To conduct photochemical grid modeling to support development of RPGs for each Class I area; and

- To share information to support each state in developing the long-term strategy for its SIP.

In addition, VISTAS states also coordinated with other RPOs to share information and undertake consultation as needed to address visibility impairment associated with sources affecting Class I areas in the VISTAS region and sources in the VISTAS region potentially affecting visibility impairment in another region.

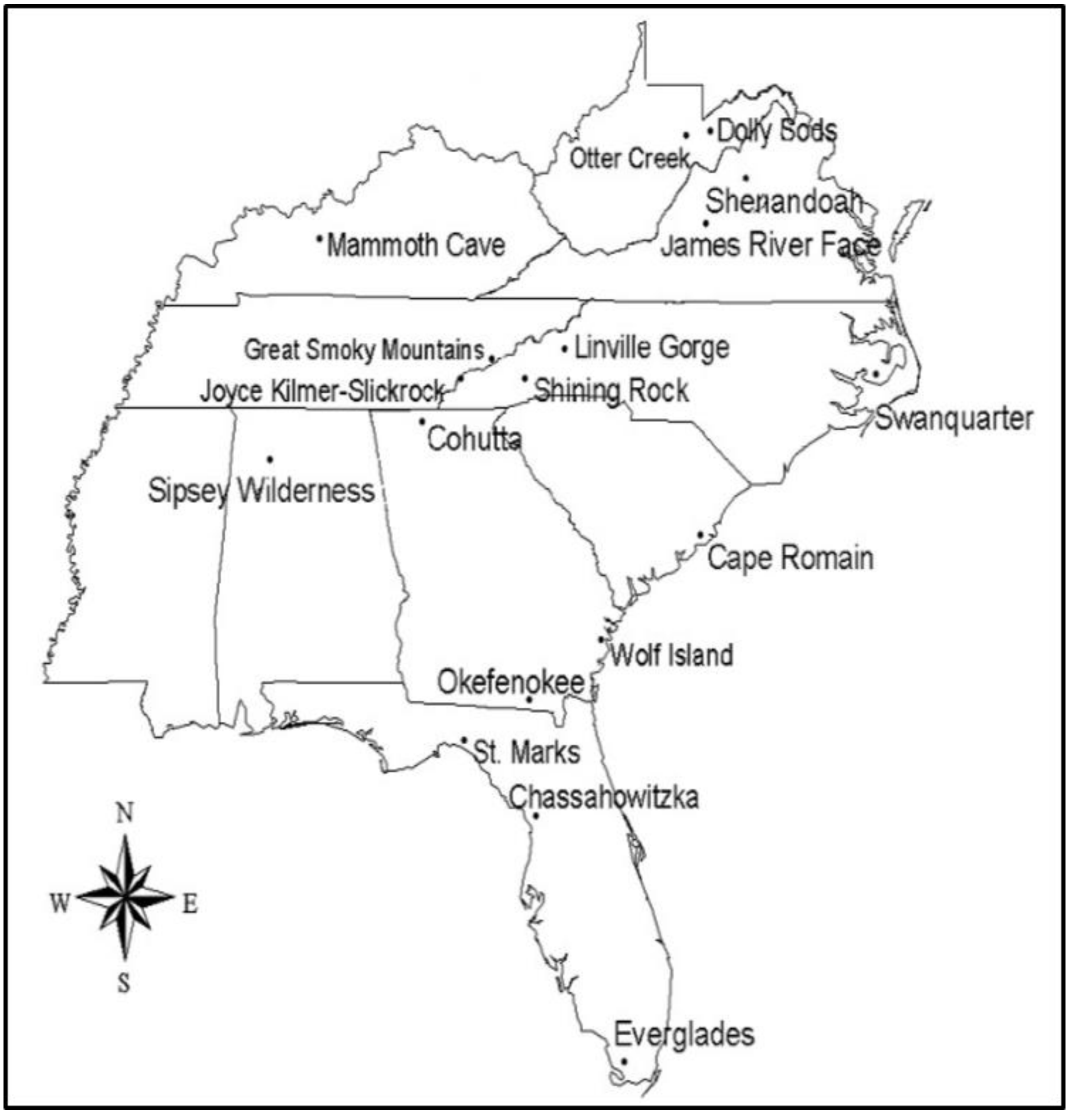


Figure 1-2: Mandatory Federal Class I Areas in the VISTAS Region

Table 1-1: Mandatory Federal Class I Areas in the VISTAS Region

State	Area Name	Acreage	Federal Land Manager
Alabama	Sipsey Wilderness Area	12,646	USDA-FS
Florida	Chassahowitzka Wilderness Area	23,360	USDI-FWS
Florida	Everglades National Park	1,397,429	USDI-NPS
Florida	St. Marks Wilderness Area	17,745	USDI-FWS
Georgia	Cohutta Wilderness Area	33,776	USDA-FS
Georgia	Okefenokee Wilderness Area	343,850	USDI-FWS
Georgia	Wolf Island Wilderness Area	5,126	USDI-FWS
Kentucky	Mammoth Cave National Park	51,303	USDI-NPS
North Carolina	Great Smoky Mountains National Park	273,551	USDI-NPS
North Carolina	Joyce Kilmer-Slickrock Wilderness Area	10,201	USDA-FS
North Carolina	Linville Gorge Wilderness Area	7,575	USDA-FS
North Carolina	Shining Rock Wilderness Area	13,350	USDA-FS
North Carolina	Swanquarter Wilderness Area	9,000	USDI-FWS
South Carolina	Cape Romain Wilderness Area	28,000	USDI-FWS
Tennessee	Great Smoky Mountains National Park	241,207	USDI-NPS
Tennessee	Joyce Kilmer-Slickrock Wilderness Area	3,832	USDA-FS
Virginia	James River Face Wilderness Area	8,703	USDA-FS
Virginia	Shenandoah National Park	190,535	USDI-NPS
West Virginia	Dolly Sods Wilderness Area	10,215	USDA-FS
West Virginia	Otter Creek Wilderness Area	20,000	USDA-FS

1.6. State and FLM Coordination

As required by CAA section 169A(d) and 40 CFR 51.308(i), states must coordinate with the FLMs during the regional haze SIP development process. 40 CFR 51.308(i)(2) requires states to provide opportunity for consultation with FLMs early in the SIP development process. Mississippi's consultation with the FLMs for the second implementation period is discussed in Section 10. The three FLMs are the United States Department of Interior (USDI) Fish and Wildlife Service (FWS), the National Park Service (NPS), and the United States Department of Agriculture (USDA) Forest Service (FS).

40 CFR 51.308(i)(3) requires the state to describe how it has addressed any comments provided by FLMs. MDEQ received comments from the National Park Service and Forest Service on Mississippi's draft Regional Haze Plan. MDEQ's consultation with the FLMs is described in Section 10 and Appendices F-3o and G.

40 CFR 51.308(i)(4) requires that the regional haze SIP include procedures for continuing consultation between the states and FLMs on the implementation of the visibility protection program. Continuing consultation should encompass development and review of periodic implementation plan revisions and five-year progress reports as well as the implementation of other programs having the potential to contribute to impairment of visibility in any Class I area within the state.

Coordination with the FLMs of Mississippi's continuing obligations to periodically revise its regional haze SIP is also discussed in Section 11. MDEQ formally commits to follow the FLM consultation procedures as prescribed in 40 CFR 51.308(i) in making these future implementation plan reviews and revisions. Pursuant to 40 CFR 51.308(i)(4), MDEQ will meet with the FLMs upon their request related to any regional haze issues.

Mississippi commits to ongoing consultation with the FLMs, will follow the consultation requirements in 40 CFR 51.308(i)(3) on any plan revision or progress report, and will engage with the FLMs upon request on any matters related to regional haze affected by Mississippi sources. Coordination with the FLMs regarding Mississippi's continuing obligations to periodically revise its regional haze SIP is also discussed in Section 10.

As required by 40 CFR 51.308(f)(2)(ii), states must also consult with those states that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory federal Class I area. Although Mississippi does not have a Class I area, Mississippi has participated in consultations with other states regarding their Class I area(s), which is further discussed in Section 10.

1.7. Cross-Reference to Regional Haze Regulatory Requirements

Table 1-2 identifies each section of the SIP that addresses regional haze rule requirements specified in 40 CFR 51.308(f), (g), and (i) for this second planning period.

Table 1-2: Cross-Reference of Sections in the SIP to Regional Haze Rule Requirements Specified in 40 CFR 51.308(f) and (g)

Rule Section	Chapter/Section in SIP	Description
(f)	11	Requirements for periodic comprehensive revisions of implementation plans for regional haze
(f)(1)	2.1, **Error! Reference source not found.**, 2.2, 2.3, 0, 3	Calculations of baseline, current, and natural visibility conditions; progress to date; and the uniform rate of progress
(f)(1)(i)	2.3	Baseline visibility conditions for the most impaired and clearest days
(f)(1)(ii)	2.2	Natural visibility conditions for the most impaired and clearest days
(f)(1)(iii)	0	Current visibility conditions for the most impaired and clearest days
(f)(1)(iv)	0	Progress to date for the most impaired and clearest days
(f)(1)(v)	0	Differences between current visibility condition and natural visibility condition
(f)(1)(vi)(A)	3	Uniform rate of progress
(f)(1)(vi)(B)	not applicable	Any adjustments to rate of progress
(f)(2)	7	Long-term strategy for regional haze
(f)(2)(i)	7	Emission reduction measures that are necessary to make reasonable progress
(f)(2)(ii)	10	Consult with those states that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory federal Class I area
(f)(2)(ii)(A)	10	Demonstrate that it has included in its implementation plan all measures agreed to during state-to-state consultations

Rule Section	Chapter/Section in SIP	Description
(f)(2)(ii)(B)	10	Consider the emission reduction measures identified by other states for their sources
(f)(2)(ii)(C)	10	In any situation in which a state cannot agree with another state on the emission reduction measures necessary to make reasonable progress in a mandatory federal Class I area, the state must describe the actions taken to resolve the disagreement
(f)(2)(iii)	2, 4, 5, 6, 7.2, 7.7, 7.8, 9, 10	Document the technical basis, including modeling, monitoring, cost, engineering, and emissions information, on which the state is relying to determine the emission reduction measures that are necessary to make reasonable progress in each mandatory federal Class I area
(f)(2)(vi)(A)	7.2	Emission reductions due to ongoing air pollution control programs, including measures to address reasonably attributable visibility impairment
(f)(2)(vi)(B)	7.9.1	Measures to mitigate the impacts of construction activities
(f)(2)(vi)(C)	7.2.2	Source retirement and replacement schedules
(f)(2)(vi)(D)	7.2.3, 7.9.1	Basic smoke management practices for prescribed fire used for agricultural and wildland vegetation management purposes and smoke management programs
(f)(2)(vi)(E)	8	The anticipated net effect on visibility due to projected changes in point, area, and mobile source emissions over the period addressed by the long-term strategy
(f)(3)(i)	8	Reasonable progress goals – The state must establish reasonable progress goals (expressed in dv) that reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period as a result of those enforceable emissions limitations, compliance schedules, and other measures.
(f)(3)(ii)(A)	not applicable	If a state in which a mandatory federal Class I area is located establishes a reasonable progress goal for the most impaired days that provides for a slower rate of improvement in visibility than the uniform rate of progress calculated under paragraph (f)(1)(vi) of this section, the state must demonstrate, based on the analysis required by paragraph (f)(2)(i) of this section, that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the state that may reasonably be anticipated to contribute to visibility impairment in the Class I area that would be reasonable to include in the long-term strategy
(f)(3)(ii)(B)	7	If a state contains sources which are reasonably anticipated to contribute to visibility impairment in a mandatory federal Class I area in another state for which a demonstration by the other State is required under (f)(3)(ii)(A), the state must demonstrate that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the state that may reasonably be anticipated to contribute to visibility impairment in the Class I area that would be reasonable to include in its own long-term strategy. The state must provide a robust demonstration, including documenting the criteria used to determine which sources or groups or sources were evaluated and how the four factors required by paragraph (f)(2)(i) were taken into consideration in selecting the measures for inclusion in its long-term strategy.
(f)(4)	not applicable	If the Administrator, Regional Administrator, or the affected Federal Land Manager has advised a state of a need for additional monitoring to assess reasonably attributable visibility impairment at the mandatory federal Class I area in addition to the monitoring currently being conducted, the state must include in the plan revision an appropriate strategy for evaluating reasonably attributable visibility impairment in the mandatory federal Class I area by visual observation or other appropriate monitoring techniques.

Rule Section	Chapter/Section in SIP	Description
(f)(5)	13.5	An assessment of any significant changes in anthropogenic emissions within or outside of the state that have occurred since the period addressed in the most recent plan required under paragraph (f) of this section including whether or not these changes in anthropogenic emissions were anticipated in that most recent plan and whether they have limited or impeded progress in reducing pollutant emissions and improving visibility.
(f)(6)	9	Monitoring strategy and other implementation plan requirements – States must submit with the implementation plan a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment that is representative of all mandatory federal Class I areas within the state. Compliance with this requirement may be met through participation in the Interagency Monitoring of Protected Visual Environments network.
(f)(6)(i)	not applicable	The establishment of any additional monitoring sites or equipment needed to assess whether reasonable progress goals
(f)(6)(ii)	9	Procedures by which monitoring data and other information are used in determining the contribution of emissions from within the state
(f)(6)(iii)	9	For a state with no mandatory Class I federal areas, procedures by which monitoring data and other information are used to in determining the contribution of emissions from within the state to regional haze visibility impairment at mandatory Class I federal areas in other states.
(f)(6)(iv)	9	The implementation plan must provide for the reporting of all visibility monitoring data to the Administrator at least annually for each mandatory federal Class I area in the state.
(f)(6)(v)	4, 7.2.4	A statewide inventory of emissions of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory federal Class I area
(f)(6)(vi)	9	Other elements, including reporting, recordkeeping, and other measures, necessary to assess and report on visibility.
(g)(1)	13.3	Periodic progress reports must contain at a minimum the following elements: (1) A description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for mandatory federal Class I areas both within and outside the state.
(g)(2)	13.5	(2) A summary of the emissions reductions achieved throughout the state through implementation of the measures described in paragraph (g)(1) of this section.
(i)	10.3	State and federal land manager coordination.

2. Natural Background Conditions and Assessment of Baseline, Modeling Base Period, and Current Conditions

The goal of the regional haze rule is to restore natural visibility conditions to the 156 Class I areas identified in the 1977 Clean Air Act Amendments. 40 CFR 51.301 contains the following definitions:

> *Natural conditions* reflect naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration, and may refer to the conditions on a single day or set of days. These phenomena include, but are not limited to, humidity, fire events, dust storms, volcanic activity, and biogenic emissions from soils and trees. These phenomena may be near or far from a Class I area and may be outside the United States.
>
> *Natural visibility* means visibility (contrast, coloration, and texture) on a day or days that would have existed under natural conditions. Natural visibility varies with time and location, is estimated or inferred rather than directly measured, and may have long-term trends due to long-term trends in natural conditions.
>
> *Natural visibility condition* means the average of individual values of daily natural visibility unique to each Class I area for either the most impaired days or the clearest days.

The regional haze SIPs must contain measures that make "reasonable progress" toward achieving natural visibility conditions by reducing anthropogenic, i.e., manmade emissions that cause haze.

An easily understood measure of visibility to most people is visual range. Visual range is the greatest distance, in kilometers or miles, at which a dark object can be viewed against the sky. For evaluating the relative contributions of pollutants to visibility impairment, however, the most useful measure of visibility impairment is light extinction, which affects the clarity and color of objects being viewed.

The measure used by the regional haze rule is the deciview index, as required by 40 CFR 51.301. Deciviews are calculated directly from light extinction using the following logarithmic equation:

$$dv = 10 * \ln\left(\frac{b_{ext}}{10 * Mm^{-1}}\right)$$

In this equation, the atmospheric light extinction coefficient, b_{ext}, is expressed in units of inverse megameters (Mm^{-1}).[4] The dv units are useful for tracking progress in improving visibility because each dv change is an equal incremental change in visibility perceived by the human eye. Most people can detect a change in visibility at one dv.

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

- natural conditions,
- baseline conditions, and
- current conditions.

Each of the three metrics includes the concentration data of the visibility impairing pollutants as different terms in the IMPROVE light extinction algorithm, with respective extinction coefficients and relative humidity factors. Total light extinction when converted to dv is calculated for the average of the 20% clearest and 20% most impaired days. The terminology for these two sets of days changed for the second round of regional haze planning owing to a focus on anthropogenically-induced visibility impairment.[5]

"Natural" visibility is determined by estimating the natural concentrations of visibility pollutants and then calculating total light extinction. "Baseline" visibility is the starting point for the improvement of visibility conditions. Baseline visibility is calculated from the average of the IMPROVE monitoring data for 2000 through 2004. The comparison of initial baseline conditions from 2000-2004 to natural visibility conditions indicates the amount of improvement necessary to attain natural visibility by 2064. Each state must estimate natural visibility levels for Class I areas within its borders in consultation with FLMs and other states as required by 40 CFR 51.308(f)(1).

Another important set of visibility monitoring data is the base period used for air quality modeling projections, in this case monitoring data from years 2009 through 2013. These monitoring data are used in conjunction with inventory and meteorological data to project expected visibility parameters for each Class I area, as described in Section 5, Section 6, and Section 7.2.6.2.

[4] Colorado State University, "The IMPROVE Algorithm." URL: http://vista.cira.colostate.edu/Improve/haze-metrics-converter/

[5] EPA, "Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program", December 2018. URL: https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf

"Current conditions" are assessed every five years as part of the regional haze planning process where actual progress in reducing visibility impairment is compared to the reductions delineated in the SIP. The five-year period comprising current conditions in the VISTAS regional haze SIPs is 2014-2018, inclusive.

Mississippi has no Class I area and, therefore, is not required to address 40 CFR 51.308(f)(1) regarding the calculation of baseline, current, and natural visibility conditions; progress to date; and the uniform rate of progress. However, MDEQ has included Section 2.0 to support decisions regarding long-term strategies for Mississippi sources potentially impacting visibility conditions and the rate of progress in Class I areas outside the state.

2.1. IMPROVE Algorithm

The IMPROVE algorithm for estimating light extinction was adopted by EPA as the basis for the regional haze metric used to track progress in reducing haze levels and estimates light extinction, which is then converted to the dv haze index.

The IMPROVE equation accounts for the effect of particle size distribution on light extinction efficiency of sulfate, nitrate, and organic carbon; the equation also accounts for light extinction by sea salt and light absorption by gaseous nitrogen dioxide. Site-specific values are used for Rayleigh scattering to account for the site-specific effects of elevation and temperature. Separate relative humidity enhancement factors are used for small and large size distributions of ammonium sulfate and ammonium nitrate and for sea salt. A complete description of the terms in the IMPROVE equation is given on the IMPROVE website.[6]

The algorithm has been revised over the years to produce consistent estimates of light extinction for all remote-area IMPROVE aerosol monitoring sites. It permits the individual particle component contributions to light extinction to be separate estimates. The current IMPROVE equation includes contributions from sea salt and an increase in the multiplier for contributions from POM as compared to the previous IMPROVE algorithm.

In the IMPROVE algorithm, as described in the equation below, light extinction (b_{ext}) and Rayleigh scattering are described in units of Mm^{-1}. Dry mass extinction efficiency terms are in units of meter squared per gram (m^2g^{-1}). Water growth terms, *f(RH)*, are unitless. The total sulfate, nitrate, and organic compound concentrations are each split into two fractions, representing small and large size distributions of those components. For masses less than 20 $\mu g/m^3$, the fraction in the large mode is estimated by dividing the total concentration of the component by 20 $\mu g/m^3$. If the total concentration of a component exceeds 20 $\mu g/m^3$, all is assumed to be in the large mode. The small and large modes of sulfate and nitrate have relative

[6] Colorado State University, "The IMPROVE Algorithm", URL: http://vista.cira.colostate.edu/Improve/the-improve-algorithm/.

humidity correction factors, $f_S(RH)$ and $f_L(RH)$, applied since these species are hygroscopic (i.e., absorb water), and their extinction efficiencies change with relative humidity.

$$b_{ext} \approx 2.2 \times f_S(RH) \times [Small\ Ammonium\ Sulfate] + 4.8 \times f_L(RH) \times [Large\ Ammonium\ Sulfate] + 2.4 \times f_S(RH) \times [Small\ Ammonium\ Nitrate] + 5.1 \times f_L(RH) \times [Large\ Ammonium\ Nitrate] + 2.8 \times [Small\ Organic\ Mass] + 6.1 \times [Large\ Organic\ Mass] + 10 \times [Elemental\ Carbon] + 1 \times [Final\ Soil] + 1.7 \times f_{SS}(RH) \times [Sea\ Salt] + 0.6 \times [Coarse\ Mass] + Rayleigh\ Scattering(Site\ Specific) + 0.33 \times [NO_2(ppb)]$$

More information on the IMPROVE algorithm may be found in Appendix E-1a and Appendix E-1b.

Table 2-1 provides the VISTAS Class I areas and their associated monitoring site identification numbers. In certain instances, a Class I area may not have a monitoring site located within its boundaries. Such sites rely on data from nearby monitoring sites to act as surrogates within the analyses described in this SIP revision. For Class I areas in the Southeastern U.S., Joyce Kilmer-Slickrock Wilderness Area relies upon data from the Great Smoky Mountains National Park IMPROVE monitoring site (GRSM1), Otter Creek Wilderness Area relies on data from the Dolly Sods Wilderness Area IMPROVE monitoring site (DOSO1), and Wolf Island Wilderness Area relies on data from the Okefenokee Wilderness Area IMPROVE monitoring site (OKEF1). For the analyses described within this document, site-specific data such as elevation and location are used for these areas in combination with the monitoring data from the surrogate IMPROVE site.

Table 2-1 provides the IMPROVE site identification number for the surrogate monitor in these situations.

Table 2-1: VISTAS Class I Areas and IMPROVE Site Identification Numbers

Class I Area	IMPROVE Site Identification Number
Cape Romain Wilderness Area	ROMA1
Chassahowitzka Wilderness Area	CHAS1
Cohutta Wilderness Area	COHU1
Dolly Sods Wilderness Area	DOSO1
Everglades National Park	EVER1
Great Smoky Mountains National Park	GRSM1
James River Face Wilderness Area	JARI1
Joyce Kilmer-Slickrock Wilderness Area	GRSM1
Linville Gorge Wilderness Area	LIGO1
Mammoth Cave National Park	MACA1
Okefenokee Wilderness Area	OKEF1
Otter Creek Wilderness Area	DOSO1
Shenandoah National Park	SHEN1
Shining Rock Wilderness Area	SHRO1
Sipsey Wilderness Area	SIPS1
St. Marks Wilderness Area	SAMA1
Swanquarter Wilderness Area	SWAN1
Wolf Island Wilderness Area	OKEF1

2.2. Estimating Natural Conditions for VISTAS Class I Areas

Natural background visibility, as defined in Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program, EPA-454/B-03-005, September 2003,[7] is based on annual average concentrations of fine particle components. There are two separate methodologies to compute natural conditions: one methodology for the 20% clearest days and one for the 20% most impaired days. In the first round of regional haze planning as well as the first mid-course review, these days were referred to as the 20% best and 20% worst days, respectively. These terms were updated to "clearest" and "most impaired" as part of two recent actions by EPA: a rule amending requirements for state plans finalized in January 2017,[8] and EPA guidance that updates recommended methodologies for tracking visibility impairment, issued in December 2018.[9] Also, as part of EPA's 2018 guidance, the recommended methodology for computing natural conditions for the 20% most impaired days changed, while no change was made for the 20% clearest days.

Natural background conditions using the current IMPROVE equation are calculated separately for each Class I area, and the methodology for calculating background conditions for the 20% most impaired days and the 20% clearest days are discussed in the preceding sections. Broadly

[7] URL: https://www3.epa.gov/ttnamti1/files/ambient/visible/tracking.pdf
[8] Final Rule: Protection of Visibility: Amendments to Requirements for State Plans, 82 FR 3078, January 10, 2017.
[9] EPA, "Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program", December 2018. URL: https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf

speaking, however, the new calculation of natural background allows Rayleigh scattering to vary with elevation. Secondly, natural conditions are adjusted (as with the 20% most impaired days) to reflect impacts of natural events heretofore unrecognized in the computation of visibility under natural background conditions.

2.2.1. Natural Background Conditions on 20% Clearest Days

EPA's 2018 guidance memo notes that days with the lowest 20% annual values of the daily haze index are used to represent the clearest days and are not selected based on the lowest anthropogenic impairment. The requirements of the regional haze rule for 20% clearest days are to ensure that no degradation from the baseline (2000-2004) occurs and do not rely on a comparison to the estimated natural background conditions on the 20% clearest days.

2.2.2. Natural Background Conditions on 20% Most Impaired Days

The methodology for computing natural background values for the 20% most impaired days separates observed visibility impairment into natural and anthropogenic contributions. The days with the highest anthropogenic visibility impairment contribution are what now comprise the 20% most impaired days, as opposed to the entirety of the visibility impairment portfolio that comprised the 20% haziest days previously. The reason for this change was to separate visibility impairment associated with significant natural events such as wildfires and dust storms, over which states have no control, from visibility impairment associated with anthropogenic emissions sources, which states may control. Further, the EPA notes that visibility conditions have never been measured without any anthropogenic impairment whatsoever, and so such conditions must be estimated.

Within these 20% most impaired days at a given Class I site, the natural visibility impairment for each day measured at said Class I site from 2000 to 2014, inclusive, are aggregated. That average value then becomes the natural background endpoint for the 20% most impaired days at the given Class I site. The 2018 EPA guidance (p. 15) notes that these new natural background visibility values are "consistently" lower than the prior natural values for 20% haziest days. The natural background conditions computed and utilized by VISTAS for the 20% most impaired days at Class I sites follow the 2018 EPA guidance without exception.

2.2.3. Summary of Natural Background Conditions for VISTAS Class I Areas

Table 2-2 provides a summary of the natural background conditions for VISTAS Class I areas.

Table 2-2: Average Natural Background Conditions for VISTAS Class I Areas

Class I Areas	Average for 20% Most Impaired Days*	Average for 20% Clearest Days*
Cape Romain Wilderness Area	9.79 dv	5.93 dv
Chassahowitzka Wilderness Area	9.03 dv	6.00 dv
Cohutta Wilderness Area	9.88 dv	4.42 dv
Dolly Sods Wilderness Area	8.92 dv	3.64 dv
Everglades National Park	8.33 dv	5.22 dv
Great Smoky Mountains National Park	10.05 dv	4.62 dv
James River Face Wilderness Area	9.47 dv	4.39 dv
Joyce Kilmer-Slickrock Wilderness Area	10.05 dv	4.62 dv
Linville Gorge Wilderness Area	9.70 dv	4.07 dv
Mammoth Cave National Park	9.80 dv	5.00 dv
Okefenokee Wilderness Area	9.45 dv	5.43 dv
Otter Creek Wilderness Area	8.92 dv	3.64 dv
Shenandoah National Park	9.52 dv	3.15 dv
Shining Rock Wilderness Area	10.25 dv	2.49 dv
Sipsey Wilderness Area	9.62 dv	5.03 dv
St. Marks Wilderness Area	9.13 dv	5.37 dv
Swanquarter Wilderness Area	10.01 dv	5.71 dv
Wolf Island Wilderness Area	9.45 dv	5.43 dv

* Data taken from Table 1 in the EPA memorandum with subject: Technical addendum including updated visibility data through 2018 for the memo titled, "Recommendation for the use of Patched and Substituted Data and Clarification of Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program."[10]

2.3. Baseline Conditions

Under 40 CFR 51.308(f)(1)(i), states with Class I areas must calculate the baseline visibility conditions for the most impaired days and the clearest days using available monitoring data with the period for establishing baseline visibility conditions as 2000 to 2004. Mississippi has no Class I areas and thus, is not required to address 40 CFR 51.308(f)(1)(i). Baseline visibility conditions at each VISTAS Class I area are estimated either using sampling data collected at IMPROVE monitoring sites or, in some cases, data records were filled using data substitution procedures. A five-year average (2000 to 2004) was calculated for the 20% clearest days as well as the 20% most impaired days at each Class I site in accordance with 40 CFR 51.308(f)(1); Guidance for Tracking Progress Under the Regional Haze Rule, EPA-454-03-004, September 2003; and the 2018 EPA guidance.

[10] URL: https://www.epa.gov/sites/production/files/2020-06/documents/memo_data_for_regional_haze_technical_addendum.pdf

2.3.1. Baseline Conditions for 20% Clearest and 20% Most Impaired Days for VISTAS Class I Areas

Table 2-3 provides a summary of the baseline conditions (2000-2004) for the 20% clearest and 20% most impaired days at VISTAS Class I areas. The baseline dv index values for the 20% most impaired and 20% clearest days at these Class I areas are based on data included in Table 1 in the EPA memorandum with subject: Technical addendum including updated visibility data through 2018 for the memo titled, "Recommendation for the use of Patched and Substituted Data and Clarification of Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program."[11]

Table 2-3: Baseline Visibility Conditions for VISTAS Class I Areas (2000-2004)

Class I Areas	Average for 20% Most Impaired Days	Average for 20% Clearest Days
Cape Romain Wilderness Area	25.25 dv	14.29 dv
Chassahowitzka Wilderness Area	24.52 dv	15.60 dv
Cohutta Wilderness Area	29.12 dv	13.73 dv
Dolly Sods Wilderness Area	28.29 dv	12.28 dv
Everglades National Park	19.52 dv	11.69 dv
Great Smoky Mountains National Park	29.11 dv	13.58 dv
James River Face Wilderness Area	28.08 dv	14.21 dv
Joyce Kilmer-Slickrock Wilderness Area	29.11 dv	13.58 dv
Linville Gorge Wilderness Area	28.05 dv	11.11 dv
Mammoth Cave National Park	29.83 dv	16.51 dv
Okefenokee Wilderness Area	25.34 dv	15.23 dv
Otter Creek Wilderness Area	28.29 dv	12.28 dv
Shenandoah National Park	28.32 dv	10.93 dv
Shining Rock Wilderness Area	28.13 dv	7.70 dv
Sipsey Wilderness Area	27.69 dv	15.57 dv
St. Marks Wilderness Area	24.68 dv	14.34 dv
Swanquarter Wilderness Area	23.79 dv	12.34 dv
Wolf Island Wilderness Area	25.34 dv	15.23 dv

2.3.2. Pollutant Contributions to Visibility Impairment (2000-2004 Baseline Data)

Figure 2-1 displays the average light extinction for the 20% most impaired days during the baseline period (2000-2004) for each VISTAS Class I area and for nearby Class I areas. Figure 2-2 displays the average light extinction for the 20% clearest during the baseline period (2000-2004) for each VISTAS Class I area and for nearby Class I areas. Similar plots for each of the VISTAS Class I areas can be found in Appendix C-2. During the baseline period, the peak visibility impairment days occur in the summer under stagnant weather conditions with high relative humidity, high temperatures, and low wind speeds. The 20% most impaired visibility days at the Southern Appalachian sites during the baseline period generally occurred in the period April to September, with sulfate being the largest component. The 20% clearest days at

[11] URL: https://www.epa.gov/sites/production/files/2020-06/documents/memo_data_for_regional_haze_technical_addendum.pdf

the Southern Appalachian sites can occur at any time of year. At St. Marks and other coastal sites, the 20% most impaired and clearest visibility days are distributed throughout the year.

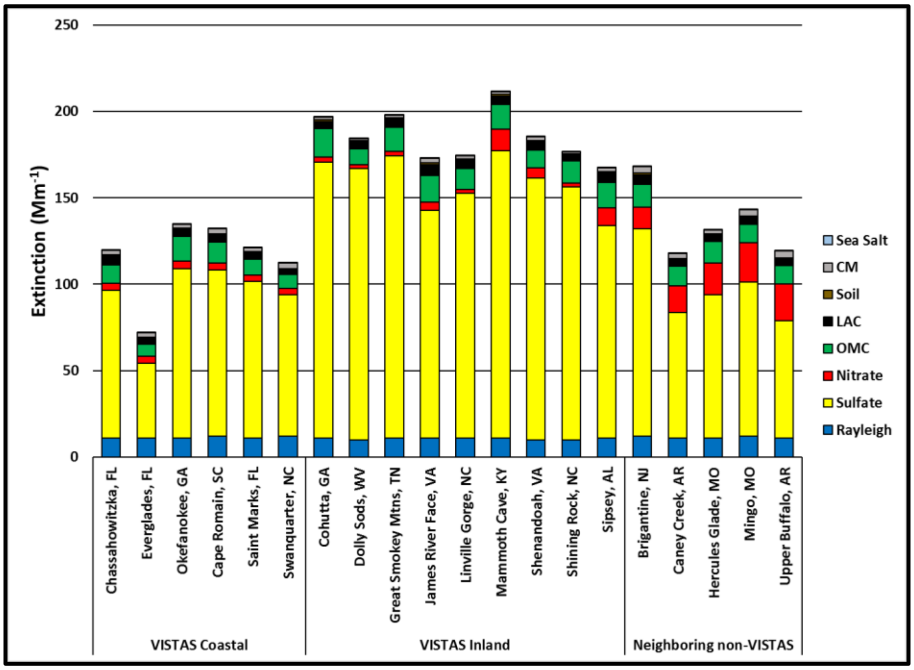


Figure 2-1: Average Light Extinction, 20% Most Impaired Days, 2000-2004, VISTAS and Neighboring Class I Areas

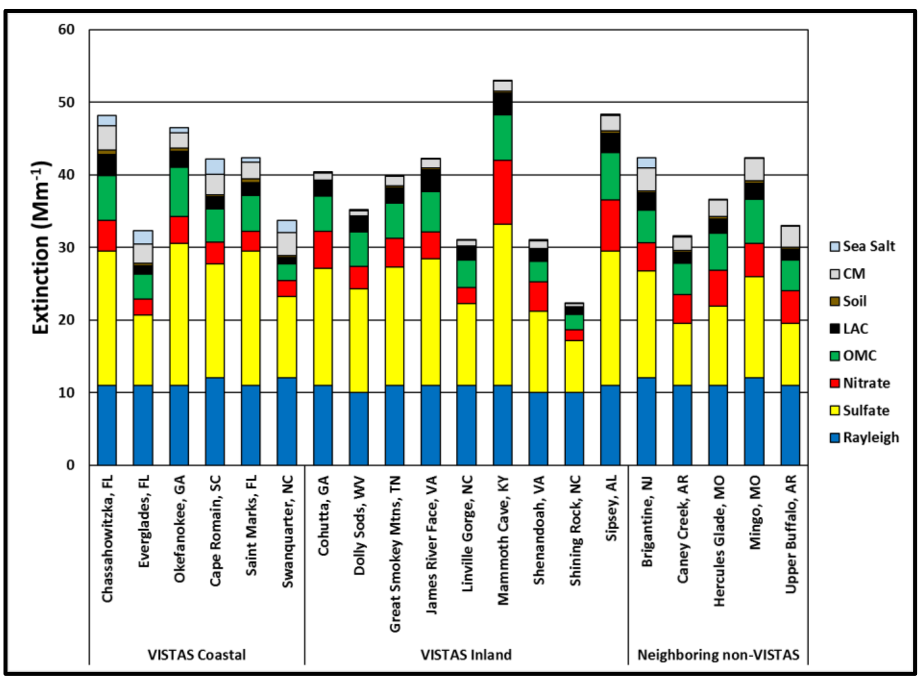


Figure 2-2: Average Light Extinction, 20% Clearest Days, 2000-2004, VISTAS and Neighboring Class I Areas

These bar charts (Figure 2-1 and Figure 2-2) are based on the IMPROVE data file called sia_impairment_daily_budgets_10_18.zip and therefore have not been updated with the patching and substitution algorithms described in EPA's June 3, 2020, guidance memorandum entitled, "Recommendation for the Use of Patched and Substituted Data and Clarification of Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program."[12] Changes to the daily data from the application of these routines is expected to be slight and will not change the conclusions of this SIP.

Ammonium sulfate, $(NH_4)_2SO_4$, is the most important contributor to visibility impairment and fine particle mass on the 20% most impaired and 20% clearest visibility days at all the VISTAS Class I areas during the baseline period. During this period, sulfate levels on the 20% most impaired days accounted for 75% to 90% of anthropogenically-driven visibility impairment. Sulfate particles are formed in the atmosphere from SO_2 emissions. Sulfate particles occur as hydrogen sulfate, H_2SO_4; ammonium bisulfate, HNH_4SO_4; and ammonium sulfate, $(NH_4)_2SO_4$, depending on the availability of ammonia, NH_3, in the atmosphere.

Across the VISTAS region, sulfate levels are higher at the Southern Appalachian sites than at the coastal sites (Figure 2-1). On the 20% clearest days, sulfate levels are more uniform across the region (Figure 2-2). [Note that in these two figures, levels at Great Smoky Mountains National Park should be considered to be representative of levels at Joyce Kilmer-Slickrock Wilderness, levels at Okefenokee Wilderness should be considered representative of Wolf Island Wilderness, and levels at Dolly Sods Wilderness should be considered representative of levels at Otter Creek Wilderness.]

The best average visibility and lowest sulfate values on the clearest days occurred at Shining Rock. Shining Rock, at 1621 meters elevation, is likely influenced on the clearest days by regional transport of air masses above the boundary layer.

Particulate Organic Matter (POM) is shown as organic matter carbon (OMC) in the figures. POM is the second most important contributor to fine particle mass and light extinction on the 20% most impaired and the 20% clearest days at the VISTAS Class I areas during the baseline period. Days for which visibility impairment is associated with elevated levels of POM and elemental carbon are associated with natural events such as wildland fires and are largely removed from the 20% most impaired days because they are regarded as natural sources. Significant fire impacts are infrequent at Class I areas nearby to Mississippi. In the fall, winter, and spring, more of the carbon is attributable to wood burning while in the summer months more of the carbon mass is attributable to biogenic emissions from vegetation.

[12] URL: https://www.epa.gov/visibility/memo-and-technical-addendum-ambient-data-usage-and-completeness-regional-haze-program

Ammonium nitrate (NH_4NO_3) is formed in the atmosphere by reaction of ammonia (NH_3) and NO_X. In the VISTAS region, nitrate formation is limited by availability of ammonia and by temperature. Ammonia preferentially reacts with SO_2 and sulfate before reacting with NO_X. Particle nitrate is formed at lower temperatures; at elevated temperatures nitric acid remains in gaseous form. For this reason, particle nitrate levels are very low in the summer and a minor contributor to visibility impairment during the baseline period of 2000-2004. Particle nitrate concentrations are higher on winter days and are more important for the coastal sites where the 20% most impaired days occur during the winter months.

Elemental Carbon (EC) is shown as light absorbing carbon (LAC) in this section's figures. EC is a comparatively minor contributor to visibility impairment in the baseline period. Sources include agriculture, prescribed, wildland, and wildfires and incomplete combustion of fossil fuels. EC levels are higher at urban monitors than at the Class I areas and suggest controls of primary PM at fossil fuel combustion sources would be more effective to reduce $PM_{2.5}$ in urban areas than to improve visibility in Class I areas

Soil fine particles are minor contributors to visibility impairment at most southeastern sites on most days in the baseline period. Occasional episodes of elevated fine soil can be attributed to Saharan dust episodes, particularly at Everglades, Florida, but rarely are seen in other VISTAS Class I areas; these contributions are now largely teased out as natural routine events. Due to its small contribution to anthropogenic visibility impairment in southeastern Class I areas, fine soil control strategies to improve visibility would not be effective.

Sea salt (NaCl) is observed at the coastal sites. During the baseline period, sea salt contributions to visibility impairment are most important on the 20% clearest days when sulfate and POM levels are low. Sea salt levels do not contribute significantly to visibility on the 20% most impaired visibility days. The new IMPROVE equation uses Chloride ion, Cl^-, from routine IMPROVE measurements to calculate sea salt levels. VISTAS used Cl^- to calculate sea salt contributions to visibility following IMPROVE guidance.

Coarse mass (CM) are particles with diameters between 2.5 and 10 microns. This component has a relatively small contribution to visibility impairment because the light extinction efficiency of coarse mass is very low compared to the extinction efficiency for sulfate, nitrate, and carbon.

Rayleigh scattering is the scattering of sunlight off the molecules of the atmosphere and varies with the elevation of the monitoring site. For VISTAS monitoring sites, this value varies from 10 to 12 Mm^{-1}.

2.4. Modeling Base Period (2009-2013)

Visibility projections discussed in Sections 5, 6, and 7.2.6.2 use IMPROVE data from 2009-2013 to estimate future year visibility at Class I areas. For each Class I area, estimated anthropogenic impairment observations from each IMPROVE site for the five-year period surrounding the 2011 modeling base year comprise the data representing the modeling base period. The year 2011 was selected as the modeling base year because the VISTAS 2028 emissions inventory is based on the 2011 Version 6 EPA modeling platform, which at the commencement of the VISTAS second round of planning for regional haze was the most current, complete modeling platform available. For the analyses in this SIP, this period consists of those years surrounding 2011 (i.e., 2009-2013). While not required by the regional haze regulation, examination of these data provides insight into the future year visibility projections for the VISTAS Class I areas.

2.4.1. Modeling Base Period (2009-2013) for 20% Clearest and 20% Most Impaired Days for VISTAS Class I Areas

Table 2-4 provides a summary of the conditions for the 20% clearest and 20% most impaired days at VISTAS Class I areas during 2009-2013, the period used as the modeling basis for this SIP revision's projection analysis described in Sections 5, 6, and 7. The baseline light extinction and dv index values for the 20% most impaired and 20% clearest days at the Class I areas are based on data and calculations included in Appendix E-6 of this SIP (Task 9a, APP_C_SESARM_2028elv5_URP_20200903.xlsx).

Table 2-4: Modeling Base Period (2009-2013) Conditions for VISTAS Class I Areas

Class I Areas	Average for 20% Most Impaired Days	Average for 20% Clearest Days
Cape Romain Wilderness Area	21.48 dv	13.59 dv
Chassahowitzka Wilderness Area	19.96 dv	13.76 dv
Cohutta Wilderness Area	21.19 dv	10.94 dv
Dolly Sods Wilderness Area	21.59 dv	9.03 dv
Everglades National Park	16.30 dv	11.23 dv
Great Smoky Mountains National Park	21.39 dv	10.63 dv
James River Face Wilderness Area	21.37 dv	11.79 dv
Joyce Kilmer-Slickrock Wilderness Area	21.39 dv	10.63 dv
Linville Gorge Wilderness Area	20.39 dv	9.70 dv
Mammoth Cave National Park	24.04 dv	13.69 dv
Okefenokee Wilderness Area	20.70 dv	13.34 dv
Otter Creek Wilderness Area	21.59 dv	9.03 dv
Shenandoah National Park	20.72 dv	8.60 dv
Shining Rock Wilderness Area*	20.39 dv	9.70 dv
Sipsey Wilderness Area	21.67 dv	12.84 dv
St. Marks Wilderness Area	20.11 dv	13.34 dv
Swanquarter Wilderness Area	19.76 dv	11.76 dv
Wolf Island Wilderness Area	20.70 dv	13.34 dv

* The IMPROVE monitoring data at Shining Rock Wilderness Area is missing complete data for 2010 and 2011. After consultation with North Carolina, a three-year average of 2009, 2012, and 2013 IMPROVE data

was used to calculate the visibility (dv) for both the 20% clearest and 20% most impaired days at Shining Rock.

2.4.2. Pollutant Contributions to Visibility Impairment (2009-2013 Modeling Base Period Data)

Figure 2-3 displays the average light extinction for the 20% most impaired days during the modeling base period (2009-2013) for each VISTAS Class I area and for nearby Class I areas. Similar plots for specific VISTAS Class I areas can be found in Appendix C-2. During the modeling base period, the peak visibility impairment days continue to occur in the summer although winter episodes became more prevalent. On nearly all days, sulfate continues to be the dominant visibility impairing pollutant. Nitrate impacts become more significant on some of the 20% most impaired days.

Figure 2-3 shows that for the VISTAS Class I areas, sulfate continues to be the driver for 20% worst visibility days. In all VISTAS Class I areas except Mammoth Cave, organic matter is the second leading cause of visibility impairment on average during 20% most impaired days. In neighboring Class I areas and at Mammoth Cave, nitrate is the second leading cause of visibility impairment on average 20% most impaired days.

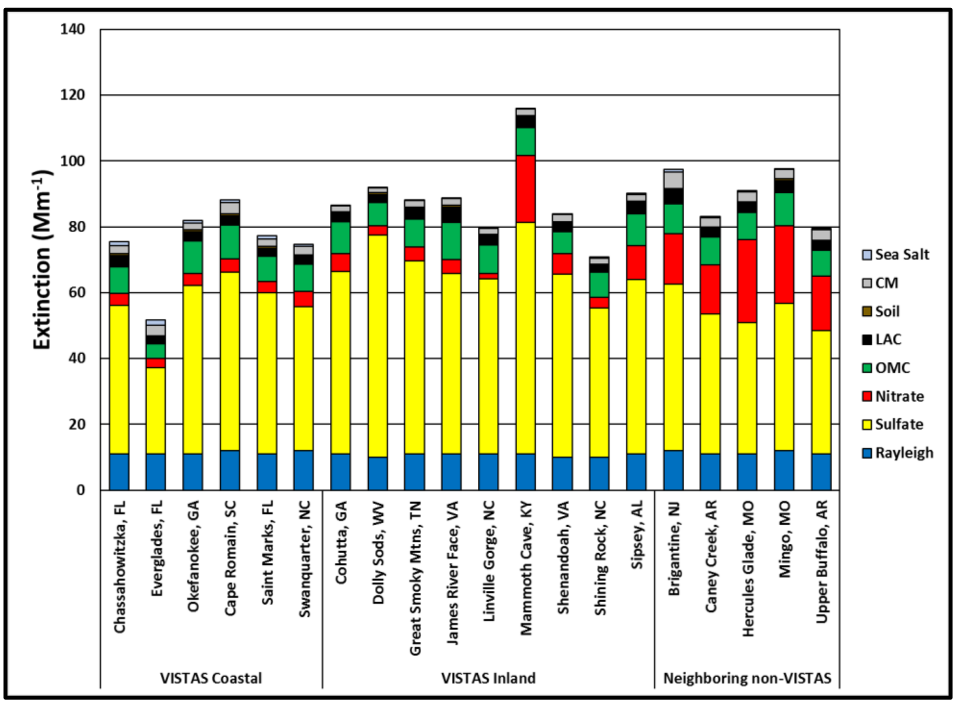


Figure 2-3: Average Light Extinction, 20% Most Impaired Days, 2009-2013, VISTAS and Neighboring Class I Areas

Figure 2-4 displays the average light extinction for the 20% clearest days during the modeling base period (2009-2013) for each VISTAS Class I area and for nearby Class I areas. On the 20% clearest days, sulfate continues to be the main component of visibility impairing pollution for

VISTAS and nearby Class I areas. Comparison to Figure 2-3 shows that no degradation of visibility occurs between the 2000-2004 and 2009-2013 data sets, and in most cases improvement on 20% clearest days occurs.

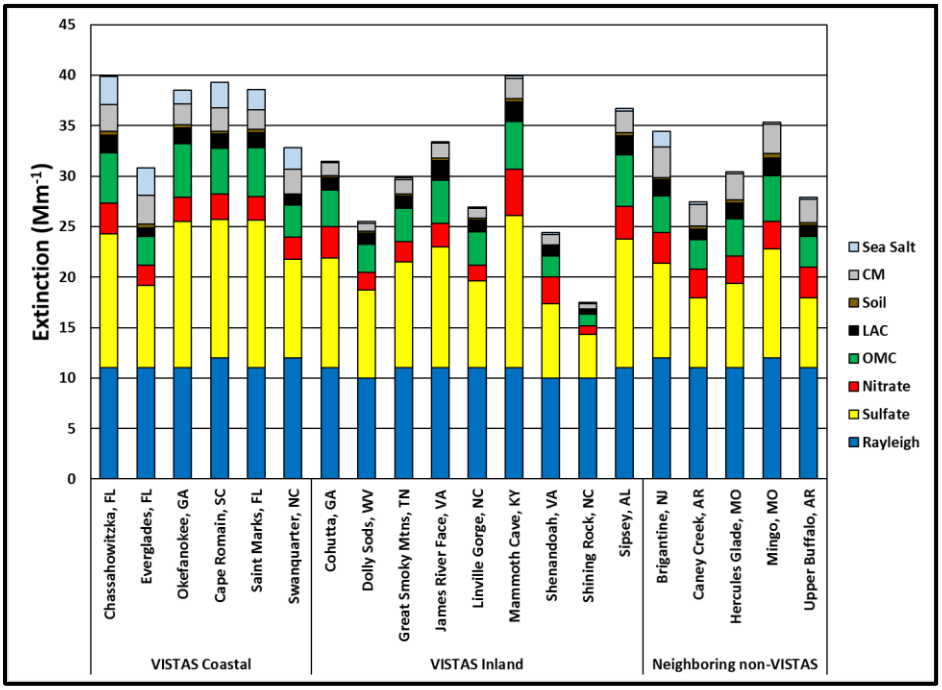


Figure 2-4: Average Light Extinction, 20% Clearest Days, 2009-2013, VISTAS and Neighboring Class I Areas

These bar charts (Figure 2-3 and Figure 2-4) are based on the IMPROVE data file called sia_impairment_daily_budgets_10_18.zip and therefore have not been updated with the patching and substitution algorithms described in EPA's 2020 guidance memo. Changes to the daily data from the application of these routines is expected to be slight and will not change the conclusions of this SIP.

2.5. Current Conditions

The current visibility estimates are comprised of measurements from the five-year period between 2014 and 2018, inclusive.

2.5.1. Current Conditions (2014-2018) for 20% Clearest and 20% Most Impaired Days for VISTAS Class I Areas

Table 2-5 provides a summary of the current conditions (2014-2018) for the 20% clearest and 20% most impaired days at VISTAS Class I areas. These data reflect values included in Table 1 on the EPA memorandum with subject: Technical addendum including updated visibility data through 2018 for the memo titled, "Recommendation for the use of Patched and Substituted Data and Clarification of Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program."[13]

Table 2-5: Current Conditions (2014-2018) for VISTAS Class I Areas

Class I Areas	Average for 20% Most Impaired Days	Average for 20% Clearest Days
Cape Romain Wilderness Area	17.67 dv	11.80 dv
Chassahowitzka Wilderness Area	17.41 dv	12.41 dv
Cohutta Wilderness Area	17.37 dv	8.10 dv
Dolly Sods Wilderness Area	17.65 dv	6.68 dv
Everglades National Park	14.90 dv	10.37 dv
Great Smoky Mountains National Park	17.21 dv	8.35 dv
James River Face Wilderness Area	17.89 dv	9.47 dv
Joyce Kilmer-Slickrock Wilderness Area	17.21 dv	8.35 dv
Linville Gorge Wilderness Area	16.42 dv	7.61 dv
Mammoth Cave National Park	21.02 dv	11.31 dv
Okefenokee Wilderness Area	17.39 dv	11.57 dv
Otter Creek Wilderness Area	17.65 dv	6.68 dv
Shenandoah National Park	17.07 dv	6.85 dv
Shining Rock Wilderness Area*	15.49 dv	4.40 dv
Sipsey Wilderness Area	19.03 dv	10.76 dv
St. Marks Wilderness Area	17.39 dv	11.15 dv
Swanquarter Wilderness Area	16.30 dv	10.61 dv
Wolf Island Wilderness Area	17.39 dv	11.57 dv

* The IMPROVE monitoring data at Shining Rock Wilderness Area is missing complete data for 2010 and 2011. After consultation with North Carolina, a three-year average of 2009, 2012, and 2013 IMPROVE data was used to calculate the visibility (dv) for both the 20% clearest and 20% most impaired days at Shining Rock.

2.5.2. Pollutant Contributions to Visibility Impairment (2014-2018 Current Data)

For the VISTAS region and neighboring Class I areas, Figure 2-5 and Figure 2-6 show light extinction averaged from 2014-2018 IMPROVE data for the 20% most impaired and clearest days, respectively. These bar charts (Figure 2-5 and Figure 2-6) are based on the IMPROVE data file called sia_impairment_daily_budgets_10_18.zip for data through 2017. For 2018 data, the IMPROVE data file called sia_impairment_daily_budgets_4_20_2.zip was used. Therefore, the data through 2017 have not been updated with the patching and substitution algorithms described in EPA's 2020 guidance memo. Changes to the daily data from the application of these routines are expected to be slight and will not change the conclusions of this SIP. Plots of the 2014 – 2018 reconstructed light extinction for the 20% most impaired days for individual VISTAS Class I areas can be found in Appendix C-2.

These figures continue to demonstrate improved visibility when compared to the 2009-2013 data or the 2000-2004 data. Emissions of SO_2 and other visibility impairing pollutants are reducing, as discussed in Section 7, and these reductions are resulting in better visibility.

[13] URL: https://www.epa.gov/sites/production/files/2020-06/documents/memo_data_for_regional_haze_technical_addendum.pdf

Figure 2-5 presents average data for 20% most impaired days and shows that on average sulfate continues to be the predominant visibility impairing pollutant.

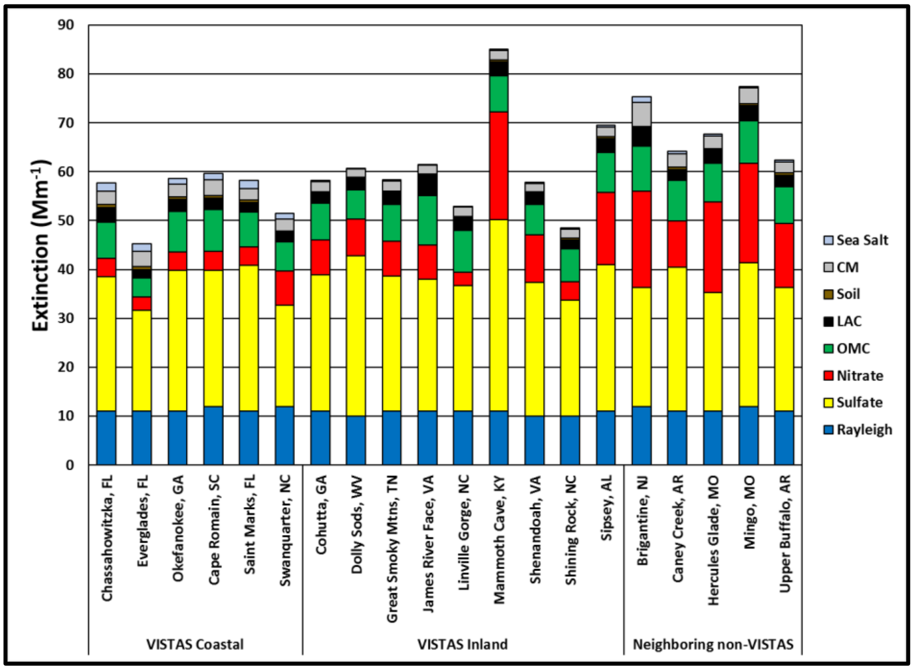


Figure 2-5: Average Light Extinction, 20% Most Impaired Days, 2014-2018, VISTAS and Neighboring Class I Areas

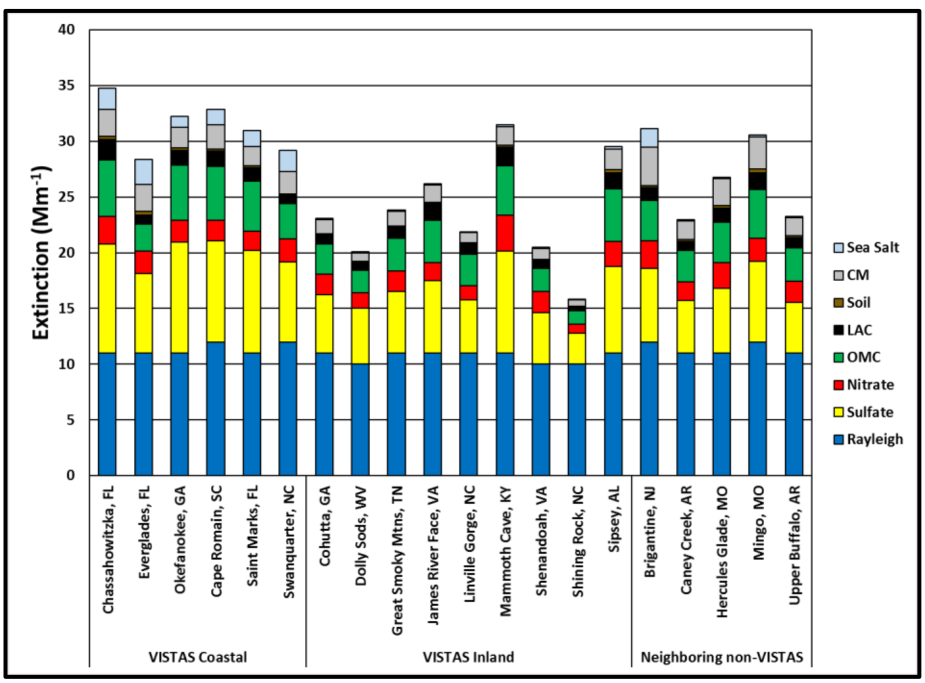


Figure 2-6: Average Light Extinction, 20% Clearest Days, 2014-2018, VISTAS and Neighboring Class I Areas

Since Breton Wilderness Area is not addressed in the evaluation of historical and current light extinction conducted by VISTAS, Figure 2-7 is included below, as provided by the Louisiana Department of Environmental Quality (LDEQ). (Note, LDEQ does not include visibility contributions from Rayleigh scattering.) Similar to other Class I areas, the major cause of reduced visibility at Breton has been and continues to be reduction in sulfate formation.

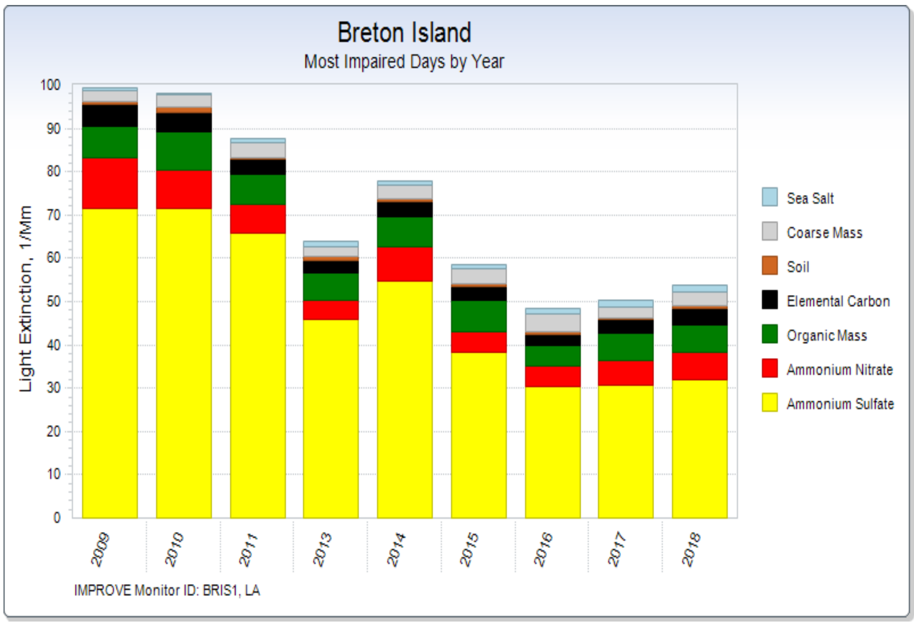


Figure 2-7: Average Light Extinction, Most Impaired Days by Year

2.6. Comparisons of Baseline, Current, and Natural Background Visibility

The regional haze rule requires that SIPs include an evaluation of progress made since the baseline period toward improving visibility on the 20% most impaired days and 20% clearest days for each state's Class I areas (40 CFR 51.308(f)(1)(iv)). The rule also requires that the SIP enumerate the deciview value by which the current visibility condition exceeds the natural visibility condition, for each state's Class I areas on the 20% most impaired days and the 20% clearest days (40 CFR 51.308(f)(1)(v)). Table 2-6 summarizes this data for each Class I area located in VISTAS for the 20% most impaired days. On 20% most impaired days, data for current conditions show that significant progress has been made as compared to baseline conditions. In many cases, the improvement in visibility from baseline conditions demonstrated by the 2014-2018 visibility data is more than half of the improvement needed to achieve natural conditions.

Table 2-6: Comparison of Baseline, Current, and Natural Conditions for 20% Most Impaired Days

Class I Areas	2000-2004 Baseline Conditions	2014-2018 Current Conditions	Change in Visibility, Baseline to Current	Natural Background Conditions	Difference Between Current Conditions and Natural Background
Cape Romain Wilderness Area	25.25 dv	17.67 dv	7.58 dv	9.79 dv	7.88 dv
Chassahowitzka Wilderness Area	24.52 dv	17.41 dv	7.11 dv	9.03 dv	8.38 dv
Cohutta Wilderness Area	29.12 dv	17.37 dv	11.75 dv	9.88 dv	7.49 dv
Dolly Sods Wilderness Area	28.29 dv	17.65 dv	10.64 dv	8.92 dv	8.73 dv
Everglades National Park	19.52 dv	14.90 dv	4.62 dv	8.33 dv	6.57 dv
Great Smoky Mountains National Park	29.11 dv	17.21 dv	11.90 dv	10.05 dv	7.16 dv
James River Face Wilderness Area	28.08 dv	17.89 dv	10.19 dv	9.47 dv	8.42 dv
Joyce Kilmer-Slickrock Wilderness Area	29.11 dv	17.21 dv	11.90 dv	10.05 dv	7.16 dv
Linville Gorge Wilderness Area	28.05 dv	16.42 dv	11.63 dv	9.70 dv	6.72 dv
Mammoth Cave National Park	29.83 dv	21.02 dv	8.81 dv	9.80 dv	11.22 dv
Okefenokee Wilderness Area	25.34 dv	17.39 dv	7.95 dv	9.45 dv	7.94 dv
Otter Creek Wilderness Area	28.29 dv	17.65 dv	10.64 dv	8.92 dv	8.73 dv
Shenandoah National Park	28.32 dv	17.07 dv	11.25 dv	9.52 dv	7.55 dv
Shining Rock Wilderness Area	28.13 dv	15.49 dv	12.64 dv	10.25 dv	5.24 dv
Sipsey Wilderness Area	27.69 dv	19.03 dv	8.66 dv	9.62 dv	9.41 dv
St. Marks Wilderness Area	24.68 dv	17.39 dv	7.29 dv	9.13 dv	8.26 dv
Swanquarter Wilderness Area	23.79 dv	16.30 dv	7.49 dv	10.01 dv	6.29 dv
Wolf Island Wilderness Area	25.34 dv	17.39 dv	7.95 dv	9.45 dv	7.94 dv

Table 2-7 summarizes this data for each Class I area located in VISTAS for the 20% clearest days. On 20% clearest days, data for current conditions show that visibility on these days has improved from the baseline conditions for all VISTAS Class I areas.

Table 2-7: Comparison of Baseline, Current, and Natural Conditions for 20% Clearest Days

Class I Areas	2000-2004 Baseline Conditions	2014-2018 Current Conditions	Change in Visibility, Baseline to Current	Natural Background Conditions	Difference Between Current Conditions and Natural Background
Cape Romain Wilderness Area	14.29 dv	11.801 dv	2.49 dv	5.93 dv	5.87 dv
Chassahowitzka Wilderness Area	15.60 dv	12.41 dv	3.19 dv	6.00 dv	6.41 dv
Cohutta Wilderness Area	13.73 dv	8.10 dv	5.63 dv	4.42 dv	3.68 dv
Dolly Sods Wilderness Area	12.28 dv	6.68 dv	5.60 dv	3.64 dv	3.04 dv
Everglades National Park	11.69 dv	10.37 dv	1.32 dv	5.22 dv	5.15 dv
Great Smoky Mountains National Park	13.58 dv	8.35 dv	5.23 dv	4.62 dv	3.73 dv
James River Face Wilderness Area	14.21 dv	9.47 dv	4.74 dv	4.39 dv	5.08 dv
Joyce Kilmer-Slickrock Wilderness Area	13.58 dv	8.35 dv	5.23 dv	4.62 dv	3.73 dv
Linville Gorge Wilderness Area	11.11 dv	7.61 dv	3.50 dv	4.07 dv	3.54 dv
Mammoth Cave National Park	16.51 dv	11.31 dv	5.20 dv	5.00 dv	6.31 dv
Okefenokee Wilderness Area	15.23 dv	11.57 dv	3.66 dv	5.43 dv	6.14 dv
Otter Creek Wilderness Area	12.28 dv	6.68 dv	5.60 dv	3.64 dv	3.04 dv
Shenandoah National Park	10.96 dv	6.85 dv	4.11 dv	3.15 dv	3.70 dv
Shining Rock Wilderness Area	7.70 dv	4.40 dv	3.30 dv	2.49 dv	1.91 dv
Sipsey Wilderness Area	15.57 dv	10.76 dv	4.81 dv	5.03 dv	5.73 dv
St. Marks Wilderness Area	14.34 dv	11.15 dv	3.19 dv	5.37 dv	5.78 dv
Swanquarter Wilderness Area	12.34 dv	10.61 dv	1.73 dv	5.71 dv	4.90 dv
Wolf Island Wilderness Area	15.23 dv	11.57 dv	3.66 dv	5.43 dv	6.14 dv

3. Glide Paths to Natural Conditions in 2064

In accordance with 40 CFR 51.308(f)(1)(vi)(A), each state with a Class I area must calculate a uniform rate of progress (URP), also known as a "glide path," for each mandatory federal Class I area located within that state. States with a Class I area must analyze and determine the consistent rate of progress over time. Starting with the baseline period of 2000-2004, states must analyze and determine the consistent rate of progress over time. States must compare the baseline visibility conditions (2000-2004) for the most impaired days to the natural visibility condition for the most impaired days to determine the uniform rate of visibility improvements needed to attain the natural visibility conditions by the end of 2064. Mississippi has no Class I area and, thus, is not required to address 40 CFR 51.308(f)(1)(vi)(A).

Glide paths were developed for each mandatory federal Class I area in the VISTAS region. The glide paths were developed in accordance with the EPA's guidance for tracking progress[14] and used data collected from the IMPROVE monitoring sites as described in Section 2 of this document. Glide paths are one of the indicators used in setting reasonable progress goals. Mississippi has no Class I area and, therefore, is not required to address 40 CFR 51.308(f)(1)(vi)(A).

4. Types of Emissions Impacting Visibility Impairment in Class I Areas Potentially Impacted by Mississippi

4.1. Baseline Emissions Inventory

The regional haze rule at 51.308(f)(6)(v) requires a statewide emissions inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. The inventory must include emissions for the most recent year for which data are available and estimates of future projected emissions. Mississippi complies with the Air Emission Reporting Requirements (AERR) in 40 CFR Part 51, Subpart A by submitting triennial emissions inventories of point sources to EPA, as well as annual inventories for larger-emitting point sources. Section 13.5.1 shows National Emission Inventory (NEI) data for 2014 and 2017 and Clean Air Markets Division (CAMD) data for 2018 and 2019. The same regional haze rule provision also requires states to commit to update the inventory periodically, which Mississippi commits to do. This section describes how the projected emissions inventory for 2028 was developed, and Section 7.2.4 shows the 2028 projected emissions data. For the inventory, VISTAS used a baseline year of 2011 and projected future year of 2028. The emission

[14] URL: https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf

inventories include carbon monoxide[15] (CO), volatile organic compounds (VOCs), NOx, $PM_{2.5}$, coarse particulate matter (PM_{10}), NH_3, and SO_2.

VISTAS contracted with ERG to perform emission inventory work as part of the air quality modeling analysis. ERG was directed by VISTAS to use EPA's 2011el-based air quality modeling platform, which includes emissions, meteorology, and other inputs for 2011, as the base year for the modeling described in EPA's TSD entitled "Documentation for the EPA's Preliminary 2028 Regional Haze Modeling."[16] EPA has projected the 2011 base year emissions[17] to a 2028 future year base case scenario. These data were the foundation of the revised emissions used for this analysis as described elsewhere. The 2011 modeling platform and projected 2028 emissions were used to drive the 2011 base year and 2028 base case air quality model simulations. As noted in EPA's TSD, the 2011 base year emissions and methods for projecting these emissions to 2028 are in large part similar to the data and methods used by EPA in the final Cross-State Air Pollution Rule (CSAPR) Update[18] and the subsequent notice of data availability (NODA)[19] to support ozone transport for the 2015 ozone NAAQS. Appendix B-1a and Appendix B-2a contain complete reports from ERG detailing the emission inventory work.

There are six different emission inventory source classifications: stationary point sources, nonpoint (formerly called "stationary area") sources, non-road and onroad mobile sources, biogenic sources, and point fires.[20] Stationary point sources are those sources that emit greater than a specified tonnage per year, with data provided at the facility level. Electric generating utilities and industrial sources are the major categories for stationary point sources. Nonpoint sources are those sources whose individual emissions are relatively small, but due to the large number of these sources, the collective emissions from the source category could be significant (e.g., dry cleaners, service stations, combustion of fuels for heating, and agricultural sources). These types of emissions are estimated on a countywide level. Non-road mobile sources are equipment that can move but do not use the roadways (e.g., lawn mowers, construction equipment, and railroad locomotives). The emissions from these sources, like nonpoint sources, are estimated on a countywide level. Onroad mobile sources include passenger cars, motorcycles, minivans, sport-utility vehicles, light-duty trucks, heavy-duty trucks, and buses that are normally operated on public roadways. The emissions from these sources are estimated by vehicle type and road type and are summed to the countywide level. Biogenic sources are the natural sources of emissions like trees, crops, grasses, and natural decay of plants. The

[15] CO is not a visibility impairing pollutant, and thus, CO data was not evaluated for this regional haze plan.
[16] EPA OAQPS, *Documentation for the EPA's Preliminary 2028 Regional Haze Modeling*, October 2017.
[17] URL: https://www.epa.gov/air-emissions-modeling/2011-version-63-technical-support-document
[18] URL: https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update
[19] URL: https://www.epa.gov/airmarkets/notice-data-availability-preliminary-interstate-ozone-transport-modeling-data-2015-ozone
[20] Note that prescribed fires and wildfires are designated events in the National Emissions Inventory.

emissions from these sources are estimated on a countywide level. The point fire sector includes both prescribed fires and wildfires.

4.1.1. Stationary Point Sources

Point source emissions are emissions from individual sources having a fixed location. Generally, these sources must have permits to operate, and their emissions are inventoried on a regular schedule. Large sources emitting at least 100 tons per year (tpy) of a criteria pollutant are inventoried every three years. The largest sources have been inventoried annually. Some state and local agencies conduct emission inventories more frequently, use lower thresholds, and include HAPs. Smaller sources have been inventoried less frequently. The point source emissions data can be grouped as electricity generating unit (EGU) sources and other industrial point sources, also called non-EGUs. Airport-related sources; including aircraft, airport ground support equipment, and jet refueling; are also part of the point source sector. In previous modeling platforms, airport-related sources were included in the non-road sector.

4.1.1.1. Electricity Generating Units

The electricity generation unit (EGU) sector contains emissions from EGUs in the 2011 NEI v2 point inventory that could be matched to units found in the National Electric Energy Database System (NEEDS) v5.15. In most cases, the base year 2011 inventory for the EGU sources used 2011 continuous emissions monitoring (CEM) data reported to the EPA's CAMD. These data provide hourly emissions profiles for SO_2 and NO_X that can be used in air quality modeling. Emissions profiles are used to estimate emissions of other pollutants (VOCs, CO, NH_3, $PM_{2.5}$) based on measured emissions of SO_2 and NO_X. The NEEDS database of units includes many smaller emitting EGUs that are not included in the CAMD hourly CEMS programs. Thus, there are more units in the NEEDS database than have CEMS data. Emissions from EGUs vary daily and seasonally as a function of variability in energy demand, utilization, and outage schedules. The temporalization of EGU units matched to CEMS is based on the base year CEMS data for those units, whereas regional profiles are used for the remaining units.

For projected year 2028 EGU point sources, the VISTAS states considered the EPA 2028el, the EPA 2023en, or 2028 emissions from the Eastern Regional Technical Advisory Committee (ERTAC) EGU projection tool from the most recent CONUS 2.7 run. The EPA 2028el emissions inventory for EGUs were created by the Integrated Planning Model (IPM) version 5.16. This scenario represents the implementation of the Cross-State Air Pollution Rule (CSAPR) Update, CSAPR, Mercury and Air Toxics Standards (MATS), Clean Power Plan (CPP) and the final actions the EPA has taken to implement the Regional Haze Rule, the Cooling Water Intakes Rule, and Combustion Residuals from Electric Utilities (CCR). The CPP was later vacated. Impacts of the CPP assumed that coal-fired EGUs would be shut down and replaced by natural gas-fired EGUs. Thus, the EPA 2028el projected emissions for EGU emissions are not reflective of probable emissions for 2028. The ERTAC EGU emissions did not consider the impacts of the CPP. After evaluating the different projection options, each VISTAS state determined the estimated emissions for each EGU for the projected year 2028. Appendix B contains a summary of the action items provided by each VISTAS state in preparing the 2028 EGU emissions inventory. For non-VISTAS states, the EPA 2028el EGU emissions were replaced with the 2028 ERTAC 2.7 EGU emissions. Mississippi used a combination of ERTAC, 2011el, 2023en, and 2028el data for projected 2028 EGU emissions.

4.1.1.2. Other Industrial Point Sources and Airport-Related Sources

The non-EGU sector uses annual emissions contained in the 2011 NEIv2. These emissions are temporally allocated to month, day, and hour using source category code (SCC)-based allocation factors. The Control Strategy Tool (CoST) was used to apply most non-EGU projection/growth factors, controls, and facility/unit/stack-level closures to the 2011 NEI-based emissions modeling inventories to create a future year inventory for 2028. Similar to the EGU sector, each state was able to make adjustments to the 2028 non-EGU inventory based on their knowledge of each facility. Airport-related source emissions for the base year 2011 were developed from the 2011 NEIv2. Aircraft emissions for 2011 are projected to future year 2028 by applying activity growth using data on itinerant operations at airports. The itinerant operations are defined as aircraft take-offs or aircraft landings. The EPA used projected itinerant information available from the Federal Aviation Administration’s (FAA) Terminal Area Forecast (TAF) System.

4.1.2. Nonpoint Sources

Nonpoint sources are those sources whose individual emissions are relatively small, but due to the large number of these sources, the collective emissions from the source category could be significant (e.g., dry cleaners, service stations, combustion of fuels for heating, and agricultural sources). Emissions are estimated by multiplying an emission factor by some known indicator of collective activity, such as fuel usage, number of households, or population. Nonpoint source emissions are estimated at the countywide level. The base year 2011 nonpoint source inventory was developed from the 2011NEIv2. The CoST was used to apply most nonpoint projection/growth factors, controls and facility/unit/stack-level closures to the 2011 NEI-based emissions modeling inventories to create a future year inventory for 2028.

4.1.3. Non-Road Mobile Sources

Non-road mobile sources are equipment that can move but do not use the roadways, such as construction equipment, railroad locomotives, commercial marine vessels, and lawn equipment. For the majority of the non-road mobile sources, the emissions for 2011 were estimated using the EPA’s National Mobile Inventory Model (NMIM, 2005). For the two source categories not included in the NMIM, i.e., railroad locomotives and commercial marine, more traditional methods of estimating the emissions were used.

For the source categories estimated using the EPA's NMIM model, the model growth assumptions were used to create the 2028 future year inventory. The NMIM model takes into consideration regulations affecting emissions from these source categories. The 2028 future-year commercial marine vessels and railroad locomotives emissions account for increased fuel consumption based on Energy Information Administration (EIA) fuel consumption projections for freight, and emissions reductions resulting from emissions standards from the Final Locomotive-Marine rule.

4.1.4. Onroad Mobile Sources

Onroad mobile sources include passenger cars, motorcycles, minivans, sport-utility vehicles, light-duty trucks, heavy-duty trucks, and buses that are normally operated on public roadways. For onroad vehicles, the Motor Vehicle Emissions Simulator (MOVES) model (MOVES2014a) was used to develop base year 2011 emissions. Key inputs for MOVES include information on the age of vehicles on the roads, vehicle miles traveled, the average speeds on the roads, the mix of vehicles on the roads, any programs in place in an area to reduce emissions for motor vehicles (e.g., emissions inspection programs), and temperature. The MOVES model takes into consideration regulations that affect emissions from this source sector. The MOVES model then was run for 2028 inventory using input data reflective of that year.

4.1.5. Biogenic Sources

Biogenic emissions for 2011 were developed using the Biogenic Emission Inventory System version 3.61 (BEIS3.61) within the Sparse Matrix Operator Kernel Emissions (SMOKE). BEIS3.61 creates gridded, hourly, model-species emissions from vegetation and soil. BEIS3.61 includes the incorporation of Version 4.1 of the Biogenic Emissions Land use Database (BELD4) and the incorporation of a canopy model to estimate leaf-level temperatures. BELD version 4.1 is based on an updated version of the USDA-United States Forest Service (USFS) Forest Inventory and Analysis (FIA) vegetation speciation-based data from 2001 to 2014 in the FIA version 5.1. Canopy coverage is based on the Landsat satellite National Land Cover Database (NLCD) product from 2011. The 2011 biogenic emissions are used for the 2028 future year without any changes.

4.1.6. Point Fires

The point fires sector includes emissions from both prescribed fires and wildfires. The point fire sector excludes agricultural burning and other open burning sources that are included in the nonpoint sector. Fire emissions are specified at geographic coordinates (point locations) and have daily emissions values. Emissions are day-specific and include satellite-derived latitude/longitude of the fire's origin and other parameters associated with the emissions such as acres burned and fuel load, which allow estimation of plume rise.

Fire emissions for the base year 2011 were taken from the 2011NEIv2. The point source day-specific emission estimates for 2011 fires rely on SMARTFIRE 2, which uses the National Oceanic and Atmospheric Administration's (NOAA's) Hazard Mapping System (HMS) fire location information as input. Additional inputs include the CONSUMEv3.0 software application and the Fuel Characteristic Classification System (FCCS) fuel-loading database to estimate fire emissions from wildfires and prescribed burns on a daily basis. SMARTFIRE 2 estimates were used directly for all states except Georgia and Florida. For Georgia, the satellite-derived emissions were removed from the fire inventory and replaced with a separate state-supplied fire inventory. Adjustments were also made to Florida to rescale their emissions to match the total acres burned that Florida reported in the NEI. The 2011 fire emissions are used for the 2028 future year without any changes.

4.1.7. Summary 2011 Baseline Emissions Inventory for Mississippi

Table 4-1 is a summary of the 2011 baseline emission inventory for Mississippi. The complete inventory and discussion of the methodology is contained in Appendix B. The emissions summaries for other VISTAS states can also be found in Appendix B. The 2011 emissions inventory was the most recent, quality assured inventory at the time of SIP development. Emissions and modeling work needs to begin three years before SIPs are due because of the significant amount of time required to complete the work one year in advance of preparing the SIPs. For this planning period, funds were not available to the states to build a new modeling platform with a more recent base year. Consequently, the 2011 base year modeling platform was selected because it was the best platform available at the time the modeling work began in early 2018. VISTAS discussed the selection of modeling platforms with EPA prior to starting this work and EPA agreed that using EPA's 2011 modeling platform was the latest available at the time and was sufficient to support the development of regional haze SIPs for the second planning period.

Table 4-1: 2011 Emissions Inventory Summary for Mississippi (tpy)

Sector	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
EGU	7,317	402	28,039	2,378	1,892	43,349	535
Non-EGU Point	33,953	1,912	37,698	9,653	8,320	14,793	26,908
Nonpoint	104,572	56,088	25,076	972,660	120,310	2,183	94,802
Onroad	433,332	1,794	91,026	4,491	2,538	405	46,084
Non-Road	145,614	22	17,266	1,811	1,722	46	28,862
Point-Fires	325,044	5,381	6,791	35,170	29,805	3,163	77,346
Total	**1,049,832**	**65,599**	**205,896**	**1,026,163**	**164,587**	**63,939**	**274,537**

4.1.8. Emissions Inventory Improvements Prior to Remodeling 2028 Future Year

The VISTAS initial emission inventory was completed in June 2018. The VISTAS initial modeling for the future year 2028 was completed in October 2019. VISTAS compared the VISTAS' emission inventory information to EPA's modeling inventory, which was released in

September 2019. EPA used a base year of 2016 and a future year of 2028. One main difference between the VISTAS and EPA modeling is that VISTAS used a base year of 2011 while EPA used a base year of 2016. This is an important difference since the future year 2028 emissions are generally projected from the base year. VISTAS noted large differences in SO_2 and NO_X emissions, with EPA's emissions being much lower. One reason for this difference was that VISTAS initial modeling used an older version of ERTAC, which did not account for many coal-fired EGU retirements and fuel switches. Table 4-2 below compares the 2028 point emissions used by VISTAS versus the latest 2028fh[21] emissions used by EPA (projected from 2016). The emissions in Table 4-2 are extracted from the VISTAS12 modeling domain, which covers the eastern US. As shown in Table 4-2, EPA's SO_2 emissions are 45.61% lower than VISTAS' estimates, and EPA's NOx emissions are 20.19% lower than VISTAS' estimates.

Table 4-2: VISTAS 2028 versus New EPA 2028

Pollutant	VISTAS 2028 (tpy)	New EPA 2028 (tpy)	Difference (tpy)	Difference (%)
NO_X	2,641,463.83	2,108,115.50	533,348.33	20.19%
SO_2	2,574,542.02	1,400,287.10	1,174,254.92	45.61%

The two tables below compare the SO_2 and NO_X emissions for the older version of ERTAC (2.7opt) and the newer version of ERTAC (16.0), with the newer version of ERTAC having much lower emissions. The older version of ERTAC was used in the VISTAS modeling in the non-VISTAS states. As explained in Section 4.1.1 above, each VISTAS state determined the estimated emissions for each EGU in their state for the projected year 2028.

Table 4-3: SO_2 Old ERTAC (2.7opt) versus SO_2 New ERTAC (16.0)

RPO	16.0 2028 (tpy)	2.7opt 2028 (tpy)	Difference (tpy)	Difference (%)
CENSARA	367,683.7	760,828.2	-393,144.5	-51.67%
LADCO	266,047.0	379,577.5	-113,530.5	-29.91%
MANE-VU	78,657.0	196,672.6	-118,015.6	-60.01%
VISTAS	161,502.5	273,582.1	-112,079.6	-40.97%
Total	**976,471.2**	**1,783,376.5**	**-806,905.3**	**-45.25%**

Table 4-4: NO_X Old ERTAC (2.7opt) versus NO_X New ERTAC (16.0)

RPO	16.0 2028 (tpy)	2.7opt 2028 (tpy)	Difference (tpy)	Difference (%)
CENSARA	244,499.3	354,795.1	-110,295.8	-31.09%
LADCO	166,429.4	198,966.9	-32,537.4	-16.35%
MANE-VU	56,315.3	83,432.5	-27,117.2	-32.50%
VISTAS	200,791.1	270,615.7	-69,824.6	-25.80%
Total	840,973.6	1,166,663.1	-325,689.5	-27.92%

[21] The "f" represents the base year emissions modeling platform iteration, which shows that it is 2014 NEI based (whereas for 2011 NEI-based platforms, this letter was "e"); and the "h" stands for the eighth configuration of emissions modeling for a 2014-NEI based modeling platform).

The Regional Haze rule and guidance indicate that future year projections should be as accurate as possible. Thus, after consulting with EPA, VISTAS decided to model the future year 2028 again in order to have more accurate visibility projections. VISTAS made several improvements to the 2028 emissions inventory before remodeling the 2028 future year. These inventory improvements are detailed in the VISTAS emissions inventory report in Appendix B-2a. Each VISTAS state was given the opportunity to adjust any point source emissions in the 2028 inventory. For EGUs in the non-VISTAS states, ERTAC 2.7 emissions were replaced with the ERTAC 16.0 emissions, except for the LADCO states where ERTAC 2.7 emissions were replaced with ERTAC 16.1 emissions.

4.2. Summary of the 2028 Emissions Inventory and Assessment of Relative Contributions from Specific Pollutants and Source Categories

As noted in Section 2.3 for the years 2000-2004 and Section 2.5 for years 2014-2018, ammonium sulfate is the largest contributor to visibility impairment at the VISTAS Class I areas, and reduction of SO_2 emissions would be the most effective means of reducing ammonium sulfate. As illustrated in Figure 4-1, 91.2% of 2011 SO_2 emissions in the VISTAS states are attributable to electric generating facilities and industrial point sources. Similarly, in Mississippi, the stationary point sources, consisting of electric generating units and industrial point sources, contribute 90.9%.

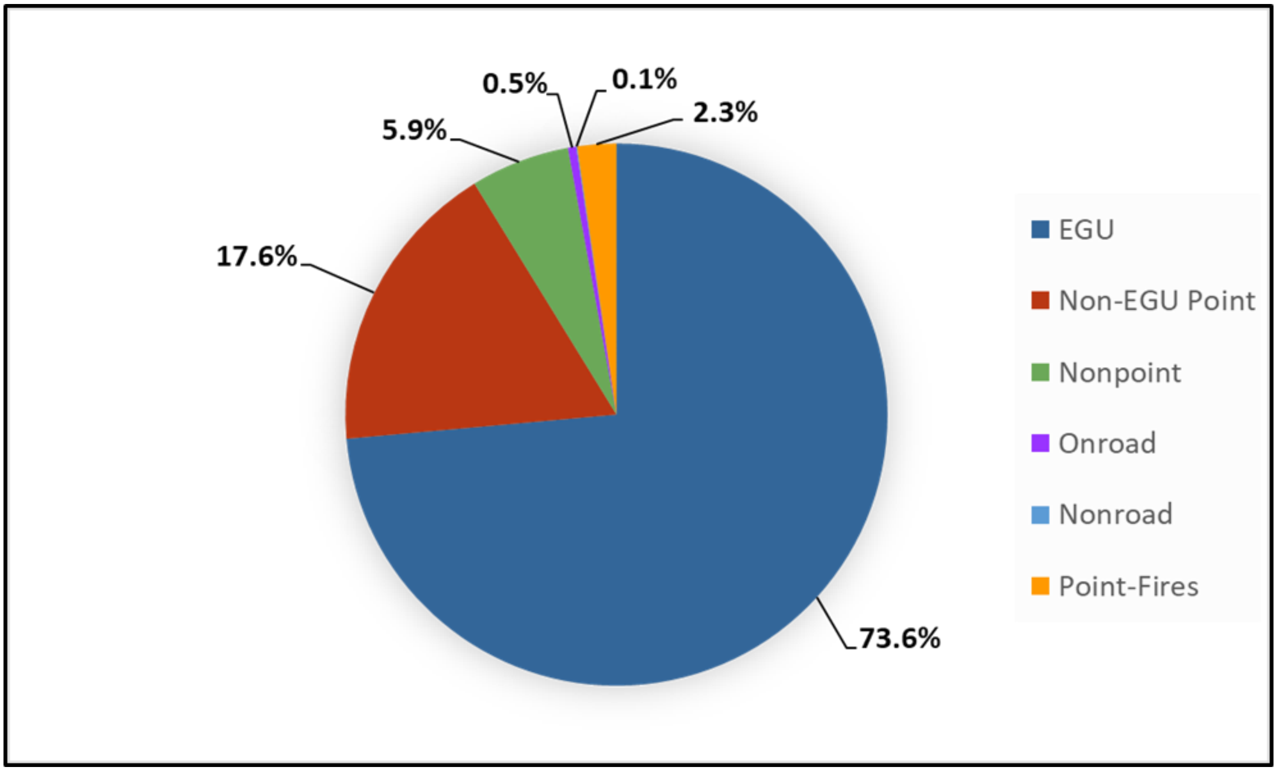


Figure 4-1: 2011 SO_2 Emissions in the VISTAS States

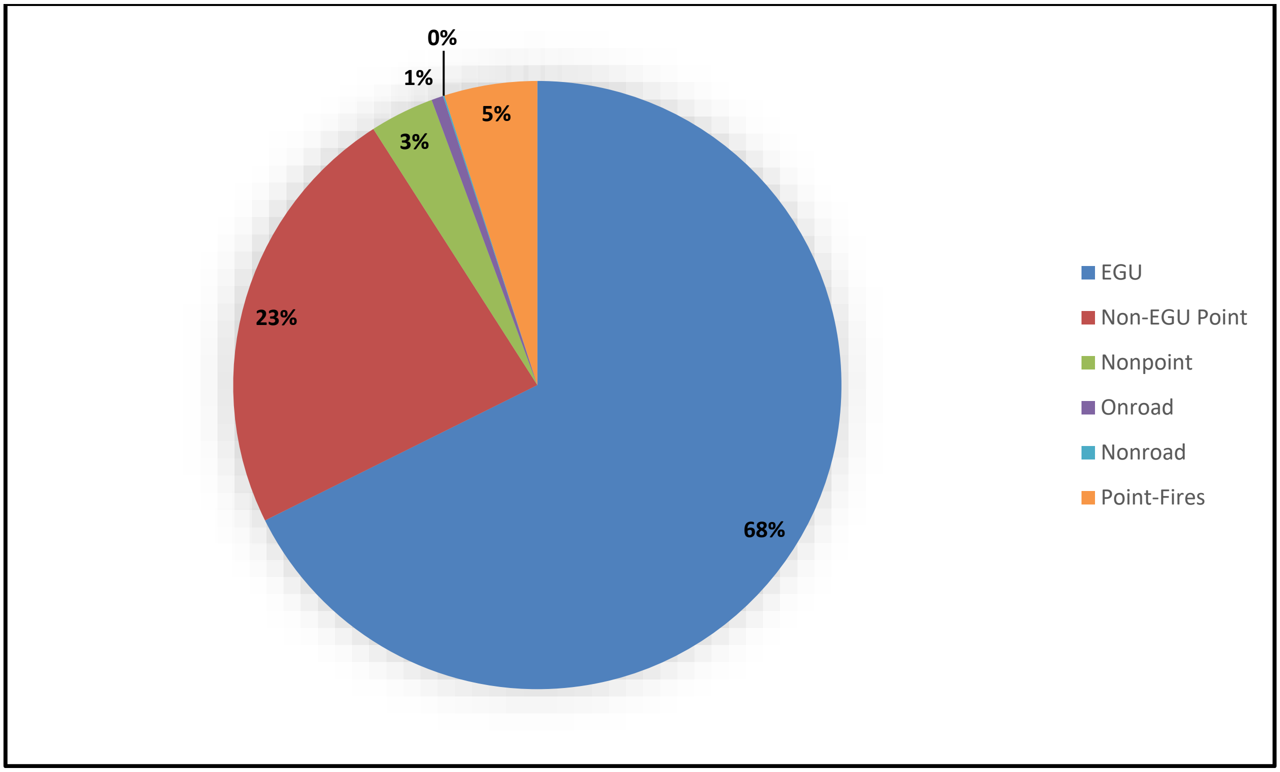


Figure 4-2: 2011 SO_2 Emissions in Mississippi

Since the largest source of SO_2 emissions comes from stationary point sources, the focus of potential controls and the impacts for those controls was on this source sector. In Mississippi, the types of sources emitting SO_2 were predominately coal fired utilities and industrial boilers.

5. Regional Haze Modeling Methods and Inputs

Modeling for regional haze was performed by VISTAS for the ten southeastern states, including Mississippi. The following sections outline the methods and inputs used by VISTAS for the regional modeling. Additional details are provided in Appendix E.

5.1. Analysis Method

The modeling analysis is a complex technical evaluation that begins by selection of the modeling system. For the most part, the modeling analysis approach for regional haze followed EPA's 2011el-based air quality modeling platform, which includes emissions, meteorology, and other inputs for 2011 as the base year for the modeling described in their regional haze TSD (EPA, 2017). EPA projected the 2011 base year emissions to a 2028 future year base case scenario. EPA's work is the foundation of the emissions used in the VISTAS analysis, with significant revisions as described in Appendix B. As noted in EPA's documentation, the 2011 base year emissions and methods for projecting these emissions to 2028 are in large part similar to the data and methods used by EPA in the final CSAPR Update[22] and the subsequent NODA[23] to support ozone transport mandates for the 2015 ozone NAAQS. VISTAS decided to use the following modeling systems:

- Meteorological Model: The Weather Research and Forecasting (WRF) model is a mesoscale numerical weather prediction system designed to serve both operational forecasting and atmospheric research needs (Skamarock, 2004; 2006; Skamarock et al., 2005). The Advanced Research WRF (ARW) version of WRF was used in this regional haze analysis study. It features multiple dynamical cores, a three-dimensional variational (3DVAR) data assimilation system, and a software architecture allowing for computational parallelism and system extensibility. WRF is suitable for a broad spectrum of applications across scales ranging from meters to thousands of kilometers.

- Emissions Model: Emissions processing was completed using the SMOKE model for most source categories. The exceptions include EGUs for certain areas, as well as the biogenic and mobile sectors. For certain areas in the modeling domain, the ERTAC EGU Forecasting Tool[24] was used to grow base year hourly EGU emissions inventories into future projection years. The tool uses base year hourly EPA CAMD data, fuel specific growth rates, and other information to estimate future emissions. The BEIS model was used for biogenic emissions. Special processors were used for fires, windblown dust, lightning, and sea salt emissions. The 2014 MOVES onroad mobile source emissions

[22] URL: https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update
[23] URL: https://www.epa.gov/airmarkets/notice-data-availability-preliminary-interstate-ozone-transport-modeling-data-2015-ozone
[24] URL: https://marama.org/technical-center/ertac-egu-projection-tool/

model was used by EPA with SMOKE-MOVES to generate onroad mobile source emissions with EPA generated vehicle activity data provided in the 2028 regional haze analysis.

- Air Quality Model: The Comprehensive Air Quality Model with Extensions (CAMx) Version 6.40 was used in this study, with the secondary organic aerosol partitioning (SOAP) algorithm module as the default. The CAMx photochemical grid model, which supports two-way grid nesting was used. The setup is based on the same WRF/SMOKE/CAMx modeling system used in the EPA 2011/2028el platform modeling. The Particulate Source Apportionment Technology (PSAT) tool of CAMx was selected to develop source contribution and significant contribution calculations.

Episode selection is an important component of any modeling analysis. EPA guidance recommends choosing time periods that reflect the variety of meteorological conditions representing visibility impairment on the 20% clearest and 20% most impaired days in the Class I areas being modeled. This is best accomplished by modeling a full year. For this analysis, VISTAS performed modeling for the full 2011 calendar year with 10 days of model spin-up in 2010.

Once base year model performance was deemed adequate, the future year emissions were processed. The air quality modeling results were used to determine a relative reduction in future visibility impairment, which was used to determine future visibility conditions and reasonable progress goals.

The complete modeling protocol used for this analysis can be found in Appendix E-1b.

5.2. Model Selection

To ensure that a modeling study is defensible, care must be taken in the selection of the models to be used. The models selected must be scientifically appropriate for the intended application and be freely accessible to all stakeholders. "Scientifically appropriate" means that the models address important physical and chemical phenomena in sufficient detail, using peer-reviewed methods. "Freely accessible" means that model formulations and coding are freely available for review and that the models are available to stakeholders, and their consultants, for execution and verification at no or low cost.

The following sections outline the criteria for selecting a modeling system that is both defensible and capable of meeting the study's goals. These criteria were used in selecting the modeling system for this modeling demonstration.

5.2.1. Selection of Photochemical Grid Model

5.2.1.1. Criteria

For a photochemical grid model to qualify as a candidate for use in a regional haze SIP, a state needs to show that it meets the same general criteria as a model for a NAAQS attainment demonstration. EPA's current modeling guidelines lists the following criteria for model selection (EPA, 2018):

- It should not be proprietary;
- It should have received a scientific peer review;
- It should be appropriate for the specific application on a theoretical basis;
- It should be used with databases that are available and adequate to support its application;
- It should be shown to have performed well in past modeling applications;
- It should be applied consistently with an established protocol on methods and procedures;
- It should have a User's Guide and technical description;
- The availability of advanced features (e.g., probing tools or science algorithms) is desirable; and
- When other criteria are satisfied, resource considerations may be important and are a legitimate concern.

5.2.1.2. Overview of CAMx

The CAMx model[25] is a state-of-science "One-Atmosphere" photochemical grid model capable of addressing ozone, PM, visibility, and acid deposition at a regional scale for periods up to one year (Ramboll Environ, 2016). CAMx is a publicly-available open-source computer modeling system for the integrated assessment of gaseous and particulate air pollution and meets all the photochemical grid model criteria above. Built on today's understanding that air quality issues are complex, interrelated, and reach beyond the urban scale, CAMx is designed to: (a) simulate air quality over many geographic scales; (b) treat a wide variety of inert and chemically active pollutants including ozone, inorganic and organic $PM_{2.5}$ and PM_{10}, mercury, and toxics; (c) provide source-receptor, sensitivity, and process analyses; and (d) be computationally efficient and easy to use. EPA has approved the use of CAMx for numerous ozone, PM, and regional haze SIPs throughout the U.S. and has used this model to evaluate regional mitigation strategies

[25] URL: http://www.camx.com

including those for most recent regional-scale rules such as CSAPR, Clean Air Interstate Rule (CAIR), and the NO_X SIP Call.

5.2.2. Selection of Meteorological Model

5.2.2.1. Criteria

Meteorological models, either through objective, diagnostic, or prognostic analysis, extend available information about the state of the atmosphere to the grid upon which photochemical grid modeling is to be carried out. The criteria for selecting a meteorological model are based on both the model's ability to accurately replicate important meteorological phenomena in the region of study and the model's ability to interface with the rest of the modeling systems – particularly the photochemical grid model. With these issues in mind, the following criteria were established for the meteorological model to be used in this study:

- Non-hydrostatic formulation;
- Reasonably current, peer reviewed formulation;
- Simulates cloud physics;
- Publicly available at no or low cost;
- Output available in Input/Output Applications Programming Interface (I/O API) format;
- Supports four-dimensional data assimilation (FDDA); and
- Enhanced treatment of planetary boundary layer heights for air quality modeling.

5.2.2.2. Overview of WRF

The WRF[26] model is a mesoscale numerical weather prediction system designed to serve both operational forecasting and atmospheric research needs (Skamarock, 2004; 2006; Skamarock et al., 2005). The ARW version of WRF was used in this regional haze analysis study and meets all the meteorological model criteria above. It features multiple dynamical cores, a three-dimensional variational data assimilation system, and a software architecture allowing for computational parallelism and system extensibility. WRF is suitable for a broad spectrum of applications across scales ranging from meters to thousands of kilometers. The effort to develop WRF has been a collaborative partnership, principally among the National Center for Atmospheric Research (NCAR), NOAA, the National Centers for Environmental Prediction (NCEP) and the Forecast Systems Laboratory (FSL), the Air Force Weather Agency (AFWA),

[26] URL: http://www.wrf-model.org/index.php

the Naval Research Laboratory, the University of Oklahoma, and the FAA. WRF allows researchers the ability to conduct simulations reflecting either real data or idealized configurations. WRF is a model that provides operational weather forecasting. It is flexible and computationally efficient while offering the advances in physics, numerics, and data assimilation contributed by the research community.

The configuration used for this modeling demonstration, as well as a more detailed description of the WRF model, can be found in the EPA's meteorological modeling report (EPA, 2014d).

5.2.3. Selection of Emissions Processing System

5.2.3.1. Criteria

The principal criterion for an emissions processing system is that it accurately prepares emissions files in a format suitable for the photochemical grid model being used. The following list includes clarification of this criterion and additional desirable criteria for effective use of the system.

- File system compatibility with the I/O API;
- File portability;
- Ability to grid emissions on a Lambert conformal projection;
- Report capability;
- Graphical analysis capability;
- MOVES mobile source emissions;
- BEIS version 3;
- Ability to process emissions for the proposed domain in a reasonable amount of time;
- Ability to process control strategies;
- No or low cost for acquisition and maintenance; and
- Expandable to support other species and mechanisms.

5.2.3.2. Overview of SMOKE

The SMOKE[27] modeling system is an emissions modeling system that generates hourly gridded speciated emission inputs of mobile, non-road, nonpoint area, point, fire and biogenic emission sources for photochemical grid models (Coats, 1995; Houyoux et al., 1999) and meets all the emissions processing system criteria above. As with most "emissions models," SMOKE is principally an emissions processing system; its purpose is to provide an efficient modern tool for converting existing base emissions inventory data into the hourly gridded speciated formatted emission files required by a photochemical grid model. For biogenic, mobile, and EGU sources, external emission models/processors were used to prepare SMOKE inputs. MOVES2014 is EPA's latest onroad mobile source emissions model and was first released in July 2014 (EPA, 2014a; 2014b; 2014c). MOVES2014 includes the latest onroad mobile source emissions factor information. Emission factors developed by EPA were used in this analysis. SMOKE-MOVES uses an emissions factor look-up table from MOVES, county-level gridded vehicle miles travelled (VMT) and other activity data, and hourly gridded meteorological data (typically from WRF) to generate hourly gridded speciated onroad mobile source emissions inputs. The ERTAC EGU Forecasting Tool[28] was developed through a collaborative effort to improve emission inventories among the Northeastern, Mid-Atlantic, Southeastern, and Lake Michigan area states; other member states; industry representatives; and multi-jurisdictional organization (MJO) representatives. The tool was used for some states to grow base year hourly EGU emissions inventories into future projection years. The tool uses base year hourly EPA CAMD data, fuel specific growth rates, and other information to estimate future emissions. Biogenic emissions were modeled by EPA using version 3.61 of BEIS. First developed in 1988, BEIS estimates VOC emissions from vegetation and nitric oxide (NO) emissions from soils. Because of resource limitations, recent BEIS development has been restricted to versions that are built within the SMOKE system. Additional information about the SMOKE model is contained in Appendix E.

5.3. Selection of the Modeling Year

A crucial step to SIP modeling is the selection of the period of time to model so that air quality conditions may be well represented and so that changes in air quality in response to changes in emissions may be projected.

EPA's most recent regional haze modeling guidance (EPA, 2018) contains recommended procedures for selecting modeling episodes. The VISTAS regional haze modeling used the annual calendar year 2011 modeling period. Calendar year 2011 satisfies the criteria in EPA's modeling guidance episode selection discussion and is consistent with the base year modeling platform. Specifically, EPA's guidance recommends choosing a time period which reflects the

[27] URL: http://www.smoke-model.org/index.cfm
[28] URL: https://marama.org/technical-center/ertac-egu-projection-tool/

variety of meteorological conditions that represent visibility impairment on the 20% clearest and 20% most-impaired days in the Class I areas being modeled (high and low concentrations necessary). This is best accomplished by modeling a full calendar year.

In addition, the 2011/2028 modeling platform was the most recent available platform when VISTAS started their modeling work. EPA's 2016-based platform became available at a later date after VISTAS had already invested a considerable amount of time and money into the modeling analysis. Using the 2016-based platform was not feasible from a monetary perspective, nor could such work be done in a timely manner.

5.4. Modeling Domains

5.4.1. Horizontal Modeling Domain

The VISTAS modeling used a 12-kilometer (km) continental U.S. (CONUS_12 or 12US2) domain. The 12-km nested grid modeling domain (Figure 5-1) represents the CAMx 12-km air quality and SMOKE/BEIS emissions modeling domain. As shown in EPA's meteorological model performance evaluation document, the WRF meteorological modeling was run on a larger 12-km modeling domain than the 12-km domain that was used for CAMx (EPA, 2014d). The WRF meteorological modeling domains are defined larger than the air quality modeling domains because meteorological models can sometimes produce artifacts in the meteorological variables near the boundaries as the prescribed boundary conditions come into dynamic balance with the coupled equations and numerical methods in the meteorological model.

An additional VISTAS_12 domain was prepared that is a subset of the CONUS_12 domain. Development of the VISTAS_12 domain (also presented in Figure 5-1) requires the EPA CONUS_12 simulation to be run using CAMx Version 6.40 modeling saving 3-dimensional concentration fields for extraction using the CAMx BNDEXTR program. Dimensions for both VISTAS_12 and CONUS_12 domains are provided in Table 5-1.

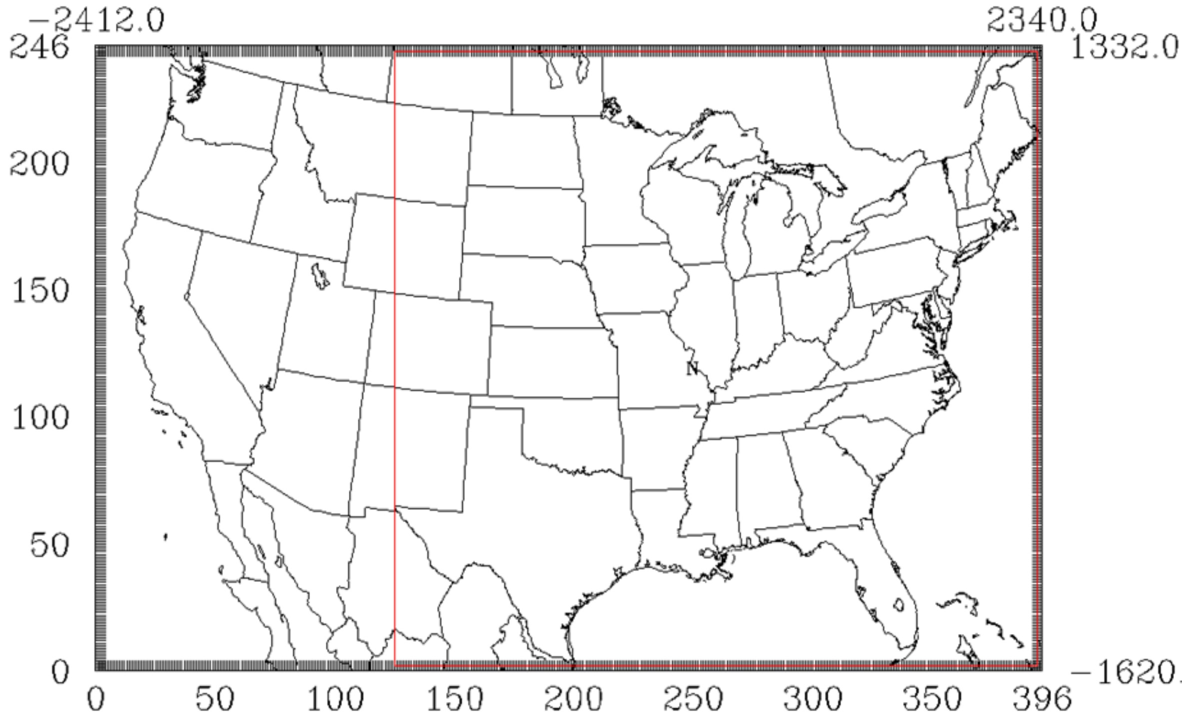


Figure 5-1: Map of 12-km CAMx Modeling Domains; VISTAS_12 Domain Represented as Inner Red Domain

Table 5-1: VISTAS II Modeling Domain Specifications

Domain	Columns	Rows	Vertical Layers	X Origin (km)	Y Origin (km)
CONUS_12	396	246	25	-2,412	-1,620
VISTAS_12	269	242	25	-912	-1,596

5.4.2. Vertical Modeling Domain

The CAMx vertical structure is primarily defined by the vertical layers used in the WRF meteorological modeling. The WRF model employs a terrain following coordinate system defined by pressure, using multiple layer interfaces that extend from the surface to 50 millibar (mb) (approximately 19 km above sea level). EPA ran WRF using 35 vertical layers. A layer averaging scheme is adopted for CAMx simulations whereby multiple WRF layers are combined into one CAMx layer to reduce the air quality model computational time. Table 5-2 displays the approach for collapsing the 35 vertical layers in WRF to 25 vertical layers in CAMx. This approach is consistent with EPA's draft 2028 regional haze modeling.[29]

[29] Table 2-2, EPA, 2017.

Table 5-2: WRF and CAMx Layers and Their Approximate Height Above Ground Level

CAMx Layer	WRF Layers	Sigma P	Pressure (mb)	Approximate Height (meters above ground level)
25	35	0.00	50.00	17,556
25	34	0.05	97.50	14,780
24	33	0.10	145.00	12,822
24	32	0.15	192.50	11,282
23	31	0.20	240.00	10,002
23	30	0.25	382.50	7,064
22	29	0.30	335.00	7,932
22	28	0.35	382,50	7,064
21	27	0.40	430.00	6,275
21	26	0.45	477.50	5,553
20	25	0.50	525.00	4,885
20	24	0.55	572.50	4,264
19	23	0.60	620.00	3,683
18	22	0.65	667.50	3,136
17	21	0.70	715.00	2,619
16	20	0.74	753.00	2,226
15	19	0.77	781.50	1,941
14	18	0.80	810.00	1,665
13	17	0.82	829.00	1,485
12	16	0.84	848.00	1,308
11	15	0.86	867.00	1,134
10	14	0.88	886.00	964
9	13	0.90	905.00	797
9	12	0.91	914.50	714
8	11	0.92	924.00	632
8	10	0.93	933.50	551
7	9	0.94	943.00	470
7	8	0.95	952.50	390
6	7	0.96	962.00	311
5	6	0.97	971.50	232
4	5	0.98	981.00	154
4	4	0.99	985.75	115
3	3	0.99	985.75	115
2	2	1.00	995.25	38
1	1	1.00	997.63	19

6. Model Performance Evaluation

The VISTAS 2011 modeling platform (VISTAS2011) used meteorological modeling files developed by EPA. The evaluation of the meteorological modeling can be found in the EPA's document titled, "Meteorological Model Performance for Annual 2011 WRF v3.4 Simulation."[30] Overall, the meteorological modeling was deemed acceptable for regulatory applications.

In keeping with the one-atmosphere objective of the CAMx modeling platform, model performance was evaluated for ozone, fine particles, and acid deposition. For the model performance analysis, model predictions were paired in space and time with observational data from various monitoring networks. Modeled 8-hour ozone concentrations were compared to observations from the EPA's Air Quality System (AQS) network. Modeled 24-hour speciated PM concentrations were compared to observations from IMPROVE, CSN, and Clean Air Status and Trends Network (CASTNet) monitoring networks. Modeled weekly speciated wet and dry deposition species were compared to observations from the National Acid Deposition Program (NADP) and CASTNet.

6.1. Ozone Model Performance Evaluation

As indicated by the statistics in Table 6-1, bias and error for maximum daily 8-hour average (MDA8) ozone are relatively low in the region. Mean bias (MB) for MDA8 ozone ≥ 60 parts per billion (ppb) during each month (May through September) was within ±5 ppb at AQS sites in the VISTAS states, ranging from -0.13 ppb (September) to 3.79 ppb (July). The mean error (ME) is less than 10 ppb in all months. Normalized mean bias (NMB) is within ±5% for AQS sites in all months except July (5.63%). The mean bias and normalized mean bias statistics indicate a tendency for the model to over predict MDA8 ozone concentrations in the months of May through August and slightly under predict MDA8 ozone concentrations in September for AQS sites. The normalized mean error (NME) is less than 15% in the region across all months.

Table 6-1: Performance Statistics for MDA8 Ozone ≥ 60 ppb by Month for VISTAS States Based on Data at AQS Network Sites

Region	Month	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
VISTAS	May	838	2.48	6.11	3.79	9.34
VISTAS	Jun	2028	1.73	7.11	2.57	10.55
VISTAS	Jul	1233	3.79	8.88	5.63	13.21
VISTAS	Aug	1531	2.38	6.94	3.59	10.48
VISTAS	Sep	681	-0.13	6.09	-0.19	9.08

[30] URL: https://www.epa.gov/sites/production/files/2020-10/documents/met_tsd_2011_final_11-26-14.pdf

Figure 6-1 through Figure 6-4 show the spatial variability in bias and error at monitor locations. Mean bias, as seen from Figure 6-1, is within ±5 ppb at most sites across the VISTAS12 domain with a maximum under-prediction of 23.44 ppb at one site (AQS monitor 550030010) in Ashland County, Wisconsin and a maximum over-prediction of 17.95 ppb in York County, South Carolina (AQS monitor 450910006); both with small sample sizes (n=1 and n=7, respectively). A positive mean bias is generally seen in the range of 5 to 10 ppb with regions of 10 to 15 ppb over-prediction seen scattered throughout the domain. The model has a tendency to underestimate in the western portion of the domain and overestimate in the eastern portion of the domain.

Figure 6-2 indicates that the normalized mean bias for days with observed MDA8 ozone ≥ 60 ppb is within ± 10% at the vast majority of monitoring sites across the VISTAS12 modeling domain. Monitors in Ashland County, Wisconsin and York County, South Carolina again bookend the NMB range with 38.03% and 27.44%, respectively. There are regional differences in model performance, as the model tends to over predict at most sites in the eastern region of the VISTAS12 domain and generally under predict at sites in and around the western and northwestern borders of the domain.

The ME, as seen from Figure 6-3, is generally 10 ppb or less at most of the sites across the VISTAS12 modeling domain although the Ashland, Wisconsin and York County, South Carolina monitors show much higher ME of 23.44 and 17.95 ppb, respectively. VISTAS states show less than 10% of their monitors above 10 ppb model error, with the majority of those within this value. Figure 6-4 indicates that the NME for days with observed MDA8 ozone ≥ 60 ppb is less than 15% at the vast majority of monitoring sites across the VISTAS12 modeling domain. Noted exceptions seen are monitors 450910006 (York County, South Carolina), 470370011 (Davidson County, Tennessee), and 120713002 (Lee County, Florida) with NMEs of 27.44%, 25.4%, and 23.07%, respectively. Somewhat elevated NMEs (> 15%) are seen in and around many of the VISTAS state metro areas.

Additional details on the ozone model performance evaluation can be found in Appendix E-5.

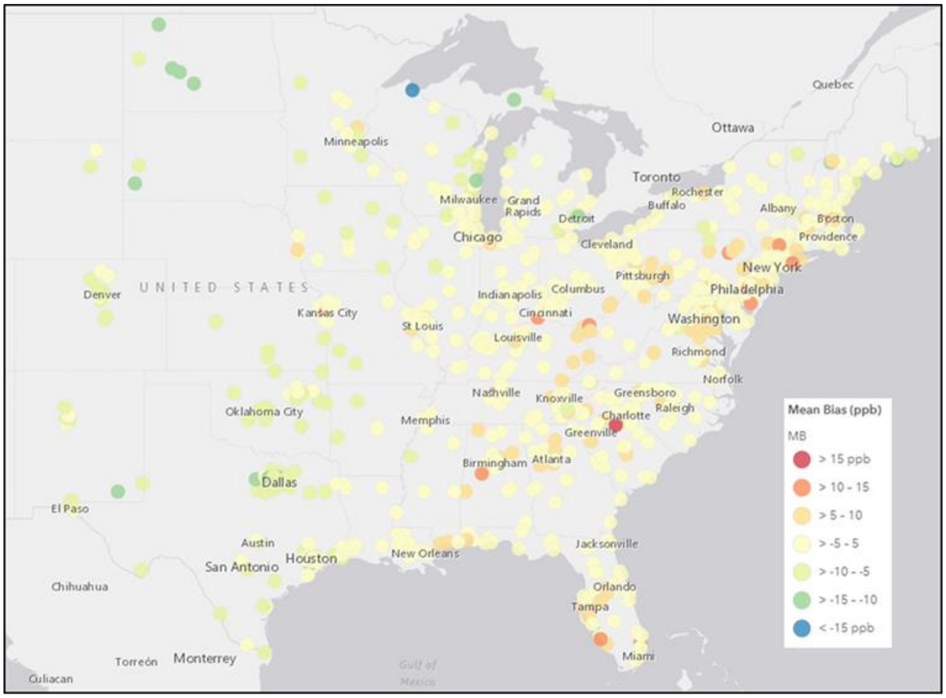


Figure 6-1: Mean Bias (ppb) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top)

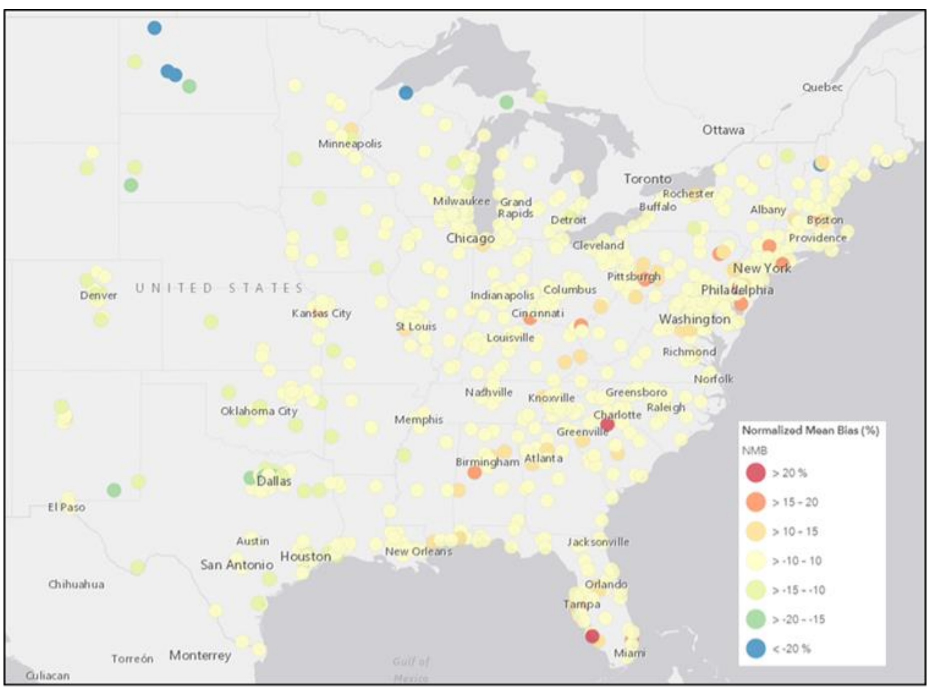


Figure 6-2: Normalized Mean Bias (%) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top)

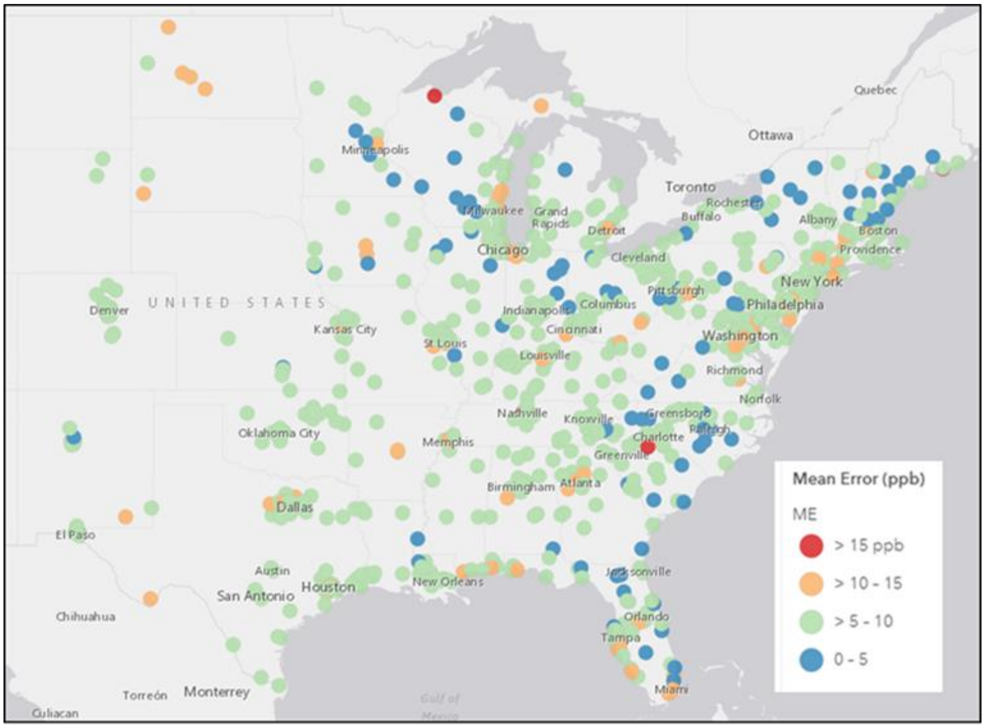


Figure 6-3: ME (ppb) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top)

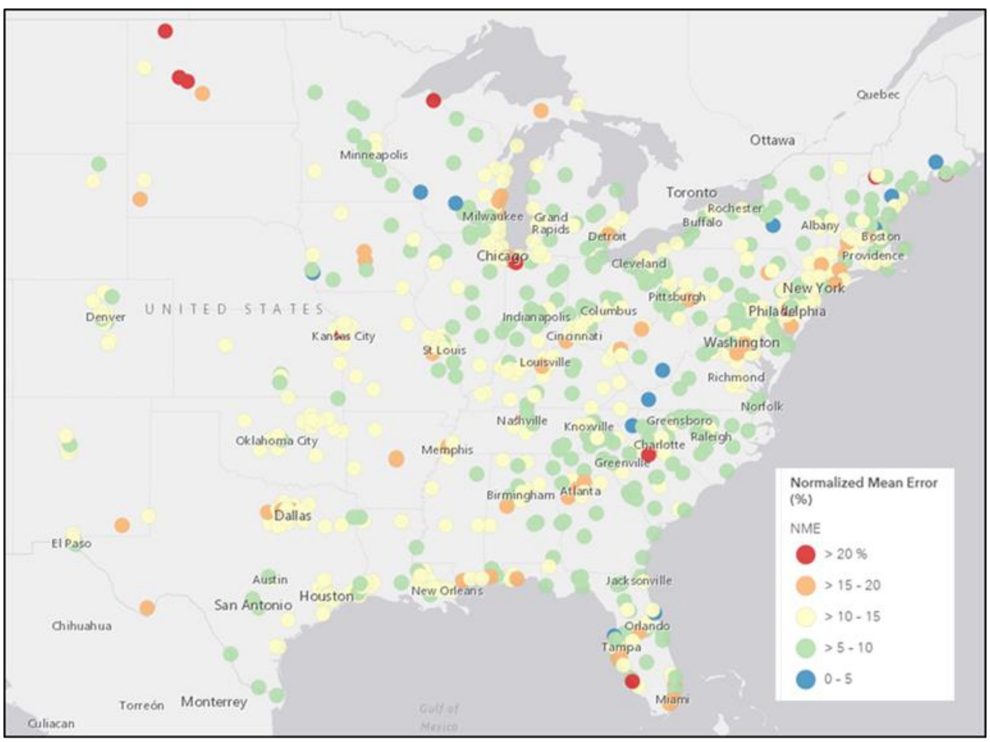


Figure 6-4: NME (%) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top)

6.2. Acid Deposition Model Performance Evaluation

The primary source for deposition data is the National Atmospheric Deposition Program (NADP).[31] The NADP monitoring networks used in this evaluation include:

- National Trends Network (NTN)
- Atmospheric Integrated Research Monitoring Network (AIRMon)
- Ammonia Monitoring Network (AMoN)

Dry deposition information is also available from CASTNet. The data from NTN and AIRMon were used in the wet deposition MPE, and the data from CASTNET and AMoN were used for dry deposition MPE. The MPE focused on the monitors from these networks within the VISTAS 12-km modeling domain (Figure 6-5).

[31] National Atmospheric Deposition Program (NRSP-3). 2018. NADP Program Office, Wisconsin State Laboratory of Hygiene, 465 Henry Mall, Madison, WI 53706. URL: http://nadp.slh.wisc.edu/

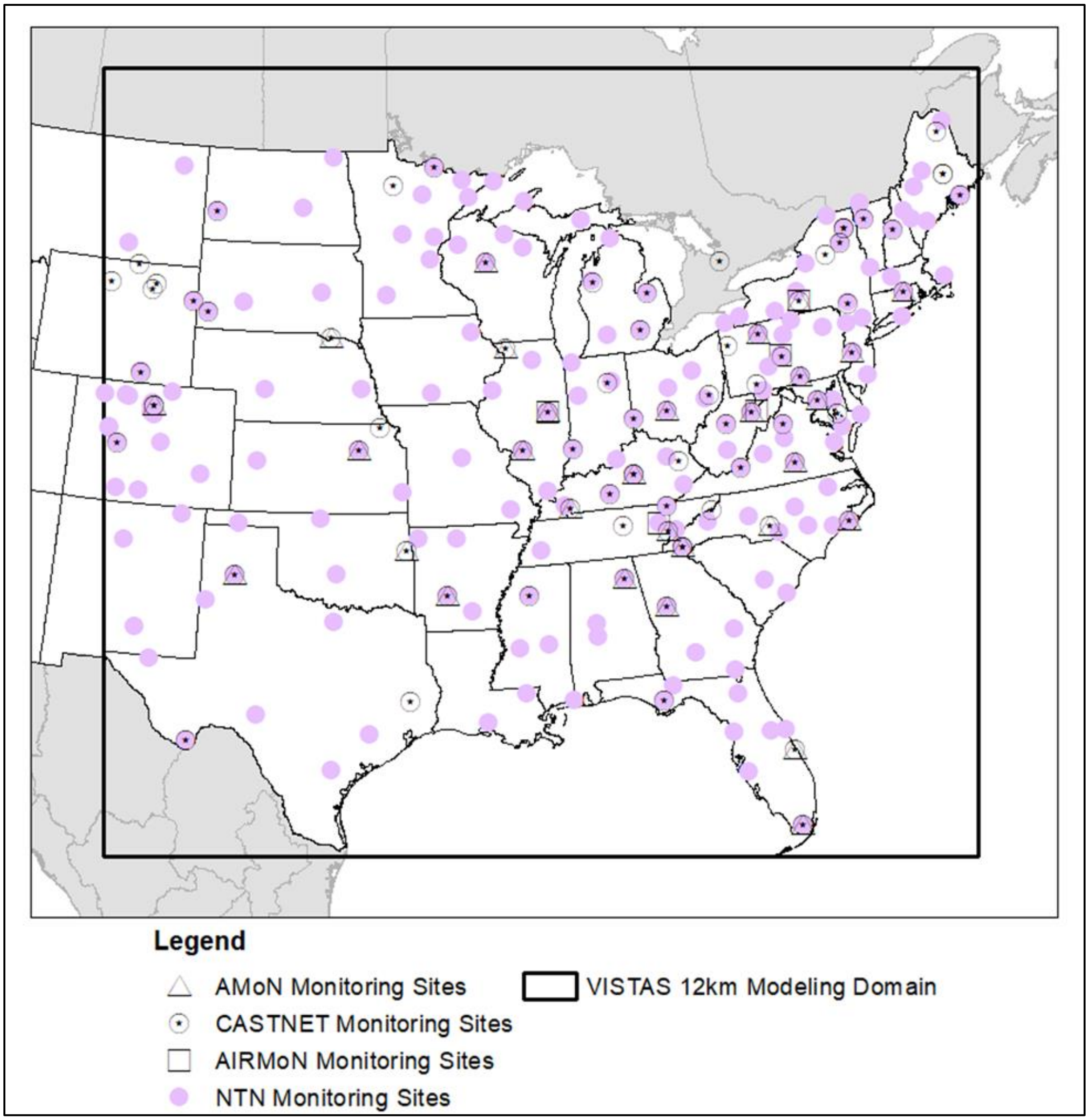


Figure 6-5: Deposition Monitors Included in the VISTAS 12 Domain

Table 6-2 summarizes the aggregated weekly MPE metrics for wet deposition in the VISTAS 12-km domain. The model demonstrates a negative mean bias for the ammonium ion (NH_4^+) and the sulfate ion (SO_4^{-2}) and a positive mean bias for the nitrate ion (NO_3^-) compared to the weekly NTN observations. The AIRMon sites have a larger positive mean bias for all pollutants.

Table 6-2: Weekly Wet Deposition MPE Metrics for NADP Sites in the VISTAS 12-km Domain

Network	Pollutant	n	MB (kg/ha)	ME (kg/ha)	NMB (%)	NME (%)	r (unitless)	MFB (%)	MFE (%)	RMSE (unitless)
NTN	NH_4^+	3,404	-0.025	0.045	-32%	58%	0.629	-19%	34%	0.092
NTN	NO_3^-	3,404	0.024	0.123	12%	62%	0.642	6%7	29%	0.242
NTN	SO_4^{-2}	3,404	-0.001	0.118	0%	57%	0.681	0%	29%	0.245
AIRMon	NH_4^+	158	-0.003	0.020	-31%	76%	0.534	-7%	41%	0.041
AIRMon	NO_3^-	158	0.051	0.097	67%	127%	0.398	25%	47%	0.192
AIRMon	SO_4^{-2}	158	0.018	0.091	20%	100%	0.352	9%	46%	0.197

When considering the total accumulated wet deposition for the calendar year, there is still under prediction of NH_4^+ and SO_4^{2-}, and a slight over prediction of NO_3^-. However, continued improvement is seen from the seasonal accumulated performance with respect to the NME and r values, as presented in Table 6-3.

Table 6-3: Accumulated Annual Wet Deposition MPE Metrics for NADP Sites in the VISTAS 12-km Domain

Pollutant	n	MB (kg/ha)	MGE (kg/ha)	NMB (%)	NME (%)	r (unitless)	MFB (%)	MFE (%)	RMSE (unitless)
NH_4^+	99	-1.245	1.246	-38%	38%	0.861	-23%	23%	1.536
NO_3^-	99	0.134	1.453	2%	17%	0.901	1%	8%	1.933
SO_4^{2-}	99	-0.585	1.604	-7%	18%	0.916	-3%	9%	2.142

The weekly dry deposition MB and ME presented in Table 6-4 would seem to suggest relatively good model performance for the CASTNET sites. The higher normalized mean and mean fractional bias and error values are due to small values in the denominator.

Table 6-4: Weekly Dry Deposition MPE Metrics for CASTNet Sites in the VISTAS 12-km Domain

Network	Pollutant	n	MB (kg/ha)	ME (kg/ha)	NMB (%)	NME (%)	r (unitless)	MFB (%)	MFE (%)	RMSE (unitless)
CASTNet	Cl^-	965	-0.001	0.001	-87%	89%	0.796	-77%	79%	0.004
CASTNet	NH_4^+	965	0.001	0.003	13%	51%	0.603	6%	24%	0.004
CASTNet	SO_4^{2-}	965	0.0004	0.007	3%	43%	0.650	1%	21%	0.009
CASTNet	SO_2	965	-0.031	0.031	-96%	96%	0.656	-93%	93%	0.052
CASTNet	NO_3^-	965	0.001	0.004	12%	80%	0.601	6%	37%	0.006
CASTNet	HNO_3	965	-0.062	0.062	-95%	95%	0.612	-90%	90%	0.077
AMoN	NH_3	355	-0.007	0.007	-95%	95%	0.463	%91	91%	0.013

As presented in Table 6-5, most pollutants, except for NO_3, are under predicted, based on the total accumulated dry deposition. SO_2 and HNO_3 have the worst under prediction of all the pollutants, followed by Cl^-.

Table 6-5: Accumulated Annual Wet Deposition MPE Metrics for CASTNet Sites in the VISTAS 12-km Domain

Pollutant	n	MB (kg/ha)	MGE (kg/ha)	NMB (%)	NME (%)	r (unitless)	MFB (%)	MFE (%)	RMSE (unitless)
Cl^-	19	-0.054	0.054	-88%	88%	0.981	-78%	78%	0.156
NH_4^+	19	-0.002	0.077	-1%	27%	0.688	0%	14%	0.090
SO_4^{2-}	19	-0.067	0.219	-8%	27%	0.537	-4%	14%	0.268
SO_2	19	-1.616	1.616	-97%	97%	0.869	-94%	94%	2.221
NO_3^-	19	0.001	0.113	1%	46%	0.572	0%	23%	0.154
HNO_3	19	-3.272	3.272	-95%.4	95%	0.607	-91%	91%	3.688

Additional details on the wet and dry acid deposition model performance evaluation can be found in Appendix E-4.

6.3. PM Model Performance Goals and Criteria

Because $PM_{2.5}$ is a mixture, the current EPA PM modeling guidance[32] recommends that a meaningful performance evaluation should include an assessment of how well the model is able to predict individual chemical components that constitute $PM_{2.5}$. Consistent with EPA's performance evaluation of the regional haze 2028 analysis, in addition to total $PM_{2.5}$, the following components of $PM_{2.5}$ were also examined.

- Sulfate ion (SO_4^{2-})
- Nitrate ion (NO_3^-)
- Ammonium ion (NH_4^+)
- Elemental Carbon (EC)
- Organic Carbon (OC) and/or Organic Carbon Mass (OCM)
- Crustal (weighted average of the most abundant trace elements in ambient air)
- Sea salt constituents (Na^+ and Cl^-)

Recommended benchmarks for photochemical model performance statistics (Boylan, 2006; Emery, 2017) were used to assess the applicability of the VISTAS modeling platform for Regional Haze SIP purposes. The goal and criteria values noted in Table 6-6 below were used for this modeling.

[32] URL: https://www.epa.gov/sites/production/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf

Table 6-6: Fine Particulate Matter Performance Goals and Criteria

Species	NMB, Goal	NMB, Criteria	NME, Goal	NME, Criteria	FB, Goal	FB, Criteria	FE, Goal	FE, Criteria	r, Goal	r, Criteria
24-hr $PM_{2.5}$ and sulfate	<± 10%	<± 30%	< 35%	< 50%	<± 30%	<± 60%	< 50%	< 75%	>0.75	>0.50
24-hr nitrate	<± 10%	<± 65%	< 65%	< 115%	<± 30%	<± 60%	< 50%	< 75%	>0.75	>0.40
24-hr OC	<± 15%	<± 50%	< 45%	< 65%	<± 30%	<± 60%	< 50%	< 75%	None	None
24-hr EC	<± 20%	<± 40%	< 50%	< 75%	<± 30%	<± 60%	< 50%	< 75%	None	None

The mapping of the CAMx species into the observed species are presented in Table 6-7.

Table 6-7: Species Mapping from CAMx into Observation Network

Network	Observed Species	CAMx Species
IMPROVE	NO_3	PNO3
IMPROVE	SO_4	PSO4
IMPROVE	NH_4	PNH4
IMPROVE	OM = 1.8*OC	SOA1+SOA2+SOA3+SOA4 +SOPA+SOPB+POA
IMPROVE	EC	PEC
IMPROVE	SOIL	FPRM+FCRS
IMPROVE	$PM_{2.5}$	PSO4+PNO3+PNH4+SOA1+SOA2+SOA3+SOA4 +SOPA+SOPB+POA+PEC+FPRM+FCRS+NA+PCL
CSN	$PM_{2.5}$	PSO4+PNO3+PNH4+SOA1+SOA2+SOA3+SOA4 +SOPA+SOPB+POA+PEC+FPRM+FCRS+NA+PCL
CSN	NO_3	PNO3
CSN	SO_4	PSO4
CSN	NH_4	PNH4
CSN	OM = 1.4*OC	SOA1+SOA2+SOA3+SOA4 +SOPA+SOPB+POA
CSN	EC	PEC

Several graphic displays of model performance were prepared, including:

- Performance goal plots ("soccer plots") that summarize model performance by species, region, and season.
- Concentration performance plots ("bugle plots") that display fractional bias or error as a function of concentration by species, region, monitoring network, and month.
- Scatter plots of predicted and observed concentrations by species, monitoring network, and month.
- Time series plots of predicted and observed concentrations by species, monitoring site, and month.
- Spatially averaged time series plots.
- Time series plots of monthly fractional bias and error by species, region, and network.

Both soccer plots and bugle plots offer a convenient way to examine model performance with respect to set goals and criteria. The bugle plots have the added benefit of adjusting the goals and criteria to consider the concentration of the species. Analysis of bugle plots generally suggests that greater emphasis should be placed on performance of those components with the greatest contribution to PM mass and visibility impairment (e.g., sulfate and organic carbon) and that greater bias and error could be accepted for components with smaller contributions to total PM mass (e.g., elemental carbon, nitrate, and soil).

6.4. PM Model Performance Evaluation for the VISTAS Modeling Domain

Further discussion of model performance in this document will focus on the comparison of observational data from the CASTNET, CSN, and IMPROVE monitors (Table 6-8) in the VISTAS12 modeling domain and model output data from the VISTAS2011 annual air quality modeling.

Table 6-8: Overview of Utilized Ambient Data Monitoring Networks

Monitoring Network	Chemical Species Measured	Sampling Period
IMPROVE	Speciated $PM_{2.5}$ and PM_{10}; light extinction data	1 in 3 days; 24-hour average
CASTNET	Speciated $PM_{2.5}$, and O_3	1-week average
CSN	Speciated $PM_{2.5}$	24-hour average

The evaluation primarily focused on the air quality model's performance with respect to individual components of fine particulate matter, as good model performance of the component species will dictate good model performance of total or reconstituted fine particulate matter. Model performance of the total fine particulate matter and the resulting total light extinction was also examined as a means to discuss the overall model performance. A full list of model performance statistics is found in Appendix E-3.

The soccer plots for all VISTAS and non-VISTAS monitors are included here for summary purposes. Plots have been developed for the monthly average performance statistics for the most significant light scattering component species (i.e., sulfate, nitrate, organic carbon, and elemental carbon).

The soccer plots of monthly concentrations show values for $PM_{2.5}$ (Figure 6-6) at CSN, IMPROVE monitors and sulfate (Figure 6-7), nitrate (Figure 6-8), organic carbon (Figure 6-9), and elemental carbon (Figure 6-10) at CSN, IMPROVE, CASTNET monitors in VISTAS and non-VISTAS states in the modeling domain. $PM_{2.5}$ is mostly inside the NMB and NME criteria for CSN/VISTAS, CSN/non-VISTAS, IMPROVE/VISTAS, and IMPROVE/non-VISTAS. Sulfate is mostly inside the NMB and NME criteria for CSN/VISTAS, CSN/non-VISTAS, IMPROVE/VISTAS, and IMPROVE/non-VISTAS; but mostly outside the NMB and NME criteria for CASTNet/VISTAS and CASTNet/non-VISTAS. Nitrate is mostly inside the NMB and NME criteria for CASTNet/VISTAS, CASTNet/non-VISTAS, CSN/VISTAS, CSN/non-

VISTAS, IMPROVE/VISTAS, and IMPROVE/non-VISTAS. Organic carbon is mostly inside the NMB and NME criteria for IMPROVE/VISTAS and IMPROVE/non-VISTAS; but mostly outside the NMB and NME criteria for CSN/VISTAS and CSN/non-VISTAS. Elemental carbon is mostly inside the NMB and NME criteria for CSN/VISTAS, IMPROVE/VISTAS, and IMPROVE/non-VISTAS; but mostly outside the NMB and NME criteria for and CSN/non-VISTAS.

Figure 6-6 contains soccer plots of NMB and NME for total $PM_{2.5}$ at CSN and IMPROVE monitors. Most CSN values are within the NMB and NME criteria. For IMPROVE, four months are outside the NMB and NME criteria for the VISTAS states and six months are outside the NMB and NME criteria for the non-VISTAS states.

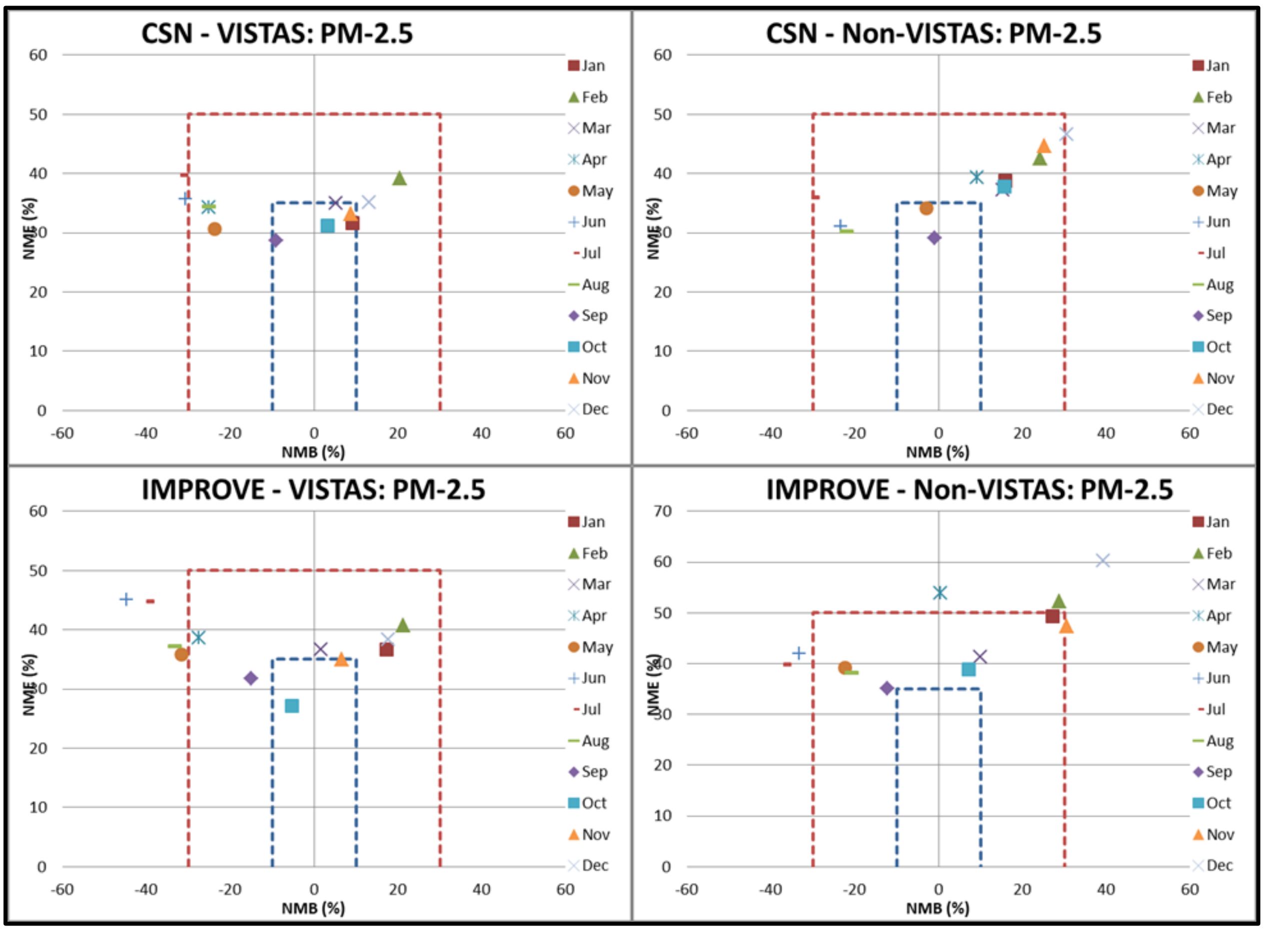


Figure 6-6: Soccer Plots of Total $PM_{2.5}$ by Network and Month for VISTAS and Non-VISTAS Sites

Figure 6-7 contains soccer plots of NMB and NME for sulfate at CASTNET, CSN, and IMPROVE monitors. For CASTNet, seven months are outside the NMB and NME criteria for the VISTAS states and seven months are outside the NMB and NME criteria for the non-VISTAS states. Most CSN values are within the NMB and NME criteria. For IMPROVE, two months are outside the NMB and NME criteria for the VISTAS states and no months are outside the NMB and NME criteria for the non-VISTAS states.

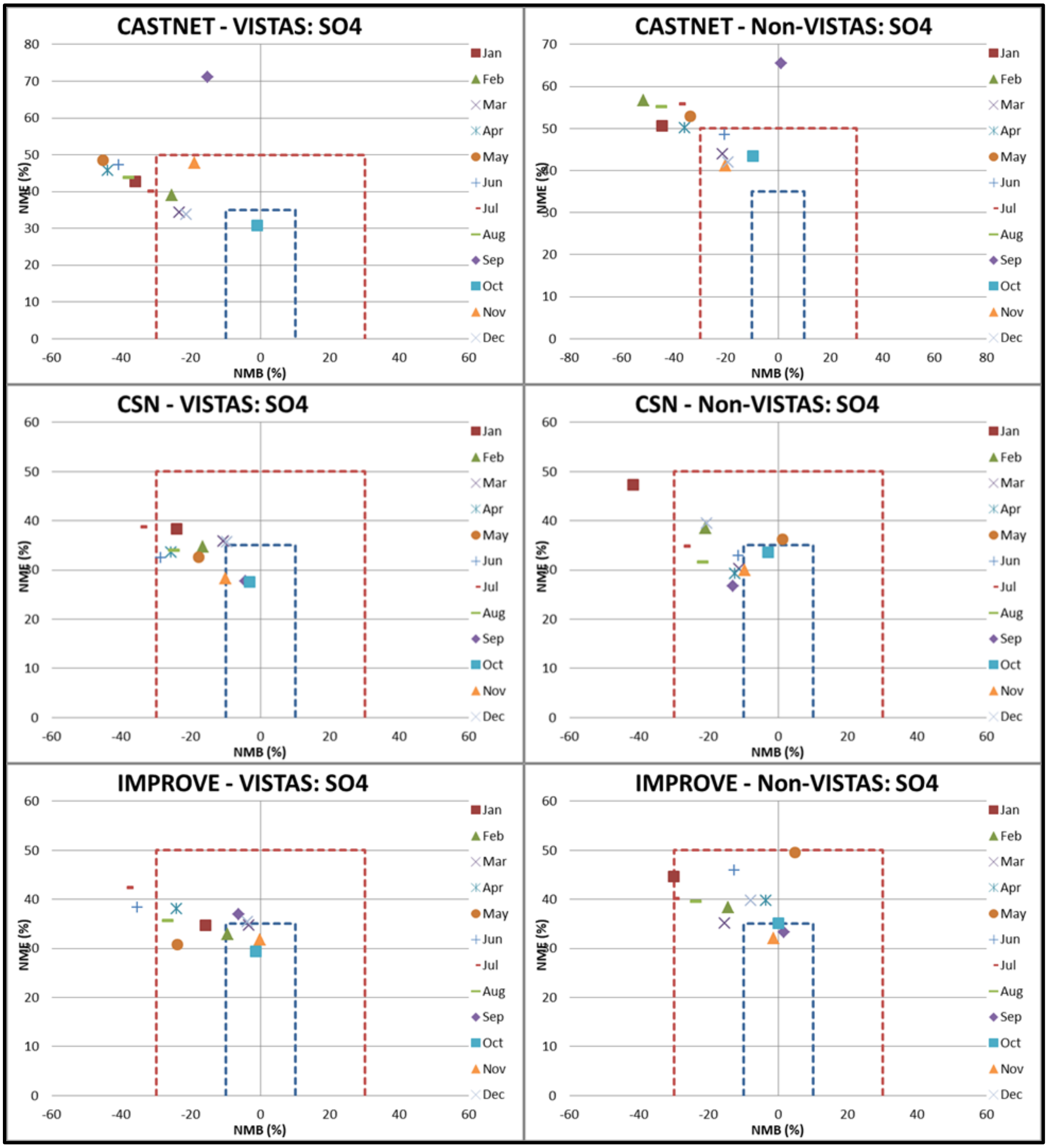


Figure 6-7: Soccer Plots by Network and Month for VISTAS and Non-VISTAS Sites

Figure 6-8 contains soccer plots of NMB and NME for nitrate at CASTNET, CSN, and IMPROVE monitors. Most CASTNet and CSN values are within the NMB and NME criteria. For IMPROVE, two months are outside the NMB and NME criteria for the VISTAS states and one month is outside the NMB and NME criteria for the non-VISTAS states.

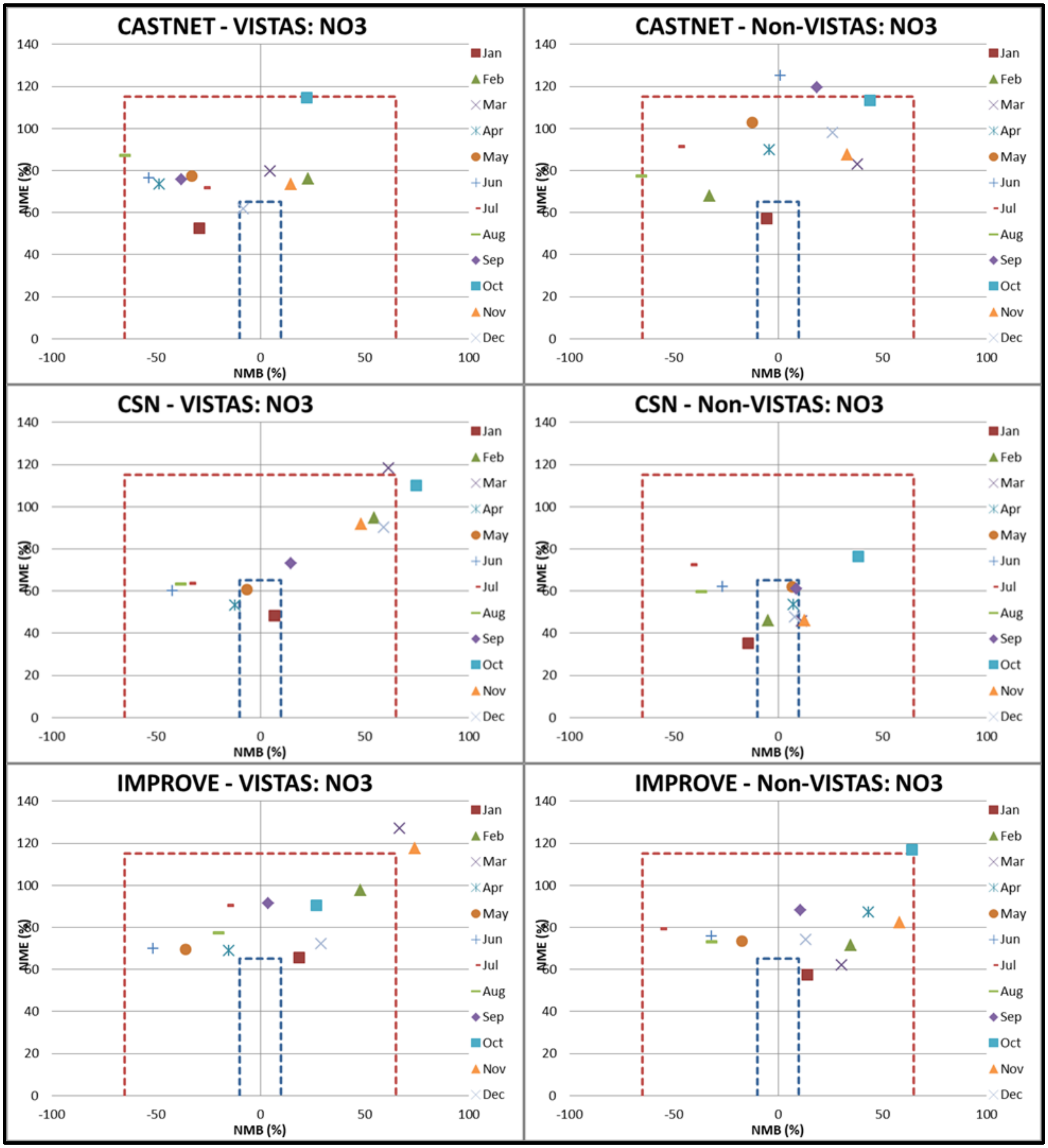


Figure 6-8: Soccer Plots of Nitrate by Network and Month for VISTAS and Non-VISTAS Sites

Figure 6-9 contains soccer plots of NMB and NME for organic carbon at CASTNET, CSN, and IMPROVE monitors. Most CSN values are outside the NMB and NME criteria. For IMPROVE, no months are outside the NMB and NME criteria for the VISTAS states and four months are outside the NMB and NME criteria for the non-VISTAS states.

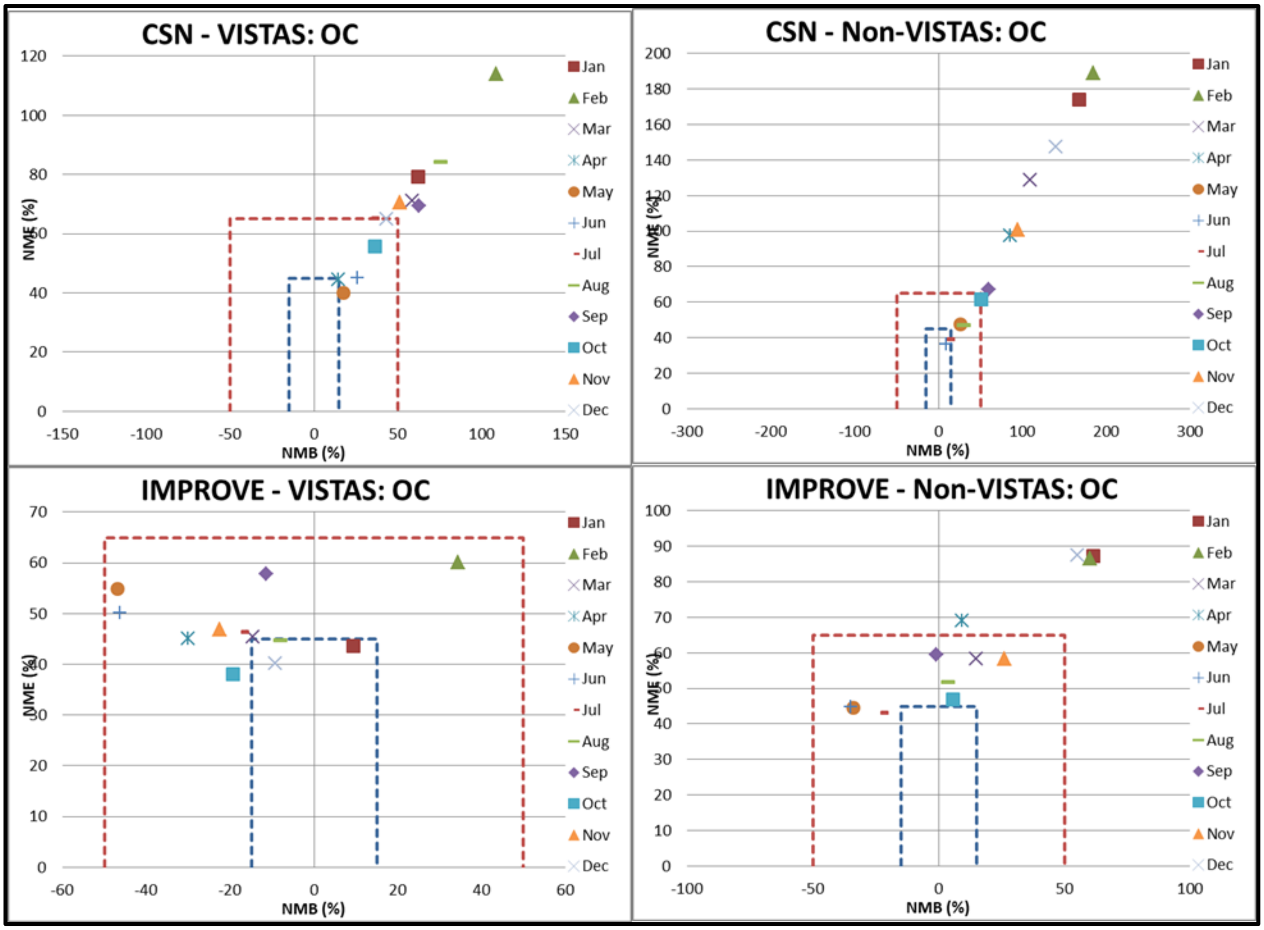


Figure 6-9: Soccer Plots of OC by Network and Month for VISTAS and Non-VISTAS Sites

Figure 6-10 contains soccer plots of NMB and NME for elemental carbon at CASTNET, CSN, and IMPROVE monitors. For CSN, two months are outside the NMB and NME criteria for the VISTAS states and six months are outside the NMB and NME criteria for the non-VISTAS states. For IMPROVE, one month is outside the NMB and NME criteria for the VISTAS states and five months are outside the NMB and NME criteria for the non-VISTAS states.

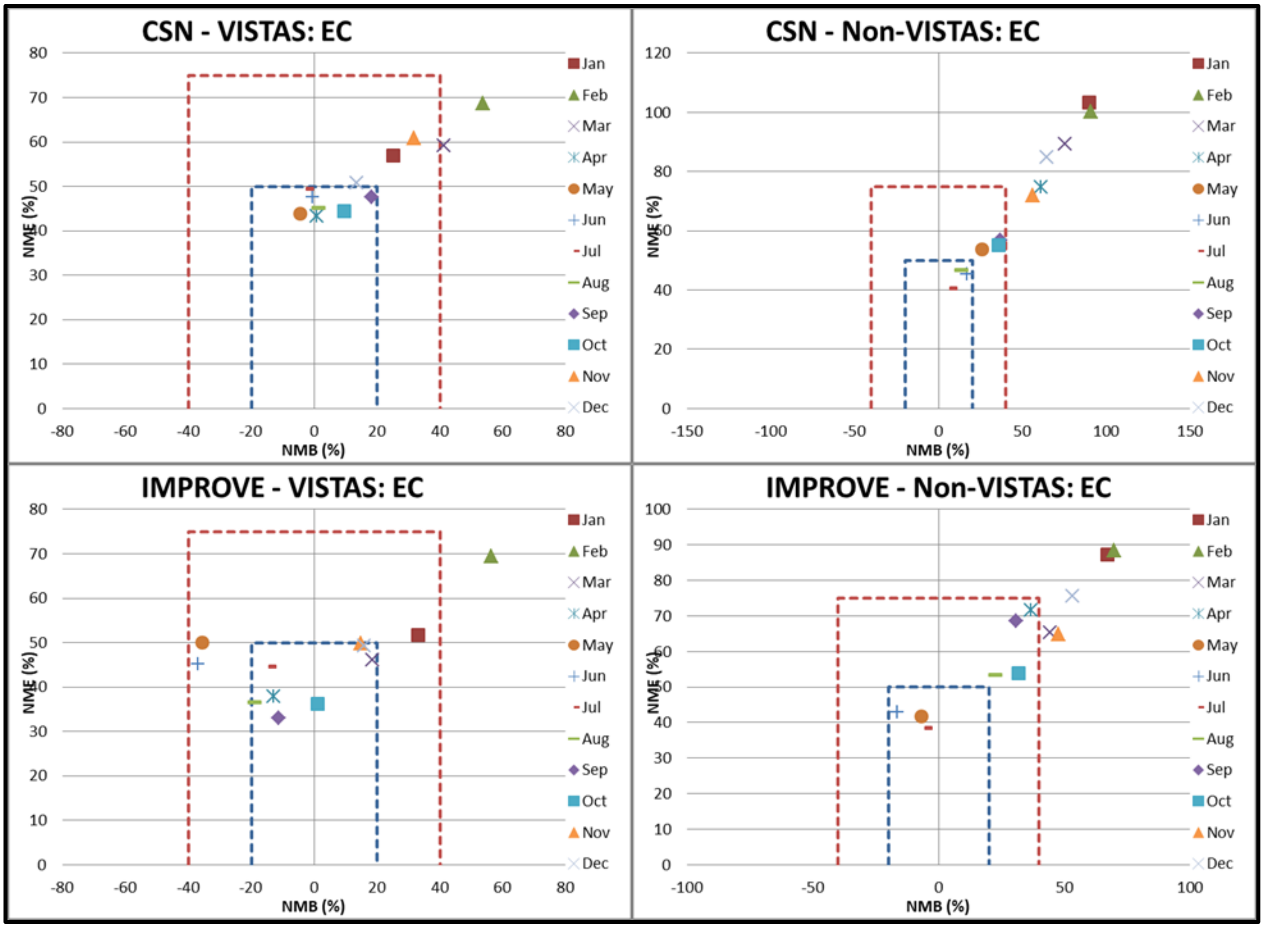


Figure 6-10: Soccer Plots of EC by Network and Month for VISTAS and Non-VISTAS Sites

Spatial plots summarizing IMPROVE observations and model NMB on the 20% most-impaired days are shown in Figure 6-11 through Figure 6-16. In each figure the top graphic presents the observed concentration, and the bottom graphic presents the NMB.

For sulfate (Figure 6-11), predictions on the 20% most-impaired days are biased low across all regions, with the most significant percentage under predictions occurring in the southwest quarter of the VISTAS12 modeling domain. Some isolated over predictions are observed in a few Class I areas near the outer domain boundaries and in the northeast.

Predictions of nitrate (Figure 6-12) on the 20% most-impaired days in the VISTAS12 modeling domain are mixed with a high positive bias in the north and a mix of negative and positive bias in the southeast.

A general positive bias of OC (Figure 6-13) is observed across the region on the 20% most-impaired days. In the SESARM states the OC has approximately the same NMB at monitors with high observed concentrations as monitors with lower observed concentrations. For EC

(Figure 6-14) the model shows a slight under prediction at monitors in the northern portion of the SESARM states and a positive bias at monitors in the southern SESARM region.

On the 20% most-impaired days, model performance for total $PM_{2.5}$ (Figure 6-15) is overall biased low across most quadrants of the VISTAS12 modeling domain (corresponding closely to the sulfate performance). A slight over prediction of $PM_{2.5}$ on those days is observed in the Northern Plains and Upper Midwest, primarily along the Canadian border (corresponding closely to high nitrate concentrations and performance).

Sea salt (Figure 6-16) is generally over predicted along boundaries with ocean water bodies (Atlantic Ocean and Gulf of Mexico) and is expectedly under predicted across the rest of the VISTAS12 modeling domain.

Table 6-9 shows model performance statistics for the Class I areas in VISTAS and closely surrounding VISTAS. The criteria for each statistic is listed in parenthesis on the first row. These criteria are provided in Table 6-6. The values in red text in Table 6-9 indicate that the criterion was not met. As stated previously, the model performance statistics should be evaluated for all of the VISTAS Class I areas collectively. As such, the averages of the statistics were calculated. The second to last row of Table 6-9 shows the average of all the Class I areas in the table, and the last row shows the average of all the VISTAS Class I areas. Of the five statistics listed in the table, only one average (i.e., NMB) did not meet the criteria, and it was only slightly above the criteria. The other four statistics met the criteria.

The EPA guidance states that it is not appropriate to assign "bright line" criteria that distinguish between adequate and inadequate model performance with a single model performance test.[33] The EPA guidance recommends that a "weight of evidence" approach be used to determine whether a particular modeling application is acceptable for use in regulatory demonstrations. The EPA recommends that air agencies conduct a variety of performance tests and weigh them qualitatively to assess model performance.

For the most part, modeled and observed $PM_{2.5}$ concentrations and light extinctions at each Class I area match reasonably well on both the 20% most-impaired days and 20% clearest days. Although model performance for sulfate at each Class I area is biased low on the 20% most-impaired days, the model performance statistics for sulfate are reasonable for regulatory modeling. Additionally, the future year sulfate concentrations are not based on the absolute modeled values, but instead the model is applied in a relative sense through calculation of relative response factors (RRFs). The RRF is the relative change in sulfates between the base year modeled value and future year modeled value. The future year sulfate concentrations are

[33] EPA Modeling Guidance for Demonstrating Air Quality Goals for Ozone, PM2.5 and Regional Haze, November 2018

then estimated by multiplying the base year actual monitored value by the RRF. Factors causing bias in the base case will also affect the future case; therefore, using the modeling in a relative sense resolves any problems posed by the under prediction of sulfates and will not lead to an under-estimation of source contributions.

Table 6-9: Sulfate Model Performance Criteria for 20% Most Impaired Days in 2011

Class I Area	# Obs.	NMB (<±30%)	MFB (<±60%)	NME (<50%)	MFE (<75%)	r (>0.5)
Breton	22	-41.83	-60.47	47.93	65.77	0.27
Brigantine	23	-32.93	-39.18	32.93	39.18	0.79
Caney Creek	11	-46.01	-70.2	52.63	75.57	0.49
Cape Romain	24	-28.85	-36.98	36.03	44.17	0.62
Chassahowitzka	24	-39.37	-48.96	44.06	54.49	-0.06
Cohutta	18	-28.18	-32.67	33.06	38.07	0.14
Dolly Sods	24	-27.18	-30.24	34.55	37.86	0.63
Everglades	14	-12.14	-19.56	38.62	43.1	0.2
Great Smoky Mountains	23	-36.92	-46.25	41.47	51.74	0.22
Hercules - Glade	20	-31.75	-41.93	37.76	47.55	0.7
James River Face	24	-36.62	-44.57	36.89	44.88	0.52
Linville Gorge	23	-16.32	-19.66	30.87	35.2	0.49
Mammoth Cave	23	-38.26	-48.89	38.27	48.91	0.8
Mingo	19	-31.4	-38.96	31.88	39.67	0.64
Okefenokee	22	-41.42	-58.55	43.98	61.54	0.52
Saint Marks	22	-40.16	-56.91	48.3	65.37	0.37
Shenandoah	24	-24.34	-30.57	29.31	35.53	0.74
Shining Rock[34]	0	--	--	--	--	--
Sipsey	19	-35.37	-43.37	35.37	43.37	0.75
Swanquarter	22	-25.28	-32.13	31.56	37.56	0.6
Upper Buffalo	23	-17	-27.18	30.66	37.22	0.71
AVERAGE - ALL	**424**	**-31.82**	**-40.97**	**37.27**	**46.7**	**0.62**
AVERAGE - VISTAS	**306**	**-31.33**	**-39.76**	**36.93**	**45.95**	**0.63**

[34] Shining Rock did not have valid monitoring data for 2011.

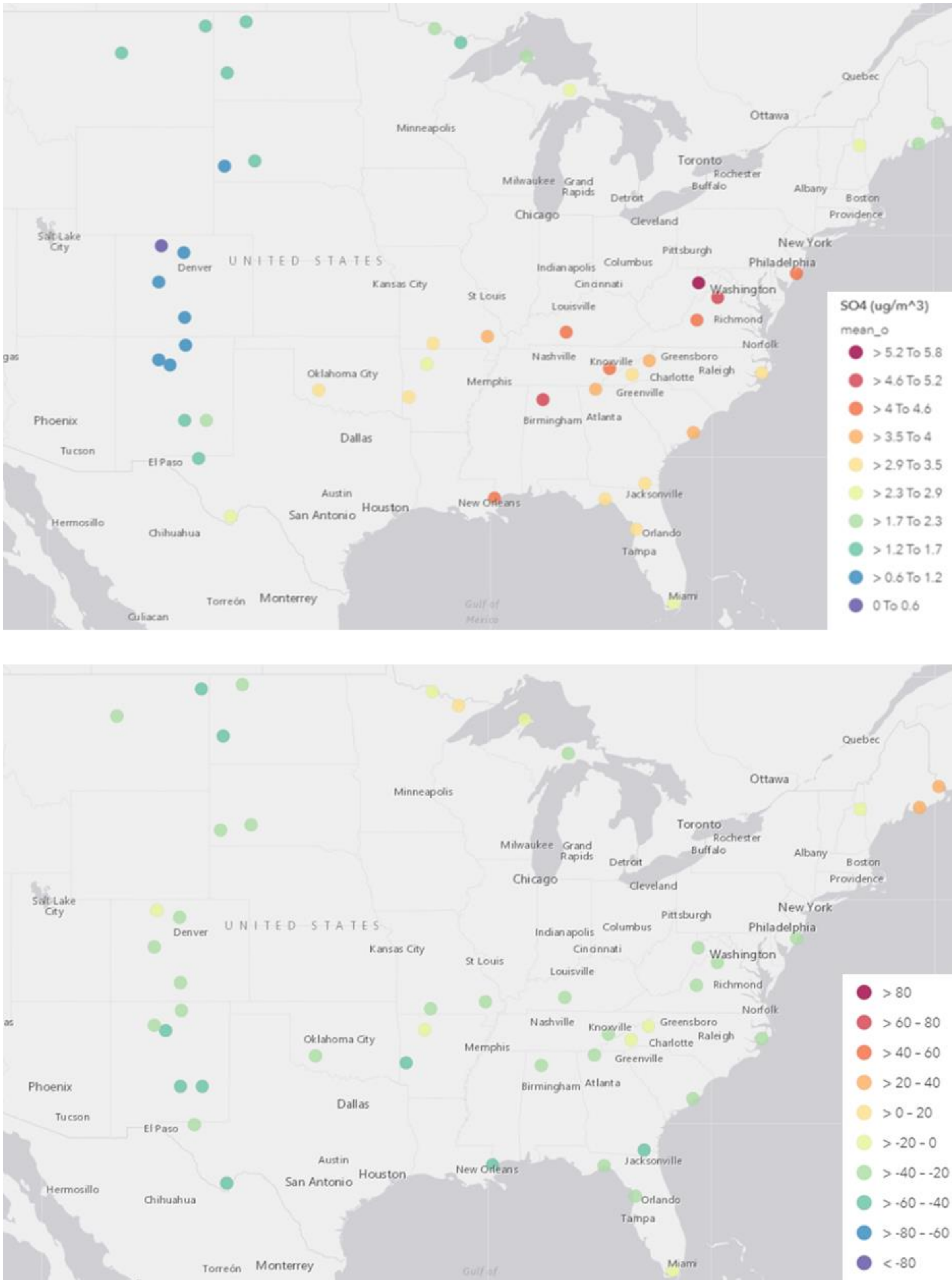
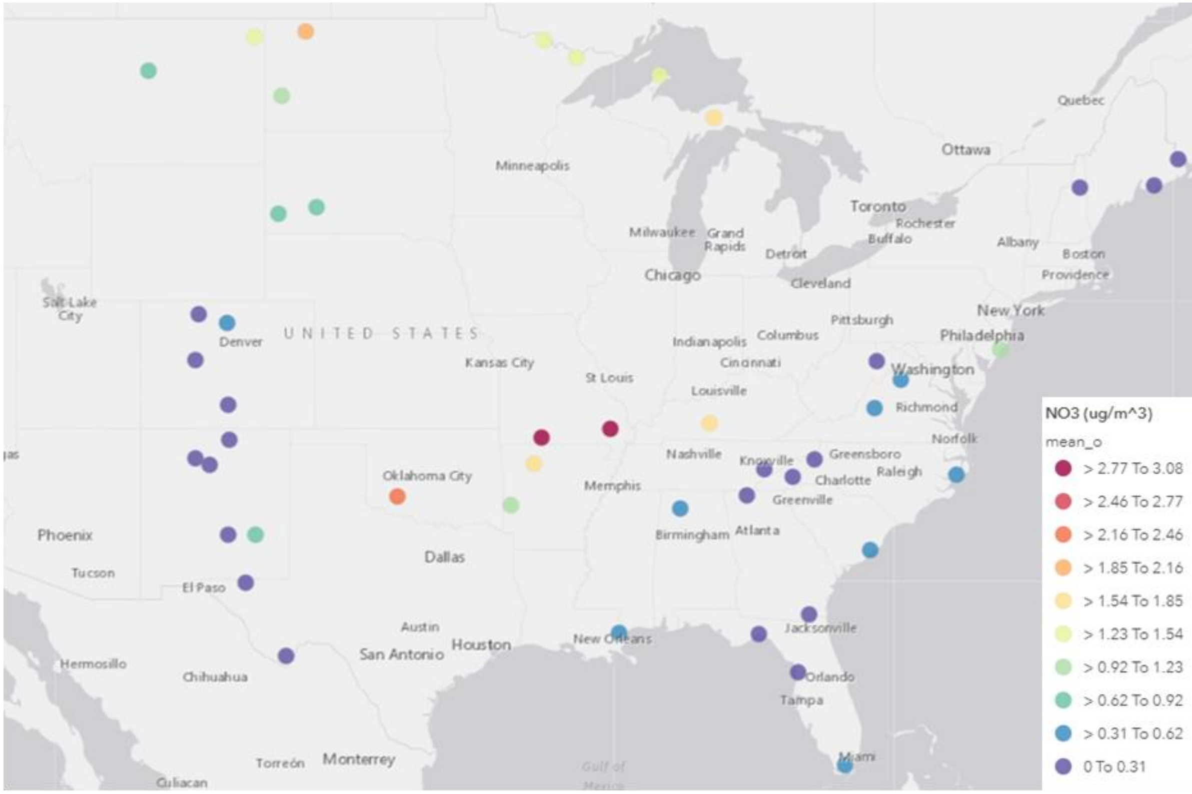


Figure 6-11: Observed Sulfate (Top) and Modeled NMB (Bottom) for Sulfate on the 20% Most-Impaired Days at IMPROVE Monitor Locations



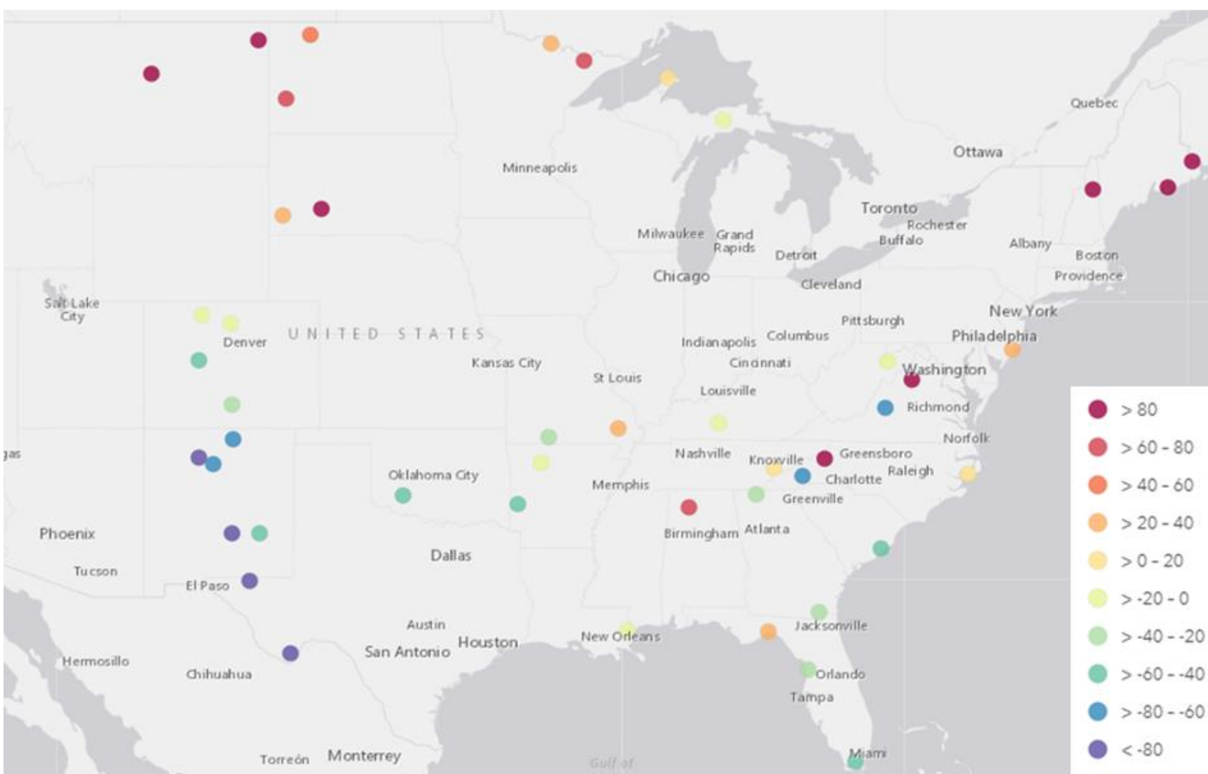


Figure 6-12: Observed Nitrate (Top) and Modeled NMB (Bottom) for Nitrate on the 20% Most Impaired Days at Improve Monitor Locations

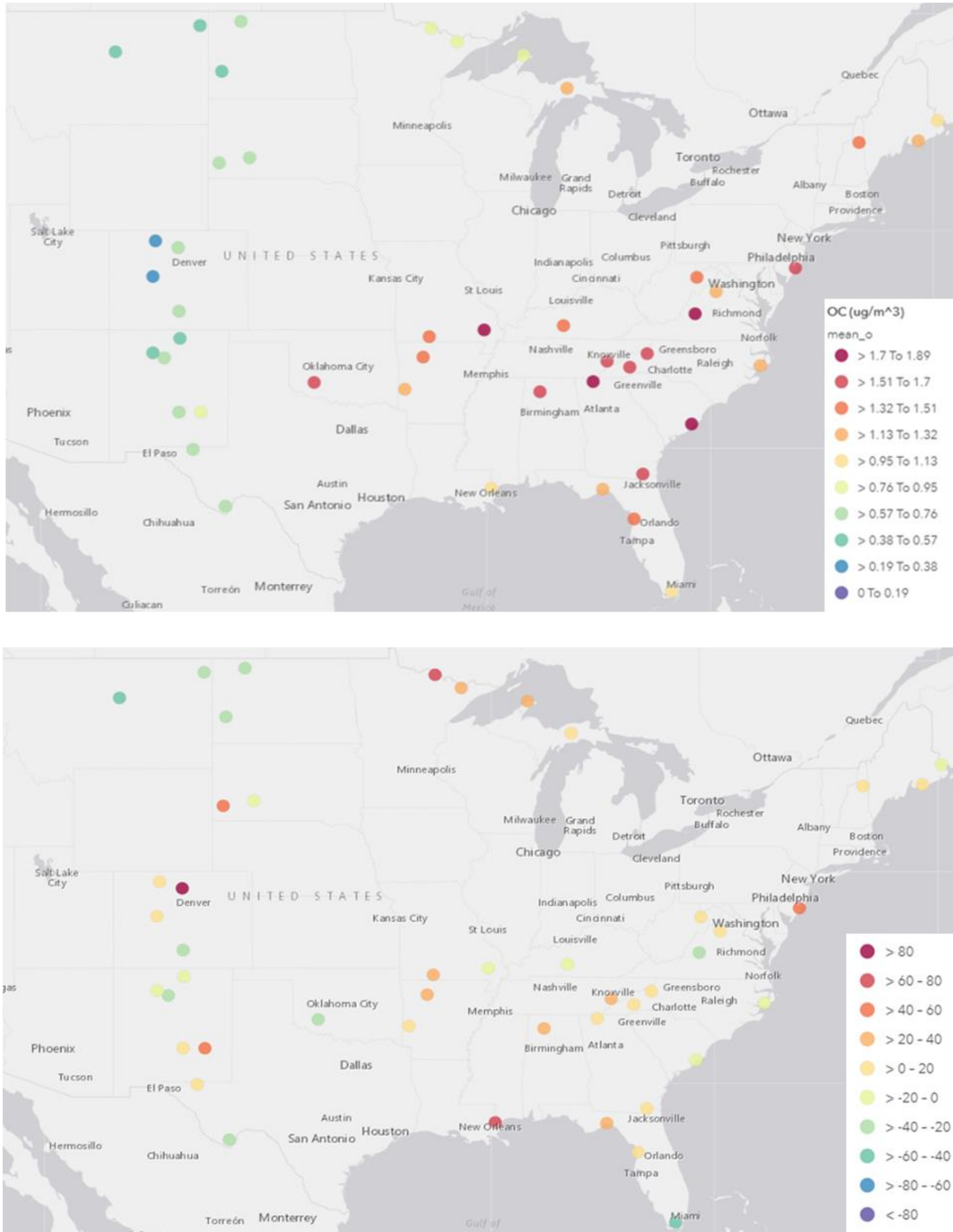


Figure 6-13: Observed OC (Top) and Modeled NMB (Bottom) for OC on the 20% Most-Impaired Days at IMPROVE Monitor Locations

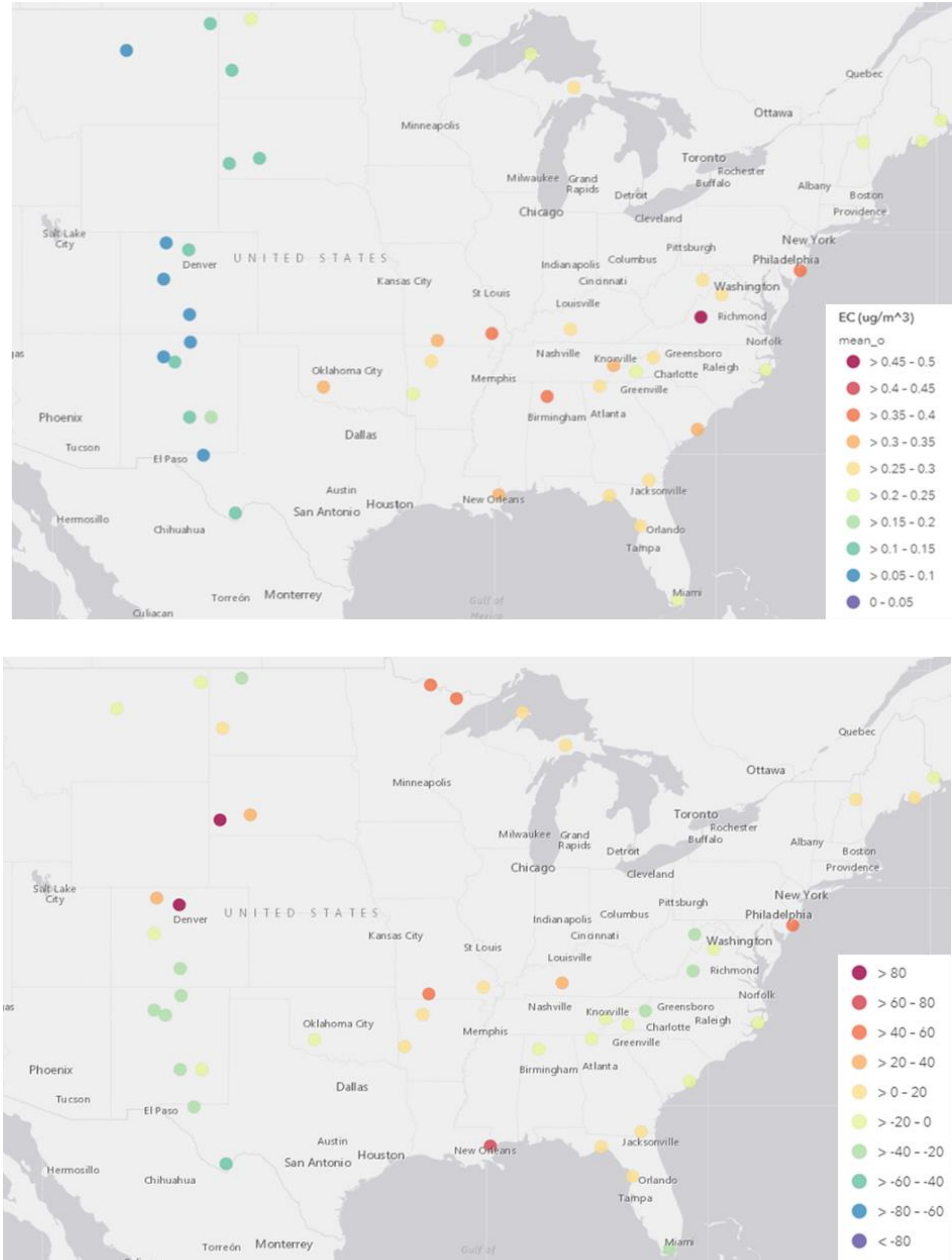


Figure 6-14: Observed EC (Top) and Modeled NMB (Bottom) for EC on the 20% Most-Impaired Days at IMPROVE Monitor Locations

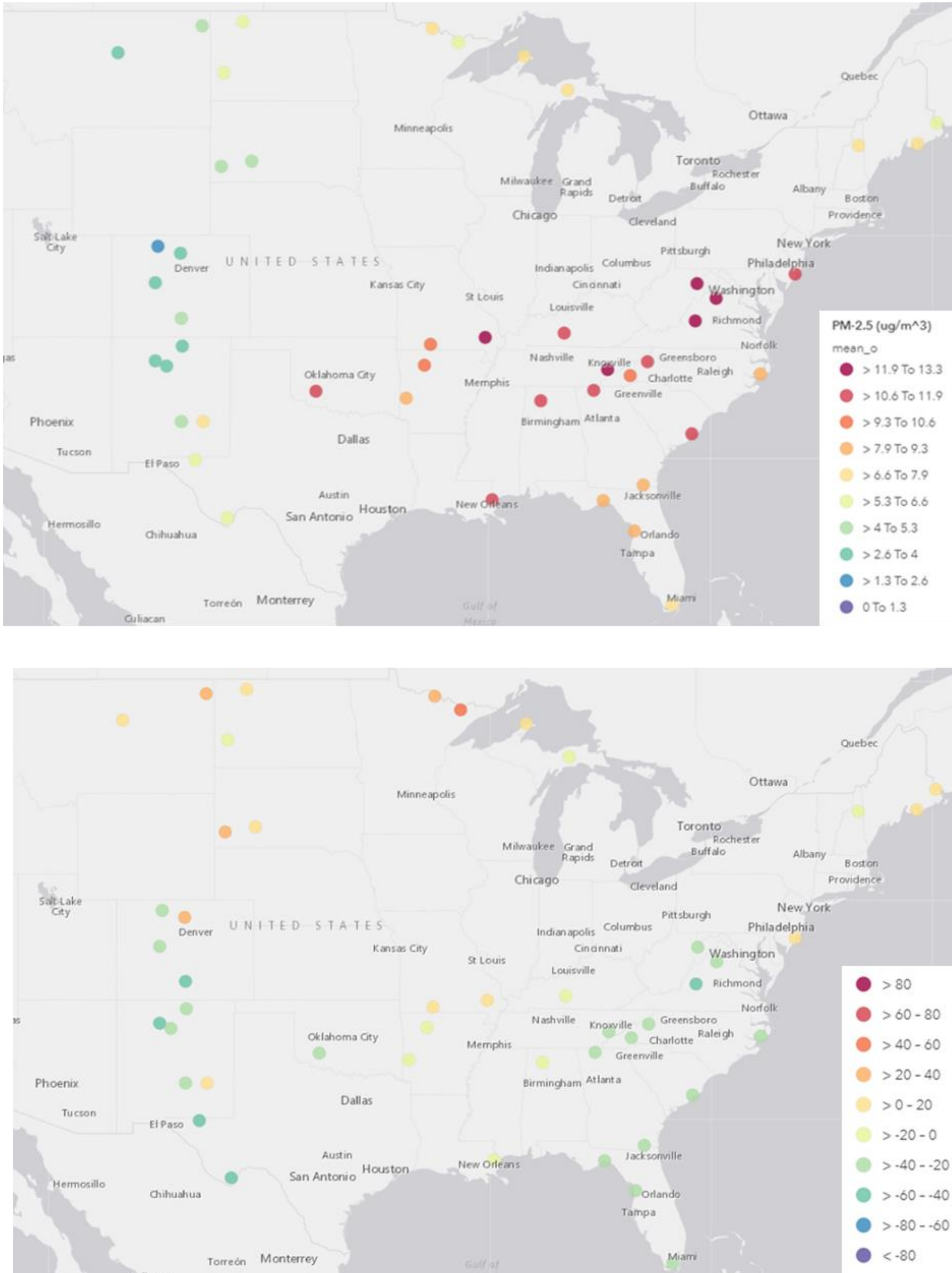
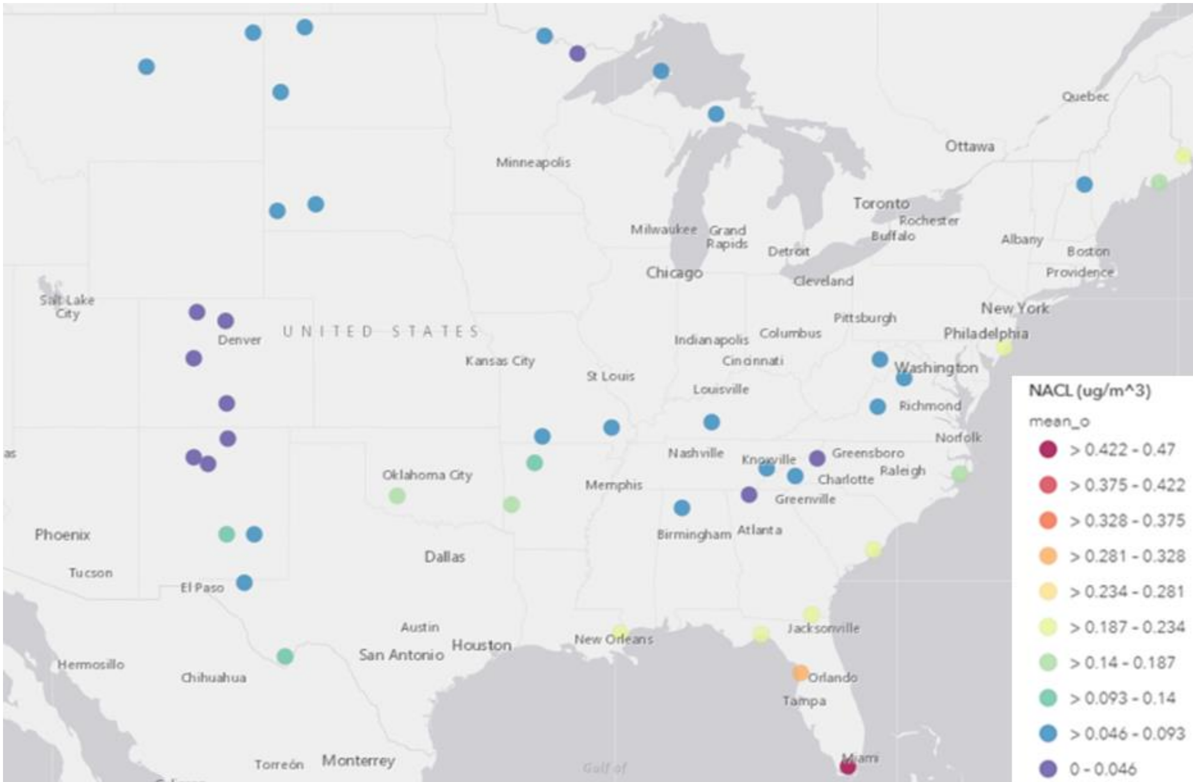


Figure 6-15: Observed Total $PM_{2.5}$ (Top) and Modeled NMB (Bottom) for Total $PM_{2.5}$ on the 20% Most-Impaired Days at IMPROVE Monitor Locations



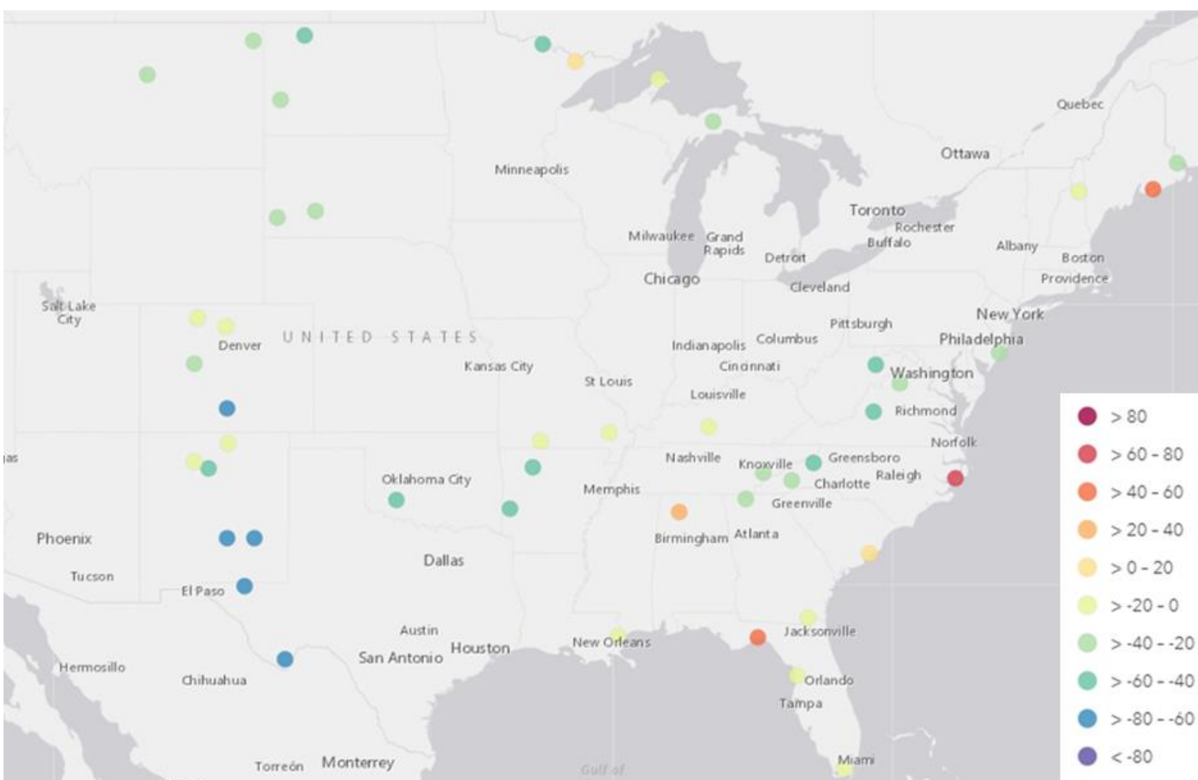


Figure 6-16: Observed Sea Salt (Top) and Modeled NMB (Bottom) for Sea Salt on the 20% Most-Impaired Days at IMPROVE Monitor Locations

Overall, based on the weight of evidence approach recommended by EPA's guidance document, MDEQ found VISTAS model performance to fall within acceptable limits. In conclusion, performance assessed at the "one atmosphere" level was deemed acceptable for ozone, wet/dry deposition, and particulate matter at various monitoring sites. MDEQ further asserts the one atmosphere modeling performed by the VISTAS contractors is representative of conditions in the southeastern states and is acceptable for use in regulatory modeling applications for ozone, particulate matter, and regional haze.

7. Long-Term Strategy

The regional haze regulation under 40 CFR 51.308(f)(2) requires states to submit a long-term strategy addressing regional haze visibility impairment for each mandatory federal Class I area within the state and for each mandatory federal Class I area located outside the state that may be affected by emissions from the state. The long-term strategy must include the enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress. The regional haze regulation also requires under 40 CFR 51.308(f)(3) that states containing mandatory federal Class I areas must establish RPGs expressed in dv. These RPGs must reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period as a result of those enforceable emission limitations, compliance schedules, and other measures established as part of the long-term strategy as well as the implementation of other CAA requirements. The RPGs, while not directly federally enforceable, must be met through measures contained in the state's long-term strategy through the year 2028.

Although Mississippi does not have a Class I area within the state, Mississippi is obligated to evaluate emissions of sources within the state that may impact Class I areas outside the state and subsequently develop a long-term strategy to ensure emissions from Mississippi do not hinder the RPGs of those affected Class I areas. The two closest Class I areas are the Sipsey Wilderness Area in Alabama, approximately 60 kilometers (km) from Mississippi's east border, and Breton Wilderness Area, consisting of islands off the southeast coast of Louisiana, also approximately 60 km from Mississippi's coastline. This section discusses development of Mississippi's long-term strategy, specifically with respect to potential impacts of emissions from Mississippi on visibility for these two Class I areas.

7.1. Overview of the Long-Term Strategy Development Process

The monitor data and the modeling analyses included with the first Mississippi regional haze SIP established that, for the VISTAS region, the key contributors to regional haze in the 2000-2004 baseline timeframe were large stationary sources of SO_2 emissions. Figure 2-1 and Figure 2-2 show the daily visibility data for 20% most impaired and 20% clearest days during the baseline period for Class I areas in VISTAS and in neighboring states. Sulfate accounted for the vast majority of the pollutant impairing species on these days for the VISTAS Class I areas.

More current speciation data for years 2014 through 2018 show significant visibility improvement on the 20% most impaired days. As shown in Figure 2-5 and Figure 2-6 for Sipsey, AL, and Figure 2-7 for Breton, LA, sulfate continues to be the predominant visibility impairing species. Unlike the data for the baseline period of 2000 to 2004, where nearly all days with poor visibility were heavily dominated by sulfate impairment, the 2014 to 2018 data show some 20% most impaired days having large organic matter or nitrate impacts at VISTAS Class I areas. The organic matter components on poor visibility days are associated with episodic events while the nitrate components are associated with anthropogenic emissions. However, the visibility during the majority of 20% most impaired days at VISTAS Class I areas during the period 2014 to 2018 continue to be impacted most heavily by sulfate. The 2014 to 2018 IMPROVE data for the VISTAS Class I areas is provided in Appendix C-2. Therefore, reducing SO_2 emissions continues to be important for generating further visibility improvements. Keeping this conclusion in mind, this section addresses the following questions:

- Assuming implementation of existing federal and state air regulatory requirements in Mississippi and the VISTAS region, how much visibility improvement, compared to the glide path, is expected at Class I areas nearest to Mississippi by 2028?
- Which mandatory federal Class I areas located outside of Mississippi are significantly impacted by visibility impairing pollutants originating from within Mississippi?
- If additional emission reductions were needed, from what pollutants and source categories would the greatest visibility benefits be realized by 2028?
- Where are these pollutants and source categories located?
- Which specific individual sources in those geographic locations have the greatest visibility impacts at a given mandatory federal Class I area?
- What additional emission controls represent reasonable progress for those specific sources?

7.2. Methodology to Develop the 2028 RPGs for the VISTAS Class I Areas Under Existing and Planned Emissions Controls

Although Mississippi is not required to set RPGs for 2028 since there are no Class I areas within the state, MDEQ is providing a summary of the information used to estimate visibility in 2028 for the VISTAS Class I areas, excluding state-specific unique factors. Several significant control programs reduce emissions of visibility impairing pollutants between the base year 2011 and the future year projection year of 2028. These programs are described in more detail below.

7.2.1. Federal Control Programs Included in the 2028 Projection Year

Federal control programs impacting onroad and off-road engines as well as industrial and EGU facilities have reduced, and will continue to reduce, emissions of SO_2 and NO_X. The reductions from these programs, as described below, are included in the 2028 future year estimates upon which visibility projections are based.

7.2.1.1. Federal EGU and Industrial Unit Trading Programs

The CAA requires each upwind state to ensure that it does not interfere with either the attainment of a NAAQS or continued compliance with a NAAQS at any downwind monitor. This section of the CAA, § 110(a)(2)(D)(i)(I), is called the "Good Neighbor" provision. The EPA has implemented a number of rules enforcing the Good Neighbor provision for a variety of NAAQS.

The EPA finalized CSAPR on August 8, 2011 (76 FR 48208). This rule required 28 states to reduce SO_2, annual NO_X, and ozone season NO_X from fossil fuel-fired EGUs in support of the 1997 and 2006 $PM_{2.5}$ NAAQS and the 1997 ozone NAAQS. CSAPR relied on a trading program to achieve these reductions and became effective January 1, 2015, as set forth in an October 23, 2014, decision by the U.S. Court of Appeals for the D.C. Circuit. Phase 1 of the program began January 2015 for annual programs and May 2015 for the ozone season program. Phase 2 began January 2017 for the annual programs and May 2017 for the ozone season program. Total emissions allowed in each compliance period under CSAPR equals the sum of the affected state emission budgets in the program. The 2017 budgets for these programs, exclusive of new unit set asides and tribal budgets, are:

- SO_2 Group 1 – 1.37 million tons,
- SO_2 Group 2 – 892,000 tons,
- Annual NO_X – 1.21 million tons, and
- Ozone Season NO_X – 586,000 tons

EPA published revised CSAPR ozone season NO_X budgets to address the 2008 ozone NAAQS on October 26, 2016 (81 FR 74504). This rule, called the CSAPR Update, reduced state budgets for NO_X during the ozone season to 325,645 tons in 2017 and 330,526 tons in 2018 and later years, exclusive of new unit set asides and tribal budgets. This rule applies to all VISTAS states except North Carolina, South Carolina, Georgia, and Florida and continues to encourage NO_X emissions reductions from fossil fuel-fired EGUs. The U.S. Court of Appeals for the D.C. Circuit remanded, but did not vacate, the CSAPR Update to EPA to address the court's holding that the rule unlawfully allows significant contributions to continue beyond downwind attainment deadlines.

The amended CSAPR Update Rule was published in the Federal Register on April 30, 2021. EPA will issue new or amended FIPs for 12 states to replace their existing CSAPR NOx Ozone Season Group 2 emissions budgets for EGUs with revised budgets under a new CSAPR NOx Ozone Season Group 3 Trading Program. Implementation of the revised emission budgets is required beginning with the 2021 ozone season. The final rule includes state-by-state adjusted ozone season emission budgets for 2021 through 2024. Emission reductions are required at power plants in the 12 states based on optimization of existing, already-installed selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) controls beginning in the 2021 ozone season, and installation or upgrade of state-of-the-art NOx combustion controls beginning in the 2022 ozone season. EPA estimates the Revised CSAPR Update will reduce summertime NOx emissions from power plants in the 12 linked upwind states by 17,000 tons in 2021 compared to projections without the rule.

7.2.1.2. MATS Rule

On February 16, 2012 (77 FR 9304), EPA promulgated the National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units. This rule is often called the Mercury and Air Toxics Standard (MATS). The standard applies to EGUs burning fossil fuel and sets standards for certain HAP emissions, many of which are acid gases. Control of these acid gases often have the co-benefit of reducing SO_2 emissions. Sources had until April 16, 2015, to comply with the rule unless granted a one-year extension for control installation or an additional extension for reliability reasons. Due to the cost of compliance with this rule, many coal-fired EGUs in Mississippi decided to retire their coal-fired EGUs, sometimes replacing them with natural gas-fired combined cycle turbines. Although the MATS rule may not have been the only driver for these retirements, the following coal-fired EGUs were retired near the timeframe of the extended compliance deadline:

7.2.1.3. 2010 SO_2 NAAQS

On June 22, 2010 (75 FR 35520), EPA finalized a new primary NAAQS for SO_2. This regulation significantly strengthened the short-term requirements by lowering the standard to 75 ppb on a 1-hour basis. Using inventory and other technical data as support, EPA determined that anthropogenic SO_2 emissions originate chiefly from point sources, with fossil fuel combustion at electric utilities accounting for 66% and fossil fuel combustion at other industrial facilities accounting for 29% of total anthropogenic SO_2 emissions. EPA simultaneously revised ambient air monitoring requirements for SO_2, requiring fewer monitors due to the use of a hybrid approach combining air quality modeling and monitoring to determine compliance with the new standard. Much of this work focuses on the evaluation of point source emissions. To ensure compliance with the 2010 SO_2 NAAQS and other federal rules directly and indirectly regulating SO_2, significant reductions in SO_2 emissions have occurred. Listed in Table 7-1 below are SO_2 reductions at those sources identified as applicable to the SO_2 Data Requirements Rule that either retired their coal-fired units, installed SO_2 controls, or converted them to natural gas to comply directly. The reductions are provided as the difference between 2017 and 2014 NEI emissions.

Table 7-1: Annual SO_2 Decreases from 2014 to 2017 for MS Facilities Subject to 1-hr SO2 DRR

Facility	2014 SO_2 Emissions (tons/year)	2017 SO_2 Emissions (tons/year)	SO_2 Decrease (tons/year)
Mississippi Power Co., Plant Jack Watson	70,667	5.12	-70,662
Mississippi Power Co., Plant Victor Daniel	14,898	204.2	-14,694
The Chemours Co. FC LLC (formerly DuPont-DeLisle)	4,792	21.66	-4,770
Pursue Energy Corporation, Thomasville Gas Plant	4,506	0	-4,506
Cooperative Energy, R.D. Morrow Plant (formerly South Mississippi Electric Power Association)	2,210	20.44	-2,190

7.2.1.4. Onroad and Non-Road Programs

The CAA authorizes the EPA to establish emission standards for motor vehicles under § 202 and the authority to establish fuel controls under § 211. The CAA generally prohibits states other than California from enacting emission standards for motor vehicles under § 209(a) and for non-road engines under § 209(e). States may choose to adopt California requirements or meet federal requirements. Federal programs to reduce emissions from onroad and non-road engines are therefore critical to improving both visibility and air quality.

Several of the programs discussed below address SO_2 emissions by reducing allowable sulfur contents in various fuels. As well as reducing SO_2 emissions, reduced sulfur content improves the efficiency of NO_X controls on existing engines and facilitates the use of state-of-the-art NO_X controls on new engines.

7.2.1.4.1. 2007 Heavy-Duty Highway Rule

In Subpart P of 40 CFR Part 86, EPA set limitations for heavy-duty engines, which became effective between 2007 and 2010. This rule limited NO_X to 0.20 grams per brake horsepower-hour (g/bhp-hr) and limited non-methane hydrocarbons to 0.14 g/bhp-hr. The rule also required that the sulfur content of diesel fuel not exceed 0.0015% by weight to facilitate the use of modern pollution control technology on these engines. These standards continue to provide benefit as older vehicles are replaced with newer models.

7.2.1.4.2. Tier 3 Motor Vehicle Emissions and Fuel Standards

The federal Tier 3 program under Subpart H of 40 CFR Part 80, 40 CFR Part 85, and 40 CFR Part 86 reduces tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. The tailpipe standards include different phase-in schedules that vary by vehicle class and begin to apply between model years 2017 and 2025. The Tier 3 gasoline sulfur standard, which reduced the allowable sulfur content to 10 parts per million (ppm) in 2017, allows manufacturers to comply across the fleet with the more stringent Tier 3 emission standards. Reduced sulfur content in gasoline will also enable the control devices on vehicles already in use to operate more effectively. Compared to older standards, the non-methane organic gases and NO_X tailpipe standards for light duty vehicles in this rule are 80% less than the existing fleet average. The heavy-duty tailpipe standards are 60% less than the existing fleet average.

7.2.1.4.3. Non-Road Diesel Emissions Programs

EPA promulgated a series of control programs in 40 CFR Part 89, Part 90, Part 91, Part 92, and Part 94 that implemented limitations by 2012 on compression ignition engines, spark-ignition non-road engines, marine engines, and locomotive engines. Environmental benefits continue into the future as consumers replace older engines with newer engines that have improved fuel economy and more stringent emissions standards. These regulations also required the use of cleaner fuels.

7.2.1.4.4. Emission Control Area Designation and Commercial Marine Vessels

On April 4, 2014, new standards for ocean-going vessels became effective and applied to ships constructed after 2015. These standards are found in MARPOL Annex VI,[35] the international convention for the prevention of pollution from ocean-going ships. These requirements also mandate the use of significantly cleaner fuels by all large ocean-going vessels when operated near the coastlines. The cleaner fuels lower SO_2 emission rates as well as emissions of other criteria pollutants since the engines operate more efficiently on the cleaner fuel. These requirements apply to vessels operating in waters of the United States as well as ships operating within 200 nautical miles of the coast of North America, also known as the North American Emission Control Area.

7.2.2. State Control Programs Included in the 2028 Projection Year

Under the North Carolina Clean Smokestacks Act, coal-fired power plants in North Carolina were required to achieve a 77% cut in NO_X emissions by 2009 and a 73% cut in SO_2 emissions by 2013.

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[35] URL: https://www.epa.gov/sites/production/files/2016-09/documents/resolution-mepc-251-66-4-4-2014.pdf

Georgia Rule 391-3-1-.02(2)(sss) "Multi-Pollutant Control for Electric Utility Generating Units" established a schedule for the installation and operation of NO_X and SO_2 pollution control systems on many of the coal-fired power plants in Georgia. This rule, adopted in 2007, required controls for all affected units to be in place before June 1, 2015. The rule reduced SO_2 emissions by approximately 90%, NO_X emissions by approximately 85%, and mercury emissions by approximately 79%.

A number of consent agreements also impose specific controls that were included in this inventory development process:

- Lehigh Cement Company/Lehigh White Cement Company (US District Court, Eastern District of Pennsylvania): EPA reached a settlement with these companies on December 3, 2019, to settle alleged violations of the CAA. The settlement will reduce emissions of NO_X and SO_2 and applied to facilities located in several states, including Alabama.

- VEPCO (US District Court, Eastern District of Virginia): Virginia Electric and Power Company (also known as Virginia-Dominion Power) agreed to spend $1.2 billion by 2013 to eliminate 237,000 tons of SO_2 and NO_X emissions each year from eight coal-fired electricity generating plants in Virginia and West Virginia.

- Anchor Glass Container (US District Court for the Middle District of Florida): On August 3, 2018, Anchor agreed to convert six of its furnaces to oxyfuel furnaces and will meet NO_X emission limits at these furnaces that are consistent or better than best available control technology. On remaining furnaces, Anchor agreed to install oxygen enriched air staging and meet more stringent emission limits. To control SO_2, Anchor agreed to install dry or semi-dry scrubber systems on two furnaces. Remaining furnaces must achieve batch optimization and meet enforceable emissions limits. Anchor also agreed to install NO_X and SO_2 continuous emissions monitoring systems at all furnaces. The expected emission reductions from the agreement are 2,000 tpy of NO_X and 700 tpy of SO_2 at facilities located in Florida, Georgia, Indiana, Minnesota, New York and Oklahoma.

7.2.3. Construction Activities, Agricultural and Forestry Smoke Management

In addition to accounting for specific emission reductions due to ongoing air pollution programs as required under the regional haze regulation section 40 CFR 51.308(d)(3)(v)(A), states are also required to consider the air quality benefits of measures to mitigate the impacts of construction activities (40 CFR 51.308(d)(3)(v)(B)) and agricultural and forestry smoke management (40 CFR 51.308(d)(3)(v)(E)). Section 7.9.1 and Section 7.9.2 provide more information on these activities.

7.2.4. Projected VISTAS 2028 Emissions Inventory

The VISTAS emissions inventory for 2028 account for post-2011 emission reductions from promulgated federal, state, local, and site-specific control programs, many of which are described in Section 7.2.1 and Section 7.2.2. The VISTAS 2028 emissions inventory is based on EPA's 2028el emissions inventory data sets.[36] Onroad and non-road mobile source emissions were created for 2028 using the MOVES model. Nonpoint area source emissions were prepared using growth and control factors simulating changes in economic conditions and environmental regulations anticipated to be fully implemented by calendar year 2028. For EGU sources in projected year 2028, VISTAS states considered the EPA 2028el, the EPA 2023en, or 2028 emissions from the ERTAC EGU projection tool CONUS2.7 run and CONUS16.0 run. The EPA 2028el emissions inventory for EGUs considered the impacts of the CPP, which was later vacated. Additionally, the EPA 2028el EGU emissions inventory used results from IPM. IPM assumes units may retire or sit idle in future years based solely on economic decisions determined within the tool. Impacts of the CPP, IPM economic retirements, and IPM economic idling resulted in many coal-fired EGUs being shut down. Thus, the EPA 2028el projected emissions for EGU are not reflective of probable emissions for 2028. The ERTAC EGU tool outputs do not consider the impacts of the CPP. For states outside of VISTAS, EGU estimates were derived from CONUS16.0 and CONUS16.1 outputs. For non-EGU point source projections to year 2028, VISTAS states considered the EPA 2023en and EPA 2028el emissions and in some cases supplied their own emissions data. In particular, North Carolina developed their own 2028 non-EGU point source emissions inventory based on application of growth and control factors to their most recent year (2016) non-EGU point source inventory. Georgia used 2016 emissions (or 2014 emissions if 2016 was not available) to represent 2028 emissions for the 33 non-EGU facilities with over 100 tpy of SO_2 in 2011, exclusive of Hartsfield-Jackson Atlanta International Airport.

These updates for 2028 are documented in the ERG emissions inventory reports included in Appendix B-2a.

Figure 7-1 and Figure 7-2 show the expected decrease in emissions of SO_2 and NO_X, respectively, across the VISTAS states from 2011 to 2028.

[36] URL: https://www.epa.gov/air-emissions-modeling/updates-2011-and-2028-emissions-version-63-technical-support-document

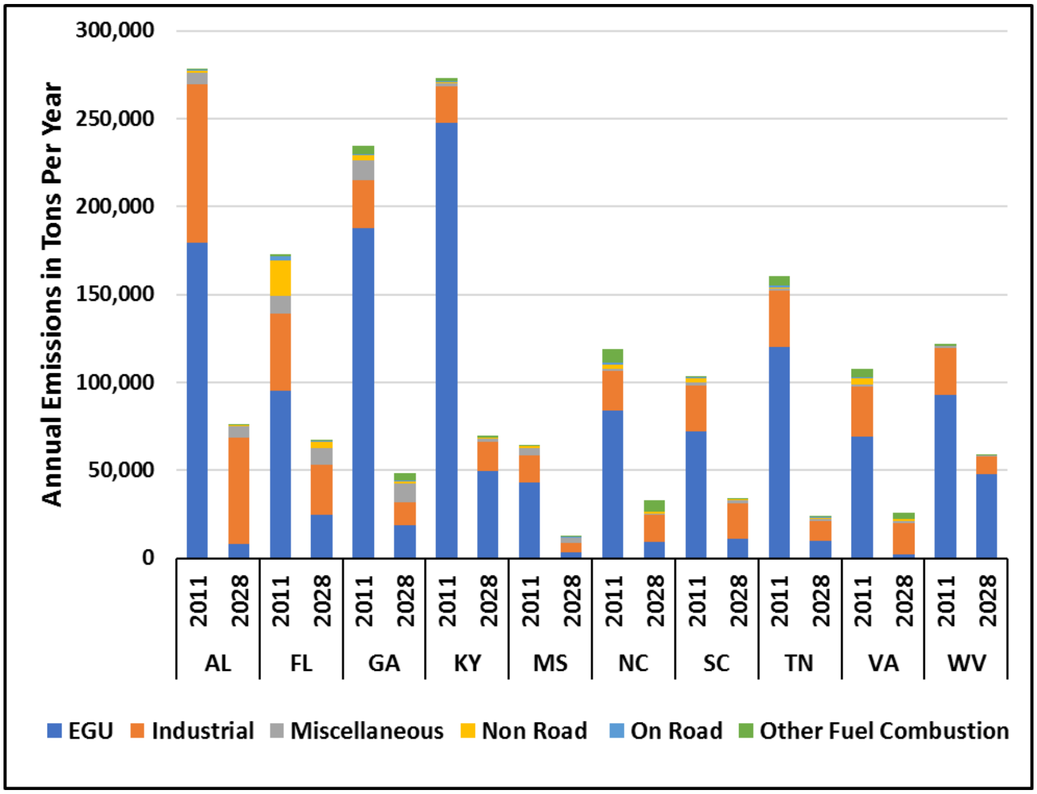

Figure 7-1: SO_2 Emissions for 2011 and 2028 for VISTAS States

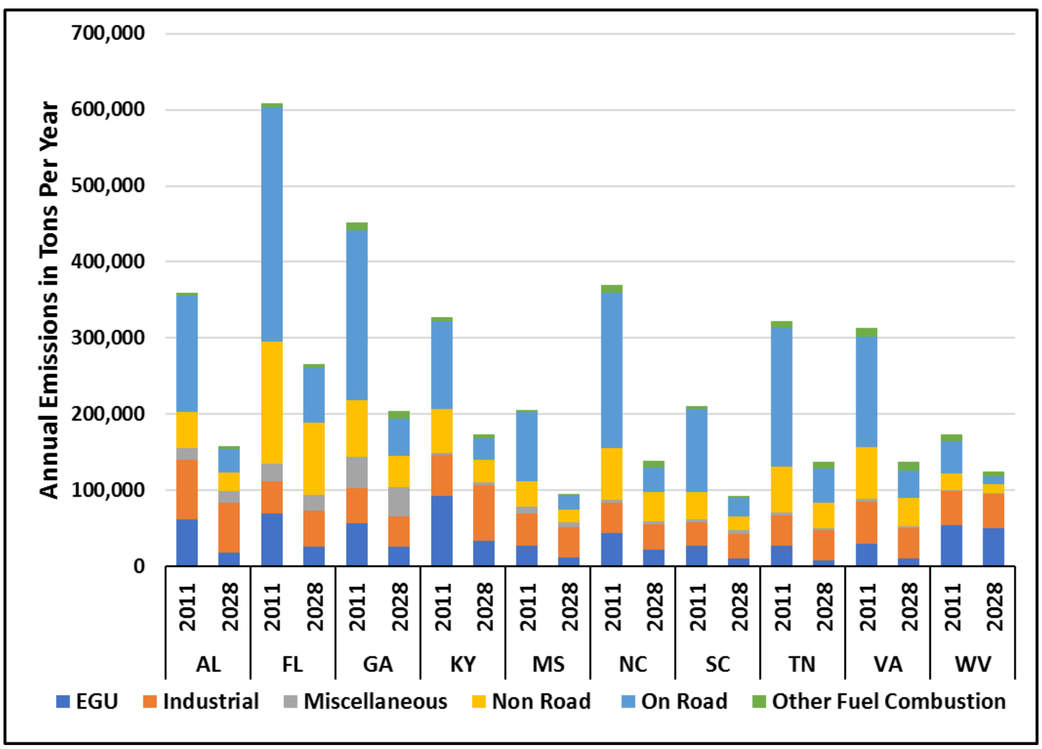

Figure 7-2: NO_X Emissions for 2011 and 2028 for VISTAS States

For SO_2 emissions in particular, which are the largest contributors to haze, emissions across VISTAS are expected to decrease from 1,633,000 tons in 2011 to 448,000 tons in 2028, a 73% decrease. The EGU sector accounts for most of the reductions although in some states industrial SO_2 emissions are also expected to decrease significantly. Emissions of NO_X in VISTAS are projected to drop from 3,343,000 tons in 2011 to 1,528,000 tons in 2028, a 54% reduction. The majority of these reductions come from the onroad sector, and such reductions are heavily dependent on federal control programs due to the CAA prohibition regarding state regulation of engine controls. The NO_X reductions from the EGU sector are also expected to continue although NO_X from EGUs now make up a much smaller portion of the overall anthropogenic NO_X inventory as compared to inventories from the prior planning period. The expected SO_2 and NO_X emission reductions are due to state and federal control programs, the construction and operation of renewable energy sources and very efficient combined cycle generating units, the use of cleaner burning fuels, and other factors.

Figure 7-3 and Figure 7-4 show the 2011 and 2028 emissions for SO_2 and NO_X, respectively, in other areas of the country. These data show significant drops in both pollutants from all other RPOs. For Class I areas that are disproportionately impacted by emissions from states in RPOs other than VISTAS, these reductions will help improve visibility impairment by 2028.

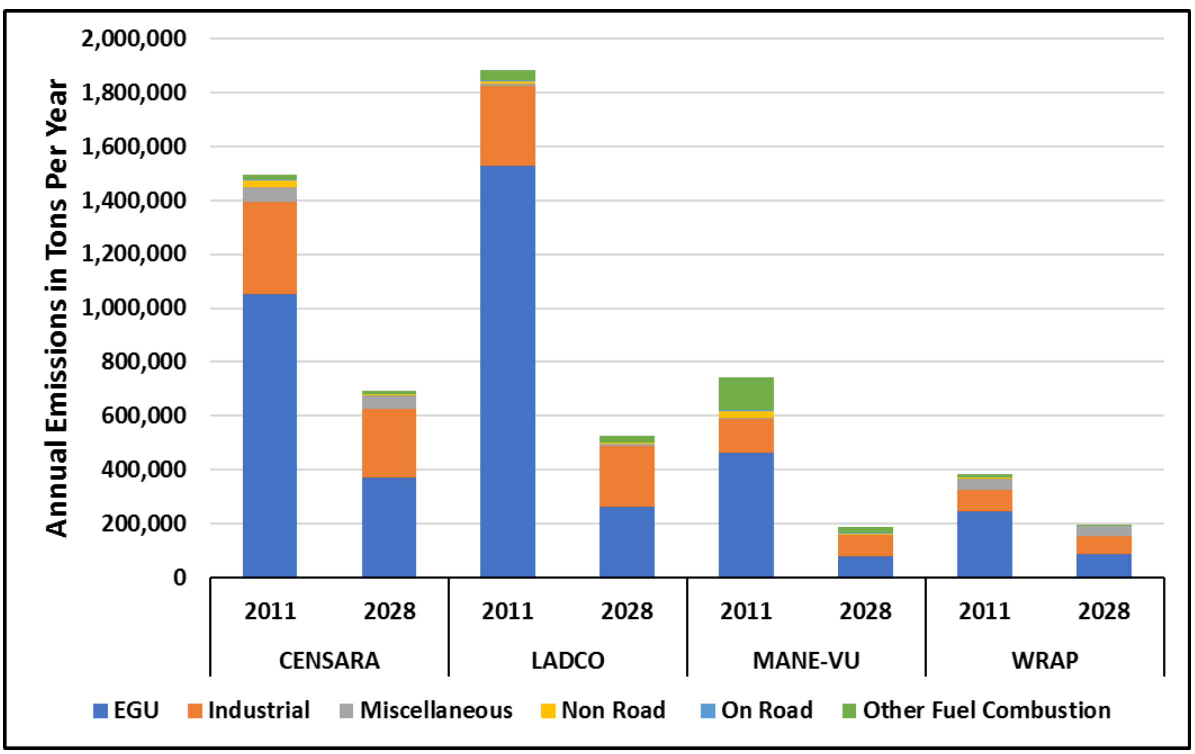

Figure 7-3: SO_2 Emissions for 2011 and 2028 for Other RPOs

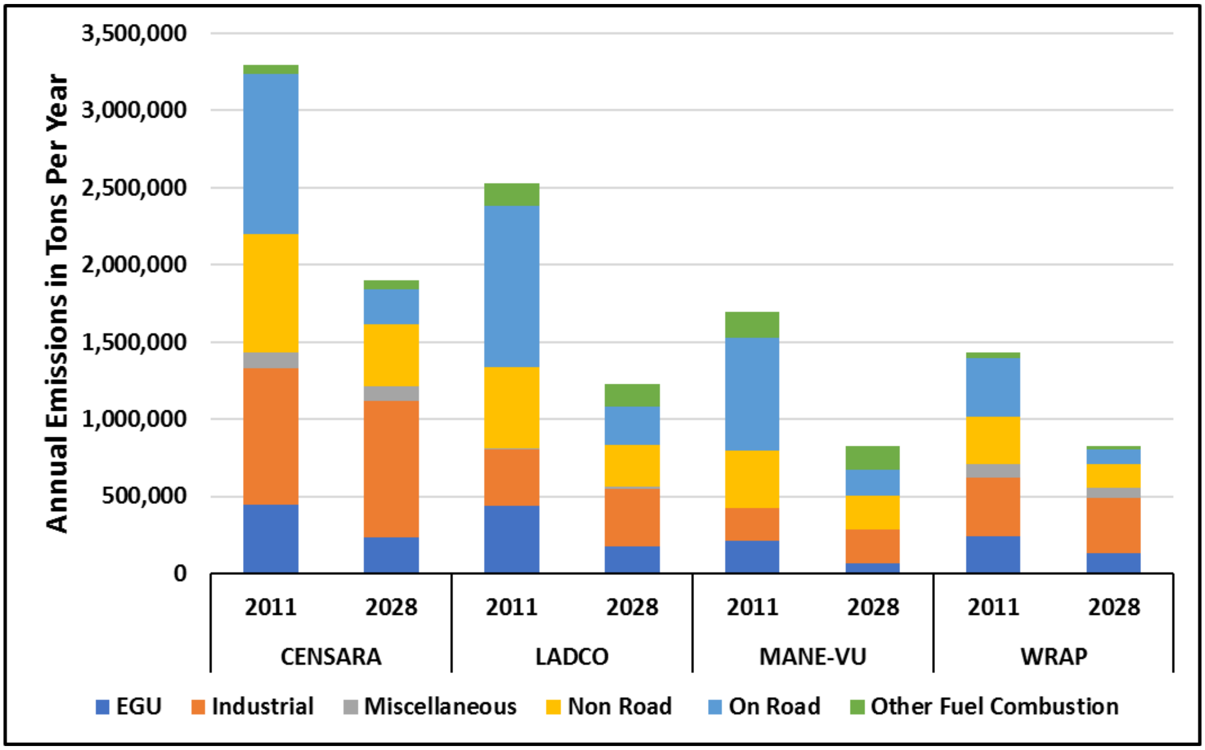

Figure 7-4: NOx Emissions for 2011 and 2028 for Other RPOs

Table 7-2 summarizes criteria pollutant emissions by state and Tier 1 NEI source sector from the 2011 and 2028 emissions inventories. The complete inventories and discussion of the methodology are contained in Appendix B-2a.

Table 7-2: 2011 and 2028 Criteria Pollutant Emissions, VISTAS States

State	Tier 1 Sector	2011 CO (tpy)	2028 CO (tpy)	2011 NO_X (tpy)	2028 NO_X (tpy)	2011 PM_{10} (tpy)	2028 PM_{10} (tpy)	2011 $PM_{2.5}$ (tpy)	2028 $PM_{2.5}$ (tpy)	2011 SO_2 (tpy)	2028 SO_2 (tpy)	2011 VOC (tpy)	2028 VOC (tpy)
AL	Chemical & Allied Product Mfg	3,123	3,122	2,411	2,409	704	704	650	650	6,559	6,583	1,629	1,576
AL	Fuel Comb. Elec. Util.	9,958	6,748	61,687	18,098	7,323	1,714	4,866	1,190	179,323	7,965	1,152	910
AL	Fuel Comb. Industrial	71,865	73,890	35,447	27,842	46,274	47,304	34,664	39,088	41,322	18,806	3,283	3,413
AL	Fuel Comb. Other	12,104	11,352	4,229	4,100	1,689	1,584	1,654	1,549	417	193	2,038	1,796
AL	Highway Vehicles	701,397	182,602	152,732	30,113	8,001	4,984	4,611	1,322	683	262	75,523	15,013
AL	Metals Processing	10,991	10,759	5,947	5,434	5,359	4,326	4,647	3,844	13,298	13,072	1,843	1,550
AL	Miscellaneous	670,765	666,279	14,735	14,567	445,039	494,515	108,297	113,981	6,746	6,679	159,034	158,720
AL	Off-Highway	261,788	253,400	47,801	25,355	3,584	1,781	3,369	1,653	1,074	193	43,396	22,709
AL	Other Industrial Processes	19,708	18,908	21,546	20,732	17,032	16,269	8,749	8,095	9,569	15,773	14,327	13,927
AL	Petroleum & Related Industries	14,882	9,353	11,226	7,416	373	310	354	292	19,196	3,365	22,103	15,109
AL	Solvent Utilization	124	119	135	120	83	74	61	54	1	1	46,790	46,658
AL	Storage & Transport	65	65	51	51	870	823	653	604	2	2,767	18,726	12,302
AL	Waste Disposal & Recycling	45,712	45,712	1,876	1,876	7,885	7,885	6,531	6,531	175	175	3,620	3,620
AL	**Subtotals:**	1,822,482	1,282,309	359,823	158,113	544,216	582,273	179,106	178,853	278,365	75,834	393,464	297,303
FL	Chemical & Allied Product Mfg	117	117	1,393	1,279	415	337	348	295	21,948	14,260	1,231	1,230
FL	Fuel Comb. Elec. Util.	36,344	25,254	69,049	26,425	11,621	8,680	9,607	7,973	95,087	24,565	1,931	1,497
FL	Fuel Comb. Industrial	72,200	78,811	31,291	29,867	33,061	38,121	28,979	33,504	15,715	8,477	4,576	3,617
FL	Fuel Comb. Other	25,015	23,851	4,601	4,590	3,498	3,278	3,448	3,248	1,183	303	4,330	3,860
FL	Highway Vehicles	1,784,678	679,511	308,752	72,019	21,329	19,834	9,377	4,412	2,104	823	183,609	51,019
FL	Metals Processing	742	480	80	80	199	192	165	159	337	31	62	49
FL	Miscellaneous	992,515	960,190	22,844	21,346	384,091	466,941	129,258	138,297	10,473	9,727	231,259	228,825
FL	Off-Highway	1,120,490	1,125,776	159,796	94,782	14,009	6,737	13,181	6,231	20,051	2,973	166,582	88,560
FL	Other Industrial Processes	13,065	13,065	8,885	12,313	28,504	28,693	11,836	12,042	4,338	4,315	14,485	14,315
FL	Petroleum & Related Industries	802	828	279	293	92	93	63	64	211	211	2,847	2,252
FL	Solvent Utilization	3	3	2	2	34	33	30	30	<0.5	<0.5	151,477	151,367
FL	Storage & Transport	104	104	154	154	1,177	971	592	528	29	29	101,966	68,391
FL	Waste Disposal & Recycling	27,944	28,108	1,240	2,301	4,151	4,199	3,492	3,534	1,224	1,265	2,707	2,734
FL	**Subtotal:**	4,074,019	2,936,098	608,366	265,451	502,181	578,109	210,376	210,317	172,700	66,979	867,062	617,716

State	Tier 1 Sector	2011 CO (tpy)	2028 CO (tpy)	2011 NO_X (tpy)	2028 NO_X (tpy)	2011 PM_{10} (tpy)	2028 PM_{10} (tpy)	2011 $PM_{2.5}$ (tpy)	2028 $PM_{2.5}$ (tpy)	2011 SO_2 (tpy)	2028 SO_2 (tpy)	2011 VOC (tpy)	2028 VOC (tpy)
GA	Chemical & Allied Product Mfg	502	476	959	931	476	406	408	353	1,580	1,054	2,571	2,399
GA	Fuel Comb. Elec. Util.	13,543	10,611	56,037	25,481	9,061	5,150	6,298	4,242	188,009	18,411	1,195	1,016
GA	Fuel Comb. Industrial	21,837	19,771	22,274	17,788	3,198	2,672	2,752	2,311	21,358	9,769	1,737	1,618
GA	Fuel Comb. Other	20,021	19,536	11,233	10,857	2,204	1,998	2,152	1,950	4,660	4,187	3,056	2,730
GA	Highway Vehicles	1,018,645	305,264	223,223	48,973	12,518	8,914	6,829	2,289	1,088	443	109,005	25,629
GA	Metals Processing	344	344	149	149	156	156	82	82	92	92	57	57
GA	Miscellaneous	1,022,524	984,133	40,646	39,003	858,861	998,804	220,258	232,719	11,424	10,688	78,048	75,220
GA	Off-Highway	471,960	477,533	74,217	40,838	5,923	2,974	5,594	2,769	2,562	967	60,843	36,837
GA	Other Industrial Processes	24,548	17,280	15,893	13,130	47,506	45,021	17,925	15,808	3,705	2,268	22,763	20,583
GA	Petroleum & Related Industries	6	6	none reported	none reported	23	22	11	13	none reported	none reported	132	131
GA	Solvent Utilization	25	24	30	28	31	31	30	30	<0.5	<0.5	84,352	83,997
GA	Storage & Transport	49	49	21	21	1,015	1,014	511	502	none reported	none reported	33,985	23,439
GA	Waste Disposal & Recycling	227,703	227,696	7,636	7,628	26,852	26,851	26,222	26,221	223	222	17,363	17,361
GA	**Subtotals:**	**2,821,707**	**2,062,723**	**452,318**	**204,827**	**967,824**	**1,094,013**	**289,072**	**289,289**	**234,701**	**48,101**	**415,107**	**291,017**
KY	Chemical & Allied Product Mfg	62	62	241	241	817	816	708	708	1,663	393	2,202	2,189
KY	Fuel Comb. Elec. Util.	15,547	12,253	92,756	33,258	13,874	7,409	9,495	5,781	247,556	49,728	1,749	1,067
KY	Fuel Comb. Industrial	10,848	10,870	20,009	17,876	2,247	2,505	1,981	2,214	5,774	4,819	1,422	1,031
KY	Fuel Comb. Other	48,175	43,582	5,765	5,477	6,891	6,158	6,781	6,072	1,868	1,166	8,390	7,183
KY	Highway Vehicles	498,702	157,636	115,685	27,819	5,480	3,448	3,345	1,015	502	209	50,326	12,938
KY	Metals Processing	61,446	61,446	1,611	1,611	4,151	4,111	3,402	3,383	6,021	3,200	2,081	2,081
KY	Miscellaneous	190,510	180,432	3,486	3,034	204,775	230,661	44,517	47,310	1,742	1,528	43,514	42,725
KY	Off-Highway	201,625	193,150	56,646	29,793	3,573	1,557	3,392	1,464	641	402	31,999	17,094
KY	Other Industrial Processes	4,985	4,992	5,682	5,662	26,177	25,483	9,042	8,737	6,468	6,465	31,759	31,489
KY	Petroleum & Related Industries	31,312	67,128	24,707	47,426	683	2,795	633	2,745	522	1,561	31,085	44,846
KY	Solvent Utilization	3	3	5	5	83	81	73	72	<0.5	<0.5	44,118	44,031
KY	Storage & Transport	23	23	6	6	2,005	1,804	484	427	3	3	22,606	16,169
KY	Waste Disposal & Recycling	25,288	25,288	1,156	1,156	5,335	5,330	4,532	4,527	161	161	2,352	2,352
KY	**Subtotals:**	**1,088,526**	**756,865**	**327,755**	**173,364**	**276,091**	**292,158**	**88,385**	**84,455**	**272,921**	**69,635**	**273,603**	**225,195**

State	Tier 1 Sector	2011 CO (tpy)	2028 CO (tpy)	2011 NO_X (tpy)	2028 NO_X (tpy)	2011 PM_{10} (tpy)	2028 PM_{10} (tpy)	2011 $PM_{2.5}$ (tpy)	2028 $PM_{2.5}$ (tpy)	2011 SO_2 (tpy)	2028 SO_2 (tpy)	2011 VOC (tpy)	2028 VOC (tpy)
MS	Chemical & Allied Product Mfg	7,477	7,454	1,864	1,841	487	481	430	428	1,377	49	1,317	1,316
MS	Fuel Comb. Elec. Util.	6,154	4,172	26,602	12,229	2,084	1,457	1,627	1,120	43,259	3,237	487	416
MS	Fuel Comb. Industrial	14,794	16,135	32,381	27,363	3,448	3,458	2,935	2,820	6,397	1,631	3,428	3,253
MS	Fuel Comb. Other	7,450	7,009	2,885	2,848	1,029	967	997	935	50	50	1,200	1,056
MS	Highway Vehicles	433,332	117,589	91,026	17,788	4,491	3,100	2,538	814	405	165	46,084	9,317
MS	Metals Processing	1,313	2,021	381	1,446	549	371	546	364	124	1,366	127	156
MS	Miscellaneous	372,960	325,044	9,080	6,803	996,316	1,211,587	142,022	160,523	4,248	3,165	81,272	77,346
MS	Off-Highway	153,473	143,429	33,132	16,707	2,493	1,074	2,353	999	1,029	143	29,662	14,770
MS	Other Industrial Processes	5,127	5,046	3,204	2,591	8,129	7,605	5,372	4,901	678	652	10,915	10,632
MS	Petroleum & Related Industries	4,592	5,412	3,641	4,105	257	322	200	270	6,240	1,407	28,840	24,313
MS	Solvent Utilization	31	30	39	37	115	113	105	104	<0.5	<0.5	38,358	37,486
MS	Storage & Transport	368	368	71	71	109	103	70	66	42	42	29,068	20,947
MS	Waste Disposal & Recycling	42,760	42,760	1,591	1,591	6,657	6,657	5,392	5,392	91	91	3,780	3,843
MS	**Subtotals:**	1,049,831	676,469	205,897	95,420	1,026,164	1,237,295	164,587	178,736	63,940	11,998	274,538	204,851
NC	Chemical & Allied Product Mfg	7,188	693	1,286	879	738	1,184	472	462	5,507	5,056	2,756	3,712
NC	Fuel Comb. Elec. Util.	32,828	10,563	43,911	21,401	8,790	3,190	6,921	2,867	83,925	8,976	934	1,095
NC	Fuel Comb. Industrial	16,197	14,319	24,394	16,775	3,828	2,910	2,899	2,430	12,354	5,139	1,500	1,172
NC	Fuel Comb. Other	29,163	28,846	9,652	9,791	4,724	4,604	4,323	4,246	7,757	5,970	4,611	4,302
NC	Highway Vehicles	1,145,623	252,167	204,008	30,968	10,447	6,512	5,510	1,646	1,082	311	112,173	21,709
NC	Metals Processing	2,675	2,122	324	454	355	547	308	471	556	433	1,493	1,005
NC	Miscellaneous	101,890	86,087	4,047	3,500	195,376	221,483	45,672	49,500	1,068	956	7,851	6,672
NC	Off-Highway	479,335	471,127	68,433	39,379	5,742	2,994	5,435	2,798	2,472	1,055	63,283	37,520
NC	Other Industrial Processes	5,731	11,412	10,261	12,529	14,515	18,192	6,970	8,780	3,279	4,105	15,218	20,374
NC	Petroleum & Related Industries	773	1,007	263	305	249	295	160	263	432	412	306	354
NC	Solvent Utilization	53	79	72	103	145	177	121	165	31	8	95,419	110,199
NC	Storage & Transport	2,174	278	125	128	590	654	306	412	7	11	24,731	15,117
NC	Waste Disposal & Recycling	66,928	67,028	2,720	2,772	11,151	11,153	9,386	9,420	251	213	5,613	5,800
NC	**Subtotals:**	1,890,558	945,728	369,496	138,984	256,650	273,895	88,483	83,460	118,721	32,645	335,888	229,031

State	Tier 1 Sector	2011 CO (tpy)	2028 CO (tpy)	2011 NO_X (tpy)	2028 NO_X (tpy)	2011 PM_{10} (tpy)	2028 PM_{10} (tpy)	2011 $PM_{2.5}$ (tpy)	2028 $PM_{2.5}$ (tpy)	2011 SO_2 (tpy)	2028 SO_2 (tpy)	2011 VOC (tpy)	2028 VOC (tpy)
SC	Chemical & Allied Product Mfg	1,217	1,217	165	165	132	131	77	76	9	4	2,110	1,843
SC	Fuel Comb. Elec. Util.	16,809	13,527	26,752	10,993	10,851	3,290	8,604	2,672	71,899	10,762	607	573
SC	Fuel Comb. Industrial	19,560	21,191	17,924	17,505	10,314	11,286	8,273	9,498	15,748	9,386	1,103	1,117
SC	Fuel Comb. Other	12,508	11,800	3,283	3,351	1,701	1,580	1,660	1,546	339	309	2,128	1,867
SC	Highway Vehicles	475,876	155,913	109,374	23,263	6,618	4,504	3,766	1,152	504	215	51,164	12,546
SC	Metals Processing	53,733	53,811	780	861	572	581	480	489	5,139	5,182	457	457
SC	Miscellaneous	214,147	200,969	4,602	4,033	280,281	341,123	51,363	56,686	1,978	1,902	48,908	47,771
SC	Off-Highway	240,507	233,340	35,569	19,154	3,036	1,477	2,856	1,369	2,268	360	35,104	19,097
SC	Other Industrial Processes	17,912	17,827	10,251	11,697	7,581	7,311	4,149	3,897	5,223	5,724	15,036	14,754
SC	Petroleum & Related Industries	none reported	none reported	none reported	none reported	none reported	none reported	none reported	none reported	none reported	none reported	31	29
SC	Solvent Utilization	7	7	1	1	14	14	13	12	<0.5	<0.5	41,039	39,341
SC	Storage & Transport	39	39	26	26	346	282	139	119	1	1	30,397	21,258
SC	Waste Disposal & Recycling	48,668	48,667	1,817	1,806	7,055	7,042	5,746	5,735	140	139	4,073	4,059
SC	**Subtotals:**	1,100,983	758,308	210,544	92,855	328,501	378,621	87,126	83,251	103,248	33,984	232,157	164,712
TN	Chemical & Allied Product Mfg	14,866	14,862	811	804	755	755	426	426	492	489	4,412	4,397
TN	Fuel Comb. Elec. Util.	5,529	3,771	27,156	8,006	5,191	2,618	4,172	2,444	120,170	10,059	769	585
TN	Fuel Comb. Industrial	18,910	22,671	27,988	25,234	10,632	12,293	9,018	10,691	27,778	8,076	1,129	1,239
TN	Fuel Comb. Other	25,945	23,479	9,207	8,441	3,470	3,044	3,182	2,928	5,441	779	5,168	4,906
TN	Highway Vehicles	739,041	233,423	182,796	44,927	9,927	6,734	5,778	1,811	769	338	80,463	20,483
TN	Metals Processing	5,066	5,066	611	611	1,492	1,492	1,251	1,251	572	681	2,923	2,923
TN	Miscellaneous	133,301	124,792	2,840	2,450	150,164	165,066	36,986	39,404	1,347	1,162	31,052	30,344
TN	Off-Highway	309,062	298,569	60,384	33,596	4,242	2,032	4,010	1,898	767	625	46,292	25,501
TN	Other Industrial Processes	5,668	6,244	7,449	8,189	11,527	11,224	6,034	5,779	2,550	1,468	15,672	14,828
TN	Petroleum & Related Industries	2,706	4,956	1,812	3,193	189	307	160	278	243	149	3,559	3,517
TN	Solvent Utilization	72	72	84	84	328	328	288	288	15	15	67,091	67,091
TN	Storage & Transport	56	56	37	29	520	393	238	184	5	4	29,921	19,812
TN	Waste Disposal & Recycling	26,959	26,959	1,392	1,392	5,710	5,710	4,813	4,813	174	137	2,549	2,839
TN	**Subtotals:**	1,287,181	764,920	322,567	136,956	204,147	211,996	76,356	72,195	160,323	23,982	291,000	198,465

State	Tier 1 Sector	2011 CO (tpy)	2028 CO (tpy)	2011 NO_X (tpy)	2028 NO_X (tpy)	2011 PM_{10} (tpy)	2028 PM_{10} (tpy)	2011 $PM_{2.5}$ (tpy)	2028 $PM_{2.5}$ (tpy)	2011 SO_2 (tpy)	2028 SO_2 (tpy)	2011 VOC (tpy)	2028 VOC (tpy)
VA	Chemical & Allied Product Mfg	83	83	7,707	1,734	169	169	73	73	203	203	486	485
VA	Fuel Comb. Elec. Util.	4,984	6,232	30,213	10,677	5,794	3,858	1,157	1,456	69,077	1,903	742	448
VA	Fuel Comb. Industrial	13,713	11,294	22,048	13,962	5,883	5,071	4,817	4,376	14,349	5,776	950	871
VA	Fuel Comb. Other	77,919	74,900	11,470	11,034	11,302	10,748	11,002	10,507	4,884	3,264	12,940	11,877
VA	Highway Vehicles	566,315	232,611	145,507	35,427	7,106	4,302	4,368	1,309	711	279	63,152	18,550
VA	Metals Processing	3,016	3,016	812	812	859	858	724	723	5,196	5,196	270	270
VA	Miscellaneous	167,730	164,877	3,186	3,077	141,777	156,214	33,384	36,128	1,487	1,439	39,308	39,107
VA	Off-Highway	383,506	391,290	67,844	37,836	5,029	2,576	4,747	2,398	3,355	892	48,417	30,266
VA	Other Industrial Processes	5,644	7,256	12,766	10,337	12,394	12,839	5,001	5,400	7,028	5,294	6,937	7,107
VA	Petroleum & Related Industries	12,445	12,993	9,618	9,748	406	541	284	424	59	65	8,525	12,152
VA	Solvent Utilization	<0.5	0	<0.5	0	66	68	61	63	<0.5	<0.5	85,760	93,969
VA	Storage & Transport	5	6	2	2	351	353	286	301	<0.5	<0.5	23,556	16,224
VA	Waste Disposal & Recycling	33,103	33,192	2,283	2,305	5,745	5,758	4,925	4,932	1,469	1,483	4,317	4,380
VA	**Subtotals:**	1,268,463	937,750	313,456	136,951	196,881	203,355	70,829	68,090	107,818	25,794	295,360	235,706
WV	Chemical & Allied Product Mfg	247	249	402	278	330	296	246	229	145	106	2,000	1,036
WV	Fuel Comb. Elec. Util.	10,106	8,663	54,289	49,885	11,066	6,822	9,100	5,462	93,080	47,746	1,011	1,162
WV	Fuel Comb. Industrial	4,424	3,896	16,592	10,820	1,977	1,291	1,086	492	16,306	6,241	540	581
WV	Fuel Comb. Other	19,471	18,115	8,661	6,695	2,893	2,751	2,803	2,671	760	677	4,059	3,472
WV	Highway Vehicles	185,437	55,258	41,840	10,124	2,101	1,273	1,269	375	179	72	20,493	5,208
WV	Metals Processing	24,179	24,088	1,806	1,839	1,468	1,362	1,046	973	2,069	1,956	520	499
WV	Miscellaneous	86,791	86,171	1,296	1,277	76,122	76,051	15,876	15,810	684	677	20,396	20,356
WV	Off-Highway	89,194	89,372	22,397	11,934	1,428	696	1,341	649	204	35	15,934	8,932
WV	Other Industrial Processes	2,726	2,616	2,464	1,941	21,016	20,439	3,655	3,664	1,983	1,350	1,283	1,443
WV	Petroleum & Related Industries	27,645	42,008	22,041	29,242	692	1,514	594	1,511	6,144	191	47,734	130,121
WV	Solvent Utilization	<0.5	<0.5	<0.5	none reported	13	2	13	2	<0.5	none reported	14,315	13,610
WV	Storage & Transport	2	2	4	21	465	220	182	74	<0.5	<0.5	8,621	5,687
WV	Waste Disposal & Recycling	31,785	31,786	1,152	1,152	4,840	4,840	3,981	3,981	63	63	2,622	2,606
WV	**Subtotals:**	482,007	362,224	172,944	125,208	124,411	117,557	41,192	35,893	121,617	59,114	139,528	194,713
VISTAS	**Totals:**	16,885,757	11,483,394	3,343,166	1,528,129	4,427,066	4,969,272	1,295,512	1,284,539	1,634,354	448,066	3,517,707	2,658,709

7.2.5. EPA Inventories

EPA created a 2016 base year emissions inventory for modeling purposes in a collaborative effort with states and RPOs. The 2016 emissions inventory data for the point source and EGU sectors originated with state submissions to the EIS and, for those units subject to 40 CFR Part 75 monitoring requirements, unit level reporting to CAMD. Other source sector data were estimated by EPA, through emissions inventory tools, or estimates based upon state supplied input. This data set includes a full suite of 2016 base year inventories and projection year data for 2023 and 2028.[37] The 2023 and 2028 projections from 2016 relied upon IPM for estimates of EGU activity and emissions. EPA has provided emission summaries of this information at state and SCC levels for both the 2016 base year and EPA's previous 2014 base year. EPA used the 2014 NEI data to create the 2014 base year data set. Point source and EGU sector information for the 2014 NEI originated with state submissions or from unit level reporting to CAMD. Other sectors in the 2014 NEI were created by EPA based on tool inputs supplied by state staff, contractor estimates, and additional sources. Evaluation of these data sets show trends that are similar to those in the VISTAS emissions inventory.

EPA has also prepared and published the 2017 NEI[38] based on point source and EGU sector data that originated with state EIS submissions or unit level reporting to CAMD. EPA developed other emissions sectors of the 2017 NEI using state-supplied input files for emission estimation tools, contractor estimates, and additional sources of data. These data represent the January 2021 version of this database, which includes all sectors and pollutants for emissions across the United States.

Figure 7-5 provides the estimated actual SO_2 emissions within the EPA inventories for 2014, 2016, and 2017 by Tier 1 category within the ten VISTAS states; the emissions inventories for years 2023 and 2028, projected from the base year 2016 data by EPA; and the 2011 and 2028 VISTAS inventories used in the RPG modeling. The 2011 and 2014 data show that SO_2 emissions were predominantly emitted from electric utility fuel combustion and industrial fuel combustion within the VISTAS region. Significant SO_2 reductions occurred by 2016, and additional reductions occurred in 2017. These SO_2 reductions are most pronounced in the electric utility fuel combustion category. EPA's 2023 and 2028 data forecast continued declines in SO_2 emissions from this category. The VISTAS 2028 data also project additional SO_2 emission reductions across the VISTAS states although these projections are higher than the EPA 2028 projections.

Figure 7-6 provides the estimated actual NO_X emissions within the EPA inventories for 2014, 2016, and 2017 by Tier 1 category within the ten VISTAS states; the emissions inventories for

[37] URL: https://www.epa.gov/air-emissions-modeling/2016v1-platform
[38] URL: https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data

years 2023 and 2028, projected from the base year 2016 data by EPA; and the 2011 and 2028 VISTAS inventories used in the RPG modeling. The 2011, 2014, and 2016 data show that NO_X emissions were predominantly emitted from onroad and off-highway source sectors. Significant reductions in NO_X occurred by 2016 as compared to 2011. During this time period reductions in emissions from onroad and off-highway source sectors as well as the electrical utility fuel combustion sector contributed to this drop. EPA's 2023 and 2028 projections forecast continued declines in NO_X emissions, most notably from the onroad and off-highway source sectors. The VISTAS 2028 data also project additional NO_X emission reductions across the VISTAS states although the estimated reductions are not as great as those from EPA.

The VISTAS 2028 data is higher than the EPA 2028 projections largely due to differences in projection methodologies for EGUs and some non-EGUs. For example, EPA relied upon IPM results that generally have lower SO_2 and NO_X emissions than ERTAC results. The IPM tool may retire or idle coal fired EGUs and certain coal fired industrial boilers that occasionally provide electricity to the grid due to economic assumptions within the model. ERTAC projections do not use economic decisions to forecast retirements or idling of units in future years. Rather, states provide estimated retirement dates based on information provided by the facility owners, consent decrees, permits, or other types of documentation. The ERTAC projections, therefore, tend to be more conservative. Other primary reasons for differences between the VISTAS 2028 and EPA 2028 projections data include, but are not limited to, different base year for emissions projections (2011 vs 2016) and differences in assumptions based on EPA's Clean Power Plan. Additional information regarding inventory developments can be found in Appendix B.

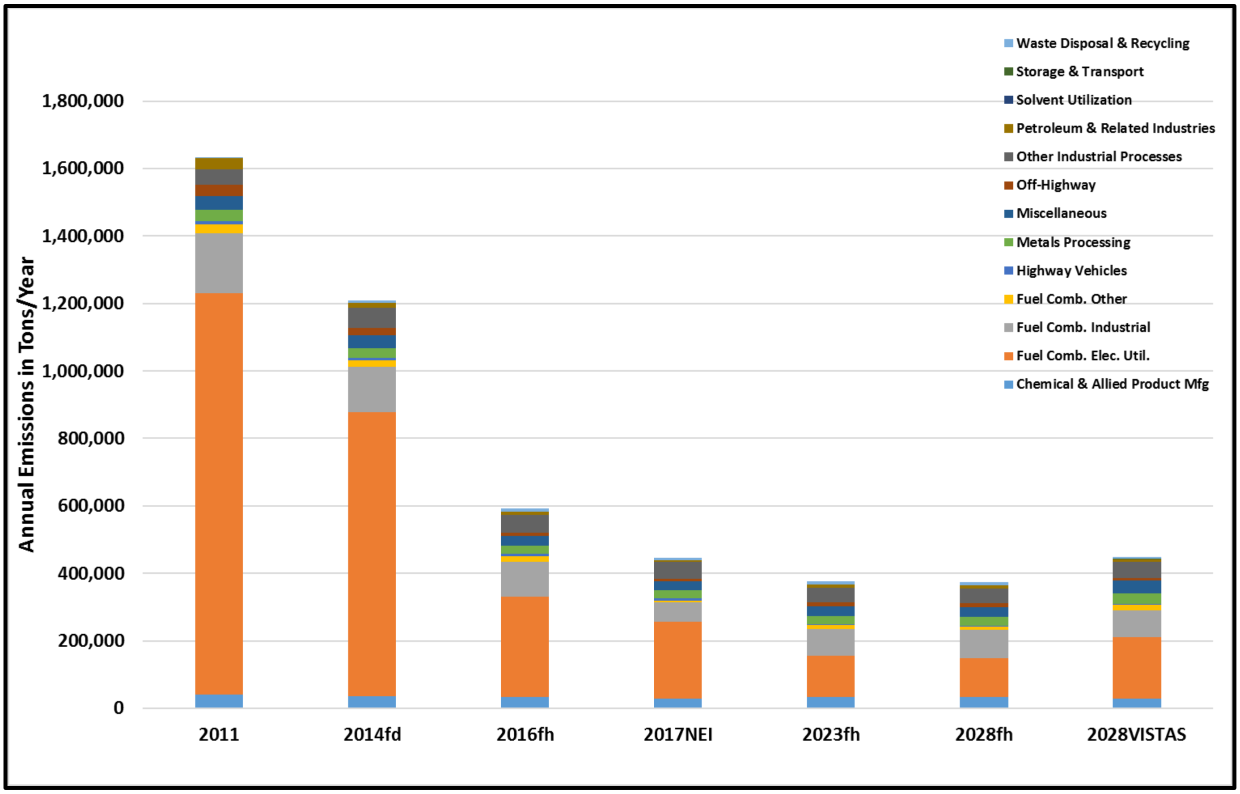

Figure 7-5: SO_2 Emissions from VISTAS States

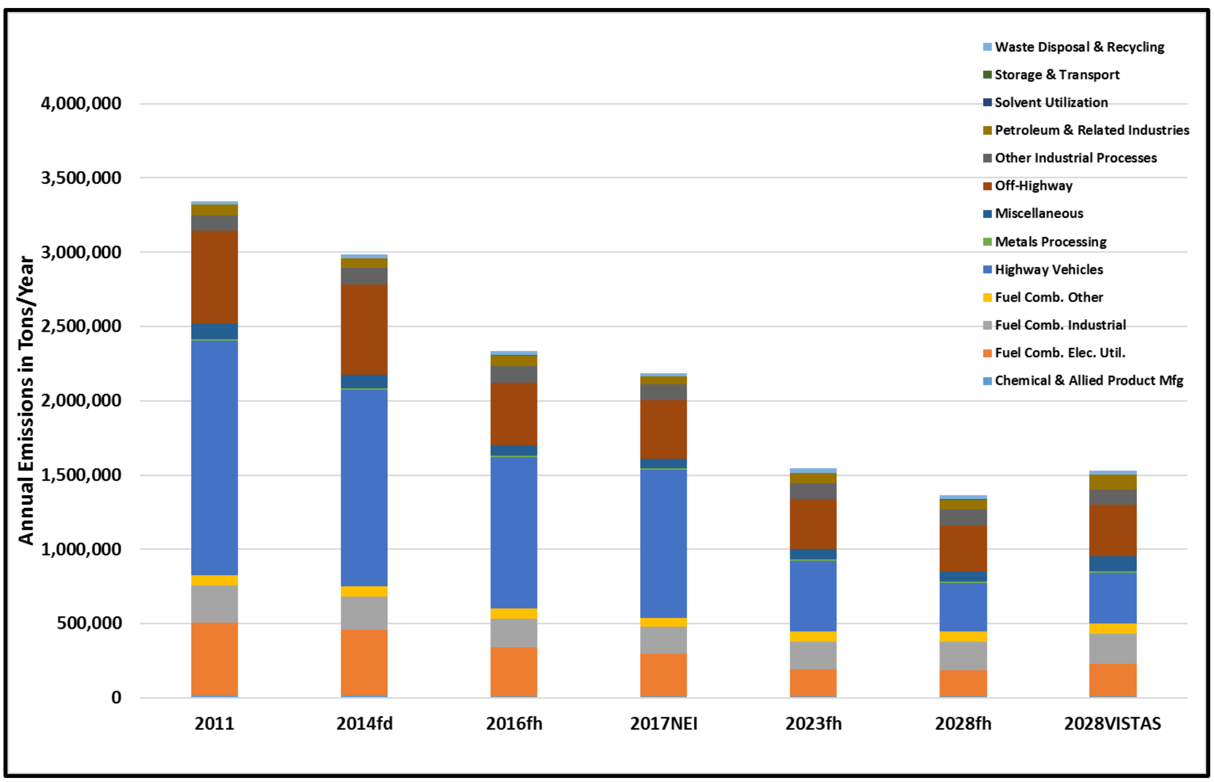

Figure 7-6: NO_X Emissions from VISTAS States

The data for Mississippi in the EPA inventories also forecast significant declines in both SO_2 and NO_X emissions. Figure 7-7 provides EPA's estimates of Mississippi's actual SO_2 emissions from 2011, 2014, 2016, and 2017 as well as EPA's projected values for 2023 and 2028 and the VISTAS projected value for 2028. EPA estimated just under 64,000 tons of SO_2 emissions from Mississippi in 2011. EPA expects that SO_2 emissions in Mississippi will drop to just under 17,500 tons by 2028, a 73% reduction. The VISTAS projection for Mississippi shows that emissions of SO_2 should drop to just under 12,000 tons by 2028, an 81% reduction.

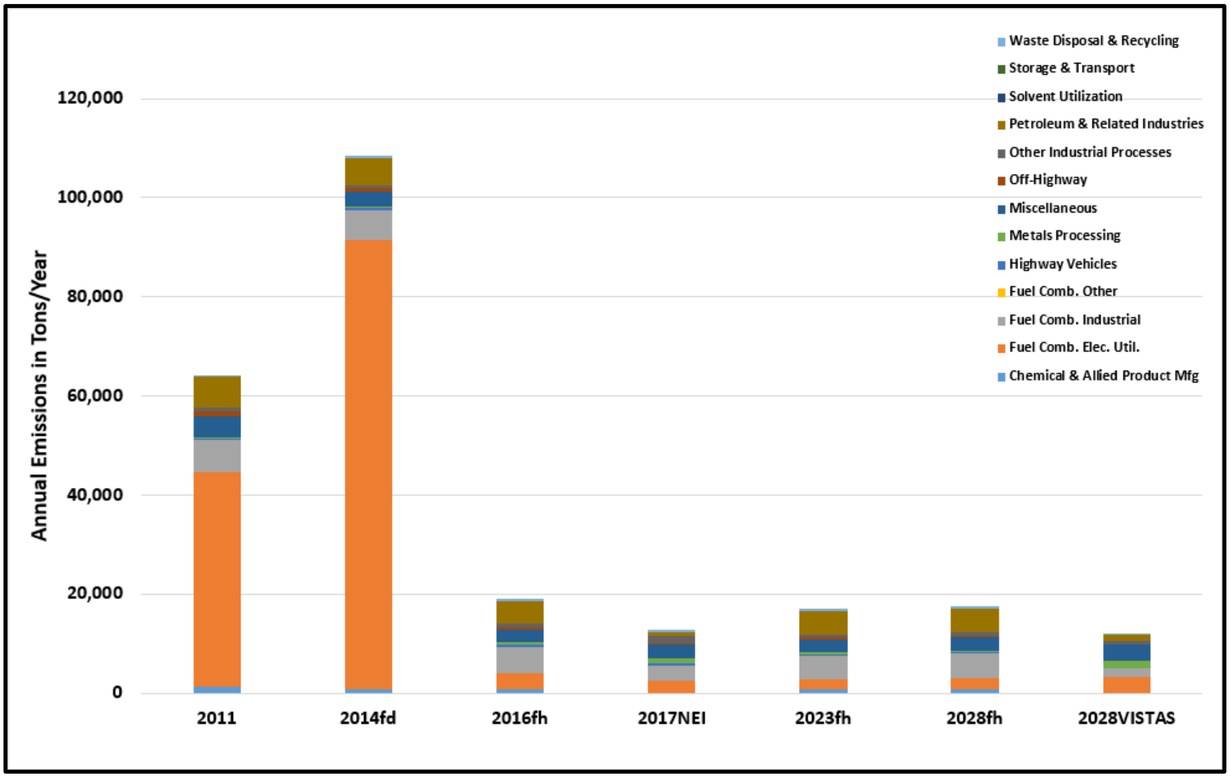

Figure 7-7: Mississippi SO_2 Emissions

Figure 7-8 provides EPA's estimates of actual NO_X emissions in Mississippi from 2011, 2014, 2016, and 2017. The figure also shows EPA's projected values for 2023 and 2028, using 2016 as the base year, and the VISTAS projections for 2028. EPA estimated nearly 206,000 tons of NO_X emissions from Mississippi in 2011. EPA expects that NO_X emissions in Mississippi will drop to about 77,000 tons by 2028, a 62% reduction. The VISTAS projections estimate that Mississippi NO_X emissions will drop to about 95,000 tons by 2028, a 54% reduction.

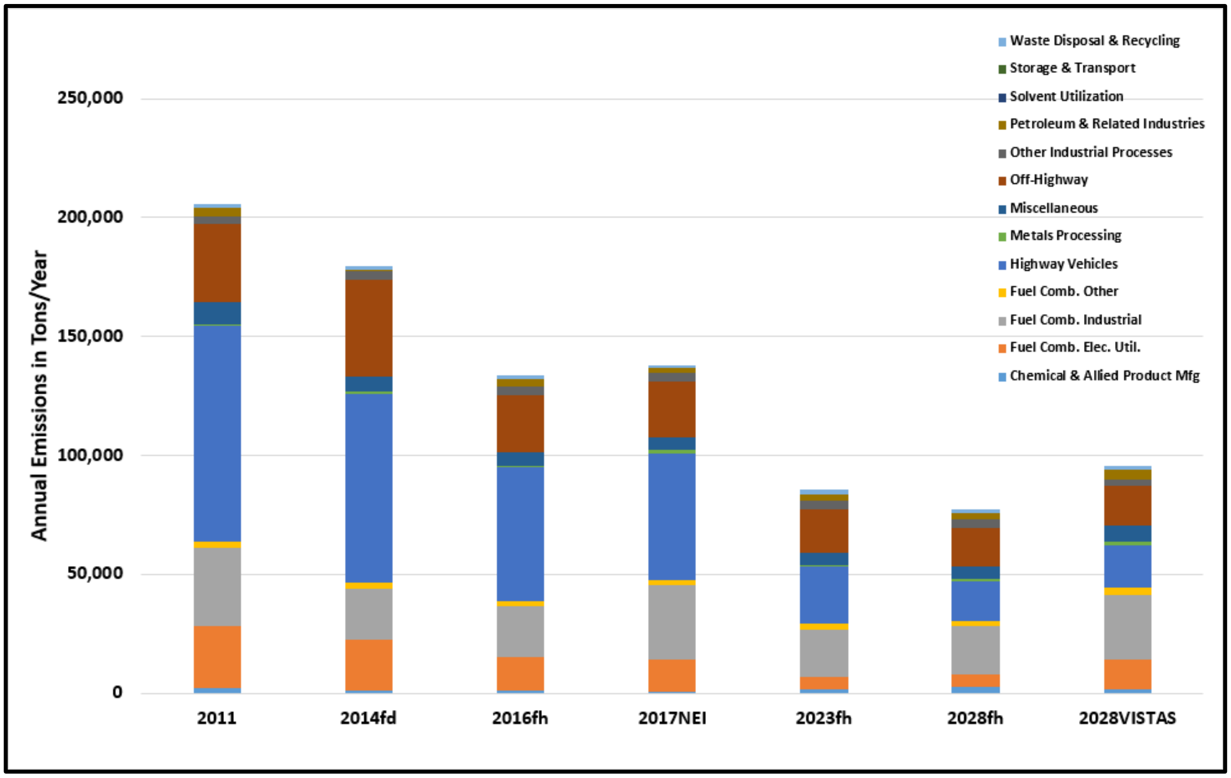

Figure 7-8: Mississippi NOx Emissions

The VISTAS 2028 projections do not include reductions from programs noted in Section 8. Therefore, the VISTAS 2028 estimates are likely conservative, and actual 2028 emissions of SO_2 and NO_X should be lower than those noted.

7.2.6. VISTAS 2028 Model Projections

VISTAS states used emissions modeling, as described in Section 5 and Section 6, to project visibility in 2028 using a 2028 emissions inventory as described in Section 4. The EPA Software for Model Attainment Test – Community Edition (SMAT-CE) tool was used to calculate 2028 deciview values on the 20% most impaired and 20% clearest days at each Class I area IMPROVE monitoring site. SMAT-CE[39] is an EPA software tool that implements the procedures in the "Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze," (SIP modeling guidance)[40] to project visibility in the future year. The SMAT-CE tool outputs individual year and five-year average base year and future year deciview values on the 20% most impaired days and the 20% clearest days.

[39] URL: https://www.epa.gov/scram/photochemical-modeling-tools
[40] URL: https://www.epa.gov/sites/production/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf

7.2.6.1. Calculation of 2028 Visibility Estimates

The visibility projections follow the procedures in Section 5 of the SIP modeling guidance. Based on recommendations in the SIP modeling guidance, the observed base period visibility data is linked to the modeling base period. In this case, for a base modeling year of 2011, the 2009-2013 IMPROVE data for the 20% most impaired days and 20% clearest days were used as the basis for the 2028 projections. Section 232.4 discusses the IMPROVE monitoring data during the modeling base period of 2009-2013.

The visibility calculations use the IMPROVE equation discussed in Section 2.1. As noted in Section 2.1, the IMPROVE algorithm uses PM species concentrations and relative humidity data to calculate visibility impairment as extinction (b_{ext}) in units of inverse megameters.

The 2028 future year visibility on the 20% most impaired days and the 20% clearest days at each Class I area is estimated by using the observed IMPROVE data from years 2009-2013 and the relative percent modeled change in PM species between 2011 and 2028. The following steps describe the process. The SIP modeling guidance contains more detailed description and examples.

- Step 1 - For each Class I area (i.e., IMPROVE site), estimate anthropogenic impairment (Mm^{-1}) on each day using observed speciated $PM_{2.5}$ data plus PM_{10} data (and other information) for each of the five years comprising the modeling base period (2009-2013) and rank the days on this indicator.[41] This ranking will determine the 20% most impaired days. For each Class I area, also rank observed visibility (in deciviews) on each day using observed speciated $PM_{2.5}$ data plus PM_{10} data for each of the five years comprising the modeling base period. This ranking will determine the 20% clearest days.

- Step 2 - For each of the five years comprising the base period, calculate the mean deciviews for the 20% most impaired days and the 20% clearest days. For each Class I area, calculate the five-year mean deciviews for the 20% most impaired and the 20% clearest days from the five year-specific values.

- Step 3 - Use an air quality model to simulate air quality with base period (2011) emissions and future year (2028) emissions. Use the resulting information to develop monitor site-specific relative response factors (RRFs) for each component of PM identified in the "revised" IMPROVE equation. The RRFs are an average percent change in species concentrations based on the measured 20% most impaired days and 20% clearest days from 2011 to 2028. The calendar days from 2011 identified from the IMPROVE data above are matched by day to the modeled days. RRFs are calculated

[41] EPA, "Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program", December 2018. URL: https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf

separately for sulfate, nitrate, organic carbon mass, elemental carbon, fine soil mass, and coarse mass. The observed sea salt is primarily from natural sources that are not expected to be year-sensitive, and the modeled sea salt is uncertain. Therefore, the sea salt RRF for all monitor sites is assumed to be 1.0.

- Step 4 – For each monitor site, multiply the species-specific RRFs by the measured daily species concentration data during the 2009-2013 base period for each day in the measured 20% most impaired day data set and each day in the 20% clearest day data set. This results in daily future year 2028 PM species concentration data.

- Step 5 - Using the results in Step 4 and the IMPROVE algorithm described in Section 2.1, calculate the future daily extinction coefficients for the previously identified 20% most impaired days and 20% clearest days in each of the five base years.

- Step 6 - Calculate daily deciview values (from total daily extinction) and then compute the future year (2028) average mean deciviews for the 20% most impaired days and 20% clearest days for each year. Average the five years together to get the final future mean deciview values for the 20% most impaired days and 20% clearest days.

In cases where an IMPROVE monitor is located within a Class I area, the five-year average modeling base period visibility is used with modeled concentrations from the grid cell containing the IMPROVE monitor to calculate future year RRFs and visibility results. In cases within VISTAS states where an IMPROVE monitor is not located within a Class I Area, surrogate IMPROVE monitors are assigned to establish modeling base period visibility values. See Section **Error! Reference source not found.** for a description and listing of these sites. When u sing a surrogate IMPROVE monitor site, the five-year average modeling base period visibility from the surrogate location is used with modeled concentrations from the actual modeled grid cell at the centroid of the Class I area to calculate future year RRFs and visibility results. In Class I areas outside of the VISTAS states, surrogate monitor modeling base period data and RRFs are used to project future year visibility.

7.2.6.2. 2028 Visibility Projection Results

Table 7-3 provides the 2028 visibility projections for VISTAS Class I areas and nearby Class I areas. More information on these projections may be found in Appendix E-6.

Table 7-3: 2028 Visibility Projections for VISTAS and Nearby Class I Areas

Class I Area	Site ID	State	2028 20% Clearest Days dv)	2028 20% Clearest Days (Mm^{-1})	2028 20% Most Impaired Days (dv)	2028 20% Most Impaired Days (Mm^{-1})
Cape Romain Wilderness Area	ROMA1	SC	12.11	33.87	16.64	53.81
Chassahowitzka Wilderness Area	CHAS1	FL	12.54	35.28	16.79	54.50
Cohutta Wilderness Area	COHU1	GA	9.15	25.51	14.90	45.63
Dolly Sods Wilderness Area	DOSO1	WV	7.55	21.79	15.29	47.82
Everglades National Park	EVER1	FL	10.64	29.13	15.52	47.87
Great Smoky Mountains National Park	GRSM1	TN	8.96	25.02	15.03	46.08
James River Face Wilderness Area	JARI1	VA	9.80	27.13	15.87	50.46
Joyce Kilmer-Slickrock Wilderness Area	GRSM1	TN	8.97	25.02	14.88	45.36
Linville Gorge Wilderness Area	LIGO1	NC	8.21	23.06	14.25	42.61
Mammoth Cave National Park	MACA1	KY	11.66	32.50	19.27	70.87
Okefenokee Wilderness Area	OKEF1	GA	11.58	32.14	16.90	55.59
Otter Creek Wilderness Area	DOSO1	WV	7.55	21.80	15.26	47.66
Shenandoah National Park	SHEN1	VA	7.27	21.20	14.47	44.02
Shining Rock Wilderness Area	SHRO1	NC	4.54	15.74	13.31	37.86
Sipsey Wilderness Area	SIPS1	AL	11.11	30.75	16.62	54.13
St. Marks Wilderness Area	SAMA1	FL	11.59	32.18	16.43	53.05
Swanquarter Wilderness Area	SWAN1	NC	10.77	29.61	15.27	47.42
Wolf Island Wilderness Area	OKEF1	GA	11.55	32.05	16.75	54.71
Breton Wilderness	BRIS1	LA	12.13	34.21	18.39	65.06
Brigantine Wilderness Area	BRIG1	NJ	11.07	30.54	18.40	65.20
Caney Creek Wilderness Area	CACR1	AR	8.79	24.75	18.32	64.25
Hercules Glade Wilderness Area	HEGL1	MO	9.75	26.88	18.80	67.92
Mingo Wilderness Area	MING1	MO	11.14	30.87	19.69	74.03
Upper Buffalo Wilderness Area	UPBU1	AR	8.93	25.07	17.82	60.73

7.2.7. Model Results for the VISTAS 2028 Inventory Compared to the URP Glide Paths for an Example Class I Area Neighboring Mississippi

Using 2000 through 2004 IMPROVE monitoring data, the dv values for the 20% clearest days in each year were averaged together, producing a single average dv value for the clearest days during that time period. Similarly, the dv values for the 20% most impaired days in each year were averaged together, producing a single average dv value for the days with the most anthropogenic visibility impairment during that time period. These values form the baseline for visibility at each Class I area and are used to gauge improvements. In this second round of visibility planning, 2011 represents the base year for air quality modeling projections. To develop an average 2011 impairment suitable for use in air quality projections, 2009 through 2013 IMPROVE monitoring data were used. The dv values for the 20% clearest days in each year are averaged together to produce a single average dv value for the clearest days. The 20% most impaired days were also averaged from this timeframe to produce a single value for the 20% most impaired days.

Figure 7-9 and Figure 7-10 illustrate the predicted visibility improvements on the 20% most impaired days by 2028, compared to the URP glide paths for Sipsey Wilderness Area and Breton Wilderness Area, respectively. The pink lines represent the URP at each Class I area. The URP starts at the 2000-2004 average of the 20% most impaired days and ends in 2064 at the estimated natural condition value for each Class I area. This line shows a uniform, linear progression between the 2000-2004 baseline and the target natural condition in 2064. The model projections shown in blue triangles start at 2011 (the observed 2009-2013 average of the visibility on the 20% most impaired days) and end at the 2028 projected visibility values for the 20% most impaired days based on existing and planned emissions controls during the period of the long-term strategy associated with this round of planning. Blue diamonds on these figures represent IMPROVE monitoring data on the 20% most impaired days at each Class I area, and the brown lines denote the five-year rolling average of each set of IMPROVE monitoring data.

At Sipsey Wilderness Area and Breton Wilderness Area, visibility improvements on the 20% most impaired days are expected to be better than the uniform rate of progress glide paths by 2028.

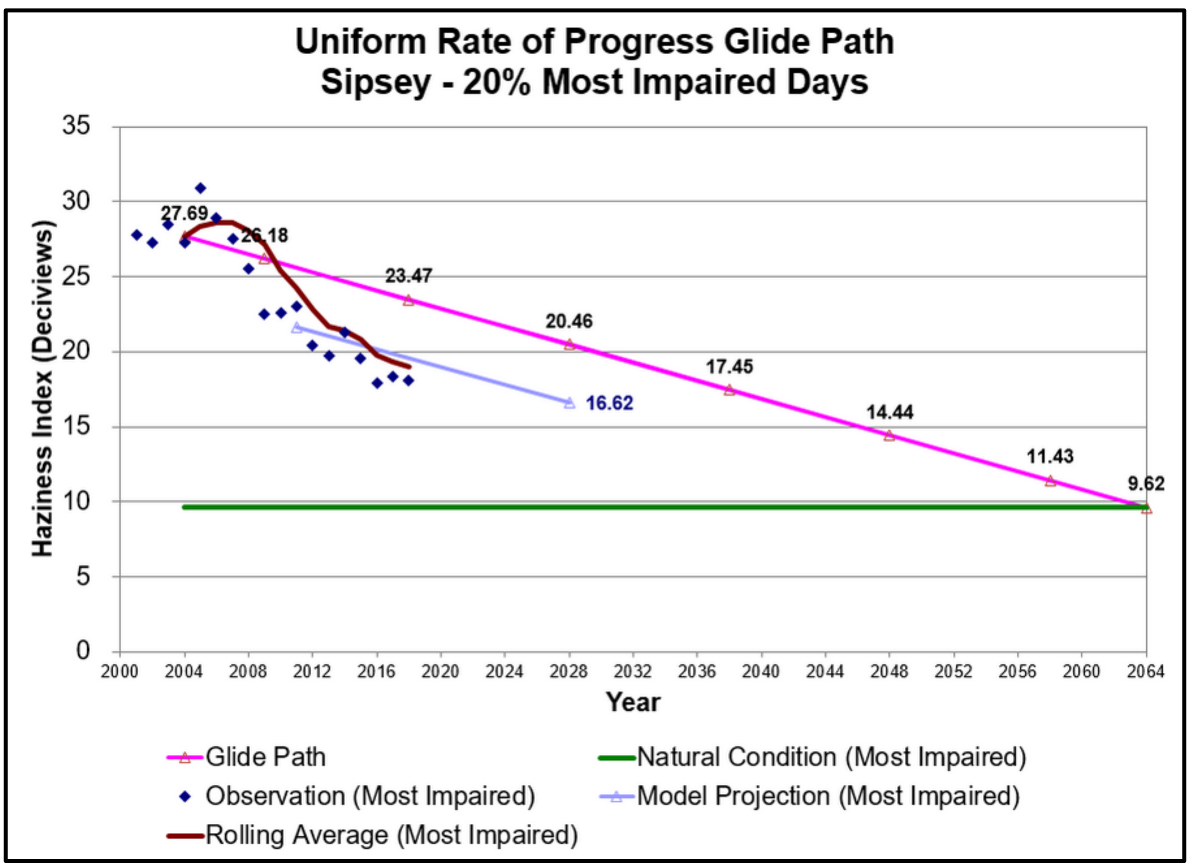

Figure 7-9: Sipsey Wilderness Area URP on the 20% Most Impaired Days

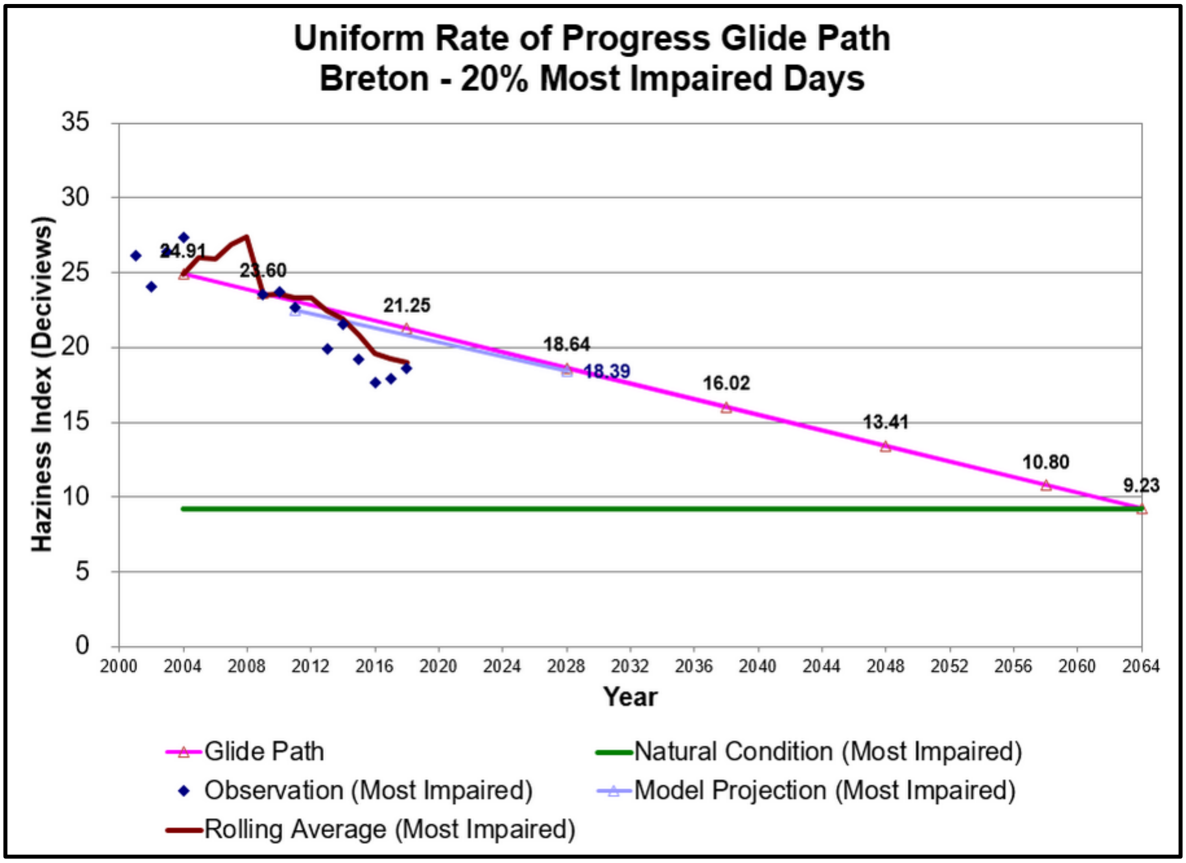

Figure 7-10: Breton Wilderness Area URP on the 20% Most Impaired Days

As illustrated in Figure 7-11, visibility improvements at all the VISTAS Class I areas except the Everglades are projected to be better than the uniform rate of progress in 2028 using the VISTAS modeling.[42] In Figure 7-11, the percentage displayed represents the difference between the 2028 projected visibility value from the VISTAS modeling analyses and the expected visibility improvement by 2028 on the URP. Because this calculation is based on the level of haze in dv, negative percentages indicate that the 2028 projected visibility value is better than the expected visibility by 2028 on the URP while positive percentages indicate that the 2028 projected visibility value is worse than the expected visibility by 2028 on the URP. For nearby areas (Sipsey and Breton), visibility improvements are ahead of the timeline noted on the URP.

[42] The VISTAS modeling performed well at every Class I area with the exception of Everglades in Florida. Because of the issues with model performance, Florida is relying on EPA's regional haze modeling for Everglades visibility projections and 2028 RPG development. See Section 6.6, "Model Performance for Everglades," on pages 146-154 of the October 4, 2021, Florida Regional Haze Plan narrative for further details.

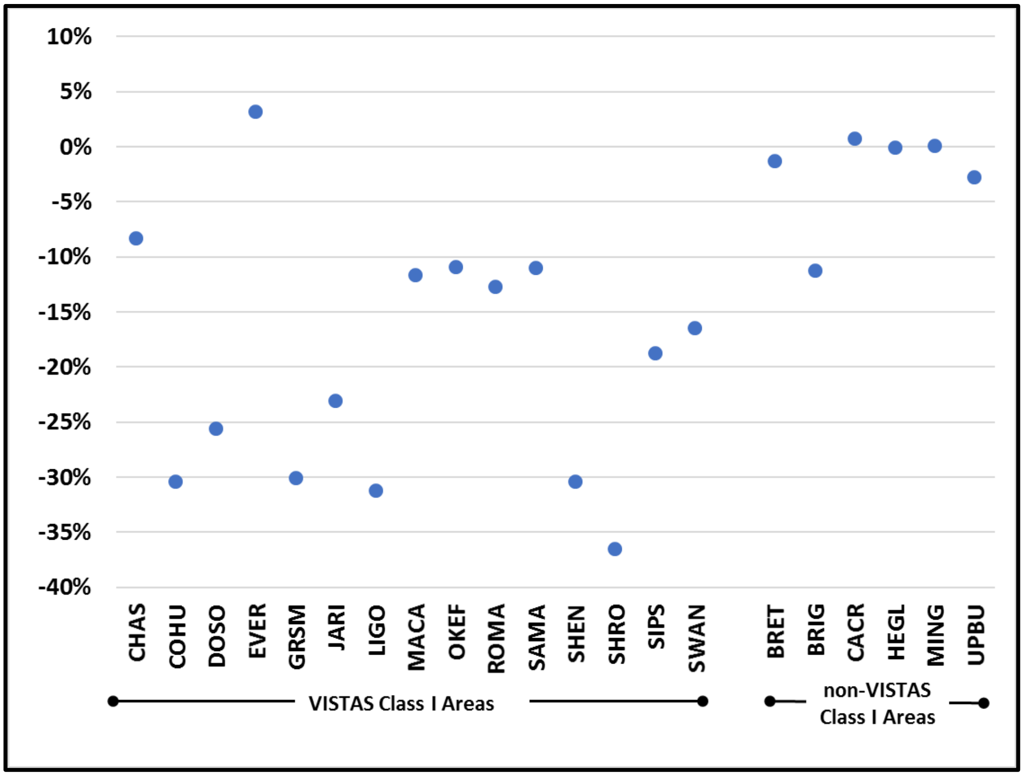

Figure 7-11: Percent of URP in 2028

Figure 7-12 illustrates the visibility improvement in 20% most impaired days. The figure shows scenery at the Sipsey Wilderness Area impacted at levels equivalent to the 2000-2004 baseline conditions on the 20% most impaired days, the 2028 projections based on the VISTAS inventory, and natural conditions.

Figure 7-12: Sipsey 20% Most Impaired Days in 2000-2004, 20% Most Impaired Days in 2028, and Natural Conditions

In addition to improving visibility on the 20% most impaired visibility days, states are also required to protect visibility on the 20% clearest days at the Class I areas to ensure no degradation of visibility on these clearest days occurs. Figure 7-13 and Figure 7-14 show the improvements expected on the 20% clearest visibility days using the VISTAS emissions inventory and associated reductions. The pink line represents the 2000-2004 average baseline conditions for the 20% clearest days. The model projections shown in blue triangles start at

2011 (the observed 2009-2013 average of the visibility on the 20% clearest days) and end at the 2028 projected visibility values for the 20% clearest days based on existing and planned emissions controls during the period of the long-term strategy associated with this round of planning. Blue diamonds depict IMPROVE monitoring data values, and the gray lines denote IMPROVE monitoring data five-year averages. As noted in Figure 7-13 and Figure 7-14, visibility conditions in 2028 on the 20% clearest visibility days are expected to continue to improve at both Sipsey and Breton.

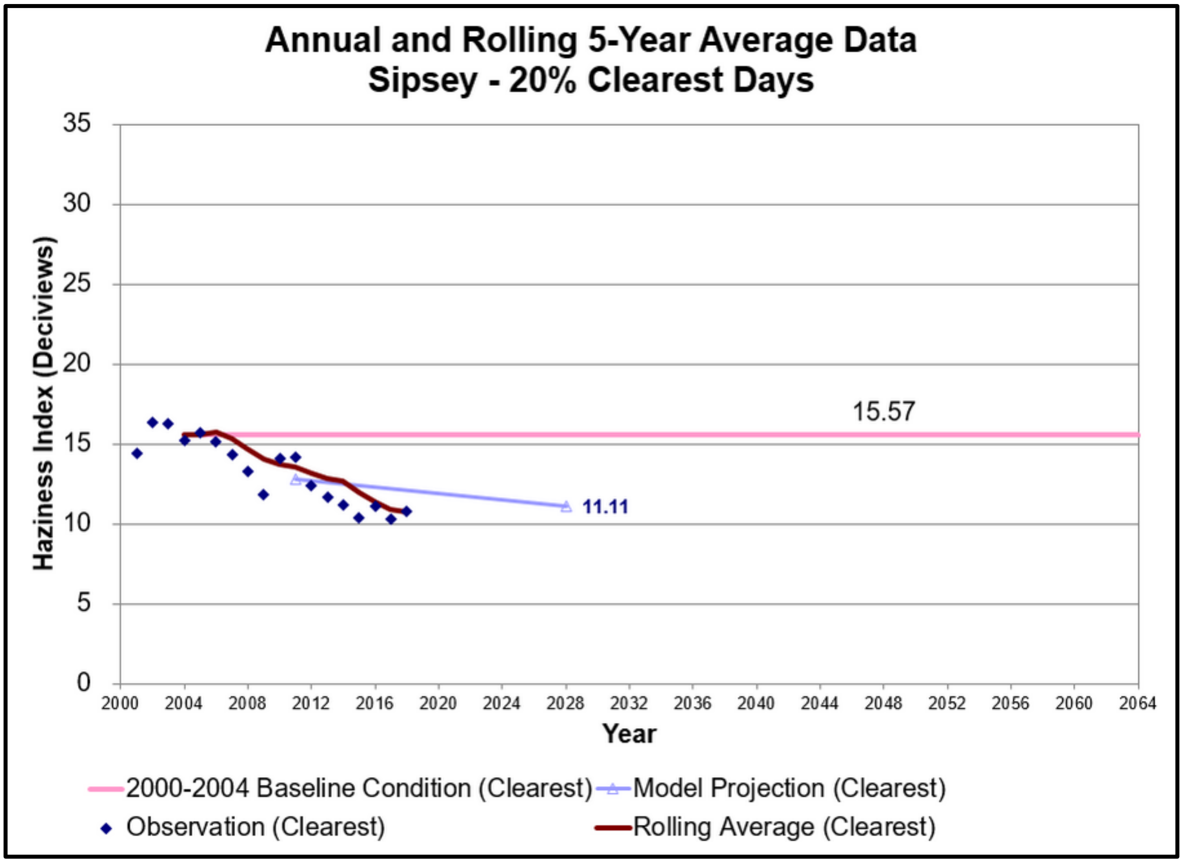

Figure 7-13: 20% Clearest Days Rate of Progress for Sipsey Wilderness Area

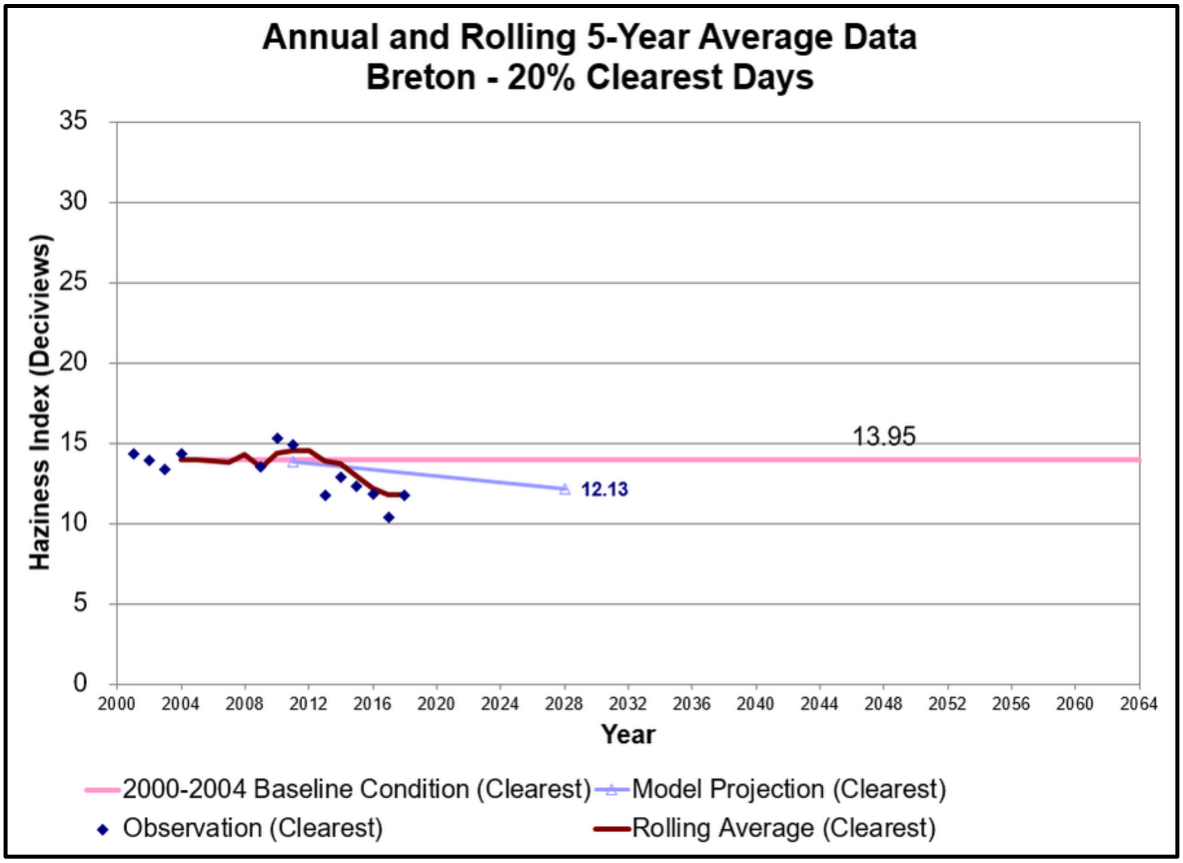

Figure 7-14: 20% Clearest Days Rate of Progress for Breton Wilderness Area

As illustrated in Figure 7-15, visibility on the 20% clearest days is projected to improve in 2028 at all VISTAS and non-VISTAS Class I areas as a result of the emission control programs included in the VISTAS 2028 emissions inventory. In this figure, a zero percent change indicates no change in visibility. A negative percentage indicates improvement in projected visibility while a positive change indicates visibility degradation.

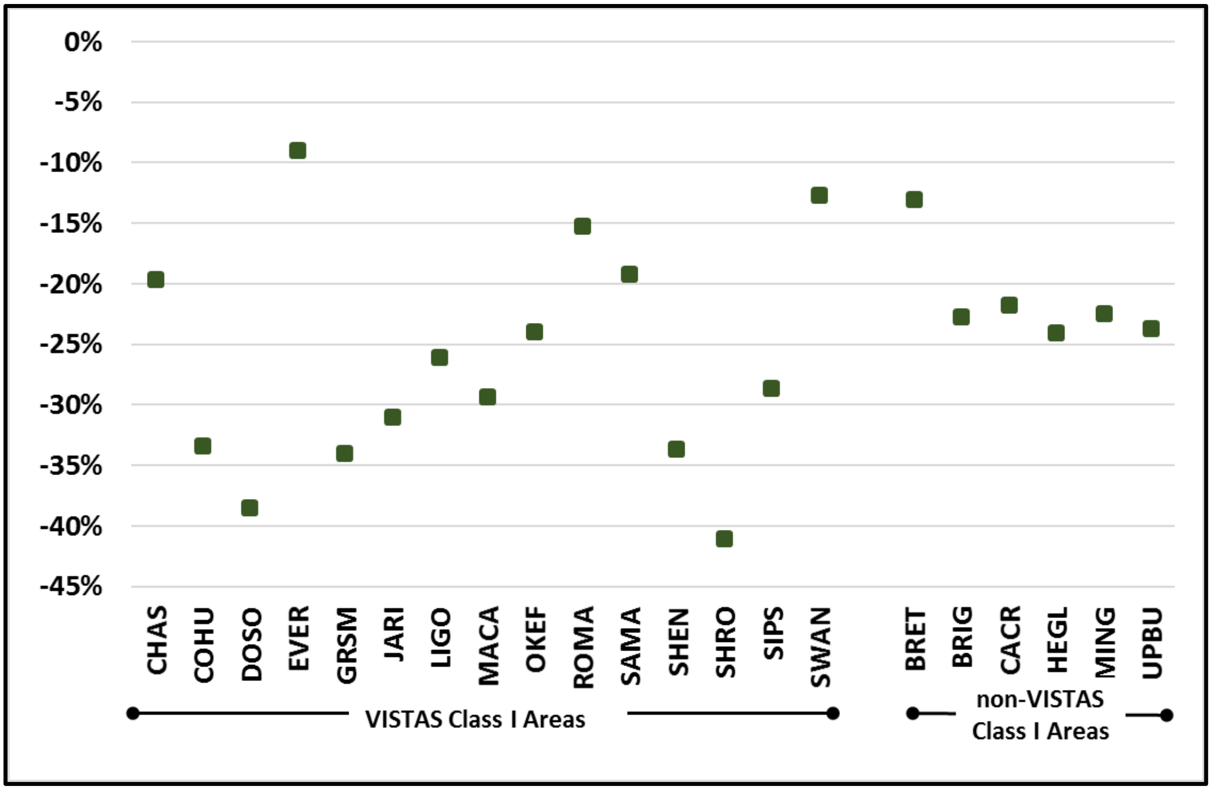

Figure 7-15: Percent Visibility Improvement on 20% Clearest Days

7.3. Relative Contribution from International Emissions to Visibility Impairment in 2028 at VISTAS Class I Areas

International anthropogenic emissions are beyond the control of states preparing regional haze SIPs. Therefore, the regional haze rule at 40 CFR 51.308(f)(1)(vi)(B) allows states to optionally propose an adjustment of the 2064 uniform rate of progress endpoint to account for international anthropogenic impacts, if the adjustment has been developed using scientifically valid data and methods. On September 19, 2019, EPA released Technical Support Document for EPA's Updated 2028 Regional Haze Modeling.[43] This document provides the results of EPA's updated 2028 visibility modeling analyses and includes projections of both domestic and international source contributions. EPA used source apportionment results to calculate the estimated source contribution of international anthropogenic emissions to visibility impairment at Class I areas on the 20% most impaired days. EPA used these estimated contributions to derive adjusted glide path endpoints for each federal Class I area.

In this study, EPA used the CAMx PSAT tool to tag certain sectors. EPA processed each sector through the SMOKE model and tracked each sector in PSAT as an individual source tag. EPA tracked sulfate, nitrate, ammonium, secondary organic aerosols, and primary PM in this manner. International anthropogenic emissions within this study include anthropogenic emissions from

[43] URL: https://www.epa.gov/visibility/technical-support-document-epas-updated-2028-regional-haze-modeling

Canada and Mexico, C3 commercial marine emissions outside of the emissions control area as described in Section 7.2.1.4.4, and international anthropogenic boundary conditions.

Results from this study show that international anthropogenic boundary conditions account for a sizable fraction of sulfate concentrations in the west in certain months, and to a lesser extent nitrate. Estimated international anthropogenic visibility impairment ranges from 3.0 Mm^{-1} to 19.7 Mm^{-1}. For Class I areas located in VISTAS, total international anthropogenic emissions impacts range from 4.10 Mm^{-1} to 8.80 Mm^{-1}. Table 7-4 provides the estimated international anthropogenic visibility impacts to VISTAS Class I area from EPA's study.

Table 7-4: VISTAS Class I Area International Anthropogenic Emissions 2028 Impairment, Mm^{-1}

Class I Area Name	State	Site ID	Non-US C3 Marine	Canada	Mexico	Boundary International	Total International Anthropogenic
Cape Romain Wilderness Area	SC	ROMA	0.50	0.81	1.24	3.68	6.23
Chassahowitzka Wilderness Area	FL	CHAS	1.30	0.62	1.01	3.81	6.75
Cohutta Wilderness Area	GA	COHU	0.10	1.31	0.68	3.20	5.29
Dolly Sods Wilderness Area	WV	DOSO	0.05	2.11	0.53	2.31	4.99
Everglades National Park	FL	EVER	2.28	0.48	0.36	4.65	7.77
Great Smoky Mountains National Park	NC/TN	GRSM	0.09	1.38	0.54	2.83	4.48
James River Face Wilderness Area	VA	JARI	0.04	2.01	0.38	2.56	4.99
Joyce Kilmer-Slickrock Wilderness Area	NC/TN	JOYC	0.09	1.38	0.54	2.83	4.84
Linville Gorge Wilderness Area	NC	LIGO	0.04	1.42	0.39	2.26	4.10
Mammoth Cave National Park	KY	MACA	0.02	3.34	0.30	3.28	6.94
Okefenokee Wilderness Area	GA	OKEF	0.99	0.98	2.23	4.60	8.80
Otter Creek Wilderness Area	WV	OTCR	0.05	2.11	0.53	2.31	4.99
Shenandoah National Park	VA	SHEN	0.02	1.98	0.30	2.42	4.72
Shining Rock Wilderness Area	NC	SHRO	0.09	1.01	1.00	2.61	4.70
Sipsey Wilderness Area	AL	SIPS	0.09	1.45	0.74	2.83	5.12
St. Marks Wilderness Area	FL	SAMA	0.59	0.76	1.43	3.78	6.57
Swanquarter Wilderness Area	NC	SWAN	0.16	1.91	0.65	2.42	5.13
Wolf Island Wilderness Area	GA	WOLF	0.99	0.98	2.23	4.60	8.80

MDEQ is not aware of any states in VISTAS that are updating the 2028 uniform rate of progress goals based on EPA's contribution study of international anthropogenic emissions in this round of regional haze planning.

7.4. Relative Contributions to Visibility Impairment: Pollutants, Source Categories, and Geographic Areas

To determine what areas and emissions source sectors impact VISTAS mandatory federal Class I areas, VISTAS relied on PSAT results examining the impacts of sulfate and nitrate from the following geographic areas and emissions sectors:

- Total SO_2 and NO_X emissions from each VISTAS state;

- Total SO_2 and NO_X emissions from the CENRAP, MANE-VU, and LADCO regional planning organizations;
- Total SO_2 and NO_X emissions from EGUs from each VISTAS state;
- Total SO_2 and NO_X emissions from EGUs from CENRAP, MANE-VU, and LADCO regional planning organizations;
- Total SO_2 and NO_X emissions from non-EGU point sources from each VISTAS state; and
- Total SO_2 and NO_X emissions from non-EGU point sources from CENRAP, MANE-VU, and LADCO regional planning organizations.

Visibility impacts in 2028 estimated by PSAT for each region (10 individual VISTAS states plus three RPOs), emission sector (total, EGU, and non-EGU), and pollutant (SO_2 and NO_X) at each mandatory federal Class I area are available for comparison.

Figure 7-16 shows the 2028 nitrate impairment from each region at mandatory federal Class I areas within VISTAS. Most mandatory federal Class I areas in VISTAS show contributions of less than 4 Mm^{-1} from nitrate in 2028, with the exceptions being Mammoth Cave National Park, Sipsey Wilderness Area, Cape Romain Wilderness Area, and Swanquarter Wilderness Area. All of the mandatory federal Class I areas in VISTAS show total contributions to nitrate impairment from the CENRAP, LADCO, and the MANE-VU sources (dark grey, medium grey, and light grey, respectively) that are larger than home state contributions, with the exception of Everglades National Park and Okefenokee Wilderness Area.

Figure 7-17 shows the 2028 sulfate impairment from each region at mandatory federal Class I areas within VISTAS. All areas, with the exception of Everglades National Park, show sulfate impacts of at least 10 Mm^{-1}. All of the mandatory federal Class I areas in VISTAS show contributions to sulfate impairment from CENRAP, LADCO, and MANE-VU sources (dark grey, medium grey, and light grey, respectively) that are larger than home state contributions, with the exception of Everglades National Park.

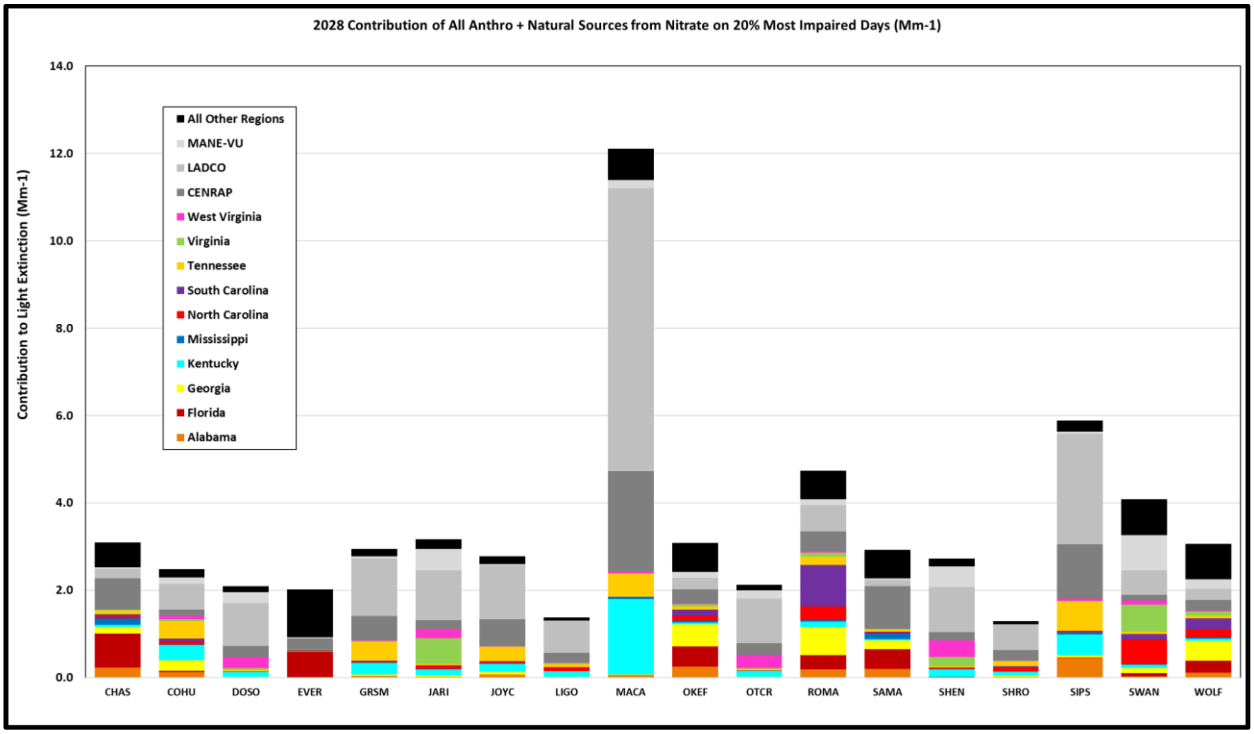

Figure 7-16: 2028 Nitrate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas

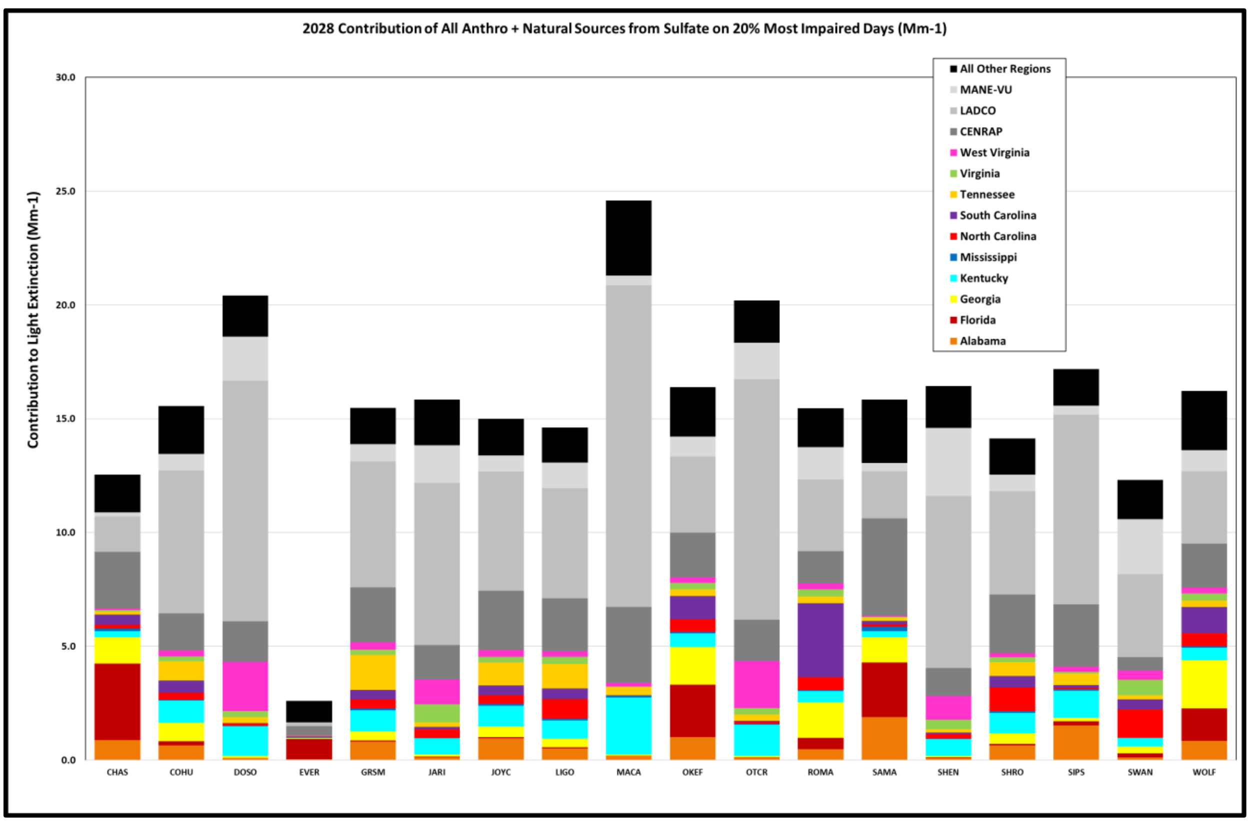

Figure 7-17: 2028 Sulfate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas

These figures indicate that sulfate continues to be the primary driver of visibility impairment in most mandatory federal VISTAS Class I areas. These figures also show that emissions from sources located outside of VISTAS have a significant impact on visibility in mandatory federal VISTAS Class I areas, with respect to both sulfate and nitrate.

Figure 7-18 and Figure 7-19 provide comparisons of projected light extinction from sulfate and nitrate in 2028 at mandatory federal Class I areas in VISTAS. These figures show the light extinction associated with all emissions within the pollutant inventory, the light extinction caused by emissions from the EGU sector, and light extinction caused by emissions from the non-EGU point source sector.

Figure 7-18 shows these data for sulfate visibility impairment. Comparison of bar heights in this figure demonstrates that sulfate visibility impairment from the EGU and non-EGU point source sectors comprise the majority of the total sulfate visibility impairment at all mandatory federal Class I areas within VISTAS except Everglades National Park. Figure 7-18 also shows that for some VISTAS mandatory federal Class I areas, visibility impairment due to sulfate from the EGU sector is significantly higher than visibility impairment due to sulfate from the non-EGU sector. Exceptions to this observation are Everglades National Park, Okefenokee Wilderness Area, Cape Romain Wilderness Area, St. Marks Wilderness Area, and Wolf Island Wilderness Area. In the case of Everglades National Park, total sulfate impairment in 2028 is expected to be less than 5 Mm^{-1}, and EGU and non-EGU sulfate contributions are minimal. Projections for Okefenokee, Cape Romain, St. Marks, and Wolf Island show that EGU and non-EGU sulfate contributions are the majority of sulfate impairment but that the relative impacts from each sector are similar.

Figure 7-19 provides nitrate light extinction data in 2028 for mandatory federal Class I areas in VISTAS. In all but four cases, the total nitrate light extinction estimated for 2028 is well beneath 4 Mm^{-1}. In the case of Mammoth Cave National Park, Cape Romain Wilderness Area, Sipsey Wilderness Area, and Swanquarter Wilderness Area, total nitrate impairment is more than 4 Mm^{-1}, but the contributions from the EGU and non-EGU point source sectors are well under half of the total nitrate contribution. Across all VISTAS Class I areas, nitrate contributions from point sources – both EGU and non-EGU – constitute a small percentage of total nitrate contributions.

Figure 7-18 and Figure 7-19 show that sulfates generally contribute more to light extinction in 2028 at VISTAS mandatory federal Class I areas than nitrates and that sulfates from EGU and non-EGU point source sectors contribute the majority of the sulfate light extinction at most of these areas. Results in Figure 7-19 also show that the majority of nitrate light extinction is not caused by NO_X emissions from EGU and non-EGU point sources.

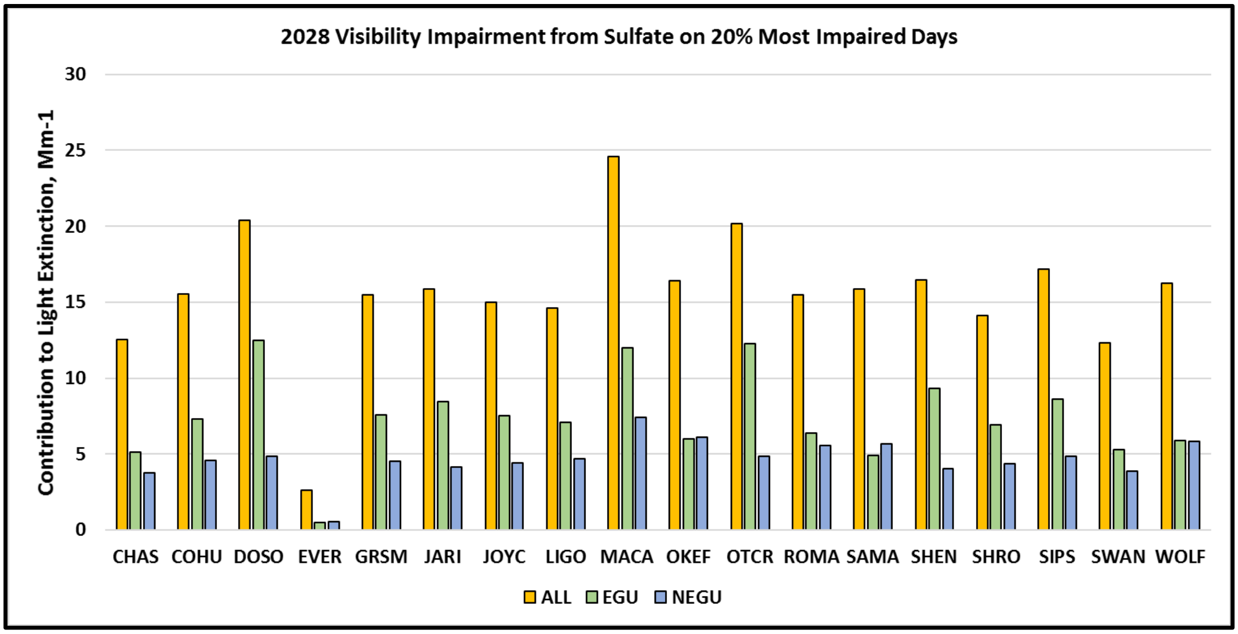

Figure 7-18: 2028 Visibility Impairment from Sulfate on 20% Most Impaired Days, VISTAS Class I Areas

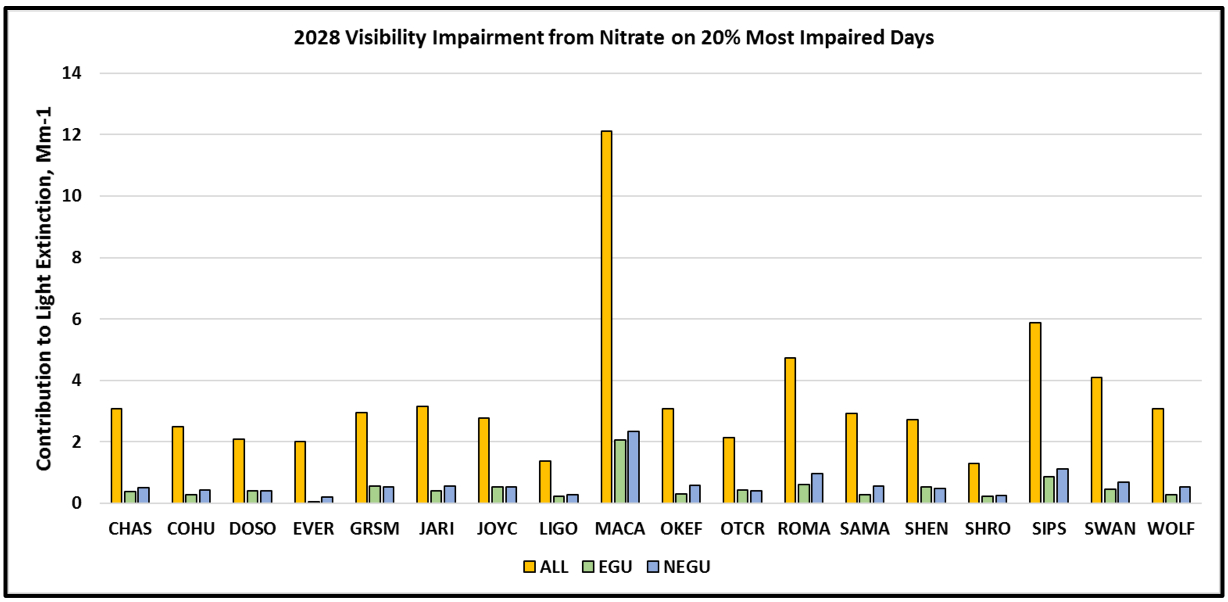

Figure 7-19: 2028 Visibility Impairment from Nitrate on 20% Most Impaired Days, VISTAS Class I Areas

These PSAT analyses support the following conclusions concerning the visibility impairing emissions, the source categories responsible for these emissions, and the locations of the pollutant emitting activities:

- Sulfate will generally be a much larger contributor to visibility impairment in 2028 at VISTAS mandatory federal Class I areas than nitrates.

- Emissions from other regional planning organizations (MANE-VU, LADCO, and CENRAP) generally have higher contributions to 2028 visibility impairment at mandatory federal Class I areas in VISTAS than the emissions from the home state.

- Emissions from EGUs and non-EGU point sources contribute the majority of the total sulfate contributions to visibility impairment in 2028 at mandatory Class I areas in VISTAS.

Figure 7-20 and Figure 7-21 provide more detailed comparisons for the Sipsey Wilderness Area and Breton Wilderness Area, respectively. These figures show that projected light extinction in 2028 from total sulfate is significantly larger than light extinction from total nitrate. At Sipsey Wilderness Area, the projected total sulfate extinction is 22.0 Mm^{-1} while total projected nitrate extinction is 6.3 Mm^{-1}. At Breton Wilderness Area, the projected total sulfate extinction is 31.9 Mm^{-1} while total projected nitrate extinction is 6.1 Mm^{-1}. These figures also show that sulfate from EGUs and non-EGUs account for a large portion of the total sulfate impact at these mandatory federal Class I areas closest to Mississippi. At Sipsey Wilderness Area, the 2028 sulfate extinction from EGU and non-EGU point sources is 13.5 Mm^{-1} while the total sulfate extinction is 22.0 Mm^{-1}. Therefore, EGU and non-EGU point sources account for 61% of the total sulfate impact at Sipsey Wilderness Area. At Breton Wilderness Area, the 2028 sulfate extinction from EGU and non-EGU point sources is 13.8 Mm^{-1} while the total sulfate extinction is 31.9 Mm^{-1}. Therefore, EGU and non-EGU point sources account for 43% of the total sulfate impact at Breton Wilderness Area.

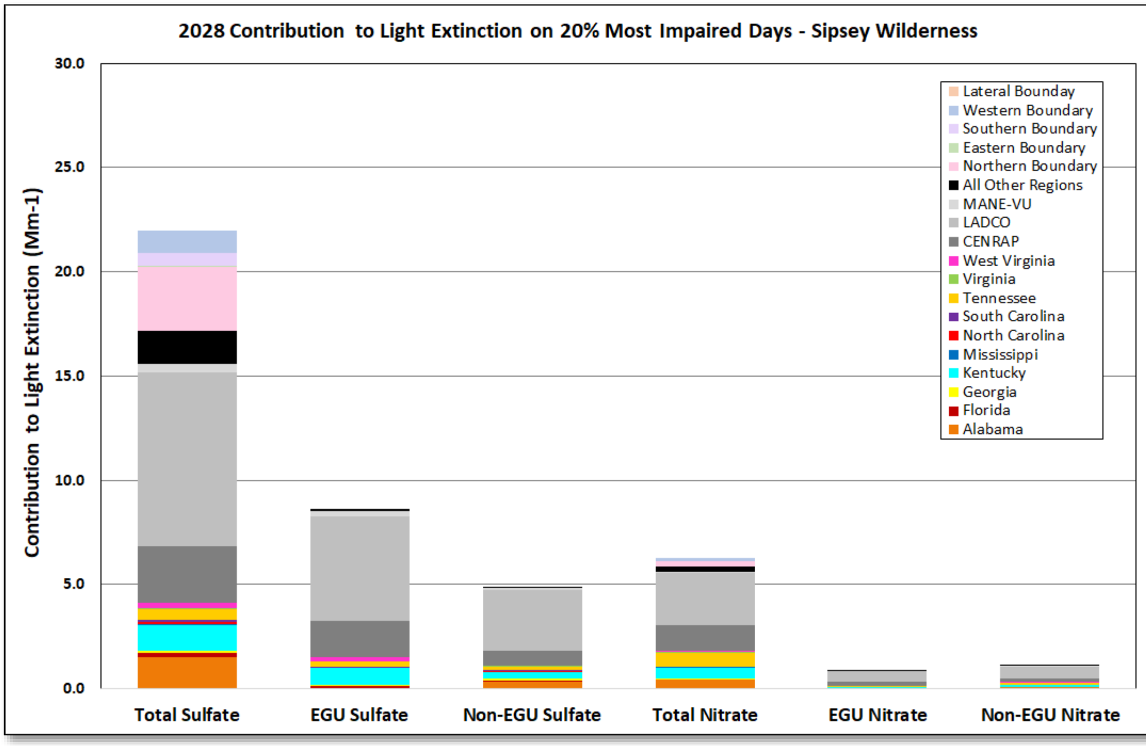

Figure 7-20: 2028 Contribution to Light Extinction on the 20% Most Impaired Days at Sipsey Wilderness Area

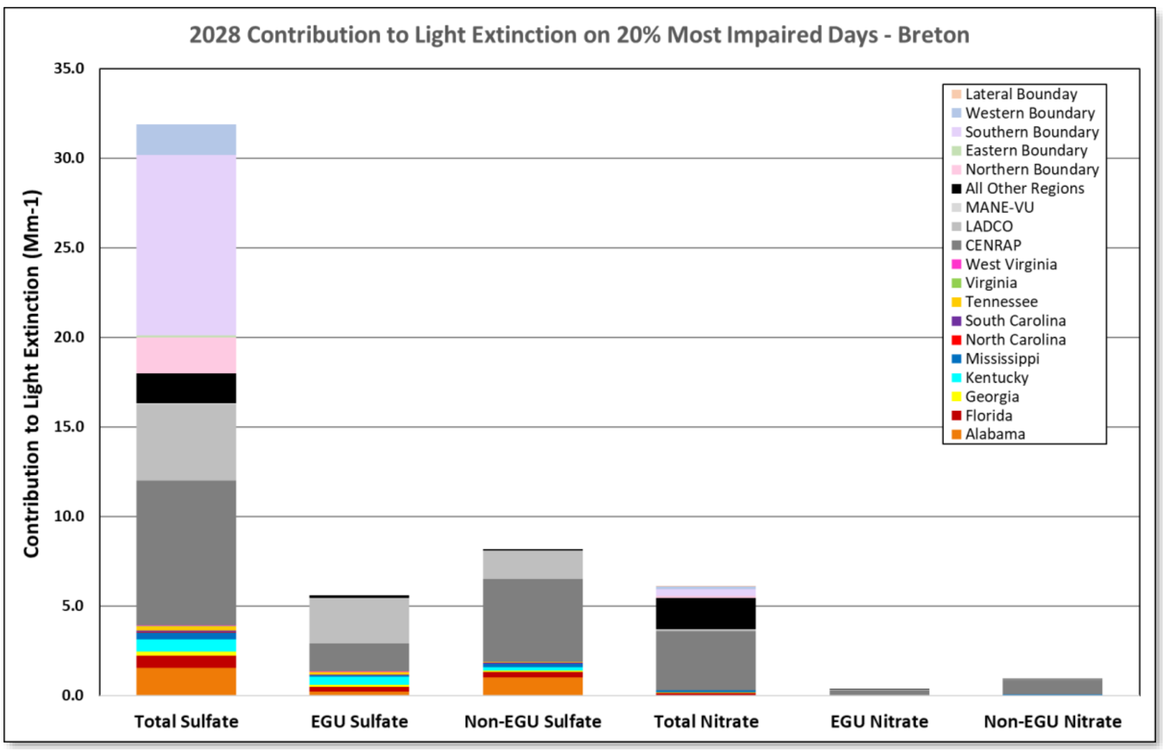

Figure 7-21: 2028 Contribution to Light Extinction on the 20% Most Impaired Days at Breton Wilderness Area

EPA released an updated 2028 visibility air quality modeling study in September 2019.[44] The goal of this effort was to project 2028 visibility conditions for each mandatory federal Class I area. This effort used EPA's 2016 modeling platform as the basis for the 2028 projections. EPA provided VISTAS an output file from the SMAT-CE tool showing visibility impairment at each Class I area by visibility impairing species. Figure 7-22 provides these outputs graphically for the VISTAS mandatory federal Class I area with an IMPROVE monitoring site. This figure, based on EPA's September 2019 modeling study, also shows that sulfates will continue to be the prevailing visibility impairing species in 2028 at VISTAS Class I areas and is consistent with a similar analysis of baseline conditions shown in Figure 2-1 and of current conditions shown in Figure 2-5. Figure 7-22 shows that sulfates, depicted by the yellow bars, have more than double the impact at each VISTAS Class I area as compared to nitrates, the next most prevalent species and depicted by the red bars, in all cases except Mammoth Cave National Park. At Mammoth Cave National Park, the projected 2028 sulfate to nitrate ratio is just under 2.0. These results corroborate the findings of the VISTAS study and indicate that focusing resources on the control of SO_2 is appropriate for this round of regional haze planning. Appendix E-8 provides the data supplied by EPA from their 2019 modeling study.

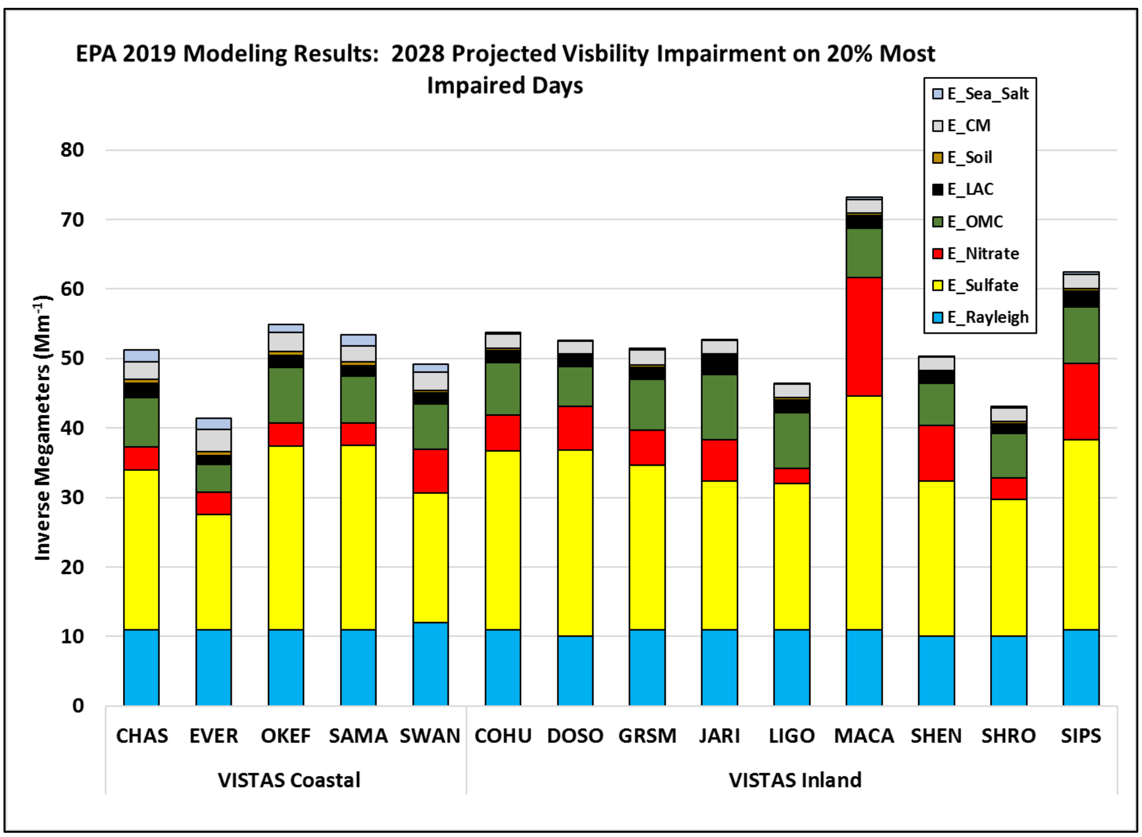

Figure 7-22: 2028 Projected Visibility Impairment by Pollutant Species, EPA 2019 Modeling Results

[44] URL: https://www.epa.gov/visibility/technical-support-document-epas-updated-2028-regional-haze-modeling

7.5. Area of Influence Analyses for Neighboring Class I Areas

Once the key pollutants and source categories contributing to visibility impairment at each Class I area have been identified, it is necessary to focus on the greatest contributing sources. Facility-level SO_2 and NO_X area of influence (AoI) analyses were performed for each Class I area to determine the relative visibility impact from each facility. Then, these facilities were ranked by their sulfate and nitrate visibility contribution at each Class I area. In addition, county-level AoI analyses were performed to confirm that SO_2 emissions from EGU and non-EGU point sources are the greatest contributors to visibility impairment at VISTAS Class I areas. The following sections contain a broad overview of the steps in the AoI analyses. See Appendix D for a more detailed discussion of these analyses and plots for additional Class I areas.

7.5.1. Back Trajectory Analyses

The first step was to generate Hybrid Single Particle Lagrangian Integration Trajectory (HYSPLIT)[45] back trajectories for IMPROVE monitoring sites in neighboring Class I areas for 2011-2016 on the 20% most impaired days. Back trajectory analyses use interpolated measured or modeled meteorological fields to estimate the most likely central path of air masses that arrive at a receptor at a given time. The method essentially follows a parcel of air backward in hourly steps for a specified length of time.

The HYSPLIT runs included starting heights of 100 meters (m), 500 m, 1,000 m, and 1,500 m. Trajectories were run 72 hours backwards in time for each height at each location. Trajectories were run with start times of 12:00 a.m. (midnight of the start of the day), 6:00 a.m., 12:00 p.m., 6:00 p.m., and 12:00 a.m. (midnight at the end of the day) local time.

Figure 7-23 contains the 100-meter back trajectories for the 20% most impaired visibility days (2011-2016) at the Breton Wilderness Area and Figure 7-24 shows these same back trajectories by season. Figure 7-25 contains the 100-meter, 500-meter, 1000-meter, and 1500-meter back trajectories for the 20% most impaired visibility days (2011-2016) at the Breton Wilderness Area. These back trajectories for the 20% most impaired days were then used to develop residence time (RT) plots.

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[45] Stein, A. F., Draxler, R. R., Rolph, G. D., Stunder, B. J. B., Cohen, M. D., and Ngan, F., (2015). NOAA's HYSPLIT atmospheric transport and dispersion modeling system, Bull. Amer. Meteor. Soc., 96, 2059-2077, http://dx.doi.org/10.1175/BAMS-D-14-00110.1

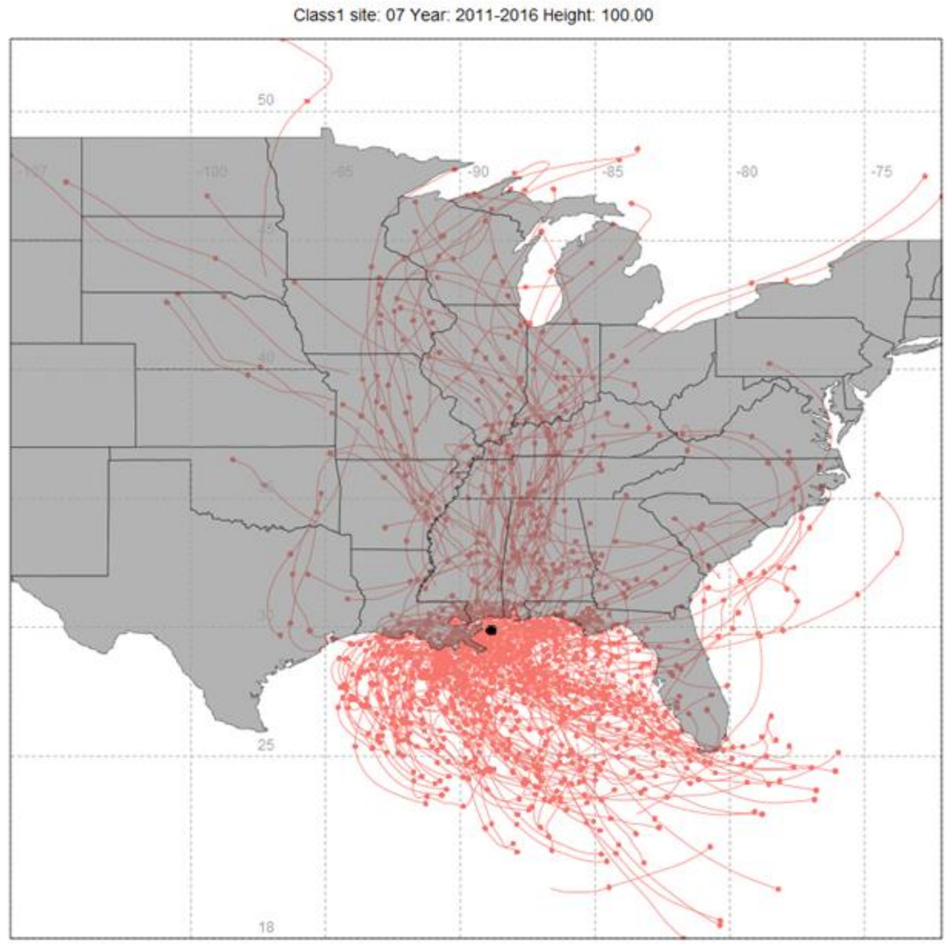


Figure 7-23: 100-Meter Back Trajectories for the 20% Most Impaired Visibility Days (2011-2016), from Breton Wilderness Area

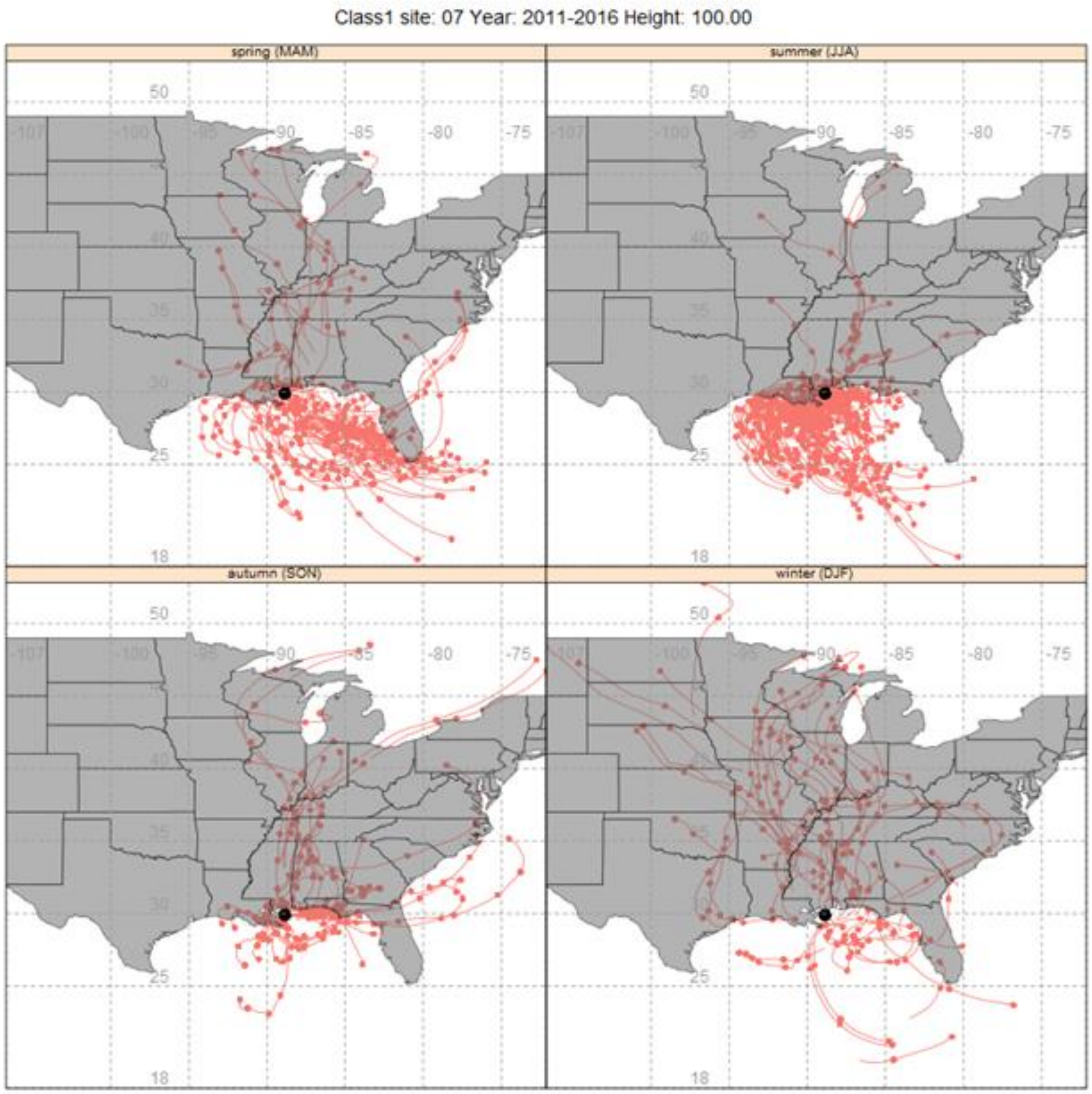


Figure 7-24: 100-Meter Back Trajectories by Season for the 20% Most Impaired Visibility Days (2011-2016) from Breton Wilderness Area

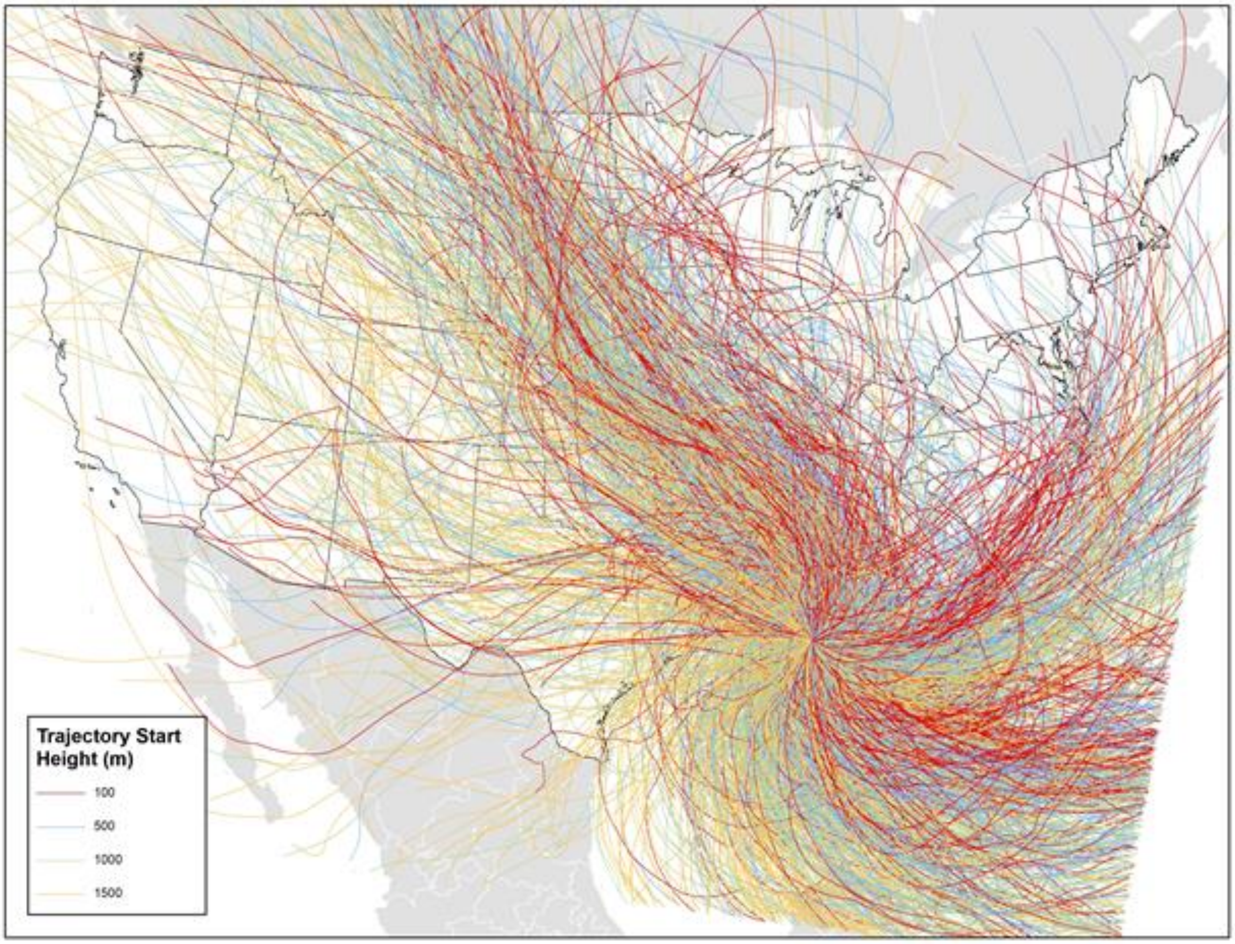
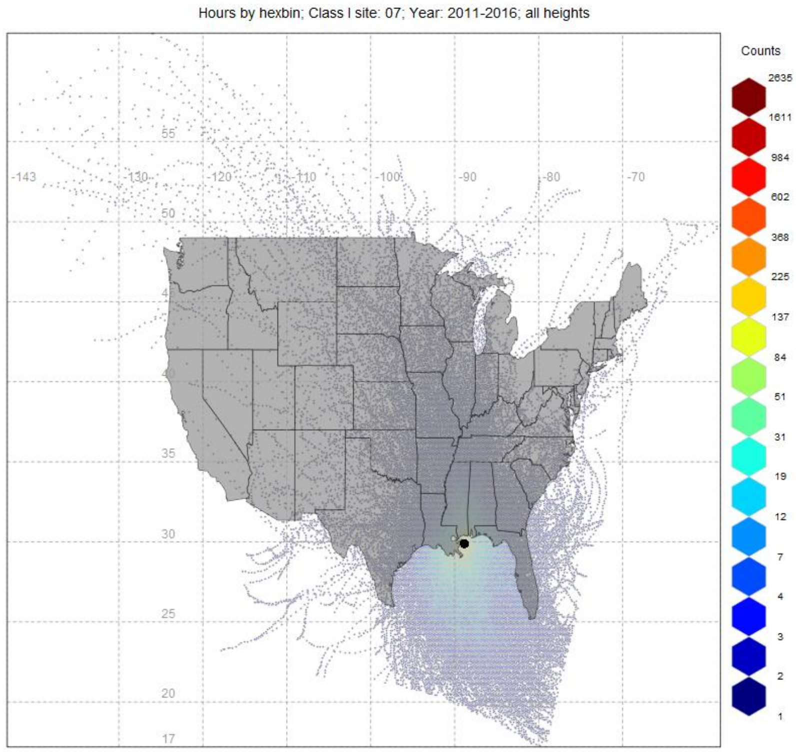


Figure 7-25: 100-Meter, 500-Meter, 1000-Meter, and 1500-Meter Back Trajectories for the 20% Most Impaired Days (2011-2016) from Breton Wilderness Area

7.5.2. Residence Time Plots

The next step was to plot residence time (RT) for each Class I area using six years of back trajectories for the 20 % most impaired visibility days in 2011-2016. Residence time is the frequency that winds pass over a specific geographic area (model grid cell or county) on the path to a Class I area. Residence time plots include all trajectories for each Class I area.

Figure 7-26 contains the RT (counts per 12-km modeling grid cell) for Breton Wilderness Area. Figure 7-27 contains the residence time (percent of total counts per 12-km modeling grid cell) for Breton Wilderness Area. As illustrated in these figures, winds influencing Breton Wilderness Area on the 20% most impaired days come from all directions, though the more predominant wind direction influencing the 20% most impaired visibility days is from the south and southwest.



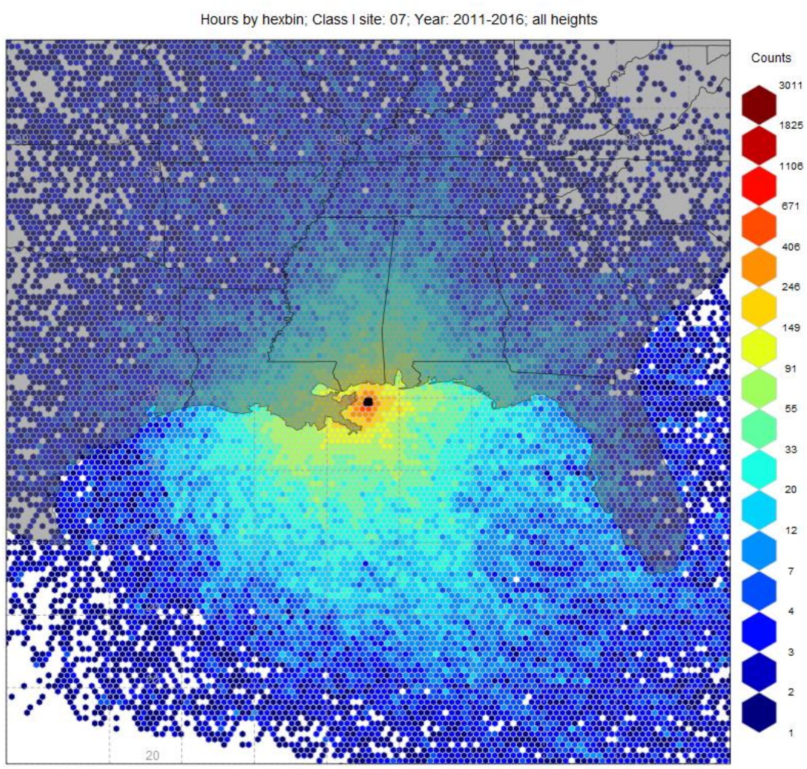
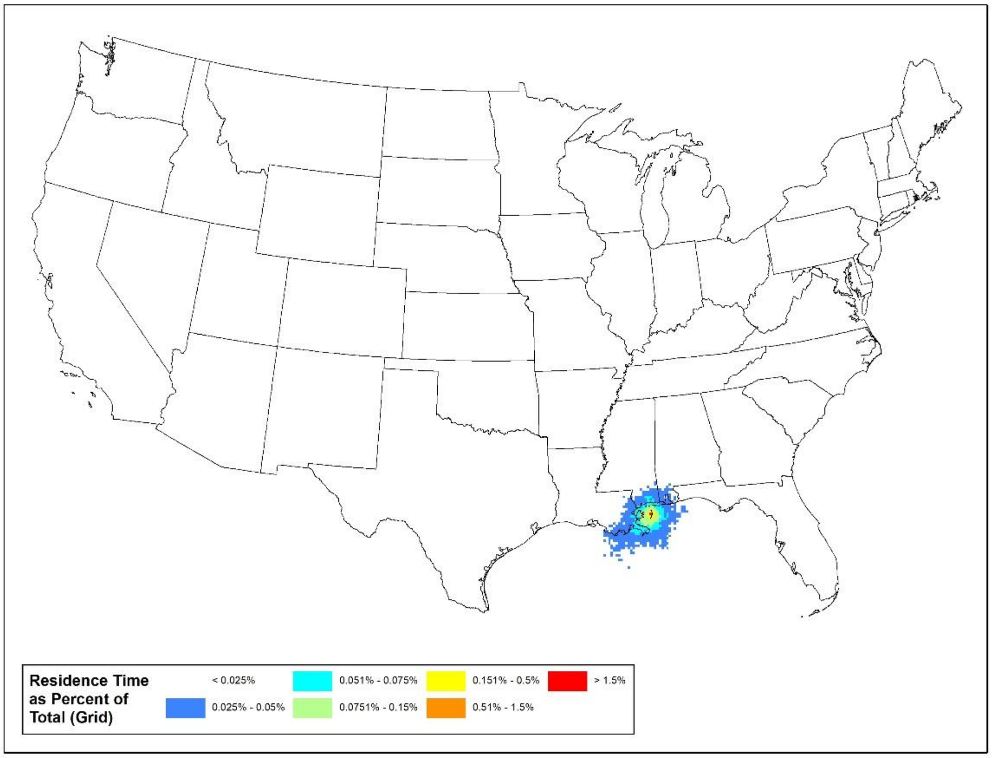


Figure 7-26: Residence Time (Counts per 12km Modeling Grid Cell) for Breton Wilderness Area – Full View (top) and Class I Zoom (bottom)



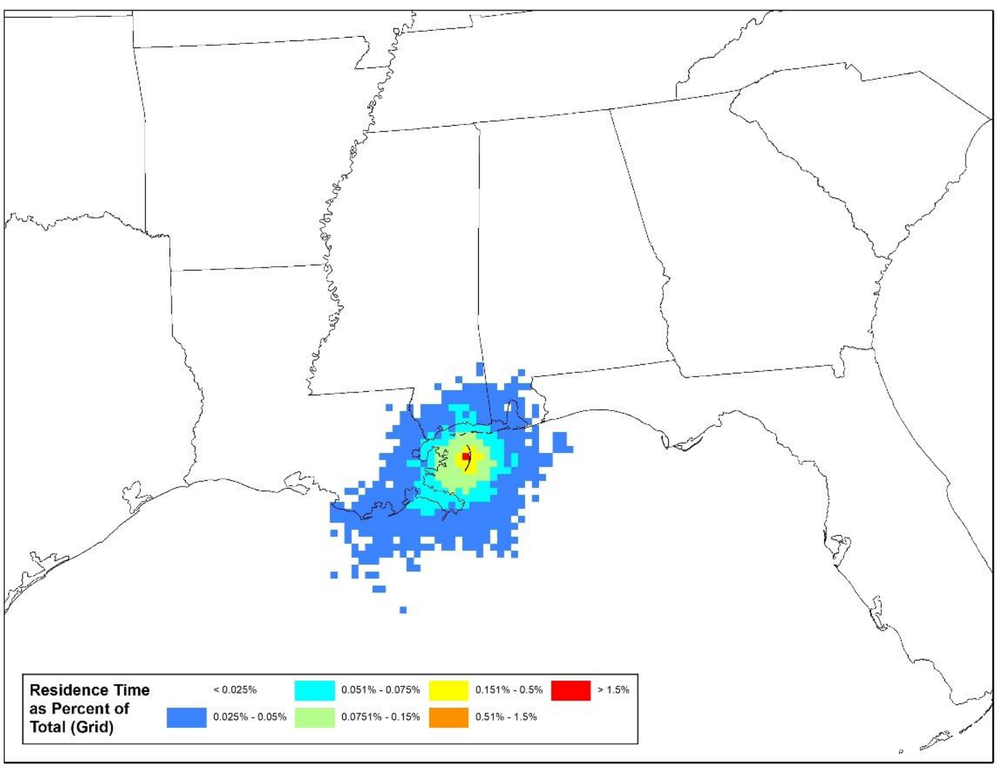


Figure 7-27: Residence Time (% of Total Counts per 12km Modeling Grid Cell for Breton Wilderness Area – Full View (top) and Class I Zoom (bottom)

7.5.3. Extinction-Weighted Residence Time Plots

The next step was to develop sulfate and nitrate extinction-weighted residence time (EWRT) plots. Each back trajectory was weighted by ammonium sulfate and ammonium nitrate extinction for that day and used to produce separate sulfate and nitrate EWRT plots. This allows separate analyses for sulfate and nitrate.

The concentration weighted trajectory (CWT)[46] approach was used to develop the EWRT, substituting the extinction values for the concentration. The extinction attributable to each pollutant is paired with the trajectory for that day. The mean weighted extinction of the pollutant species for each grid cell is calculated according to the following formula:

$$\overline{E}ij = EWRT = \frac{1}{\sum_{k=1}^{N} \tau_{ijk}} \sum_{k=1}^{N} (bext_k)\tau_{ijk}$$

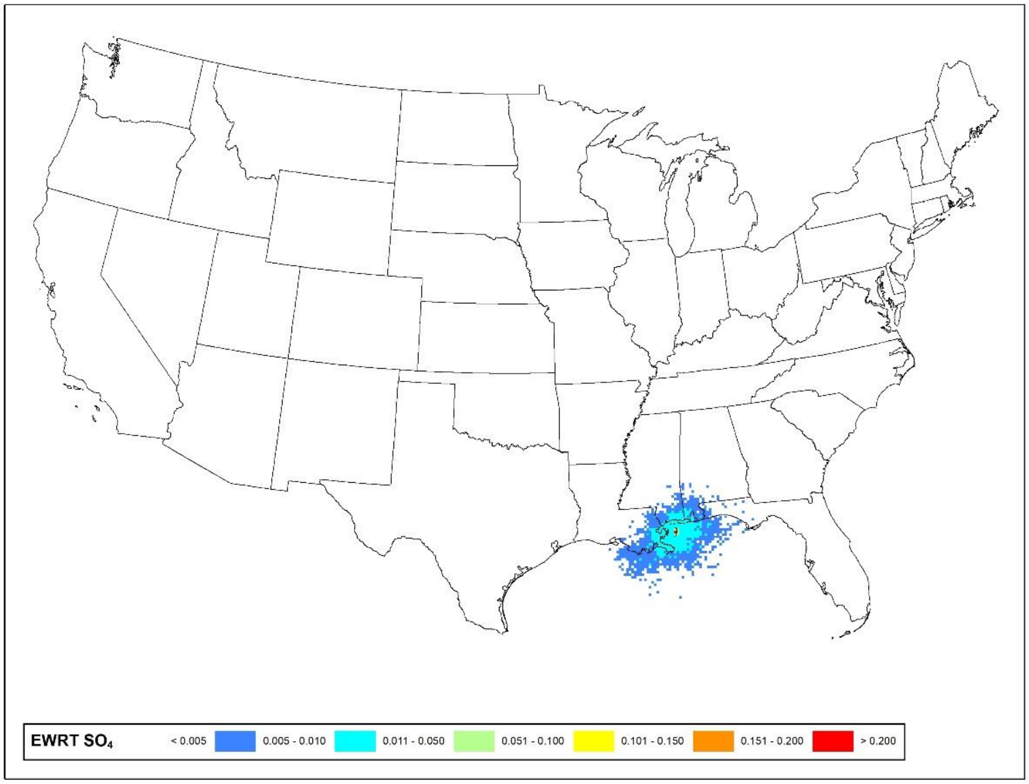
Where:

- *i* and *j* are the indices of the grid;
- *k* is the index of the trajectory;
- *N* is the total number of trajectories used in the analysis;
- b_{ext} is the 24-hour extinction attributed to the pollutant measured upon arrival of trajectory *k*; and
- τ_{ijk} is the number of trajectory hours that pass through each grid cell (*i*, *j*), where *i* is the row and *j* is the column.

The higher the value of the EWRT ($\overline{E}_{ij}$), the more likely that the air parcels passing over cell (i, j) would cause higher extinction at the receptor site for that light extinction species. Since this method uses the extinction value for weighting, trajectories passing over large sources are more discernible than those passing over moderate sources.

Figure 7-28 contains the sulfate extinction weighted residence time (sulfate EWRT per 12-km modeling grid cell) for Breton Wilderness Area for the 20% most impaired days from 2011 to 2016. Figure 7-29contains the nitrate extinction weighted residence time (nitrate EWRT per 12-km modeling grid cell) for Breton Wilderness Area for the 20% most impaired days from 2011 to 2016. It should be noted that the sulfate extinction weighted residence times are significantly higher (approximately ten times higher) than the nitrate extinction weighted residence times, demonstrating the importance of focusing on SO_2 emission reductions.

[46] Hsu, Y.-K., T. M. Holsen and P. K. Hopke (2003). "Comparison of hybrid receptor models to locate PCB sources in Chicago". In: Atmospheric Environment 37.4, pp. 545–562. DOI: 10.1016/S1352-2310(02)00886-5



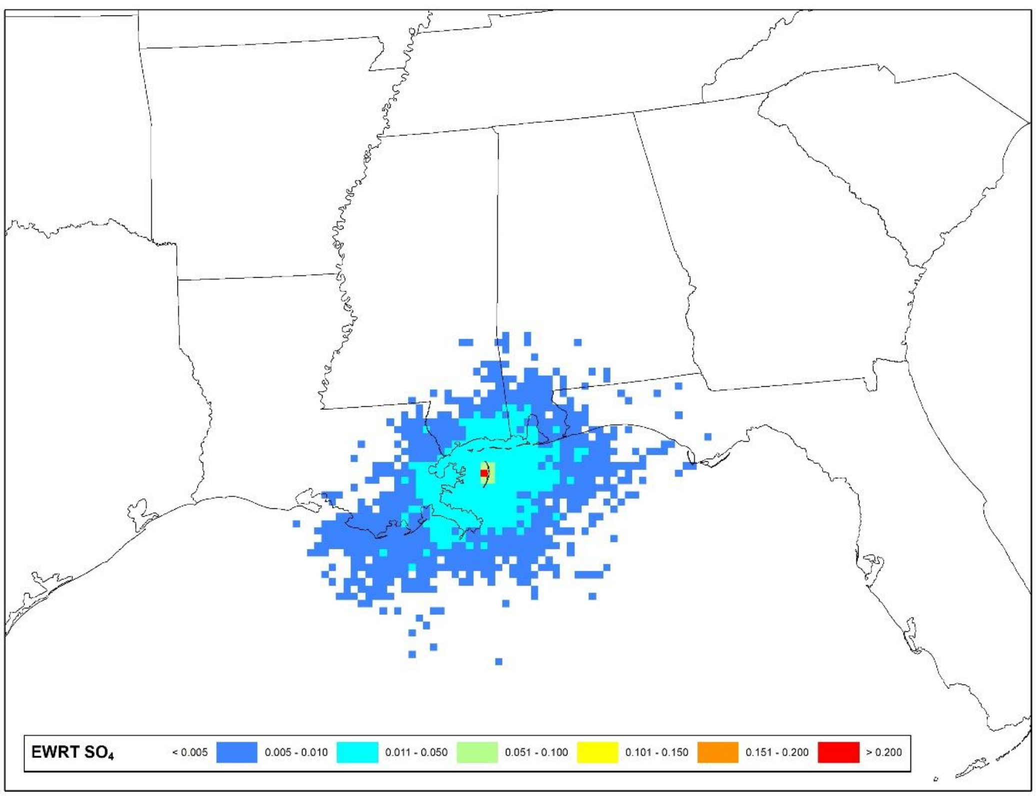
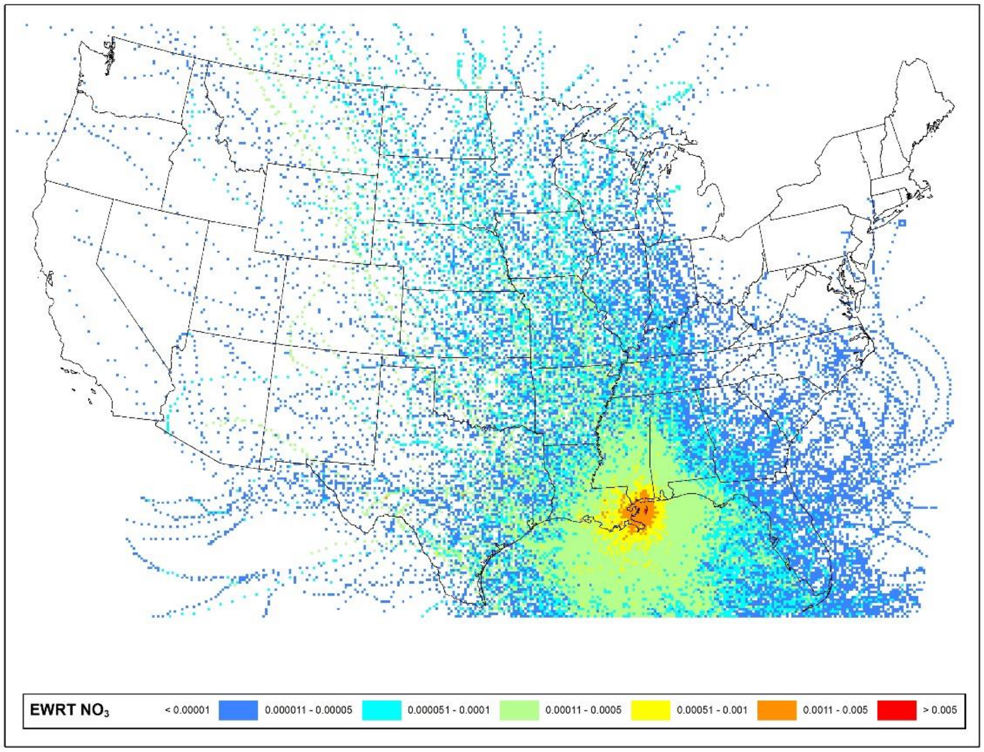


Figure 7-28: Sulfate Extinction Weighted Residence Time (Sulfate EWRT per 12km Modeling Grid Cell) for Breton Wilderness Area - Full View (top) and Class I Zoom (bottom)



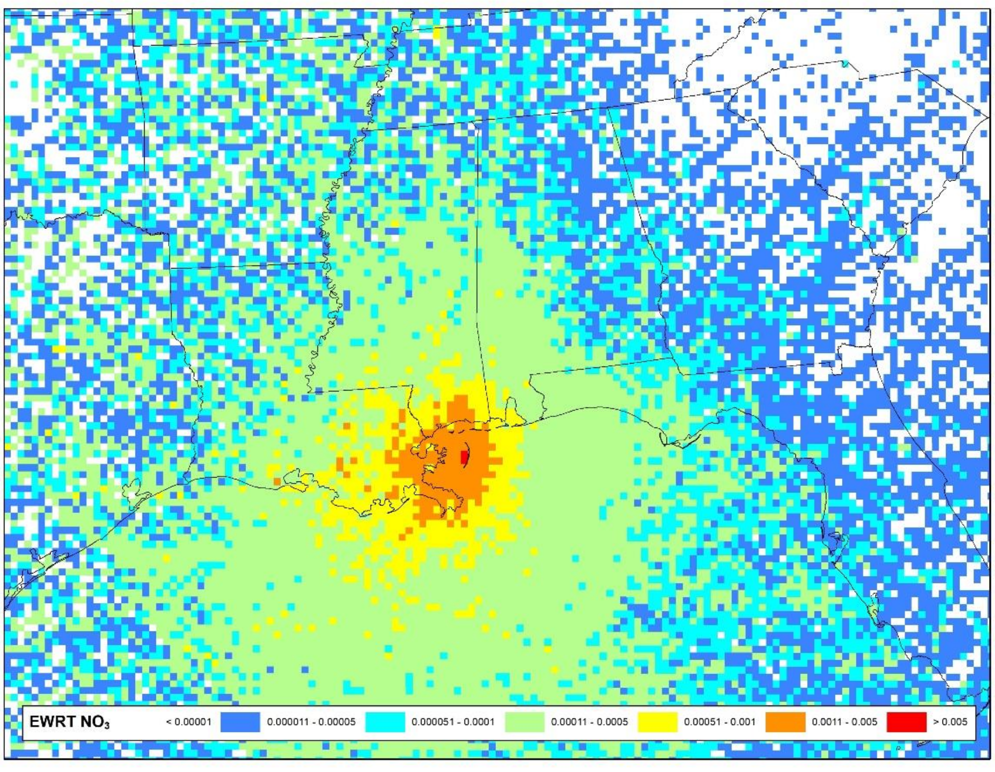


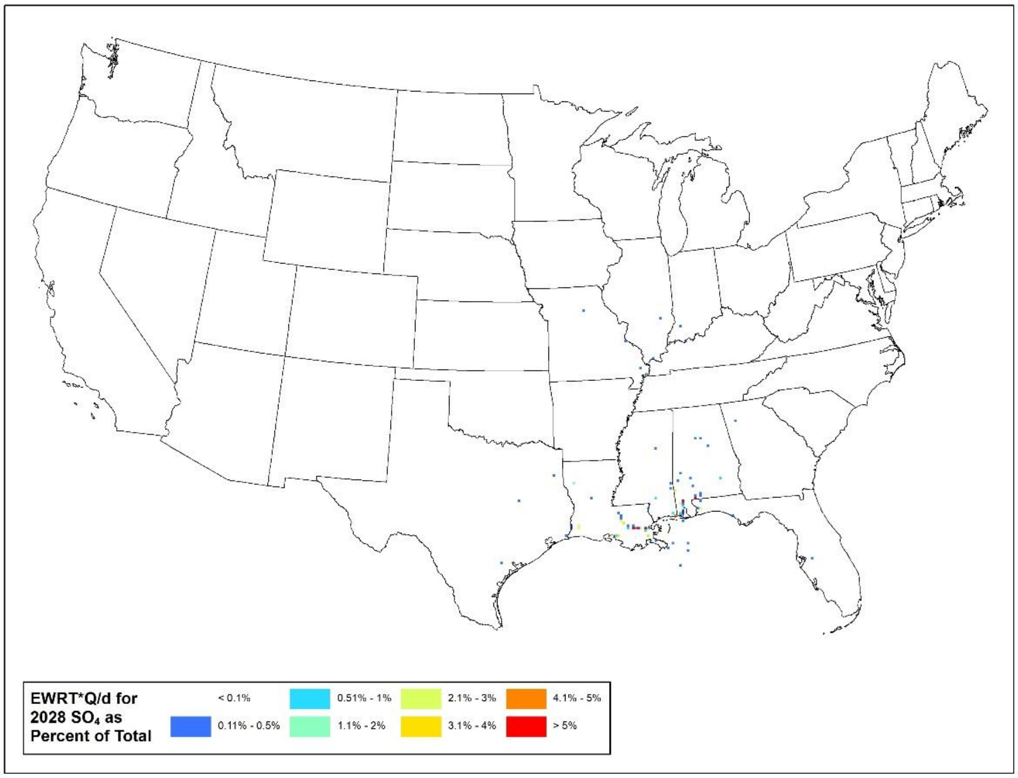
Figure 7-29: Nitrate Extinction Weighted Residence Time (Nitrate EWRT per 12-km Modeling Grid Cell) for Breton Wilderness Area - Full View (top) and Class I Zoom (bottom)

7.5.4. Emissions/Distance Extinction Weighted Residence Time Plots

Extinction weighted residence times were then combined with 12-km gridded SO_2 and NO_x emissions from the 2028 emissions inventory. As a way of incorporating the effects of transport, deposition, and chemical transformation of point source emissions along the path of the trajectories, these data were weighted by 1/d, where d was calculated as the distance, in kilometers, between the center of the grid cell in which a source is located and the center of the grid cell in which the IMPROVE monitor is located. For Class I areas without an IMPROVE monitor (WOLF, JOYC, and OTCR), the grid cell for the centroid of the Class I area was used.

The grid cell total point SO_2 or NO_X emissions (Q, in tons per year) were divided by the distance (d, in kilometers) to the trajectory origin; for a final value (Q/d). This value was then multiplied by the sulfate or nitrate EWRT grid values (i.e., EWRT*(Q/d)) on a grid cell by grid cell basis. Next, the sulfate and nitrate EWRT *(Q/d) values were normalized by the domain-wide total and displayed as a percentage. This information allows the individual facilities to be ranked from highest to lowest based on sulfate and/or nitrate contributions. It should be noted that if non-normalized EWRT*(Q/d) values had been used to rank facilities from highest to lowest, the order would have been identical to the ranking from the normalized EWRT*(Q/d) values.

Figure 7-30 contains the sulfate emissions/distance extinction weighted residence time (percent of total Q/d*EWRT per 12-km modeling grid cell) for Breton Wilderness Area. Figure 7-31 contains the nitrate emissions/distance extinction weighted residence time (percent of total Q/d*EWRT per 12-km modeling grid cell) for Breton Wilderness Area. These maps help visualize where the sources of the largest visibility impacts are located. Figure 7-30 and Figure 7-31 illustrate the relative importance of Mississippi sources of SO_2 and NO_X, respectively, compared to sources in neighboring states.



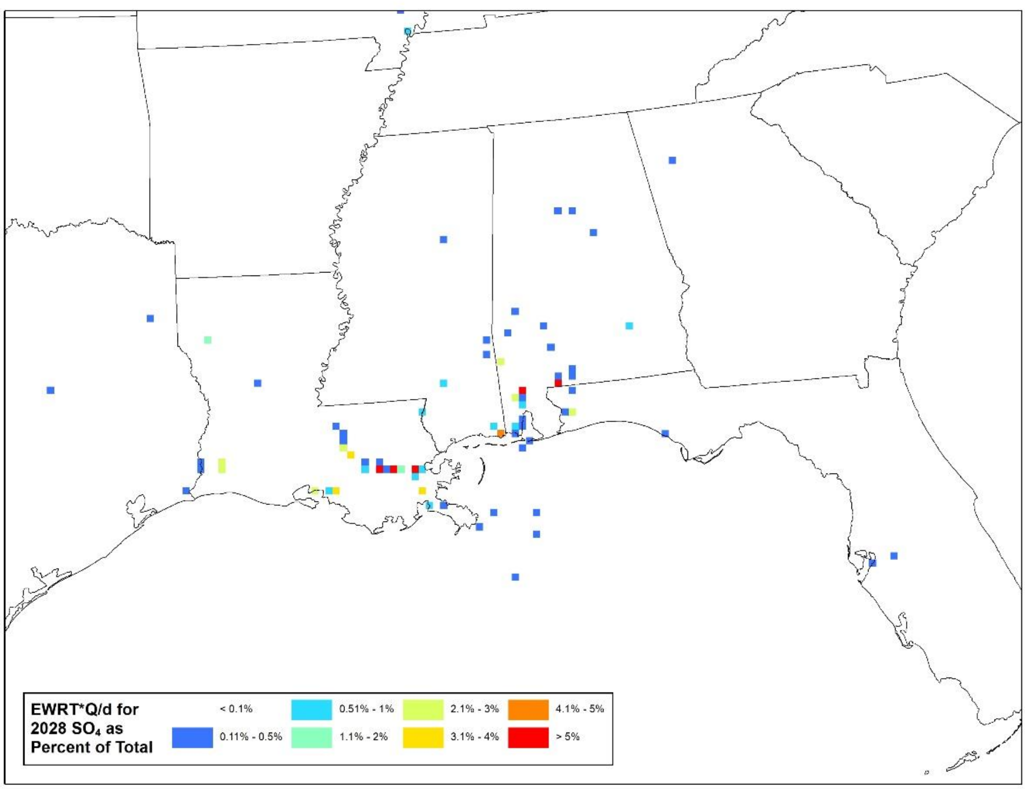
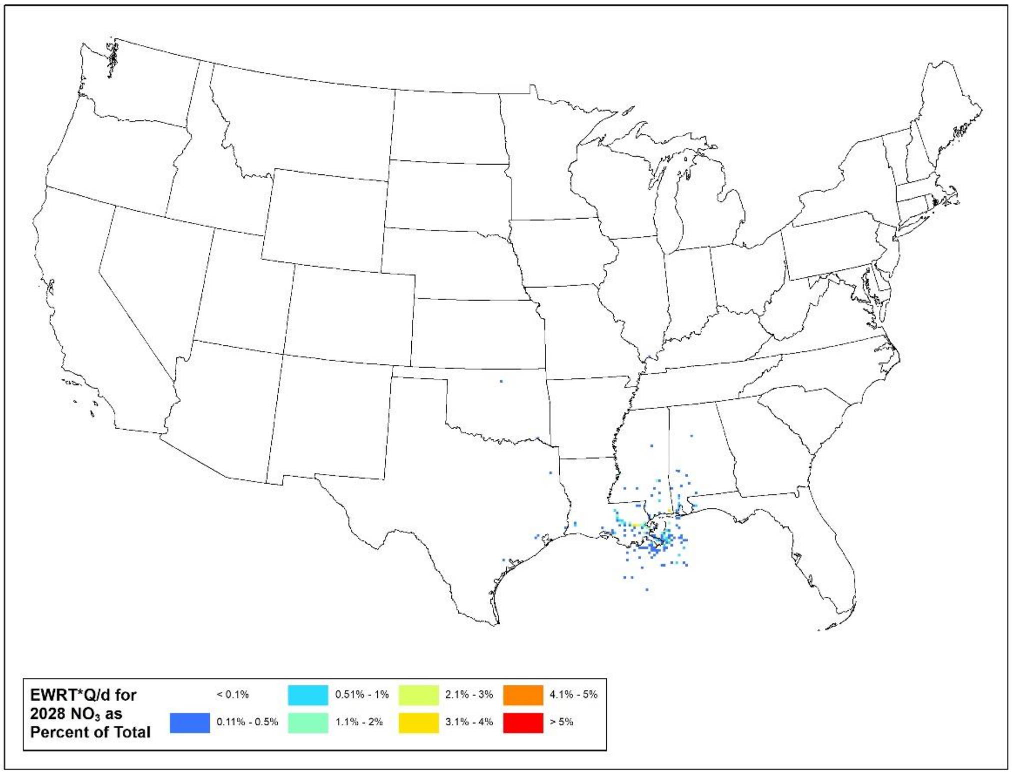


Figure 7-30: Sulfate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Breton Wilderness Area – Full View (top) and Class I Zoom (bottom)



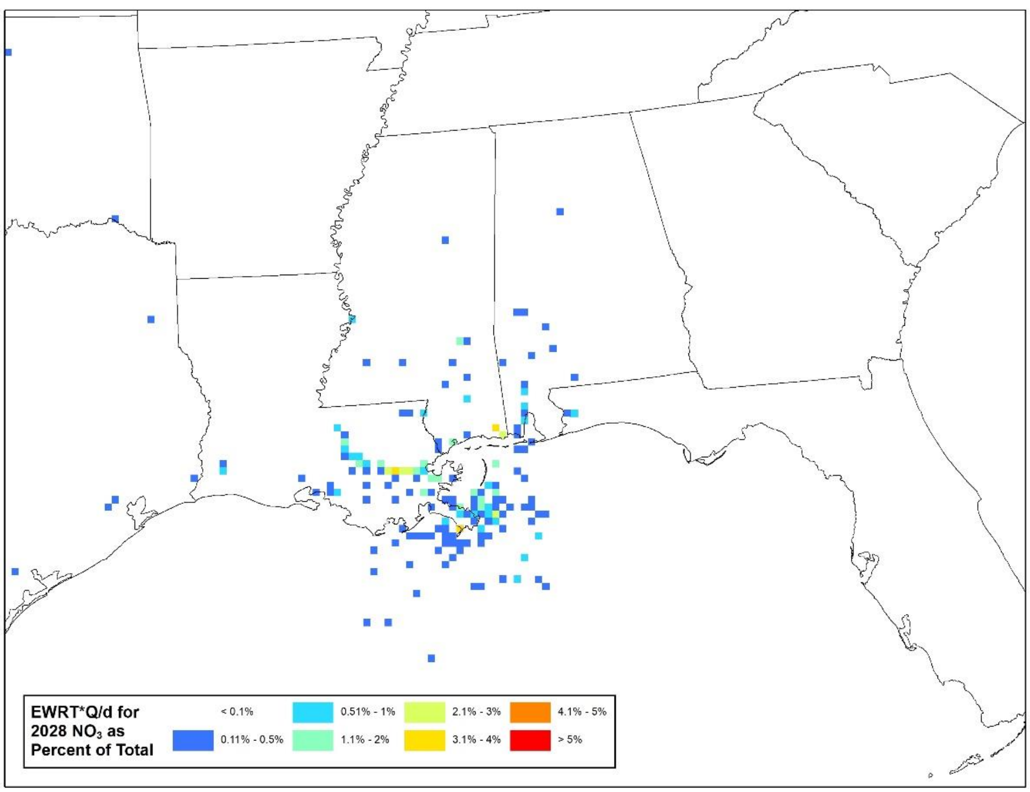


Figure 7-31: Nitrate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Breton Wilderness Area – Full View (top) and Class I Zoom (bottom)

7.5.5. Ranking of Sources for Neighboring Class I Areas

The Q/d*EWRT data was further paired with additional point source metadata that defined the facility. Such data included facility identification numbers, facility names, state and county of location, Federal Information Processing Standard (FIPS) codes, North American Industry Classification System (NAICS) codes, and industry description. Spreadsheets for individual Class I areas were then exported from the database for further analysis by the states. This information allows the individual facilities to be ranked from highest to lowest based on sulfate and/or nitrate contributions.

It should be noted that while point sources account for most of the sulfate extinction, these sources only account for a portion of the nitrate extinction. Much of the nitrate extinction can be attributable to the onroad and nonpoint sectors. As such, a similar analysis for county level data was conducted, that included county total point source contributions. This allows the point source contribution to be directly compared to the other source categories.

Similar analyses were conducted to rank SO_2 and NO_X emissions contributions for the county-level sources (nonpoint, onroad, non-road, fires, and total point source sectors). The process was similar to the process for point sources previously described, except calculations of RT and EWRT were completed at the county level as opposed to grid cells. The calculation of “d” was from the centroid of the county to the trajectory origin, in km. Similar to point sources, the final spatial join was made between the county-level EWRT, emissions, and source information for each sector.

Table 7-5 contains the NO_X and SO_2 source contributions to visibility impairment on the 20% most impaired days at Breton Wilderness Area. Table 7-6 contains the NO_X and SO_2 source contributions to visibility impairment on the 20% most impaired days at Sipsey Wilderness Area. Based on these contributions, it is clear that SO_2 from point sources is the dominant source category at Breton Wilderness Area (69.40%) and Sipsey Wilderness Area (42.91%).

Table 7-5: NO_X and SO_2 Source Contributions to Visibility Impairment on the 20% Most Impaired Days at Breton Wilderness Area

Category	NO_X	SO_2	Total
Nonpoint	2.33%	2.60%	4.93%
Non-Road, MAR	8.93%	1.37%	10.30%
Non-Road, Other	1.23%	0.21%	1.43%
Onroad	1.73%	0.18%	1.91%
Point	8.71%	69.40%	78.10%
Pt_Fires_Prescribed	0.45%	2.87%	3.32%
Total	23.36%	76.64%	100.00%

Table 7-6: NOx and SO2 Source Contributions to Visibility Impairment on the 20% Most Impaired Days at Sipsey Wilderness Area

Category	NO_X	SO_2	Total
Nonpoint	5.90%	10.00%	15.90%
Non-Road, MAR	4.19%	0.08%	4.26%
Non-Road, Other	4.31%	0.21%	4.53%
Onroad	8.86%	0.35%	9.21%
Point	14.08%	42.91%	56.99%
Pt_Fires_Prescribed	2.76%	6.35%	9.11%
Total	40.09%	59.91%	100.00%

In order to compare the contributions from counties on a relative basis, an additional analysis was conducted by adding new columns to normalize the EWRT*(Q/d) by the area of each county to develop a metric to compare the contributions from counties on a relative basis. The previous calculation (prior to being normalized by area) had a propensity to attribute higher contributions to larger counties simply because they typically contained more emission sources and more hourly trajectory end points. Normalizing the contribution by the area of the county (i.e., EWRT*(Q/d) per square kilometer) provides a sense of the source emission density within the county. This allows county contributions to be directly compared, without large counties being weighted more heavily by simply having more emission sources and more hourly trajectory end points. County contributions (normalized or non-normalized by area) can be found in Appendix D.

All county and emissions source identifying information were joined in an Access database with calculations of Q/d, EWRT, EWRT*(Q/d), fraction and sum contributions, and any other source information. The database was then used to generate individual spreadsheets for each Class I area.

Table 7-7 contains the AoI NO_X and SO_2 facility contributions to visibility impairment on the 20% most impaired days at Breton Wilderness Area. Breton Wilderness Area was the only Class I area impacted by Mississippi sources that contribute an AoI ≥ 1.00%. This table shows the facilities contributing more than 1.00% sulfate plus nitrate. The full list of all facilities can be found in Appendix D. The lists of individual facilities identified by the AoI analysis for each Class I area were used to determine which facilities were tagged in the PSAT source contribution analysis.

Table 7-7: AoI NO_X and SO_2 Facility Contributions to Visibility Impairment on the 20% Most Impaired Days at Breton Wilderness Area

State	Facility ID	Facility Name	Distance (km)	2028 NOx (tpy)	2028 SO2 (tpy)	Nitrate (%)	Sulfate (%)	Sulfate + Nitrate (%)
LA	22087-5608111	Rain CII Carbon LLC - Chalmette Coke Plant & CT Terminal	108.7	90.0	4281.9	0.02%	9.49%	9.51%
AL	01097-1056111	Ala Power - Barry	147.8	2181.9	6025.6	0.11%	4.64%	4.76%
LA	22093-5273111	Rain CII Carbon LLC - Gramercy Coke Plant	176.1	575.8	7892.8	0.03%	4.55%	4.57%
AL	01053-7440211	Escambia Operating Company LLC	193.3	349.3	7963.0	0.01%	4.13%	4.14%
MS	28059-8384311	Chevron Products Company, Pascagoula Refinery	61.1	1534.1	741.6	0.32%	3.51%	3.84%
LA	22089-8020911	Rain CII Carbon LLC - Norco Coke Plant	149.8	492.3	4067.1	0.05%	3.72%	3.76%
LA	22101-8020311	Columbian Chemicals Co - North Bend Plant	252.7	640.3	7834.0	0.03%	3.14%	3.17%
LA	22075-7203711	Phillips 66 Co - Alliance Refinery	110.9	839.1	1262.3	0.22%	2.71%	2.93%
LA	22005-15086711	AA Sulfuric Corp - Sulfuric Acid Plant	215.6	53.4	5952.7	0.00%	2.87%	2.88%
AL	01097-949811	Akzo Nobel Chemicals Inc	143.8	20.7	3335.7	0.00%	2.64%	2.64%
AL	01097-1061611	Union Oil of California - Chunchula Gas Plant	134.4	349.2	2573.2	0.01%	2.07%	2.08%
AL	01129-1028711	American Midstream Chatom, LLC	179.8	425.9	3106.4	0.02%	1.93%	1.95%
FL	12033-752711	GULF POWER - Crist	173.5	2998.4	2615.7	0.07%	1.73%	1.80%
LA	22101-7205611	Orion Engineered Carbons LLC - Ivanhoe Carbon Black Plant	279.0	911.2	7660.3	0.05%	1.71%	1.76%
LA	22121-7206311	Sid Richardson Carbon Co - Addis Plant	238.9	328.6	8289.6	0.01%	1.62%	1.63%
LA	22051-7228511	Cornerstone Chemical Co	137.2	1104.3	1031.0	0.22%	1.39%	1.61%
LA	22019-8361211	R S Nelson	430.1	4932.2	15028.4	0.03%	1.47%	1.49%
MS	28059-6251011	Mississippi Power Company, Plant Victor J Daniel	76.7	3736.5	224.4	0.63%	0.65%	1.28%
LA	22031-7354411	CLECO Power LLC - Dolet Hills Power Station	509.3	4197.1	20768.1	0.01%	1.05%	1.06%

7.6. Screening of Sources for Reasonable Progress Analysis

In order to gain a better understanding of the source contributions to modeled visibility, VISTAS used CAMx PSAT modeling. PSAT uses multiple tracer families to track the fate of both primary and secondary PM. PSAT allows emissions to be tracked (tagged) for individual facilities as well as various combinations of sectors and geographic areas (e.g., by state).

VISTAS states used the NO_X and SO_2 facility contributions from the AoI analysis to help select sources to be tagged with PSAT. Each state submitted their list of facilities to be tagged. In the end, SO_2 and NO_X emissions for 87 individual facilities were tagged and the visibility contributions (Mm^{-1}) for the 20% most impaired days were determined at all Class I areas in the VISTAS_12 domain. In addition, PSAT tags previously discussed in Section 7.4 include total sulfate and nitrate contributions from EGU + non-EGU point sources at each Class I area. This allows a percent contribution (individual facility contribution divided by the total sulfate and nitrate contributions from EGU + non-EGU point sources) to be determined for each facility at each Class I area. If the sulfate contribution was greater than or equal to 1.00%, then the facility was considered for a SO_2 reasonable progress control analysis (also referred to as a four-factor analysis or "FFA").[47] If the nitrate contribution was greater than or equal to 1.00%, then the facility was considered for a NO_X reasonable progress control analysis. Details of the PSAT modeling can be found in Appendix E-7a and details of the percent contribution calculations can be found in Appendix E-7b.

7.6.1. Selection of Sources for PSAT Tagging

MDEQ used the NO_x and SO_2 facility contributions from the AoI analysis to help select sources to be tagged with PSAT. MDEQ requested that all Mississippi facilities with an AoI contribution of 1.00% or more sulfate plus nitrate contribution be tagged with PSAT. MDEQ believes this captures the most important sources contributing to regional haze at other states'

[47] Section 169A(g)(1) of the CAA and the regional haze rule at 40 CFR 51.308(f)(2)(i) require a state to evaluate the following four "statutory" factors when establishing the RPG for any Class I area within a state: (1) cost of compliance, (2) time necessary for compliance, (3) energy and non-air quality environmental impacts of compliance, and (4) remaining useful life of any existing source subject to such requirements. This evaluation of the four CAA factors is referred to in this document interchangeably as a 'reasonable progress control analysis' or '4-factor analysis' or 'FFA.' On August 20, 2019, EPA issued a memorandum entitled "Guidance on Regional Haze State Implementation Plan for the Second Implementation Period." (2019 EPA Guidance) This memorandum included guidance for characterizing the four statutory factors including which emission control measures to consider, selection of emission information for characterizing emissions-related factors, characterizing the cost of compliance (statutory factor 1), characterizing the time necessary for compliance (statutory factor 2), characterizing energy and non-air environmental impacts (statutory factor 3), charactering remaining useful life of the source (statutory factor 4), characterizing visibility benefits, and reliance on previous analysis and previously approved approaches. The 2019 EPA guidance also contains guidance on decisions on what control measures are necessary to make reasonable progress.

Class I areas. Based on these criteria, MDEQ selected the sources listed in Table 7-8 for PSAT tagging.

Table 7-8: Facilities Selected by Mississippi for PSAT Tagging

State	Facility ID	Facility Name
MS	28059-8384311	Chevron Products Company, Pascagoula Refinery
MS	28059-6251011	Mississippi Power Company, Plant Victor J Daniel

In addition, other VISTAS states selected sources for PSAT tagging. The detailed PSAT selection process for each VISTAS state is provided in their individual regional haze SIPs.

Based on the sources selected by MDEQ and the other VISTAS states, VISTAS selected 87 facilities for SO_2 and NO_X PSAT tagging. Some of the 87 facilities were selected by multiple states. Table 7-9 lists PSAT tags selected for facilities in AL and FL.

Table 7-10 lists PSAT tags selected for facilities in GA, KY, MS, NC, SC, and TN. Table 7-11 lists PSAT tags selected for facilities in VA and WV. Table 7-12 lists PSAT tags selected for facilities in AR, MO, PA, IL, IN, and OH. The contributions from all 87 PSAT tags were evaluated at all Class I areas in the VISTAS_12 domain.

A detailed description of the PSAT modeling and post-processing for creating PSAT contributions for Class I areas is contained in Appendix E-7a and Appendix E-7b.

Table 7-9: PSAT Tags Selected for Facilities in AL and FL

State	RPO	Facility ID	Facility Name	SO_2 (TPY)	NOx (TPY)
AL	VISTAS	01097-949811	Akzo Nobel Chemicals Inc	3,335.72	20.71
AL	VISTAS	01097-1056111	Ala Power - Barry	6,033.17	2,275.76
AL	VISTAS	01129-1028711	American Midstream Chatom, LLC	3,106.38	425.87
AL	VISTAS	01073-1018711	DRUMMOND COMPANY, INC.	2,562.17	1,228.55
AL	VISTAS	01053-7440211	Escambia Operating Company LLC	18,974.39	349.32
AL	VISTAS	01053-985111	Escambia Operating Company LLC	8,589.60	149.64
AL	VISTAS	01103-1000011	Nucor Steel Decatur LLC	170.23	331.24
AL	VISTAS	01109-985711	Sanders Lead Co	7,951.06	121.71
AL	VISTAS	01097-1061611	Union Oil of California - Chunchula Gas Plant	2,573.15	349.23
FL	VISTAS	12123-752411	BUCKEYE FLORIDA, LIMITED PARTNERSHIP	1,520.42	1,830.71
FL	VISTAS	12086-900111	CEMEX CONSTRUCTION MATERIALS FL. LLC.	29.51	910.36
FL	VISTAS	12017-640611	DUKE ENERGY FLORIDA, INC. (DEF)	5,306.41	2,489.85
FL	VISTAS	12086-900011	FLORIDA POWER & LIGHT (PTF)	13.05	170.61
FL	VISTAS	12033-752711	GULF POWER - Crist	2,615.65	2,998.39
FL	VISTAS	12086-3532711	HOMESTEAD CITY UTILITIES	0.00	97.09
FL	VISTAS	12031-640211	JEA	2,094.48	651.79
FL	VISTAS	12105-717711	MOSAIC FERTILIZER LLC	7,900.67	310.42
FL	VISTAS	12057-716411	MOSAIC FERTILIZER, LLC	3,034.06	159.71
FL	VISTAS	12105-919811	MOSAIC FERTILIZER, LLC	4,425.56	141.02
FL	VISTAS	12089-845811	RAYONIER PERFORMANCE FIBERS LLC	561.97	2,327.10
FL	VISTAS	12089-753711	ROCK TENN CP, LLC	2,606.72	2,316.77
FL	VISTAS	12005-535411	ROCKTENN CP LLC	2,590.88	1,404.89
FL	VISTAS	12129-2731711	TALLAHASSEE CITY PURDOM GENERATING STA.	2.86	121.46
FL	VISTAS	12057-538611	TAMPA ELECTRIC COMPANY (TEC)	6,084.90	2,665.03
FL	VISTAS	12086-899911	TARMAC AMERICA LLC	9.38	879.70
FL	VISTAS	12047-769711	WHITE SPRINGS AGRICULTURAL CHEMICALS, INC	3,197.77	112.41

Table 7-10: PSAT Tags Selected for Facilities in GA, KY, MS, NC, SC, and TN

State	RPO	Facility ID	Facility Name	SO_2 (TPY)	NOx (TPY)
GA	VISTAS	13127-3721011	Brunswick Cellulose Inc	294.20	1,554.51
GA	VISTAS	13015-2813011	Ga Power Company - Plant Bowen	10,453.41	6,643.32
GA	VISTAS	13103-536311	Georgia-Pacific Consumer Products LP (Savannah River Mill)	1,860.18	351.52
GA	VISTAS	13051-3679811	International Paper – Savannah	3,945.38	1,560.73
GA	VISTAS	13115-539311	TEMPLE INLAND	1,791.00	1,773.35
KY	VISTAS	21183-5561611	Big Rivers Electric Corp - Wilson Station	6,934.16	1,151.95
KY	VISTAS	21091-7352411	Century Aluminum of KY LLC	5,044.16	197.66
KY	VISTAS	21177-5196711	Tennessee Valley Authority - Paradise Fossil Plant	3,011.01	3,114.52
KY	VISTAS	21145-6037011	Tennessee Valley Authority (TVA) - Shawnee Fossil Plant	19,504.75	7,007.34
MS	VISTAS	28059-8384311	Chevron Products Company, Pascagoula Refinery	741.60	1,534.12
MS	VISTAS	28059-6251011	Mississippi Power Company, Plant Victor J Daniel	231.92	3,829.72
NC	VISTAS	37087-7920511	Blue Ridge Paper Products - Canton Mill	1,127.07	2,992.37
NC	VISTAS	37117-8049311	Domtar Paper Company, LLC	687.45	1,796.49
NC	VISTAS	37035-8370411	Duke Energy Carolinas, LLC - Marshall Steam Station	4,139.21	7,511.31
NC	VISTAS	37013-8479311	PCS Phosphate Company, Inc. - Aurora	4,845.90	495.58
NC	VISTAS	37023-8513011	SGL Carbon LLC	261.64	21.69
SC	VISTAS	45015-4834911	ALUMAX OF SOUTH CAROLINA	3,751.69	108.08
SC	VISTAS	45043-5698611	INTERNATIONAL PAPER GEORGETOWN MILL	2,767.52	2,031.26
SC	VISTAS	45019-4973611	KAPSTONE CHARLESTON KRAFT LLC	1,863.65	2,355.82
SC	VISTAS	45015-4120411	SANTEE COOPER CROSS GENERATING STATION	4,281.17	3,273.47
SC	VISTAS	45043-6652811	SANTEE COOPER WINYAH GENERATING STATION	2,246.86	1,772.53
SC	VISTAS	45015-8306711	SCE&G WILLIAMS	392.48	992.73
TN	VISTAS	47093-4979911	Cemex - Knoxville Plant	121.47	711.50
TN	VISTAS	47163-3982311	EASTMAN CHEMICAL COMPANY	6,420.16	6,900.33
TN	VISTAS	47105-4129211	TATE & LYLE, Loudon	472.76	883.25
TN	VISTAS	47001-6196011	TVA BULL RUN FOSSIL PLANT	622.54	964.16
TN	VISTAS	47161-4979311	TVA CUMBERLAND FOSSIL PLANT	8,427.33	4,916.52
TN	VISTAS	47145-4979111	TVA KINGSTON FOSSIL PLANT	1,886.09	1,687.38

Table 7-11: PSAT Tags Selected for Facilities in VA and WV

State	RPO	Facility ID	Facility Name	SO_2 (TPY)	NOx (TPY)
VA	VISTAS	51027-4034811	Jewell Coke Company LLP	5,090.95	520.17
VA	VISTAS	51580-5798711	Meadwestvaco Packaging Resource Group	2,115.31	1,985.69
VA	VISTAS	51023-5039811	Roanoke Cement Company	2,290.17	1,972.97
WV	VISTAS	54033-6271711	ALLEGHENY ENERGY SUPPLY CO, LLC-HARRISON	10,082.94	11,830.88
WV	VISTAS	54049-4864511	AMERICAN BITUMINOUS POWER-GRANT TOWN PLT	2,210.25	1,245.10
WV	VISTAS	54079-6789111	APPALACHIAN POWER COMPANY - JOHN E AMOS PLANT	10,984.24	4,878.10
WV	VISTAS	54023-6257011	Dominion Resources, Inc. - MOUNT STORM POWER STATION	2,123.64	1,984.14
WV	VISTAS	54041-6900311	EQUITRANS - COPLEY RUN CS 70	0.10	511.06
WV	VISTAS	54083-6790711	FILES CREEK 6C4340	0.15	643.35
WV	VISTAS	54083-6790511	GLADY 6C4350	0.11	343.29
WV	VISTAS	54093-6327811	KINGSFORD MANUFACTURING COMPANY	16.96	140.88
WV	VISTAS	54061-16320111	LONGVIEW POWER	2,313.73	1,556.57
WV	VISTAS	54051-6902311	MITCHELL PLANT	5,372.40	2,719.62
WV	VISTAS	54061-6773611	MONONGAHELA POWER CO.- FORT MARTIN POWER	4,881.87	13,743.32
WV	VISTAS	54073-4782811	MONONGAHELA POWER CO-PLEASANTS POWER STA	16,817.43	5,497.37
WV	VISTAS	54061-6773811	MORGANTOWN ENERGY ASSOCIATES	828.64	655.58

Table 7-12: PSAT Tags Selected for Facilities in AR, MO, PA, IL, IN, and OH

State	RPO	Facility ID	Facility Name	SO_2 (TPY)	NOx (TPY)
AR	CENRAP	05063-1083411	ENTERGY ARKANSAS INC-INDEPENDENCE PLANT	32,050.48	14,133.10
MO	CENRAP	29143-5363811	NEW MADRID POWER PLANT-MARSTON	16,783.71	4,394.10
MD	MANE-VU	24001-7763811	Luke Paper Company	22,659.84	3,607.00
PA	MANE-VU	42005-3866111	GENON NE MGMT CO/KEYSTONE STA	56,939.25	6,578.47
PA	MANE-VU	42063-3005211	HOMER CITY GEN LP/ CENTER TWP	11,865.70	5,215.96
PA	MANE-VU	42063-3005111	NRG WHOLESALE GEN/SEWARD GEN STA	8,880.26	2,254.64
IL	LADCO	17127-7808911	Joppa Steam	20,509.28	4,706.35
IN	LADCO	18173-8183111	Alcoa Warrick Power Plt Agc Div of AL	5,071.28	11,158.55
IN	LADCO	18051-7363111	Gibson	23,117.23	12,280.34
IN	LADCO	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT	30,536.33	8,806.77
IN	LADCO	18125-7362411	INDIANAPOLIS POWER & LIGHT PETERSBURG	18,141.88	10,665.27
IN	LADCO	18129-8166111	Sigeco AB Brown South Indiana Gas & Ele	7,644.70	1,578.59
OH	LADCO	39081-8115711	Cardinal Power Plant (Cardinal Operating Company) (0641050002)	7,460.79	2,467.31
OH	LADCO	39031-8010811	Conesville Power Plant (0616000000)	6,356.23	9,957.87
OH	LADCO	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	22,133.90	7,149.97
OH	LADCO	39053-8148511	General James M. Gavin Power Plant (0627010056)	41,595.81	8,122.51
OH	LADCO	39053-7983011	Ohio Valley Electric Corp., Kyger Creek Station (0627000003)	3,400.14	9,143.84

7.6.2. PSAT Contributions at Class I Areas Potentially Impacted by Mississippi Sources

The original PSAT results were determined based on the initial 2028 SO_2 and NO_X point emissions, which may be found in Appendix B-1a and Appendix B-1b. As described in Section 4.1.8 and Section 7.2.4, the 2028 EGU and non-EGU point emissions were updated for a new 2028 model run (Task 2B and Task 3B reports), but the original PSAT runs were not redone. Details of the updated emissions may be found in Appendix B-2a and Appendix B-2b. Instead, the original PSAT results were linearly scaled to reflect the updated 2028 emissions. The details of the PSAT adjustments can be found in Appendix E-7b.

The adjusted PSAT results were used to calculate the percent contribution of each tagged facility to the total sulfate and nitrate point source (EGU + non-EGU) contribution at each Class I area. Then, the facilities were sorted from highest impact to lowest impact.

With respect to the two tagged Mississippi facilities, Table 7-13 contains PSAT results for Breton Wilderness Area, and Table 7-14 contains PSAT results for Sipsey Wilderness Area. The tables show that neither Mississippi facility selected for PSAT modeling significantly impacts nearby Class I Areas, with results showing sulfate contributions from each facility well below 1.00% and nitrate contributions from each facility much lower than sulfate contributions.

The full list of tagged facilities and their contributions to each Class I area can be found in Appendix E-7b.

Table 7-13: PSAT Results for Mississippi Facilities Significantly Impacting Breton Wilderness Area (LA)

Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised Nitrate PSAT, %	Final Revised EGU+NEG (Mm^{-1})
28059-8384311	Chevron Products Company, Pascagoula Refinery	61.1	0.052	0.346%	0.003	0.020%	15.046
28059-6251011	Mississippi Power Company, Plant Victor J Daniel	76.7	0.017	0.110%	0.006	0.041%	15.046

Table 7-14: PSAT Results for Mississippi Facilities Significantly Impacting Sipsey Wilderness Area (AL)

Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised Nitrate PSAT, %	Final Revised EGU+NEG (Mm^{-1})
28059-8384311	Chevron Products Company, Pascagoula Refinery	456.6	0.002	0.013%	0.000	0.000%	15.470
28059-6251011	Mississippi Power Company, Plant Victor J Daniel	437.8	0.002	0.013%	0.000	0.000%	15.470

7.6.3. Selection of Sources for Reasonable Progress Evaluation

EPA has made clear that each state has the authority to select the sources to evaluate for reasonable progress analysis and to determine the factors used in making such selection as long as the factors used in the process are explained and justified in the state's plan. Subsection 169A(b) requires EPA to "provide guidelines to the **States**" [emphasis added] and "require **each applicable implementation plan for a State**" [emphasis added] to address reasonable progress including the requirement for long-term strategies. In promulgating its regional haze rules, EPA stated that "**The State must include in its implementation plan a description of the criteria it used to determine which sources or groups of sources** it evaluated and how the four factors were taken into consideration in selecting the measures for inclusion in its long-term strategy" [emphasis added]. EPA's August 20, 2019, guidance on Regional Haze SIPs for the second implementation period, goes on to clearly state that the selection of emission sources for analysis is the responsibility of the state. The 2019 EPA guidance states the following:

> The Regional Haze Rule does not explicitly list factors that a state must or may not consider when selecting the sources for which it will determine what control measures are necessary to make reasonable progress. A state opting to select a set of its sources to analyze must reasonably choose factors and apply them in a reasonable way given the statutory requirement to make reasonable progress towards natural visibility. Factors could include, but are not limited to, baseline source emissions, baseline source visibility impacts (or a surrogate metric for the impacts), the in-place emission control measures and by implication the emission reductions that are possible to achieve at the source through additional measures, the four statutory factors (to the extent they have been characterized at this point in SIP development), potential visibility benefits (also to the extent they have been characterized at this point in SIP development), and the five additional required factors listed in 40 CFR 51.308(f)(2)(iv).

The 2019 EPA guidance also discusses which pollutants to consider. The guidance discusses methods for estimating baseline visibility impacts for selected sources, including residence time analysis and photochemical modeling, both of which were used by Mississippi and other VISTAS states. The selection of pollutants to consider and the residence time analysis are discussed in Section 7.4 and Section 7.5 of this SIP. The use of photochemical modeling to better understand source contribution to modeled visibility and further refine the sources selected is discussed in Section 7.6.

The 2019 EPA guidance also discussed using estimates of visibility impacts to select sources including the use of a visibility impact threshold level for selecting sources. The VISTAS states have used a two-step process for selecting sources. The first step was a screening analysis using the NO_X and SO_2 source category and facility contributions from the AoI analysis described in Section 7.5. The second step was CAMx PSAT modeling of the sources selected in step 1. Based on the PSAT modeling results, sources were then selected for reasonable progress analysis. This two-step process was used to select sources that have the largest contribution to visibility impairment, and thus, greatest opportunity for reasonable progress improvement at Class I areas.

In the regional haze SIPs developed for the first round of planning, many VISTAS states used the AoI approach and a 1.00% AoI threshold by emission unit. In this second round of planning for regional haze SIPs, the VISTAS states used the AoI/PSAT approach and a ≥ 1.00% PSAT threshold by facility for screening sources for reasonable progress evaluation. Using a facility-wide basis for emissions estimates pulled in more facilities as compared to an emission unit-by-unit basis. As a result, more facilities with smaller visibility impacts (in Mm^{-1}) were examined as compared to the first round of regional haze planning. Although the VISTAS screening approach results in a reasonable number of sources for evaluation and focuses on the sources and pollutants with the largest impacts, using this two-step approach resulted in no Mississippi facilities above the VISTAS 1.00% PSAT threshold for sulfate or nitrate. As shown in Table 7-13 and Table 7-14, the resulting PSAT sulfate and nitrate percent contributions for both Mississippi facilities tagged for PSAT modeling were below the 1.00% threshold used to select facilities for reasonable progress evaluation by VISTAS states.

Table 7-15: Facilities in Mississippi Selected for Reasonable Progress Analysis

State	Facility ID	Facility Name
MS	28059-8384311	Chevron Products Company, Pascagoula Refinery
MS	28059-6251011	Mississippi Power Company, Plant Victor J Daniel

Conclusion: MDEQ selected two sources – Plant Daniel and the Chevron Pascagoula Refinery – and opted to show they are already effectively controlled for SO_2 in lieu of a four-factor analysis (see 2019 EPA Guidance pp. 22-26). MDEQ's effective controls analysis of these sources is located in Section 7.7.

7.6.4. Evaluation of Recent Emission Inventory Information

The regional haze rule at 40 CFR 51.308(f)(2)(iii) requires the state to document the emissions information on which the state is relying to determine the emission reduction measures that are necessary to make reasonable progress in each mandatory federal Class I area it affects. The emissions information must include, but need not be limited to, information on emissions in a year at least as recent as the most recent year for which the state has submitted emission inventory information to the EPA Administrator in compliance with the triennial reporting requirements.

Mississippi examined the 2017 and 2020 emissions information that has been reported to EPA and compared these emissions to the 2028 emissions that were used in the modeling. Table 7-16 shows all the facilities with SO_2 emissions greater than 100 tpy in 2017, sorted from highest 2017 SO_2 emissions to lowest, and Table 7-17 shows all the facilities with NO_X emissions greater than 100 tpy in 2017, sorted from highest 2017 NO_X emissions to lowest. In addition to 2017 emissions, the tables include the 2020 emissions submitted for the 2020 NEI. Projected emissions for 2028 are also shown based on the 2028 remodel inventory (see Section 4.1.8 for additional information). The last two columns show the difference between the 2028 remodel value and 2017 and 2020 values, respectively.

Mississippi relied primarily on evaluation of 2028 remodel emissions for screening sources for reasonable progress analysis and developing a long-term strategy. There are some facilities where the most recent 2017 and 2020 emissions are significantly lower than the 2028 emissions used in the modeling and for the selection of sources for reasonable progress analysis. Likewise, there are some facilities where the most recent 2017 and/or 2020 emissions are significantly higher than the 2028 emissions used in the modeling and for the selection of sources for reasonable progress analysis. These differences, either way, can be contributed to a conservative projection of emissions for 2028, recent or projected unit retirements, operational or process changes, or the installation of air pollution controls that were taken into consideration when estimating 2028 emissions. In summary, review of the 2017 and 2020 emissions data does not change Mississippi's conclusions regarding reasonable progress or the long-term strategy.

Table 7-16: SO_2 Emissions Comparison Between 2017, 2020, and 2028[48]

EIS Facility ID	Facility	SO_2 2017 (tpy) (NEI Data)	SO_2 2020 (tpy) (MS Data)	SO_2 2028 Remodel (tpy)	SO_2 2028 Remodel minus 2017 (tpy)	SO_2 2028 Remodel minus 2020 (tpy)
7053011	CHOCTAW GENERATION LIMITED PARTNERSHIP	2245	2326	2753	508	427
16908111	MISSISSIPPI POWER COMPANY, DAVID M RATCLIFFE	1253	10	8	-1245	-2
8384311	CHEVRON PRODUCTS COMPANY, PASCAGOULA REFINERY	668	524	742	73	217
17942211	MISSISSIPPI SILICON LLC	648	504	648	0	144
8232711	GEORGIA PACIFIC MONTICELLO LLC	591	106	508	-83	403
12603611	STEEL DYNAMICS COLUMBUS	457	389	108	-348	-281
7154011	RAIN CII CARBON LLC	378	347	746	369	399
8498711	INTERNATIONAL PAPER, VICKSBURG MILL	267	123	364	97	242
6251011	MISSISSIPPI POWER COMPANY, PLANT VICTOR J DANIEL	204	181	232	20	44
8215811	INTERNATIONAL PAPER, COLUMBUS MILL	157	183	341	183	158
16526211	ROXUL USA INC	148	119	#N/A	#N/A	#N/A
7098911	PETRO HARVESTER OPERATING COMPANY LLC, SOUTH CYPRESS CREEK FACILITY	128	84	360	232	275

[48] An indication of "#N/A" indicates the facility was recently constructed and was not in operation at the time the 2028 inventory was developed.

Table 7-17: NOx Emissions Comparison Between 2017, 2020, and 2028

EIS Facility ID	Facility	NOx 2017 (tpy)	NOx 2020 (tpy) *MS data	NOx 2028 Remodel (tpy)	NOx 2028 Remodel minus 2017 (tpy)	NOx 2028 Remodel minus 2020 (tpy)
6251011	MISSISSIPPI POWER COMPANY, PLANT VICTOR J DANIEL	4155	2922	3736	-419	814
7035611	TEXAS EASTERN TRANSMISSION LP, UNION CHURCH	2966	1816	1167	-1799	-649
8384311	CHEVRON PRODUCTS COMPANY, PASCAGOULA REFINERY	2041	1901	1534	-506	-367
8232711	GEORGIA PACIFIC MONTICELLO LLC	1909	1846	2384	475	538
7053011	CHOCTAW GENERATION LIMITED PARTNERSHIP,	1805	1608	2223	418	615
6788111	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	1630	2928	8	-1622	-2920
6970611	MISSISSIPPI POWER COMPANY, CHEVRON COGEN	1449	1254	267	-1182	-987
8216311	LEAF RIVER CELLULOSE, LLC	1333	965	363	-969	-602
8215811	INTERNATIONAL PAPER, COLUMBUS MILL	1288	1279	1587	299	308
7035911	TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC, STATION 80	1198	1777	3435	2237	1659
16908111	MISSISSIPPI POWER COMPANY, DAVID M RATCLIFFE	1151	168	174	-977	6
6993911	FLORIDA GAS TRANSMISSION COMPANY, WIGGINS COMPRESSOR STATION NO. 10	1039	921	981	-58	60
8384811	CF INDUSTRIES NITROGEN LLC	1025	991	1955	930	964
17942211	MISSISSIPPI SILICON LLC	837	598	836	-1	238
8233711	ENTERGY MISSISSIPPI INC, BAXTER WILSON PLANT	794	2095	4570	3776	2475
8498711	INTERNATIONAL PAPER, VICKSBURG MILL	742	1029	743	1	-286
12603611	STEEL DYNAMICS COLUMBUS	711	499	330	-381	-170
7083611	TEXAS GAS TRANSMISSION LLC, GREENVILLE COMPRESSOR STATION	524	426	526	2	100
6284611	GULF SOUTH PIPELINE COMPANY LLC, MCCOMB COMPRESSOR STATION	488	520	527	39	7

EIS Facility ID	Facility	NOx 2017 (tpy)	NOx 2020 (tpy) *MS data	NOx 2028 Remodel (tpy)	NOx 2028 Remodel minus 2017 (tpy)	NOx 2028 Remodel minus 2020 (tpy)
7100711	SOUTHERN NATURAL GAS COMPANY LLC, LOUISVILLE COMPRESSOR STATION	484	693	222	-262	-471
7182711	TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC, STATION 77	450	261	209	-241	-52
7083911	ENTERGY MISSISSIPPI INC, GERALD ANDRUS PLANT	437	1622	1354	917	-268
6942611	SOUTHERN NATURAL GAS COMPANY LLC, MULDON COMPRESSOR STATION	433	516	436	3	-80
7153011	TENNESSEE GAS PIPELINE COMPANY LLC, DEKALB COMPRESSOR STATION	398	1848	0	-397	-1848
7070111	TENNESSEE GAS PIPELINE COMPANY LLC, COLUMBUS COMPRESSOR STATION	384	1834	84	-300	-1750
6802311	ENTERGY MISSISSIPPI INC, REX BROWN PLANT[49]	375	#N/A	375	-1	#N/A
7035711	SOUTHERN NATURAL GAS COMPANY LLC, GWINVILLE	366	582	385	19	-198
6320811	TEXAS GAS TRANSMISSION LLC, CLARKSDALE COMPRESSOR STATION	360	2	57	-302	56
7984011	GEORGIA-PACIFIC WOOD PRODUCTS LLC, TAYLORSVILLE	359	197	376	17	179
6993011	COOPERATIVE ENERGY, A MISSISSIPPI ELECTRIC COOPERATIVE, BATESVILLE	328	397	267	-61	-130
7054511	SOUTHERN NATURAL GAS COMPANY LLC, ENTERPRISE	253	291	251	-3	-41
7083811	ANR PIPELINE COMPANY, GREENVILLE COMPRESSOR STATION	253	983	332	79	-650
8230811	CHEMOUR COMPANY FC LLC, THE, DELISLE PLANT	242	202	712	470	510
7037011	TVA MAGNOLIA COMBINED CYCLE	237	237	74	-163	-163
7154411	COOPERATIVE ENERGY, A MISSISSIPPI ELECTRIC COOPERATIVE, R D MORROW PLANT	234	5	4675	4441	4670
7183811	TEXAS GAS TRANSMISSION LLC, LAKE CORMORANT	222	485	294	72	-191

[49] The Entergy Mississippi Inc, Rex Brown Plant was retired in 2019.

EIS Facility ID	Facility	NOx 2017 (tpy)	NOx 2020 (tpy) *MS data	NOx 2028 Remodel (tpy)	NOx 2028 Remodel minus 2017 (tpy)	NOx 2028 Remodel minus 2020 (tpy)
8484211	TRONOX LLC, HAMILTON FACILITY	207	233	268	61	35
7051611	COLUMBIA GULF TRANSMISSION, BANNER COMPRESSOR STATION	204	889	781	578	-108
12587611	ROLLS ROYCE NORTH AMERICA, ROLLS ROYCE CENTER OF EXCELLENCE	200	27	41	-159	14
7289311	SOUTHERN NATURAL GAS COMPANY LLC, RANKIN COMPRESSOR STATION	195	290	109	-86	-181
8215911	TVA CALEDONIA COMBINED CYCLE PLANT	173	181	83	-89	-98
7184711	TVA SOUTHAVEN COMBINED CYCLE PLANT	165	193	84	-81	-109
16518111	AMITE BIOENERGY LLC, WOOD PELLET MANUFACTURING FACILITY	163	202	#N/A	#N/A	#N/A
12589611	TVA ACKERMAN COMBINED CYCLE	150	141	62	-88	-78
6952811	TRUNKLINE GAS COMPANY, LLC, INDEPENDENCE COMPRESSOR STATION	147	89	2737	2589	2648
7053111	ENTERGY MISSISSIPPI LLC, CHOCTAW COUNTY	145	173	31	-114	-142
6284911	ERGON REFINING INC	143	115	160	16	44
6945311	SHUQUALAK LUMBER COMPANY INC, PLANER MILL	138	114	84	-54	-30
8498411	RESOLUTE FP US INC, GRENADA OPERATIONS	134	180	225	91	45
12609611	KINGSFORD MANUFACTURING COMPANY	130	116	99	-31	-18
6966711	ENTERGY MISSISSIPPI INC, HINDS COUNTY PLANT	126	105	32	-94	-73
8232511	HOOD INDUSTRIES INC, WIGGINS	112	95	132	20	37
8384911	FIRST CHEMICAL CORPORATION	110	119	70	-39	-49

7.7. Effective Control Demonstrations for the Selected Mississippi Emissions Sources

Plant Daniel and the Chevron Pascagoula Refinery met Mississippi's source selection threshold. MDEQ is demonstrating that Plant Daniel and the Chevron Pascagoula Refinery are effectively controlled for SO_2 (2019 EPA Guidance, pp. 22-26), as explained below in Sections 7.7.1 and 7.7.2, and thus, FFAs were not completed for these two sources.

The 2019 EPA Guidance states that it may be reasonable for a state not to select a source for an FFA if it is effectively controlled. A source may already have effective controls in place as a result of a previous regional haze SIP or other CAA requirement. In general, if post-combustion controls were selected and installed recently to meet a CAA requirement, there will be a low likelihood that a significant technological advancement has been made since installation that could provide further reasonable emission reductions (2019 EPA Guidance, p. 22).

7.7.1. Mississippi Power Company – Plant Victor J Daniel

Background: Mississippi Power Company, Plant Victor J Daniel ("Plant Daniel") is an Electricity Generating facility with two coal-fired steam electric generators (Units 1 and 2) located in Escatawpa, Mississippi in Jackson County. Plant Daniel is approximately 76.7 km from Breton National Wilderness Area in Louisiana and approximately 438 km from Sipsey Wilderness Area in Alabama.

Units Evaluated:

- Unit 1 (AA-001) and Unit 2 (AA-002) are the most significant SO_2 emissions units at Plant Daniel and are the subject of this effective controls demonstration. Below is a description of both Units 1 and 2:
  - 5,460.5 MMBtu/hr (nominal) Combustion Engineering Tangentially-Fired Utility Boilers equipped with low-NO_x burners, an electrostatic precipitator (ESP) for control of PM, a wet flue gas desulfurization (FGD) system for control of SO_2 and acid gases, and an activated carbon injection (ACI) system for control of mercury.
  - The boilers are permitted to combust coal (bituminous and subbituminous), #2 fuel oil, used oil, natural gas, petroleum contaminated soil, boiler cleaning waste, and wood waste.
  - Emissions are typically routed through the FGD stack; however, exhaust gases may be routed through a bypass stack during upsets and emergency situations.

Excluded Units:

- The facility has other insignificant sources of SO_2 which are excluded from this demonstration and are listed in Table 7-18 below (i.e., AA-003, AA-004, AA-005, and AA-006).

Table 7-18: Plant Daniel SO_2 Emissions Percentage by Emission Point

Source	Proportion of Facility Recent SO_2 Emissions (2018-2021)
AA-001 (Unit 1) – 5,460.5 MMBtu/hr Boiler	46.48%
AA-002 (Unit 2) – 5,460.5 MMBtu/hr Boiler	44.69%
AA-003 – 1,946 MMBtu/hr Turbine	2.30%
AA-004 – 1,946 MMBtu/hr Turbine	2.27%
AA-005 – 1,946 MMBtu/hr Turbine	2.21%
AA-006 – 1,946 MMBtu/hr Turbine	2.05%

Effective Controls Demonstration for SO_2:

- Plant Daniel is subject to the Mercury and Air Toxics Standards (MATS) rule, codified in 40 CFR 63, Subpart UUUUU, and complies with the SO_2 emission standard of 0.20 lb SO_2/MMBtu (30-day rolling average) established by the rule as a surrogate for HCl.

- Units 1 and 2 have wet FGD which operate year-round. The wet FGD system for Units 1 and 2 is designed to achieve a control efficiency of approximately 96% SO_2 control. In addition, the wet FGD is designed to achieve 90-95% control of HCl Mist, and the ESPs for these units provide approximately 99% PM control. The monthly average control efficiency of the wet FGD for Units 1 and 2 from 2020 to 2022 are provided in Table 7-19 below. The monthly average SO_2 emissions to the scrubber (in lb/MMBtu) are available in the quarterly fuel reports required by the Title V permit issued by MDEQ, and the SO_2 emissions at the scrubber outlet (in lb/MMBtu) are available from EPA's Clean Air Market Program Data. The calculated monthly average control efficiency for each unit demonstrates that each wet FGD system consistently operated above the 96% design efficiency.

- Because Plant Daniel Units 1 and 2 already have effective SO_2 controls in place as a result of the 2012 MATS rule (i.e., wet FGD), installed in 2015, there is a low likelihood of a significant technological advancement that could provide further reasonable emission reductions. (2019 EPA Guidance, pp. 22-23)

Table 7-19: Plant Daniel Monthly Average SO_2 Control Efficiency for Unit 1 and Unit 2

		Unit #1				Unit #2			
Year	Month	Operating Time[a] (hr)	SO_2 Inlet[b] (lb/MMBtu)	SO_2 Outlet Rate[a] (lb/MMBtu)	Control Eff. (%)	Operating Time[a] (hr)	SO_2 Inlet[b] (lb/MMBtu)	SO_2 Outlet Rate[a] (lb/MMBtu)	Control Eff. (%)
2020	1	82	0.83	0.0095	98.9%	326	0.76	0.0131	98.3%
2020	2	83	0.54	0.0429	92.1%	298	0.62	0.0059	99.0%
2020	3	213	0.70	0.0082	98.8%	717	0.65	0.0048	99.3%
2020	4	6	0.59	0.0013	99.8%	0	--	--	--
2020	5	648	0.62	0.0102	98.4%	32	0.54	0.0047	99.1%
2020	6	720	0.67	0.0076	98.9%	719	0.68	0.0063	99.1%
2020	7	677	0.69	0.0076	98.9%	744	0.70	0.0085	98.8%
2020	8	744	0.63	0.0072	98.9%	744	0.64	0.0087	98.6%
2020	9	526	0.67	0.0126	98.1%	719	0.68	0.0075	98.9%
2020	10	0	--	--	--	730	0.72	0.0066	99.1%
2020	11	0	--	--	--	720	0.81	0.0078	99.0%
2020	12	579	0.76	0.0099	98.7%	638	0.73	0.0107	98.5%
2021	1	744	0.62	0.0050	99.2%	598	0.64	0.0052	99.2%
2021	2	495	0.69	0.0147	97.9%	464	0.72	0.0110	98.5%
2021	3	388	0.71	0.0074	99.0%	744	0.70	0.0054	99.2%
2021	4	720	0.80	0.0075	99.1%	600	0.78	0.0079	99.0%
2021	5	704	0.55	0.0065	98.8%	0	--	--	--
2021	6	720	0.46	0.0027	99.4%	0	--	--	--
2021	7	713	0.49	0.0048	99.0%	0	--	--	--
2021	8	744	0.49	0.0055	98.9%	0	--	--	--
2021	9	516	0.53	0.0058	98.9%	0	--	--	--
2021	10	358	0.50	0.0062	98.8%	329	0.73	0.0256	96.5%
2021	11	419	0.76	0.0104	98.6%	304	0.79	0.0122	98.5%
2021	12	167	0.81	0.0112	98.6%	744	0.84	0.0098	98.8%
2022	1	556	0.72	0.0086	98.8%	559	0.76	0.0106	98.6%
2022	2	574	0.80	0.0094	98.8%	0	--	--	--
2022	3	743	0.83	0.0154	98.1%	155	0.81	0.0160	98.0%
2022	4	360	0.82	0.0200	97.6%	708	0.86	0.0164	98.1%
2022	5	508	0.85	0.0189	97.8%	744	0.88	0.0170	98.1%
2022	6	720	0.78	0.0175	97.8%	720	0.78	0.0142	98.2%
2022	7	288	0.76	0.0112	98.5%	744	0.77	0.0137	98.2%
2022	8	0	--	--	--	744	0.79	0.0125	98.4%
2022	9	191	0.86	0.0167	98.1%	605	0.82	0.0112	98.6%
2022	10	287	0.80	0.0108	98.7%	0	--	--	--
2022	11	154	0.76	0.0152	98.0%	0	--	--	--
2022	12	154	1.02	0.0353	96.5%	532	0.94	0.0129	98.6%

[a] The monthly operating hours and SO_2 outlet emission rate were retrieved from EPA's Clean Air Market Program Data (https://campd.epa.gov/).

[b] The montly average inlet SO_2 emission rate is reported in the quarter fuel monitoring reports required by Condition 5.B.1 of the Title V Permit.

- MDEQ evaluated recent past actual emission rates for SO_2 (on an annual basis) at Plant Daniel, following installation of MATS controls, and compared these rates to the permitted allowable MATS standard of 0.20 lb SO_2/MMBtu. The results are as follows:

Table 7-20: Comparison of Plant Daniel Actual lb SO_2/MMBtu emission rate and the MATS SO_2 limit of 0.2 SO_2/MMBtu

Facility Name	Unit ID	Year	SO_2 (tons)	Heat Input (MMBtu)	Annual SO_2 lb/MMBtu
Daniel Electric Generating Plant	1	2016	76	1.26E+07	0.012
Daniel Electric Generating Plant	1	2017	107	1.63E+07	0.013
Daniel Electric Generating Plant	1	2018	129	1.42E+07	0.018
Daniel Electric Generating Plant	1	2019	104	1.19E+07	0.017
Daniel Electric Generating Plant	1	2020	69	1.13E+07	0.012
Daniel Electric Generating Plant	1	2021	93	2.27E+07	0.008
Daniel Electric Generating Plant	1	2022	132	1.42+07	0.015
Daniel Electric Generating Plant	2	2016	65	1.36E+07	0.010
Daniel Electric Generating Plant	2	2017	82	1.27E+07	0.013
Daniel Electric Generating Plant	2	2018	107	1.58E+07	0.014
Daniel Electric Generating Plant	2	2019	103	1.44E+07	0.014
Daniel Electric Generating Plant	2	2020	94	1.80E+07	0.010
Daniel Electric Generating Plant	2	2021	59	1.08E+07	0.011
Daniel Electric Generating Plant	2	2022	154	1.89E+07	0.014

The average emission rates for Unit 1 and Unit 2 on an annual basis are 0.014 lb SO_2/MMBtu and 0.012 lb SO_2/MMBtu, respectively. This demonstrates an adequate margin of compliance with the MATS standard of 0.20 lb SO_2/MMBtu limit (30-day rolling average) while allowing for operational variability within a 30-day averaging period.

- As concerns future emissions, projected 2028 emissions provided in Table 7-16 continue to reflect effective control of both Units 1 and 2.

- Additionally, based on Mississippi Power Company's Integrated Resource Plan[50] filed on April 15, 2021, with the Mississippi Public Service Commission, either Unit 1 or Unit 2 will be retired by 2027.[51] Gulf Power, who owns 50% of the two coal-fired units at Plant Daniel, will retire the other unit by January 2024, according to their Ten-Year Power Plant Site Plan: 2021-2030[52] filed April 1, 2021 with the Florida Public Service Commission.[53]

[50] URL: https://www.psc.state.ms.us/InSiteConnect/InSiteView.aspx?model=INSITE_CONNECT&queue=CTS_ARCHIVEQ&docid=658803

[51] Reference to the Integrated Resource Plan is included as supplemental information only. MDEQ is not relying on the retirement of Unit 1 or 2 as part of the effective controls demonstration for the second planning period.

[52] URL: https://www.floridapsc.com/pscfiles/library/filings/2021/03162-2021/03162-2021.pdf.

[53] Reference to the Gulf Power's Ten Year Power Plant Site Plan is included as supplemental information only. MDEQ is not relying on the retirement of Unit 1 or 2 as part of the effective controls demonstration for the second planning period.

7.7.2. Chevron Products Company, Pascagoula Refinery

Background: Chevron Products Company, Pascagoula Refinery ("Chevron Pascagoula Refinery") is a petroleum refinery located east of the City of Pascagoula in an unincorporated area of Jackson County, Mississippi. The Chevron Pascagoula Refinery is located 61.6 km from Breton Wilderness Area in Louisiana and 457 km from Sipsey Wilderness Area in Alabama.

Units Evaluated:

- The units listed below in Table 7-21 are the most significant SO_2 emission units at the Chevron Pascagoula Refinery and are the subject of this effective controls demonstration. Following the table is a description of each unit.

Table 7-21: Chevron Refinery Emission Units with Over 25 Tons of SO_2 Emissions in Recent Years

Emission Unit	2018 (tpy)	2019 (tpy)	2020 (tpy)	2021 (tpy)
017/F-1603 (AH-051)	94.55	85.43	28.76	83.27
115/F-6410 (BH-231)	35.75	34.07	46.15	33.51
181/F-8620 (BT-541)	50.94	43.68	41.18	41.74
529/T-14/T-15 (AZ-571)	46.41	51.03	46.16	51.64
560/F-7910/20/30/40 (CH-003)	38.08	29.67	37.32	33.72
693/F-1101/1102 (AE-013)	32.78	31.49	36.04	40.15
694/F-6101/6102 (BE-211)	31.19	28.09	35.26	22.06

- 017/F-1603 (AH-051) – Fluidized Catalytic Cracking Unit (FCCU) Catalyst Regenerator
  - Regenerator with an 81.4 MMBtu/hr start-up air preheat furnace combusting refinery fuel gas (RFG)

- 115/F-6410 (BH-231) - Reformer Furnace (process heater)
  - Reformer furnace with exhaust routed to three stacks
  - 730 MMBtu/hr furnace combusting RFG and exhaust routed from the turbine (BH-231) and used as combustion air in the furnace

- 181/F-8620 (BT-541) - Reformer Furnaces and Gas Turbine
  - 780 MMBtu/hr reformer furnaces combusting RFG
  - 270 MMBtu/hr gas turbine combusting natural gas, with exhaust routed to the furnace as combustion air

- 529/T-14/T-15 (AZ-571) - Sulfur Tank Vent Afterburner
  - Thermal oxidizer that controls emissions from two wharf sulfur storage tanks
  - Burner rating of 0.5 MMBtu/hr, combusting natural gas and flash gas

- 560/F-7910/20/30/40 (CH-003) - Platformer Furnaces
  - 850 MMBtu/hr process heaters combusting RFG
  - Equipped with ultra-low NOx burners (ULNB)

- 693/F-1101/1102 (AE-013) – Vacuum Column and Atmospheric Column Furnaces for Crude Unit 1
  - 612 MMBtu/hr process heaters combusting RFG

- 694/F-6101/6102 (BE-211) – Vacuum Column and Atmospheric Column Furnaces for Crude Unit 2
  - 600 MMBtu/hr process heaters combusting RFG
  - Gas from the vacuum column is treated in a DEA absorber to remove hydrogen sulfide before it is burned in the atmospheric furnace
  - Equipped with ULNB

Excluded Units: The facility has other less significant sources of SO_2 which are excluded from this demonstration. Emission units listed in bold below in Table 7-22 represent those selected for this effective control demonstration.

Table 7-22: Proportion of Chevron SO_2 Emission by Unit

Emission Unit	Source Description	Proportion of Facility SO_2 in 2020
529/T-14/T-15	**T-14/T-15 VENT**	**8.80%**
115/F-6410	**F-6410 RFG 730 MMBtu/hr**	**8.80%**
181/F-8620	**F-8620 RFG 780 MMBtu/hr**	**7.85%**
560/F-7910/20/30/40	**(4) 850MMBtu/hr HEATERS**	**7.12%**
693/F-1101/1102	**F-1101/1102 RFG FURNACES**	**6.87%**
694/F-6101/6102	**F-6101/6102 HEATERS**	**6.72%**
017/F-1603	**F-1603 CATALYST REGEN**	**5.48%**
043/F-2440/90	F-2440/90 RFG 550 MMBtu/hr	3.92%
051/F-2745	F-2745 RFG 30.8 MMBtu/hr	3.73%
052/F-2765	F-2765 RFG 30.8 MMBtu/hr	3.27%
162/F-8300C	F8300C RFG 203.5 MMBtu/hr	3.04%
508/F-8300B	F-8300B RFG 203.5MMBtu/hr	2.55%
160/F-8300A	F8300A RFG 203.5 MMBtu/hr	2.55%
172/F-8400	F-8400 RFG 275 MMBtu/hr	1.92%
108/F-6250	F-6250 RFG 218 MMBtu/hr	1.85%
034/F-2101	F-2101 RFG 265 MMBtu/hr	1.79%
036/F-2103	F-2103 RFG 265 MMBtu/hr	1.72%
035/F-2102	F-2102 RFG 265 MMBtu/hr	1.63%
225/F-1305	F-1305 RFG 140 MMBtu/hr	1.36%

Emission Unit	Source Description	Proportion of Facility SO_2 in 2020
223/F-1201/1301/1302	F1201/1301/1302 RFG 125	1.25%
731/T-47	504K GAL SPENT ACID TANK	1.20%
591/F-8007	160MMBtu/hr REFORMATE HTR	1.20%
730/T-44	571K GAL SPENT ACID TANK	1.19%
224/F-1304	F-1304 RFG 100 MMBtu/hr	1.03%
109/F-6260	F-6260 RFG 110 MMBtu/hr	0.95%
156/F-8130	F-8130 RFG 65 MMBtu/hr	0.75%
628/F-8220	F-8220 86MMBtu/hr HTR	0.71%
018/F-1601	F-1601 RFG 165 MMBtu/hr	0.70%
154/F-8110	F-8110 RFG 65 MMBtu/hr	0.66%
177/F-8560	F-8560 RFG 80 MMBtu/hr	0.62%
176/F-8510	F-8510 RFG 55 MMBtu/hr	0.62%
590/PLANT 79	PLANT 79 CCR VENT	0.61%
226/F-1306	F-1306 RFG 40 MMBtu/hr	0.54%
106/F-6210	F-6210 RFG 55 MMBtu/hr	0.53%
010/F-1531	F-1531 RFG 65 MMBtu/hr	0.53%
155/F-8120	F-8120 RFG 65 MMBtu/hr	0.53%
630/F-8280	F-8280 70MMBtu/hr HTR	0.51%
038/F-2201	F-2201 RFG 48 MMBtu/hr	0.46%
011/F-1532	F-1532 RFG 42 MMBtu/hr	0.45%
012/F-1501/02/03	F1501/2/3 RFG 493 MMBtu/hr	0.42%
107/F-6230	F-6230 RFG 55 MMBtu/hr	0.42%
085/F-3806	F-3806 - FLARE NO. 6	0.40%
122/F-6532	F-6532 RFG 37 MMBtu/H	0.37%
042/F-2410	F-2410 RFG 39.2 MMBtu/hr	0.37%
627/F-8210	F-8210 51.6 MMBtu/hr HTR	0.36%
082/F-3803	F-3803 - FLARE NO. 3	0.30%
183/F-8610	F-8610 RFG 38 MMBtu/hr	0.28%
732/T-48	845K GAL SPENT ACID TANK	0.27%
130/F-6701	F-6701 RFG 40 MMBtu/hr	0.26%
629/F-8250	F-8250 44 MMBtu/hr HTR	0.24%
121/F-6531	F-6531 RFG 45 MMBtu/hr	0.10%
083/F-3804	F-3804 - FLARE NO. 4	0.10%
534/PLANT 45	BERTH 1 SPENT ACID LOADG	0.05%
084/F-3805	F-3805 - FLARE NO. 5	0.02%
196/F-9080	F-9080 RFG 19.25 MMBtu/hr	0.01%
201/F-9180	F-9180 RFG 19.25 MMBtu/hr	0.01%
204/F-9280	F-9280 RFG 19.25 MMBtu/hr	0.01%

Effective Controls Demonstration for SO_2:

- 529/T-14/T-15 (AZ-571) – This thermal oxidizer burns gases from two wharf sulfur tanks (T-14 and T-15) and has a 99% sulfur compound reduction efficiency. The thermal oxidizer is required to meet the State standard on H_2S in 11 Miss. Admin. Code Pt. 2, R. 1.4.B(2)., which requires any gas stream exceeding one grain of H_2S per 100 standard cubic feet (i.e., 1 gr/100 scf) to be incinerated. Table 7-23 shows the very consistent emissions rate of the thermal oxidizer, which indicates no foreseeable reason for an increase in emissions from the sulfur tanks.

Table 7-23: Chevron Refinery AZ-571 Thermal Oxidizer SO_2 Emissions

Input Year	AZ-571 (T-14 & T-15) Thermal Oxidizer	
	lb/hr SO_2	lb SO_2/long ton sulfur throughput
2018	10.60	0.01389
2019	11.65	0.01389
2020	10.54	0.01391
2021	11.79	0.01389
2022	9.49	0.01389

- 017/F-1603 (AH-051) – Emissions from the Fluidized Catalytic Cracking Unit's (FCCU) Catalyst Regenerator Vent are regulated by numerous federal standards. With regards to SO_2, the FCCU at the Chevron Pascagoula Refinery was addressed in a national consent decree filed June 29, 2005 – United States of America, et al. v. Chevron U.S.A., Inc., No. C 03-04650.[54] The consent decree imposes SO_2 emission limits of 25 ppmvd @ 0% O_2 on a 365-day rolling average basis and 50 ppmvd @ 0% O_2 on a 7-day rolling average basis. These limits were incorporated in a federally enforceable Permit to Construct issued May 24, 2005, and last modified April 14, 2009. The SO_2 limits are equivalent to the Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007 (40 CFR 60, Subpart Ja). These limits are consistent with refinery consent decrees settled nation-wide[55], as well as best available control technology (BACT) determinations made according to the Prevention of Significant Deterioration (PSD) regulations as recently as 2021.[56]

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[54] Consent decree filed June 29, 2005, Case 3:03-cv-04650-CRB, Document 123, available at: https://www.epa.gov/sites/default/files/documents/chevron-cd.pdf.

[55] Such consent decrees include the U.S.A., et al. v. CITGO Petroleum Corporation, et al. (Civil Action No. H-04-3883); U.S.A., et al. v. ConocoPhillips (Civil Action No. H-05-0258); U.S.A., et al. v. ExxonMobil Corporation, et al. (Civil Action No. 05C5809). See EPA's Petroleum Refinery National Case Results website for copies of these Consent Decrees: https://www.epa.gov/enforcement/petroleum-refinery-national-case-results.

[56] BACT determinations for SO_2 emissions from Fluid Catalytic Cracking (FCC) Units / Regenerator Vents for permits issued in the past five years include RBLC IDs LA-0385 (Marathon Petroleum Company, Garyville Refinery), KS-0042 (Coffeyville Resources Refining & Marketing, LLC, Coffeyville Refinery), WI-0311 (Superior

Over the past five years (2018-2022), the Chevron Pascagoula Refinery had an average 365-day rolling SO_2 concentration of 11.35 ppm, with a standard deviation of 3.52 ppm and a maximum value of 15.91 ppm.[57] During the same five-year period, the average 7-day rolling SO_2 concentration was 12.27 ppm, with a standard deviation of 8.80 ppm and a maximum value of 38.96 ppm. These values both demonstrate compliance with the federally enforceable permit provisions for SO_2 on the FCCU Catalyst Regenerator Vent, as well as show consistent SO_2 emissions as averaged over an annual basis in particular. Day-to-day emissions of SO_2 at this unit are dependent on the sulfur content of the crude oil, which is generally beyond the refinery's control, though they blend oil to achieve more consistency in the refining process.

- Excluding the sulfur tanks with thermal oxidizer and FCCU Catalyst Regenerator Vent, the remaining selected SO_2 sources being evaluated are process heaters or furnaces primarily combusting refinery fuel gas (RFG). RFG is collected at various points throughout the refinery and routed to common headers which then feed the refinery's process heaters, furnaces, and boilers; therefore, the total sulfur content of the RFG dictates the amount of SO_2 emitted at each heater, furnace, and boiler. The Chevron Pascagoula Refinery undertook a substantial project termed the "Holistic Sulfur Project" to increase the sulfur recovery throughput at the refinery and reduce the total sulfur content of the RFG, as well as reduce the sulfur content in gasoline and diesel produced at the refinery. In order to reduce the sulfur content of the RFG, the refinery was modified to increase the sulfur processing capacity at two sulfur recovery units (i.e., SRU II and SRU III) and remove non-H_2S sulfur compounds in the RFG through the addition of a hydrotreating process at the Coker Unit. The average total sulfur content of the RFG was reduced from approximately 216 ppmv to 75 ppmv sulfur on an annual basis.

  The "Holistic Sulfur Project" was addressed in a PSD Permit to Construct initially issued April 14, 2009, and last modified April 11, 2017. The project was completed in 2016. The PSD Permit to Construct contains a federally enforceable SO_2 emission limit of 638.8 tons per year (12-month rolling total) on the total SO_2 emissions from all refinery process heaters, furnaces, and boilers combusting RFG. Additionally, the RFG-fired emission sources contain specific short-term emission limits on SO_2, based on a 24-hour average. The Chevron Pascagoula Refinery must demonstrate compliance with these limits by either continuously monitoring the total sulfur content of the RFG and amount of RFG combusted by each source or by continuously monitoring the SO_2 emissions from the specific RFG-fired source. The Holistic Sulfur Project resulted in actual emissions

Refining Company LLC), and LA-0355 (Marathon Petroleum Company, Garyville Refinery). BACT determinations are available at EPA's RACT/BACT/LAER Clearinghouse database: https://cfpub.epa.gov/rblc/index.cfm?action=Search.BasicSearch&lang=en.

[57] Appendix H: Chevron Pascagoula Refinery SO_2 Data provides additional documentation of SO_2 emissions from the evaluated sources.

decreases of SO_2 of 310 tons per year, as determined using the PSD methodology of past actual emissions to current permitted emissions. Given the recent implementation of this extensive project, there are likely no additional, cost-effective measures available to reduce the total sulfur content in the RFG or the subsequently formed SO_2 emissions at the process heaters and furnaces under evaluation. Table 7-24 indicates that the refinery SO_2 emissions at each heater or furnace do not fluctuate significantly from year to year.

Table 7-24: Chevron Refinery Heater/Furnace Annual Average SO_2 Emission Rates (lb/hr)

Heater/Furnace	2018	2019	2020	2021	2022	Standard deviation
F-1101/02	8.33	7.19	8.23	9.17	8.33	0.63
F-6101/02	7.12	6.41	8.05	5.04	5.54	1.08
F-6410	8.16	7.78	10.53	7.65	7.47	1.13
F-8620	11.63	9.97	9.41	9.53	5.63	1.97
F-7910/20/30/40	8.69	6.77	8.52	7.70	9.18	0.85

- As concerns future emissions, projected 2028 emissions provided in Table 7-16 continue to reflect effective control of the refinery's SO_2 emission sources and account for the controls already in place at the refinery.

7.8. Demonstration that the Measures are Not Necessary for Reasonable Progress

In summary, Section 4.1 of EPA's 2021 Guidance Memo states that there may be circumstances in which a source's existing measures are not necessary to make reasonable progress. Specifically, if a state can demonstrate that a source will continue to implement its existing measures and will not increase its emission rate, it may not be necessary to require those measures under the regional haze program to prevent future emission increases. In this case, a state may reasonably conclude that a source's existing measures are not necessary to make reasonable progress and thus do not need to be included in the SIP. A determination that a source's existing measures are not necessary to make reasonable progress should be supported by a robust technical demonstration. This empirical, weight-of-evidence demonstration should be based on data and information on (1) the source's past implementation of its existing measures and its historical emission rate, (2) the source's projected emissions and emission rate, and (3) any enforceable emissions limits or other requirements related to the source's existing measures.

The following discussion demonstrates that the effective SO_2 control measures already in place for the two selected Mississippi sources, Plant Daniel and the Chevron Pascagoula Refinery, do not need to be adopted into the Mississippi SIP because they are required by existing, federally enforceable emissions standards and control requirements. These emissions standards and control requirements ensure these sources will continue to implement their existing SO_2 control measures, and thus, will not increase their SO_2 emission rates as discussed further in Section 7.8. These existing SO_2 control measures are not necessary to make reasonable progress towards the visibility goals in the Breton Wilderness Area, specifically. (See Section 4.1 on pages 8-10 of EPA's 2021 Guidance Memo.)

7.8.1. Plant Daniel – Measures Not Necessary for Reasonable Progress

7.8.1.1. Past Implementation of Existing Measures and Historical Emission Rate

Plant Daniel is subject to the Mercury and Air Toxics Standards (MATS) codified in 40 CFR 63, Subpart UUUUU and complies with the SO_2 emission standard of 0.20 lb/MMBtu (30-day rolling average) established by the rule, for which compliance was required by 2016. Plant Daniel is also subject to the Acid Rain Program requirements (2004 to present). Plant Daniel's SO_2 average annual facility-wide emission rate (lb/MMBtu) has declined by 99% since 2000, and annual emissions (tons) have also decreased by approximately 99%, which can be seen below in Table 7-25. Also, as noted in this table, following installation of control equipment on the coal-fired EGUs in 2016 to comply with MATS, the SO_2 emission rates at Plant Daniel have been consistently low, further substantiated by the data presented in Table 7-19 and Table 7-20.

Table 7-25: Plant Daniel SO_2 Emissions and Heat Input 1999-2022

Year	SO_2 Emissions (tons)	Heat Input (MMBtu)	SO_2 Emission Rate (lb/MMBtu)
1999	24,352	63,774,308	0.764
2000	27,008	68,927,069	0.784
2001	28,806	103,697,381	0.556
2002	27,207	97,326,502	0.559
2003	27,611	81,436,378	0.678
2004	31,243	100,503,731	0.622
2005	29,036	99,062,181	0.586
2006	31,767	103,697,208	0.613
2007	32,135	101,563,412	0.633
2008	27,029	98,684,673	0.548
2009	19,891	99,828,753	0.399
2010	20,818	97,987,832	0.425
2011	10,126	76,897,485	0.263
2012	7,033	75,584,351	0.186
2013	7,785	72,861,983	0.214
2014	14,898	91,307,172	0.326
2015	8,412	84,734,204	0.199
2016	156	77,441,183	0.004
2017	205	80,479,799	0.005
2018	253	86,019,529	0.006
2019	224	81,993,742	0.005
2020	181	86,375,918	0.004
2021	169	89,559,275	0.004
2022	302	87,013,955	0.007

7.8.1.2. Projected Emissions and Emission Rate

VISTAS projected Plant Daniel's 2028 annual SO_2 emissions to be around 6% higher than the average of the most recent four-year period (2019-2022), with an estimate of 232 tons compared to a current average of 219 tons. Annual heat input has stayed consistent over recent years, with an average annual heat input of 83,431,315 MMBtu for the four-year period of 1999-2002 and a current average annual heat input of 86,235,723 MMBtu (2019-2022), an increase of about 3%. Based on the VISTAS 2028 emissions projections, recent average annual SO_2 emissions trends, and heat input value trends, it is reasonable to expect that Plant Daniel's SO_2 emission rate will continue to remain steady for the foreseeable future, assuming both units are not retired altogether by 2027. Additionally, Mississippi Power Company's Integrated Resource Plan indicates they do not project a capacity need until 2031 or later under the various planning scenarios considered, further substantiating the VISTAS 2028 emissions projection as conservative.

7.8.1.3. Enforceable Emissions Limits or Other Requirements Related to the Source's Existing Measures

Plant Daniel's Title V Permit (Permit No.: 1280-00090, available online here[58]) currently includes three applicable emission standards for SO_2:

- Mississippi's SO_2 limit of 4.8 lb/MMBtu per hour heat input in condition 3.B.4;
- Standards of Performance for Fossil-Fuel-Fired Steam Generators (40 CFR 60, Subpart D), specifically 40 CFR 60.43(a)(2) and (b) and 60.45(g)(2)(i), with an SO_2 standard of 1.2 lb/MMBtu heat input when firing coal alone or with wood residue OR ≤ ng/J value obtained from equation

  $$PS = \frac{y(340) + z(520)}{y + z}$$

  in condition when firing a combination of fuels where y is the percentage of total heat input derived from liquid fossil fuel and z is the percentage of total heat input derived from solid fossil fuel, rolling 3-hour average, found in condition 3.B.8; and
- The MATS limit of 0.20 lb/MMBtu (input based) or 1.5 lb/MWh (output based), based on a rolling 30-boiler operating day average, found in condition 3.B.11.

Plant Daniel's existing MATS limit, as incorporated in the federally enforceable Title V Permit, is the most stringent applicable SO_2 emission limit. The MATS rule requires the control devices

[58] URL: https://opcgis.deq.state.ms.us/ensearchonline/ai_info.aspx?ai=1321

be operated at all times that coal is being fired, including startups and shutdowns. Plant Daniel is required to demonstrate compliance with the MATS SO_2 limit using a continuous emissions monitoring system (CEMS).

7.8.2. Chevron Pascagoula Refinery – Measures Not Necessary for Reasonable Progress

7.8.2.1. Past Implementation of Existing Measures and Historical Emission Rate

Under a 2005 settlement agreement, the Chevron Pascagoula Refinery was required to significantly reduce emissions, particularly of SO_2 and NO_x. This Consent Decree resulted in an estimated emission rate reduction of 2,900 lb/hr of SO_2 by imposing certain requirements made enforceable through federally enforceable Construction Permits, in accordance with the terms of the Consent Decree, and incorporated in the Title V Permit. Table 7-26 summarizes the impacts of the Consent Decree on a short-term lb/hr emission rate basis.

Table 7-26: Major BART-eligible Units Involved in the Consent Decree

	Max Daily Averages (2001-2003)			**Future Planned Emissions / Consent Decree**			
	NOx	**SO_2**	**VOC**	**NOx**	**SO_2**	**VOC**	
BART Eligible Unit	*lb/hr*	*lb/hr*	*lb/hr*	*lb/hr*	*lb/hr*	*lb/hr*	**Controls**
F-1603/FCC Regenerator	374	841	111	80	60	99	NOx reducing catalyst
F-2101/Boiler No.1	86	4.3	1.8	0	0	0	Boilers being replaced by ULNB boilers
F-2102/Boiler No.2	82	4.3	1.7	0	0	0	
F-2103/Boiler No.3	84	4.6	1.8	0	0	0	
F-2745/SRU II w/Thermal Oxidizer	2.3	870	0.4	2.3	36	0.36	SCOT tail gas treatment systems
F-2765/SRU III w/Thermal Oxidizer	10.5	730	1.4	10.5	36	1.36	
F-3801/Flare No. 1	8.7	110.8	3.9	0.69	0.003	0.007	Flare gas recovery system
F-3801/Flare No. 2	15.6	213.8	7.0	0.69	0.003	0.007	
F-3801/Flare No. 3	7.3	174.2	3.3	0.69	0.003	0.007	
F-3801/Flare No. 4	4.1	63.3	1.8	0.69	0.003	0.007	
F-6101/6102 Crude Unit No.2 Heaters	282	16.4	5.3	28.16	16.41	5.35	ULNB will be installed
Total Reductions*				**- 832.78**	**- 2884.28**	**- 33.30**	
*This table represents 96% of the SO_2 emissions from BART-eligible units.							

Following the Consent Decree, the Chevron Pascagoula Refinery undertook the Holistic Sulfur Project, initially permitted by a PSD Permit to Construct issued in 2009, resulting in further reductions in SO_2 from the desulfurization of the refinery fuel gas and from the oxygen enrichment project at SRUs II and III. Completion of construction and startup for the Holistic Sulfur Project took place at the end of 2015, with decreases noted after 2015. (Note that under the same PSD Permit to Construct, a new Base Oil Plant was constructed, which resulted in increases of actual emissions, offsetting some decreases from the Holistic Sulfur Project.) Table 7-27 shows significant decreases in annual SO_2 emissions occurring after 2005, with additional annual decreases after 2015.

Table 7-27: Chevron Refinery Annual SO_2 Emissions 2002-2021

Year	SO_2 Emissions (tons)
2002	5,680
2005	6,058
2008	1,369
2009	715
2010	550
2011	772
2012	861
2013	750
2014	653
2015	810
2016	594
2017	668
2018	609
2019	552
2020	524
2021	557

7.8.2.2. Projected Emissions and Emission Rate

VISTAS projected Chevron's 2028 annual SO_2 emissions to be 742 tons. More information on this projection can be found in Section 7.2.4. This 2028 projection of 742 tons SO_2 is 88% less than Chevron's 2005 annual emissions of 6,058 tons and 33% higher than their 2021 emissions of 557 tons. The projected increase in SO_2 emissions over 2021 emissions is not a result of any expansion or anticipated increase in refining capacity but rather a more conservative estimate to ensure modeled visibility impacts from the refinery are sufficiently accounted for. Based on the U.S. "Refinery Capacity Report" published by the U.S. Energy Information Administration available here,[59] refinery capacity has remained quite stable over the past 10 years, fluctuating less than 7% over the course of a decade. Specifically, refining capacity in Mississippi, of which Chevron constitutes roughly 90%, has increased by only 1.1% over the past five years

[59] URL: https://www.eia.gov/petroleum/refinerycapacity/

(Mississippi Number and Capacity Report[60]). Therefore, MDEQ believes the 2028 projections are conservative, since SO_2 emissions are largely a result of the amount of RFG produced during the refining process and subsequently combusted. Current U.S. policies regarding Corporate Average Fuel Economy (CAFÉ) standards, Renewable Fuel Standards (RFS), and electric vehicle subsidies, among others, are intended to reduce the U.S. demand for fossil fuel-derived products and are, therefore, expected to reduce the need for additional refining capacity in the U.S.

7.8.2.3. Enforceable Emissions Limits or Other Requirements Related to the Source's Existing Measures

The PSD Permit to Construct the Pascagoula Base Oil Project and Holistic Sulfur Project was initially issued April 14, 2009, and last modified April 11, 2017, to reflect all "as-built" changes resulting from these projects. This PSD Permit to Construct contains a federally enforceable SO_2 emission limit of 638.8 tons per year (12-month rolling total) on the total SO_2 emissions from all refinery process heaters, furnaces and boilers combusting RFG. This facility-wide SO_2 emission limit is based on an annual average total sulfur content of 75 ppmv in the RFG. The facility-wide ton per year emission limit supersedes all other annual ton per year emission limits on any RFG-fired heaters, furnaces, and boilers. Additionally, the RFG-fired emission sources contain specific federally enforceable short-term emission limits on SO_2 (i.e., lb/hr limits based on 24-hour average) in the PSD Permit to Construct referenced above, and in the existing version of the Title V Permit. The Chevron Pascagoula Refinery must demonstrate compliance with both the annual and short-term limits by either continuously monitoring the total sulfur content of the RFG and amount of RFG combusted by each source or continuously monitoring the SO_2 emissions from the specific RFG-fired emission source. The PSD Permit to Construct also limits SO_2 emissions from SRUs II and III to a total combined emission rate of 42.35 tons per year, as determined on a 12-month rolling total basis using a continuous emissions monitoring system.

With regards to the emission units evaluated for control effectiveness at the Chevron Pascagoula Refinery, a summary of the current enforceable emissions limits are listed below in Table 7-28 and can also be found in the PSD Permit to Construct, last modified April 11, 2017,[61] or the Title V Permit, last modified on January 15, 2014.[62] (The PSD Permit to Construct and Title V Permit can be found online here.[63])

[60] URL: https://www.eia.gov/dnav/pet/xls/PET_PNP_CAP1_DCU_SMS_A.xls

[61] 11 Miss. Admin. Code Pt. 2, R. 2.5.D(4). allows for operation under the Permit to Construct until the application for modification of the Title V Permit is due. Chevron submitted a timely application to renew the Title V permit, which addressed the changes made in the PSD Permit to Construct, issued April 14, 2009, and last modified April 11, 2017.

[62] The Title V regulations in 11 Miss. Admin. Code Pt. 2, Ch. 6 allow a Title V source to continue operating under an expired Title V permit if the source submitted a timely and complete renewal application, which Chevron Pascagoula Refinery did.

[63] URL: https://opcgis.deq.state.ms.us/enonline/ai_info.aspx?ai=2299

Table 7-28: Enforceable SO_2 Limits for Chevron Refinery

Source	Enforceable SO_2 Limits
017/F-1603 (AH-051)	Consent Decree - 05/24/2005 (Title V Permit Condition No. 3.AH.51.1) - 500 lb/hr (3-hr rolling average) - 153.5 tpy (12-month rolling total) - 25 ppmvd @ 0% O_2 (365-day rolling average) - 50ppmvd @ 0% O_2 (7-day rolling average) 40 CFR 60, Subpart J (Title V Permit Condition No. 3.AH.51.4) - Fresh feed sulfur content - 0.30% by weight on a 7-day rolling average, including periods of startup, shutdown, and malfunction.
115/F-6410 (BH-231/BH-232)* (Limits apply to both the heater and natural gas turbine emissions, which are routed to the heater as combustion air.)	PSD Permit to Construct issued April 14, 2009, and last modified April 11, 2017 - 46.0 lb/hr (24-hr rolling average) - Subject to facility-wide annual limit of 638.8 tpy
181/F-8620 (BT-541)* (Limits apply to both the heater and natural gas turbine emissions, which are routed to the heater as combustion air.)	PSD Permit to Construct issued April 14, 2009, and last modified April 11, 2017 - 49.32 lb/hr (24-hr rolling average) - Subject to facility-wide annual limit of 638.8 tpy
529/T-14/T-15 (AZ-571)	Title V (Condition No. 3.B.4.5) - Gas stream incineration since gases are greater than 1 grain per 100 standard cubic feet of H_2S
560/F-7910/20/30/40 (CH-003)**	Title V (Condition No. 3.B.5.8) - 52.24 lb/hr (24-hr rolling average) PSD Permit to Construct issued April 14, 2009, and last modified April 11, 2017 - Subject to facility-wide annual limit of 638.8 tpy
693/F-1101/1102 (AE-013)*	PSD Permit to Construct issued April 14, 2009, and last modified April 11, 2017 - 37.59 lb/hr (24-hr rolling average) - Subject to facility-wide annual limit of 638.8 tpy
694/F-6101/6102 (BE-211)*	Title V (Condition No. 3.B.5.12) - 33.54 lb/hr (24-hr rolling average) PSD Permit to Construct issued April 14, 2009, and last modified April 11, 2017 - Subject to facility-wide annual limit of 638.8 tpy
* Subject to 40 CFR 60, Subpart J (Standards of Performance for Petroleum Refineries), which limits H_2S in the fuel gas to 230 mg/dscm (or 165 ppmv H_2S) ** Subject to 40 CFR 60, Subpart Ja (Standards of Performance for Petroleum Refineries for which construction, reconstruction, or modification commenced after May 14, 2007), which limits H_2S to ≤ 162 ppmv (rolling 3-hr average basis) and ≤ 60 ppmv (365-day rolling average)	

7.8.3. Weight-of-Evidence Conclusion

The weight-of-evidence presented in Sections 7.8.1 and 7.8.2 for Plant Daniel and the Chevron Pascagoula Refinery, respectively, demonstrates that the existing, effective SO_2 control measures are not necessary to incorporate in the Regional Haze SIP for reasonable progress for the following reasons:

- Plant Daniel and the Chevron Pascagoula Refinery will continue to implement their existing, effective SO_2 control measures, as they are necessary for meeting various emission limits and standards derived from applicable federal standards, a consent decree, and/or PSD evaluations and subsequent construction permits, as incorporated into Title V permits.
- The SO_2 emission rates at these two facilities are not expected to increase in the future for the reasons detailed in Sections 7.8.1 and 7.8.2 above. Additionally, as an existing major stationary source, should Chevron request an increase to the permitted SO_2 limits, the request would be treated as a change in the method of operation, requiring a PSD evaluation and potentially both Best Available Control Technology and an analysis of the impairment to visibility at the Breton Wilderness Area as required by Mississippi's PSD regulations in 11 Miss. Admin. Code Pt. 2, Ch. 5.
- Existing SO_2 emissions limits on the affected units at these facilities are housed in federally enforceable permits containing sufficient monitoring, recordkeeping, and reporting to demonstrate compliance with the limits.

Therefore, MDEQ concludes that the existing SO_2 control measures at Plant Daniel and the Chevron Refinery Pascagoula are sufficient for demonstrating these sources will not impact reasonable progress at Class I areas near Mississippi and are also already incorporated in federally enforceable permits such that they may be excluded from the SIP.

7.9. Consideration of Five Additional Factors

Section 51.308(f)(2)(iv) of the Regional Haze Rule requires that states must consider five additional factors when developing a long-term strategy. These five additional factors are:

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

B. Measures to mitigate the impacts of construction activities;

C. Source retirement and replacement schedules;

D. Basic smoke management practices for prescribed fire used for agricultural and wildland vegetation management purposes and smoke management programs; and

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

Factors B and D are addressed below in Section 7.9.1 and Section 7.9.2, respectively.

Factors A and C are addressed in other sections of this document. For Factor A, the emission reductions from ongoing air pollution control programs, including, where applicable, measures to address reasonably attributable visibility impairment, are included in the baseline and 2028 emissions inventories discussed in Section 4 and in Section 7.2. For Factor C, specific existing and planned emission controls are explained in Section 7.2, more specifically in Section 7.2.4 (*Projected VISTAS 2028 Emissions Inventory*) and Section 7.2.5 (*EPA Inventories*).

For Factor E, the anticipated net effect on visibility due to projected changes in point, area, and mobile source emissions over the period addressed by the long-term strategy is discussed in Section 7.2, including the table comparing 2011 actual emissions to 2028 projected emissions, and is reflected in the reasonable progress goals of nearby states' Class I areas which Mississippi may impact.

7.9.1. Dust and Fine Soil from Construction Activities

As discussed in Section 2.3.2, fine soils were a relatively minor contributor to visibility impairment at the Class I areas nearby to Mississippi during the baseline period of 2000-2004. Figure 2-1 and Figure 2-2 show that no VISTAS Class I areas experienced significant visibility impairment from soils during this timeframe. Fine soils continue to be only a minor contributor to visibility at the neighboring Class I areas potentially impacted by Mississippi during the most current period of monitoring data (2014-2018). Figure 2-5 and Figure 2-6 show that no VISTAS Class I areas experienced significant visibility impairment from soils during the 2014-2018 timeframe. Figure 2-7 also shows that the nearby Breton Class I area did not experience significant visibility impairment from soils during the 2014-2018 timeframe.

Mississippi has no specific provisions to mitigate dust emissions from construction activities. However, there are two general State regulations that may be applied to construction activities should dust mitigation be deemed necessary:

(1) 11 Miss. Admin. Code Pt. 2, R. 1.3.C.[64] regulates "general nuisances," including dust generated from material handling, transport, storage or leaving a building or equipment that may cause a public nuisance. MDEQ has required industrial sources to implement dust management plans through a federally enforceable permit mechanism when there is the potential for the day-to-day operations of an industrial source to contribute to dust leaving the site. However, MDEQ has not required such plans to address temporary construction activities.

(2) 11 Miss. Admin. Code Pt. 2, R. 2.5.A.[65] provides a general requirement to perform construction in such a manner to reduce fugitive dust emission from construction activities to a minimum. This general requirement is included in every Permit to Construct air emissions equipment issued by MDEQ.

Given the distance of the closest Class I areas to Mississippi, use of these provisions to reduce dust from construction activities is not anticipated to be necessary to ensure reasonable progress.

7.9.2. Smoke Management

Since there are no Class I areas in Mississippi and the Class I area that is closest and of greatest concern, Breton, is over 45 km offshore, localized prescribed fires will have little impact on the Class I areas in other states. As can be seen in Figure 7-22, elemental carbon from sources including agriculture, prescribed wildland fires, and wildfires, is a relatively minor contributor to visibility impairment at the Class I areas surrounding Mississippi. The Mississippi Forestry Commission finalized Smoke Management Guidelines in 2012, which were last revised in 2022, and are available on their website here.[66] Under current smoke management practices, the Mississippi Forestry Commission, in conjunction with MDEQ, issues burning permits based on daily weather forecasts. A permit is required for any fire set for a recognized agricultural or forestry purpose to qualify for protection under the Mississippi Prescribed Burning Act. More information on prescribed burn permits and implementation by the Mississippi Forestry Commission is available here.[67]

[64] "Air Emission Regulations for the Prevention, Abatement, and Control of Air Contaminants." (Amended May 24, 2018) URL: https://www.mdeq.ms.gov/wp-content/uploads/2018/11/Air-Regs-Chapter-1-Air-Emission-Regulations-Amended-May-24-2018.pdf

[65] "Permit Regulations for the Construction and/or Operation of Air Emissions Equipment." (Amended July 28, 2005) URL: https://www.mdeq.ms.gov/wp-content/uploads/2017/06/11-Miss.-Admin.-Code-Pt.-2-Ch.-2.pdf

[66] URL: www.mfc.ms.gov/wp-content/uploads/2022/08/Voluntary_Smoke_Management_Guidelines_2022.pdf

[67] URL: https://www.mfc.ms.gov/burning-info/request-a-burn-permit/

MDEQ prohibits open burning in the "Air Emission Regulations for the Prevention, Abatement, and Control of Air Contaminants," specifically 11 Miss. Admin. Code Pt. 2, R. 1.3.G.,[68] with exceptions for the following:

(1) Fires set for the burning of agricultural wastes in the field and/or silvicultural wastes for forest management purposes, as permitted by the Mississippi Forestry Commission and discussed above;

(2) Open burning of land-clearing debris meeting certain restrictions; and

(3) Open burning of leaves and other yard waste by residential property owners, only if allowed by local ordinance.

7.10. Consideration of NO_X and Nitrate in Source Selection

As stated in EPA's August 2019 regional haze guidance, "When selecting sources for analysis of control measures, a state may focus on the PM species that dominate visibility impairment at the Class I areas affected by emissions from the state and then select only sources with emissions of those dominant pollutants and their precursors." Both SO_2 and NO_X emissions sources were analyzed during the AoI and PSAT modeling work for consideration in source selection. Identical screening thresholds were used for SO_2/sulfate and NO_X/nitrate. No Mississippi facilities exceeded the PSAT screening threshold for NO_X/nitrate. Also, for the two facilities selected for evaluation of SO_2 emissions reduction measures for demonstrating reasonable progress, MDEQ did not perform any reasonable progress analyses on the NO_X emissions from these sources due to the minimum contribution to visibility impairment relative to SO_2 emissions.

MDEQ concluded that ammonium sulfate is the dominant pollutant impacting visibility at the two nearby Class I areas (i.e., Breton and Sipsey), followed by organic matter carbon (OM or OMC) and ammonium nitrate. Figure 7-32 shows the visibility impairment by species at the Breton Wilderness Area for 2009-2018. Figure 7-33 shows the visibility impairment by species at the Sipsey Wilderness Area for 2000-2019. Although ammonium sulfate has decreased dramatically over these 10-year periods and ammonium nitrate has slightly increase, ammonium sulfate is still the dominant species.

[68] URL: https://www.mdeq.ms.gov/wp-content/uploads/2018/11/Air-Regs-Chapter-1-Air-Emission-Regulations-Amended-May-24-2018.pdf

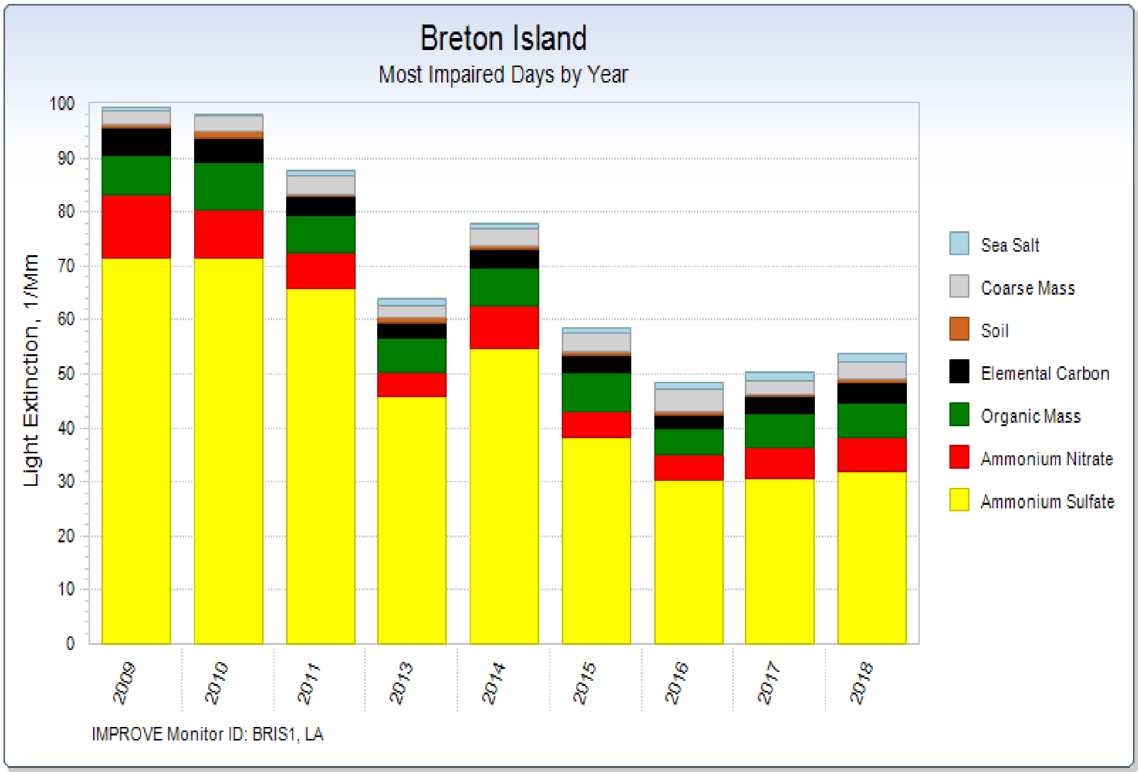

Figure 7-32: Average Light Extinction, Most Impaired Days by Year at Breton

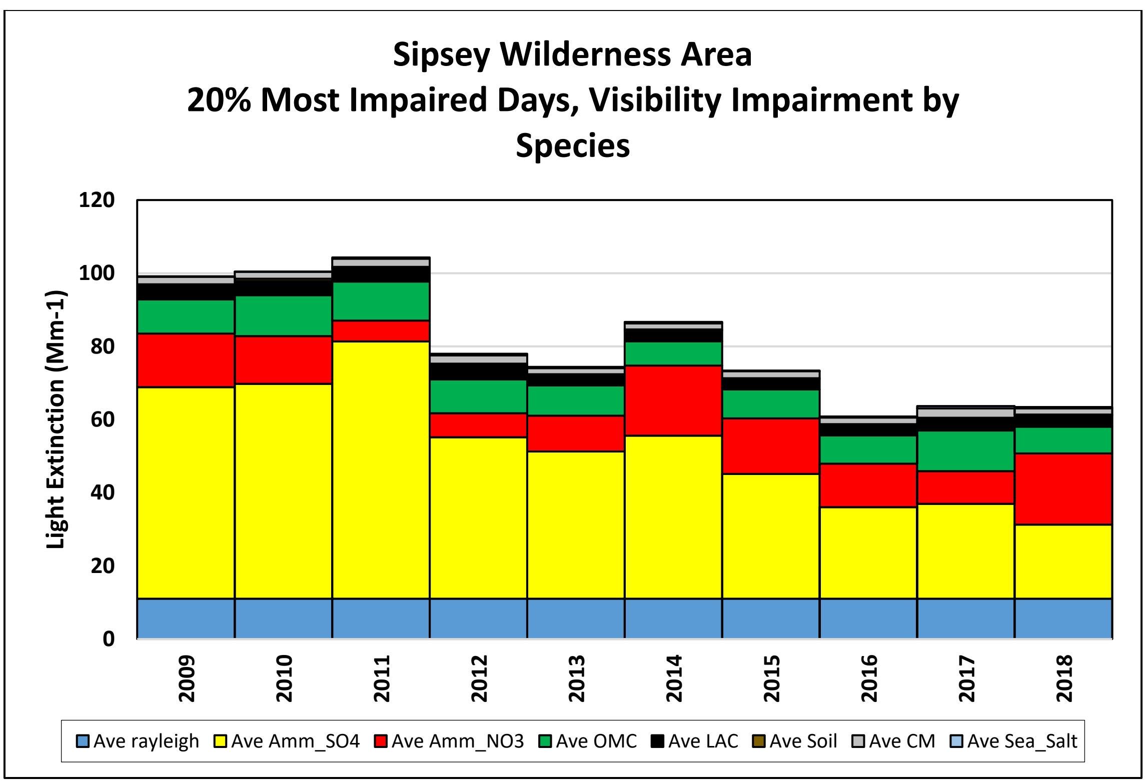

Figure 7-33: Average Light Extinction, Most Impaired Days by Year at Sipsey

The large decreases in sulfate and slight increase in nitrate can be explained by inorganic chemistry and thermodynamics. SO_2 is oxidized to SO_3, which is then oxidized to SO_4 (sulfate). Due to its low vapor pressure, all SO_4 will be found in particulate form: H_2SO_4 (sulfuric acid mist), $(NH_4)HSO_4$ (ammonium bisulfate which is half neutralized), or $(NH_4)_2SO_4$ (ammonium sulfate which is fully neutralized). The amount of free NH_3 in the atmosphere does not impact the amount of sulfate formed, but it will determine which form of sulfate is present (H_2SO_4 vs. $(NH_4)HSO_4$ vs. $(NH_4)_2SO_4$). NO_X is oxidized to HNO_3 (nitric acid), which is a gas, though this reaction is reversible. Under the right conditions (temperatures and available NH_3), HNO_3 is converted to NH_4NO_3, which is a particle. This conversion is reversible ($NH_4NO_3 \leftrightarrow HNO_3 + NH_3$) under the appropriate conditions. NH_3/NH_4 preferentially combines with sulfate. When there is an abundance of sulfate, there is little available NH_3 to form NH_4NO_3. As SO_2 emissions decrease, sulfate concentrations decrease linearly. As sulfate decreases, more NH_3 is available to convert HNO_3 to NH_4NO_3, resulting in increasing nitrate.

IMPROVE assumes all sulfate is $(NH_4)_2SO_4$ and all nitrate is $(NH_4)NO_3$. The extinction coefficients (amount of light extinction per mass of visibility impairing pollutant) used by IMPROVE are slightly higher for ammonium nitrate compared to ammonium sulfate. Also, the molecular weight of $(NH_4)_2SO_4$ is 132 and $(NH_4)NO_3$ is 80. If one sulfate molecule is removed (by reducing SO_2), one $(NH_4)_2SO_4$ molecule is removed, resulting in two NH_3 molecules being freed to form two $(NH_4)NO_3$ molecules. Two $(NH_4)NO_3$ molecules weigh 21.2% more than one $(NH_4)_2SO_4$ molecule (calculated as (80*2)/132=1.212).

The control of ammonium nitrate is dependent on the limiting gaseous pollutant (HNO_3 or NH_3). If NH_3 is the limiting pollutant, reductions of NH_3 will have large benefits and reductions of NOx will have limited benefits until the levels of HNO_3 drop to a level where HNO_3 becomes the limiting pollutant (and vice versa). In the southeastern U.S., nitrate formation is typically limited by available NH_3, which preferentially combines with sulfates first. Therefore, NO_X reductions will have minimal impacts on nitrate concentrations.

Figure 7-34 and Figure 7-35, contain the nitrate PSAT results on the 20% most impaired days for Sipsey Wilderness Area and Breton Wilderness Area, respectively. Figure 7-34 shows that the combined contribution from Mississippi EGU and non-EGU NO_X point sources is (0.001 + 0.029)/6.255 = 0.48% of the total nitrate at Sipsey Wilderness Area. Figure 7-35 shows that the combined contribution from Mississippi EGU and non-EGU NO_X point sources is (0.014 + 0.039)/6.118 = 0.87% of the total nitrate at Breton Wilderness Area. The majority of the nitrate at these Class I areas is coming from states other than Mississippi and from non-point emission sources (e.g., mobile sources).

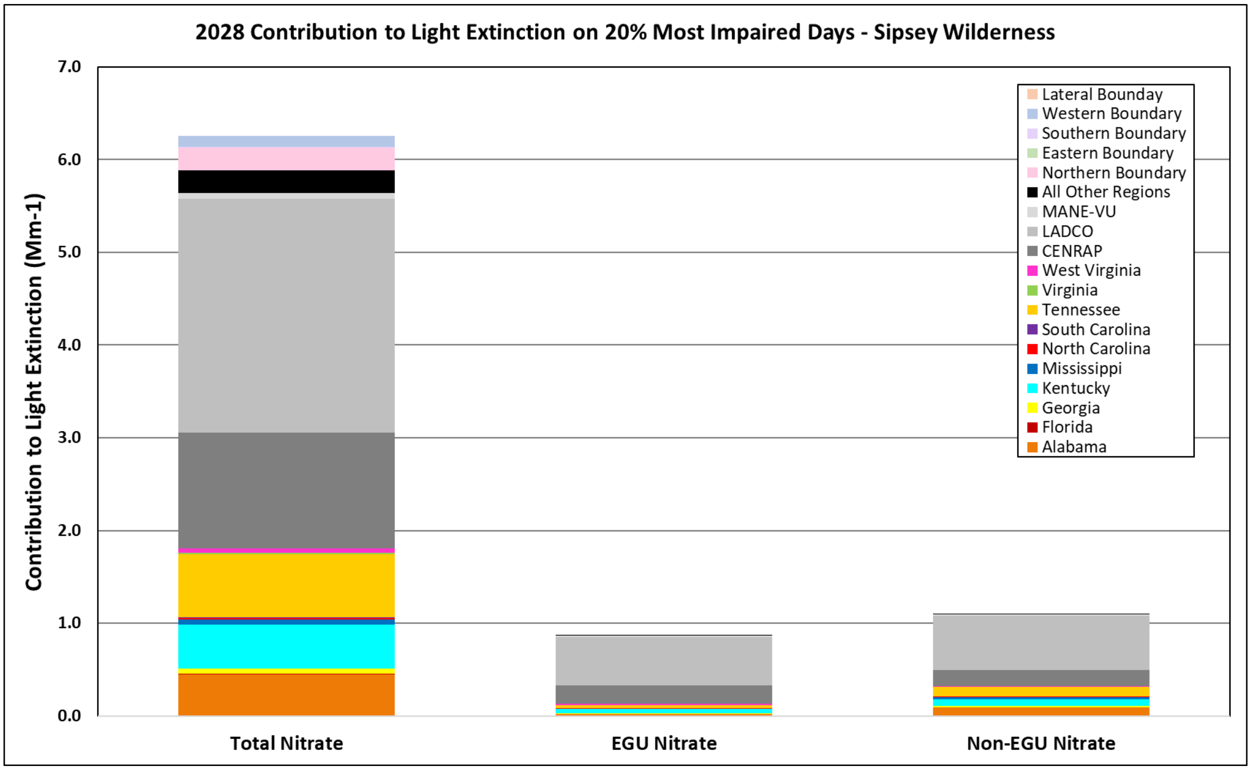

Figure 7-34: 2028 Contribution to Nitrate Light Extinction on the 20% Most Impaired Days at Sipsey Wilderness Area

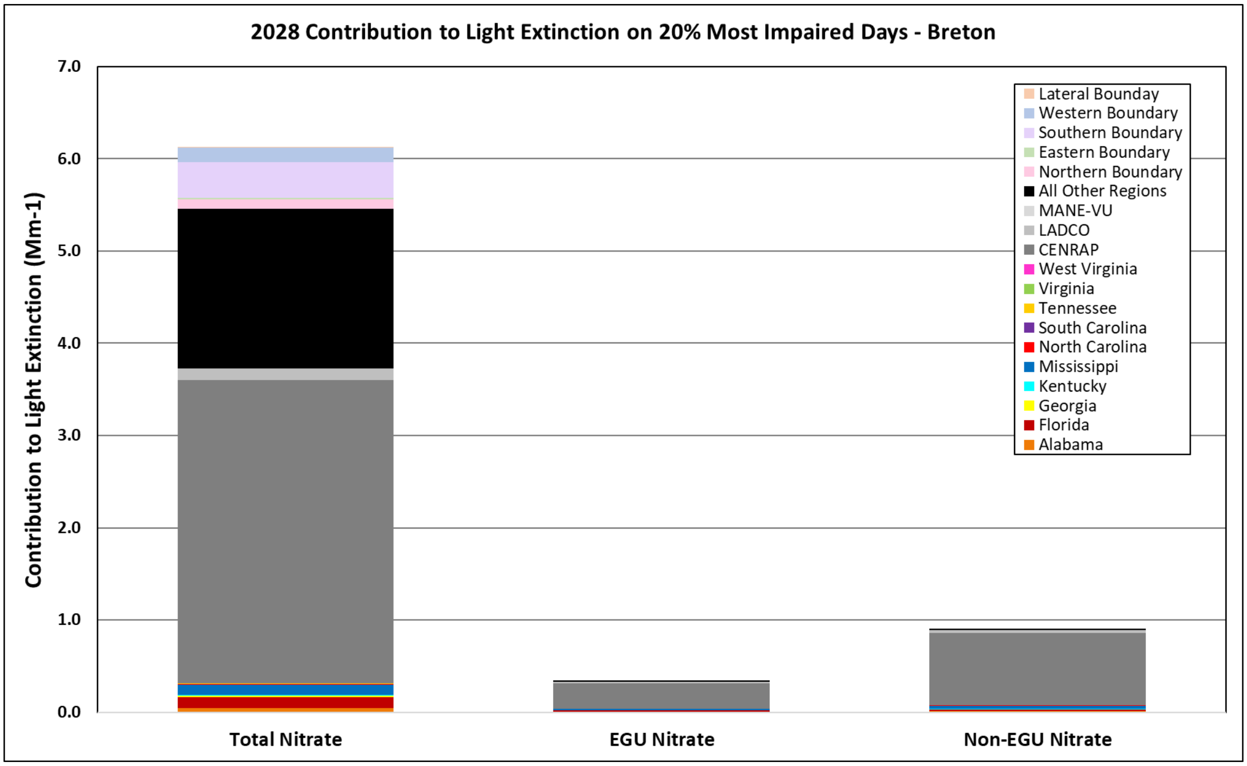

Figure 7-35: 2028 Contribution to Nitrate Light Extinction on the 20% Most Impaired Days at Breton Wilderness Area

Figure 7-20 and Figure 7-21 contain the sulfate and nitrate PSAT results on the 20% most impaired days for Sipsey Wilderness Area and Breton Wilderness Area, respectively. Figure 7-20 shows that the combined contribution from Mississippi EGU and non-EGU NO_X point sources is 0.11% of the total sulfate + nitrate at Sipsey Wilderness Area (i.e., 0.001 + 0.029)/28.251). Figure 7-21 shows that combined contribution from Mississippi EGU and non-EGU NO_X point sources is 0.14% of the total sulfate + nitrate at Breton Wilderness Area (i.e., 0.014 + 0.039)/38.012). The PSAT source apportionment modeling demonstrates that NO_X emissions from all point sources (EGU + non-EGU) in Mississippi contribute less than 1% of the total sulfate + nitrate light extinction at all Class I areas. Therefore, NO_X emissions from individual EGU and non-EGU point sources in Mississippi will contribute even smaller percentages to the total sulfate + nitrate light extinction. Detailed calculations for the combined contribution from Mississippi EGU and non-EGU NO_X point sources to the total sulfate + nitrate are contained in Appendix E-7a.

MDEQ analyzed visibility impairment per ton of SO_2 and per ton of NO_X emissions for the two Mississippi facilities selected for reasonable progress analysis (see Table 7-15). The sulfate visibility impairment per ton of SO_2 emissions was compared against the nitrate visibility impairment per ton of NO_X emissions as a ratio as follows:

$$Ratio\ (facility, Class\ I\ area) = \frac{\left[\frac{Sulfate\ visibility\ impairment\ in\ Mm^{-1}}{2028\ SO_2\ emissions\ in\ tpy}\right]}{\left[\frac{Nitrate\ visibility\ impairment\ in\ Mm^{-1}}{2028\ NO_X\ emissions\ in\ tpy}\right]}$$

The sulfate/ton to nitrate/ton ratios by facility at the Sipsey Wilderness Area and Breton Wilderness Area are shown in Table 7-29. (The cells with "#DIV/0!" indicate a nitrate PSAT visibility impact of zero associated with NO_X emissions.) Sulfate visibility impacts per ton are higher than nitrate visibility impacts per ton. For example, the sulfate/ton to nitrate/ton ratio at the Breton Wilderness Area is 45.6 for Plant Daniel and 35.8 for Chevron Pascagoula Refinery. This means that the reduction of one ton of SO_2 at Plant Daniel will have the equivalent effect of reducing 45.6 tons of NO_X, and the reduction of one ton of SO_2 at Chevron Pascagoula Refinery will have the equivalent effect of reducing 35.8 tons of NO_X. These results clearly indicate that SO_2 emission reductions have a significantly higher benefit on improving visibility at these Class I areas compared to controlling NO_X emissions. This supports MDEQ's decision to focus on SO_2 emission reductions for this second planning period.

Table 7-29: Facility-Level Comparison of Sulfate versus Nitrate Visibility Impairment for Breton Wilderness Area and Sipsey Wilderness Area

Facility ID	Facility Name	2028 Sulfate Visibility Impairment in Mm^{-1}		2028 SO_2 emissions (tons)	2028 Nitrate Visibility Impairment in Mm^{-1}		2028 NOx Emissions (tons)	Breton Ratio	Sipsey Ratio
		Breton	Sipsey		Breton	Sipsey			
6251011	Mississippi Power Co, Plant Victor J Daniel	0.017	0.002	232	0.006	0.000	3736	45.6	#DIV/0!
8384311	Chevron Products Co, Pascagoula Refinery	0.052	0.002	742	0.003	0.000	1534	35.8	#DIV/0!

In summary, NO_X/nitrate was evaluated in the source selection approach. However, no NO_X/nitrate sources were selected for a reasonable progress analysis because no facilities exceeded the NO_X/nitrate screening thresholds in step 2 of the two-step selection process (i.e., PSAT modeling), and the PSAT modeling clearly demonstrated that contributions from Mississippi's point source NO_X emissions is insignificant. Therefore, additional NO_X controls would not be reasonable. Specifically, the PSAT source apportionment modeling demonstrates that NO_X emissions from all point sources (EGU + non-EGU) in Mississippi contribute less than 1% of the total sulfate + nitrate light extinction at all Class I areas. Therefore, NO_X emissions from individual EGU and non-EGU point sources in Mississippi will contribute even smaller percentages to the total sulfate + nitrate light extinction. Although the contribution to visibility impairment from sulfates has decreased and the contribution from nitrates has slightly increased, sulfates are still the dominant visibility impairing species at the Breton and Sipsey Wilderness Areas. If sulfates continue to decrease and nitrates continue to increase in the future, it may be appropriate to consider NO_X emission sources for reasonable progress analyses in Mississippi's Regional Haze SIP for future planning periods.

7.11. Summary of Long-Term Strategy

In conclusion, Mississippi's long-term strategy will continue to rely on 1) existing federal standards documented in Section 7.2.1 and 2) the State's authorized Prevention of Significant Deterioration program in 11 Miss. Admin. Code Pt. 2, Ch. 5[69] which requires major sources and major modifications to specifically evaluate impacts of $PM_{2.5}$ and its precursors (i.e., NO_X and SO_2) to Class I areas. As documented in Section 7.8, the weight-of-evidence approach used to evaluate the two selected facilities in Mississippi demonstrates that the existing, effective SO_2 control measures are not necessary to incorporate in the Regional Haze SIP for reasonable progress.

Mississippi has no Class I areas, and no surrounding states or FLMs requested consultation with Mississippi concerning any of Mississippi's emissions sources during the second planning period. As noted in Table 7-2, Mississippi projects significant decreases in both SO_2 and NO_X

[69] URL: https://www.mdeq.ms.gov/wp-content/uploads/2017/06/11-Miss.-Admin.-Code-Pt.-2-Ch.-5-Amended-April-28-2016-website-version.pdf.

from anthropogenic sources (excluding prescribed fires) through 2028, with state-wide SO_2 emissions decreases of 81% and state-wide NO_X emissions decreases of 54%. Mississippi expects such downward trends to continue with planned retirements of EGUs, a nationwide move towards electrification and decreasing dependence on fossil fuels, and an impending, more stringent primary $PM_{2.5}$ NAAQS. The projected 2028 emissions of SO_2 and NO_X from Mississippi constitute only 2.7% and 6.2% of the total emissions from all VISTAS states. Mississippi's projected contributions to visibility in 2028, measured as light extinction (Mm^{-1}), from natural and anthropogenic sources are only 1.2% and 1.9% of total sulfate and nitrate contributions, respectively, at Breton Wilderness Area and only 0.3% and 0.9% of total sulfate and nitrate contributions, respectively, at Sipsey Wilderness Area. These factors coupled with the robust visibility modeling performed by VISTAS demonstrate that Mississippi sources collectively have a negligible impact on visibility in Class I areas such that additional control measures are not required as part of Mississippi's long-term strategy to support reasonable progress in Class I areas.

8. Reasonable Progress Goals (RPGs)

The rule at 40 CFR 51.308(f)(3) requires states with Class I areas to establish RPGs in units of deciviews for each Class I area within the state that reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period (2028), as a result of those enforceable emissions limitations, compliance schedules, and other measures required that can be fully implemented by the end of the applicable implementation period (2028), as well as the implementation of other requirements of the CAA. The long-term strategy and the RPGs must provide for an improvement in visibility for the most impaired days since the baseline period and ensure no degradation in visibility for the clearest days since the baseline period. Mississippi is not required to establish RPGs under 40 CFR 51.308(f)(3) because the State has no Class I areas.

If a state in which a mandatory federal Class I area is located establishes an RPG for the most impaired days that provides for a slower rate of improvement in visibility than the URP, the state must demonstrate, based on the analysis required by 40 CFR 51.308(f)(2)(i), that there are no additional emission reduction measures for anthropogenic sources in the state that may reasonably be anticipated to contribute to visibility impairment in the Class I area that would be reasonable to include in the long-term strategy. (See 40 CFR 51.308(f)(3)(ii)(A) for additional requirements.)

Further, if a state contains sources that are reasonably anticipated to contribute to visibility impairment in a mandatory federal Class I area in another state for which that state has established an RPG that provides for slower rate of improvement in visibility than the URP, the state must demonstrate that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the state that may reasonably be anticipated to contribute to visibility impairment in the Class I area that would be reasonable to include in its own long-term strategy. (See 40 CFR 51.308(f)(3)(ii)(B).) MDEQ is not aware of any sources in Mississippi that are reasonably anticipated to contribute to visibility impairment in a Class I area in another state for which an RPG has been established that would adversely impact the projected rate of improvement in visibility through 2028.

It is notable that the RPGs established in a SIP are not directly enforceable, but the RPGs can be used to evaluate whether the SIP is adequately providing reasonable progress towards achieving natural visibility. (See 40 CFR 51.308(f)(3)(iii).)

Since there are no Class I areas in Mississippi, there are no RPGs for Mississippi to set. The RPGs for the Class I areas in neighboring states will be set by those states. Mississippi has worked collaboratively with all of the VISTAS states by meetings, conference calls and sharing Regional Haze SIP Pre-hearing Drafts. Because there are no Class I areas in Mississippi, MDEQ worked with neighboring states on emissions contributing to visibility impairment in their Class I areas. Mississippi is in agreement with the RPGs for the Class I areas in the neighboring states.

9. Monitoring Strategy

The SIP is to be accompanied by a strategy for monitoring regional haze visibility impairment under 40 CFR 51.308(f)(6). States with no Class I areas, such as Mississippi, are only required to address 40 CFR 51.308(f)(6)(iii) and (v) related to procedures for monitoring data and a statewide emissions inventory, respectively. The Regional Haze Rule states at 40 CFR 51.308(f)(6):

> (6) The State must submit with the implementation plan a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment that is representative of all mandatory Class I Federal areas within the State. Compliance with this requirement may be met through participation in the Interagency Monitoring of Protected Visual Environments network. The implementation plan must also provide for the following:
>
>> (i) The establishment of any additional monitoring sites or equipment needed to assess whether reasonable progress goals to address regional haze for all mandatory Class I Federal areas within the State are being achieved.
>>
>> (ii) Procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I Federal areas both within and outside the State.
>>
>> (iii) For a State with no mandatory Class I Federal areas, procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I Federal areas in other States.
>>
>> (iv) The implementation plan must provide for the reporting of all visibility monitoring data to the Administrator at least annually for each mandatory Class I Federal area in the State. To the extent possible, the State should report visibility monitoring data electronically.
>>
>> (v) A statewide inventory of emissions of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I Federal area. The inventory must include emissions for the most recent year for which data are available and estimates of future projected emissions. The State

must also include a commitment to update the inventory periodically.

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

Such monitoring is intended to provide the data needed to satisfy four objectives:

- Track the expected visibility improvements resulting from emissions reductions identified in this SIP.
- Better understand the atmospheric processes of importance to haze.
- Identify chemical species in ambient particulate matter and relate them to emissions from sources.
- Evaluate regional air quality models for haze and construct RRFs for using those models.

The primary monitoring network for regional haze nationwide is the IMPROVE network.[70] Given that IMPROVE monitoring data from 2000-2004 serves as the baseline for the regional haze program, the future regional haze monitoring strategy must necessarily be based on, or directly comparable to, IMPROVE. The IMPROVE measurements provide the only long-term record available for tracking visibility improvement or degradation, and, therefore, Mississippi intends to rely on the IMPROVE network for complying with the regional haze monitoring requirements in the rule.

Figure 9-1 shows the IMPROVE monitoring network for the VISTAS Region.

[70] IMPROVE is a cooperative measurement effort managed by a Steering Committee that consists of representatives from various organizations (EPA, NPS, USFS, FWS, BLM, NOAA, four organizations representing state air quality organizations (NACAA, WESTAR, NESCAUM, and MARAMA), and three Associate Members: AZ DEQ, Env. Canada, and the South Korea Ministry of Environment). The IMPROVE program establishes current visibility and aerosol conditions in mandatory Class I areas; identifies chemical species and emission sources responsible for existing man-made visibility impairment; documents long-term trends in visibility; and provides regional haze monitoring at mandatory federal Class I areas. (Source: http://vista.cira.colostate.edu/Improve/improve-program/) The National Park Service (NPS) manages and oversees the IMPROVE monitoring network. The IMPROVE monitoring network samples particulate matter from which the chemical composition of the sampled particles is determined. The measured chemical composition is then used to calculate visibility. Samples are collected and data are reviewed, validated, and verified by NPS/NPS contractors before submission to EPA's Air Quality System (AQS), https://www.epa.gov/aqs). The network also posts raw (http://views.cira.colostate.edu/fed/) and summary data (http://vista.cira.colostate.edu/Improve/rhr-summary-data/) to assist states and local air agencies and multijurisdictional organizations. Details about the IMPROVE monitoring network and procedures are available at http://vista.cira.colostate.edu/Improve/.

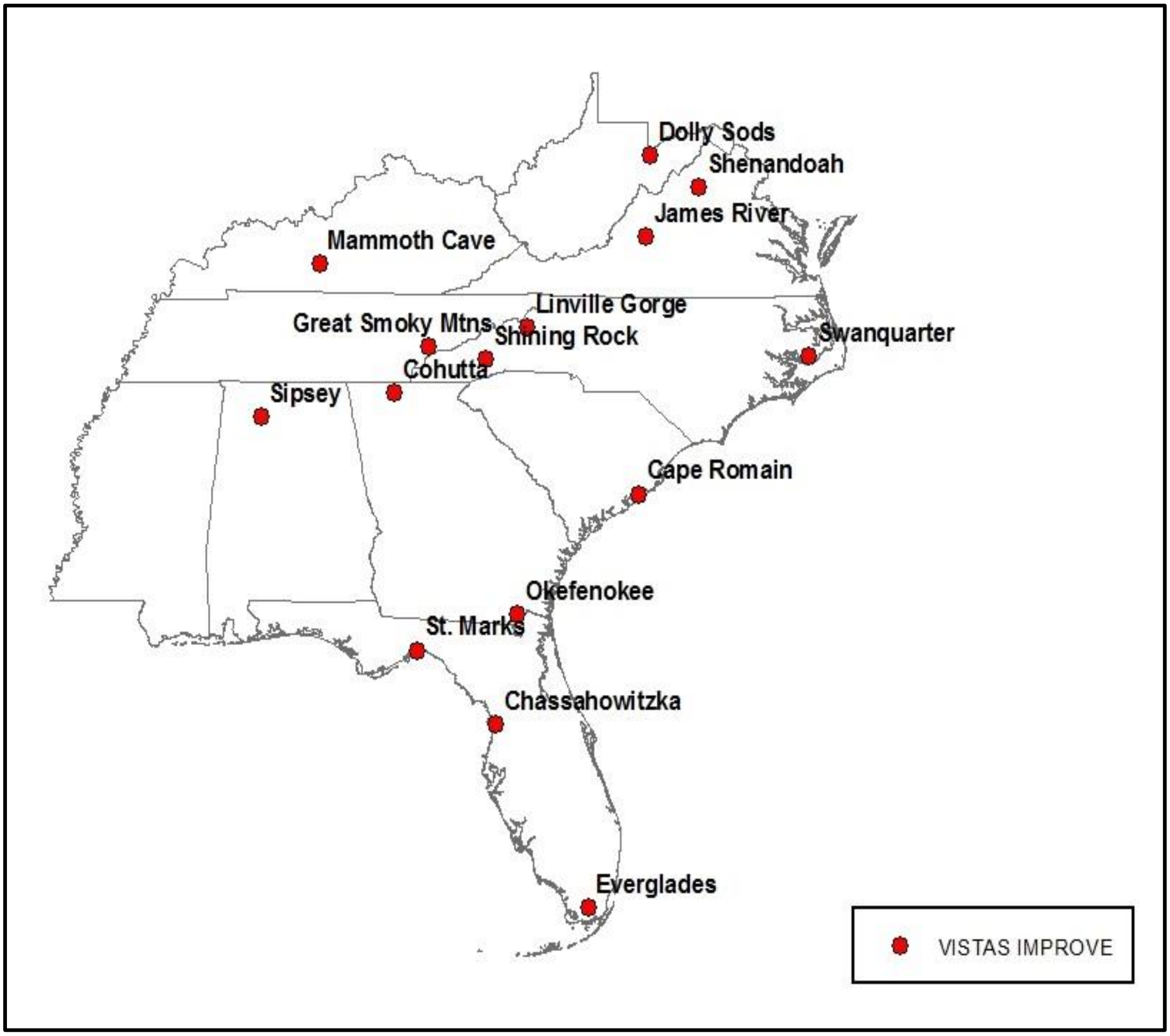

Figure 9-1: VISTAS States IMPROVE Monitoring Network

The IMPROVE measurements are central to the VISTAS states' regional haze monitoring strategies. Any reduction in the scope of the IMPROVE network in the neighboring Class I areas could jeopardize the State's ability to demonstrate reasonable progress toward visibility improvement in neighboring Class I areas and plan for appropriate future programs. In particular, Mississippi's regional haze strategy relies on emission reductions that will result from federal and state programs in both Mississippi and in neighboring states, which occur on different time scales and will most likely not be spatially uniform. Monitoring at Class I areas is important to document the different air quality responses to the emissions reductions that occur in those unique air sheds during the second implementation period to document reasonable progress.

Because the current IMPROVE monitors in the VISTAS Class I areas represent unique airsheds and a significant component of the contributions are regional, any reduction of the IMPROVE network by shutting down these monitoring sites impedes tracking progress or planning improvements at the affected Class I areas.

Data produced by the IMPROVE monitoring network will be used for preparing the five-year progress reports and the 10-year comprehensive SIP revisions, each of which relies on analysis of the preceding five years of data. Consequently, the monitoring data from the IMPROVE sites needs to be readily available and up to date. Presumably, the IMPROVE network will continue to process information from its own measurements at about the same pace and with the same attention to quality as it has shown to date. A website has been maintained by Colorado State University, FLMs, and RPOs to provide ready access to the IMPROVE data and data analysis tools. These databases provide a valuable resource for states and the funding and necessary upkeep of the repository is crucial.

The remainder of this section addresses the requirements of 40 CFR 51.308(f)(6). Mississippi relies on the IMPROVE monitoring network to fulfill the requirements for states with no Class I areas in paragraph 40 CFR 51.308(f)(6).

- 40 CFR 51.803(f)(6)(i): This provision applies only to states with Class I areas. Thus, Mississippi is not required to address this requirement.

- 40 CFR 51.308(f)(6)(ii): This provision applies only to states with Class I areas. Thus, Mississippi is not required to address this requirement.

- 40 CFR 51.308(f)(6)(iii): This provision is for states with no mandatory Class I Federal areas and thus, applies to Mississippi. For a state with no Class I areas, the state must provide for procedures by which monitoring data and other information are used in determining the contribution of emissions from within the state to regional haze visibility impairment at Class I areas in other states. MDEQ will use data produced by the IMPROVE monitoring network for preparing the five-year progress reports and the 10-year comprehensive SIP revisions, each of which rely on analysis of the preceding five years of IMPROVE monitor data.

- 40 CFR 51.308(f)(6)(iv): This provision applies only to states with Class I areas. Thus, MDEQ is not required to address this requirement.

- 40 CFR 51.308(f)(6)(v): The requirements of 40 CFR 51.308(f)(6)(v) are addressed in Section 4, Section 7.2.4, and Section 13.1 of the SIP. Section 4 provides the 2011 Baseline Emissions Inventory for MS (Table 4-1) and the 2011 SO_2 emissions inventory for Mississippi shown by major source categories (Figure 4-2). Section 7 includes Table 7-2 which lists the criteria pollutants, excluding lead, for Mississippi and the VISTAS states for 2011 and 2028 (projected). MDEQ will continue to participate in SESARM/VISTAS efforts for projecting future emissions and will continue to comply with the AERR to update emissions inventories annually and triennially, in accordance with the AERR regulations in 40 CFR Part 51, Subpart A and MDEQ's Emissions Inventory Quality Assurance Project Plan (QAPP) last approved by EPA on April 12, 2018.

- 40 CFR 51.308(f)(6)(vi): This provision applies only to states with Class I areas. Thus, MDEQ is not required to address this requirement.

10. Consultation Process

The VISTAS states have jointly developed the technical analyses that define the amount of visibility improvement that can be achieved by 2028 as compared to the uniform rate of progress for each Class I area. VISTAS initially used an AoI analysis to identify the areas and source sectors most likely contributing to poor visibility in Class I areas. This AoI analysis involved running the HYSPLIT Model to determine the origin of the air parcels affecting visibility within each Class I area. This information was then spatially combined with emissions data to determine the pollutants, sectors, and individual sources that are most likely contributing to the visibility impairment at each Class I area. This information indicated that the pollutants and sector with the largest impact on visibility impairment in 2028 were SO_2 and NO_X from point sources. Next, VISTAS states used the results of the AoI analysis to identify sources to “tag” for PSAT modeling. PSAT modeling uses "reactive tracers" to apportion particulate matter among different sources, source categories, and regions. PSAT was implemented with the CAMx photochemical model to determine visibility impairment due to individual sources. PSAT results showed that in 2028 the majority of visibility impairment at VISTAS Class I areas will continue to be from point source SO_2 and NO_X emissions. Using the PSAT data, VISTAS states identified, for the reasonable progress analyses, sources shown to have a sulfate or nitrate impact on one or more Class I areas greater than or equal to 1.00% of the total sulfate plus nitrate point source visibility impairment on the 20% most impaired days for each Class I area. The states collectively accept the conclusions of these analyses for use in evaluating reasonable progress.

10.1. Interstate Consultation

10.1.1 Statewide Contributions to Visibility Impairment

In accordance with 40 CFR 51.308(f)(2), MDEQ used the results of the PSAT analysis to determine how Mississippi’s state-wide emissions may affect Class I areas outside of Mississippi.

In the PSAT analysis, VISTAS tagged statewide emissions of SO_2 and NO_x. Although PM is another pollutant that can contribute to visibility impairment, VISTAS did not tag PM emissions in the PSAT analysis after concluding that SO_2 and NO_x emissions, particularly from point sources, are projected to have the largest impact on visibility impairment in 2028. Table 10-1 below shows the relative contribution of Mississippi’s SO_2 and NO_x emissions to sulfate and nitrate visibility impairment at 57 Class I areas, compared to the relative contribution from other states and RPOs. Table 10-1 shows the top ten Class I areas outside of Mississippi impacted by Mississippi emissions, ranked by absolute impact in inverse megameters. All Class I areas listed, except for Breton Wilderness Area in Louisiana, Mingo Wilderness Area in Missouri, and Upper Buffalo Wilderness in Arkansas, are VISTAS Class I areas. MDEQ consulted with all the

VISTAS states throughout the SIP development process. MDEQ also directly consulted with the LDEQ, and MDEQ also participated in CENSARA regional haze coordination calls, which included consultation with Missouri and Arkansas. LDEQ did not consider Mississippi to significantly impact Breton and did not request consultation with Mississippi.

Table 10-1: Top Ten Class I Areas impacted by Mississippi emissions of SO_2 and NO_x, ranked by absolute impact

Site ID	State	% Impact	Absolute Impact (Mm^{-1})
BRET2	LA	0.80%	0.51
SAMA	FL	0.61%	0.32
CHAS	FL	0.49%	0.27
MING	MO	0.30%	0.21
MACA	KY	0.18%	0.12
SIPS	AL	0.23%	0.12
UPBU	AR	0.20%	0.12
OKEF	GA	0.20%	0.11
SHRO	NC	0.23%	0.10
JOYC	NC	0.21%	0.09

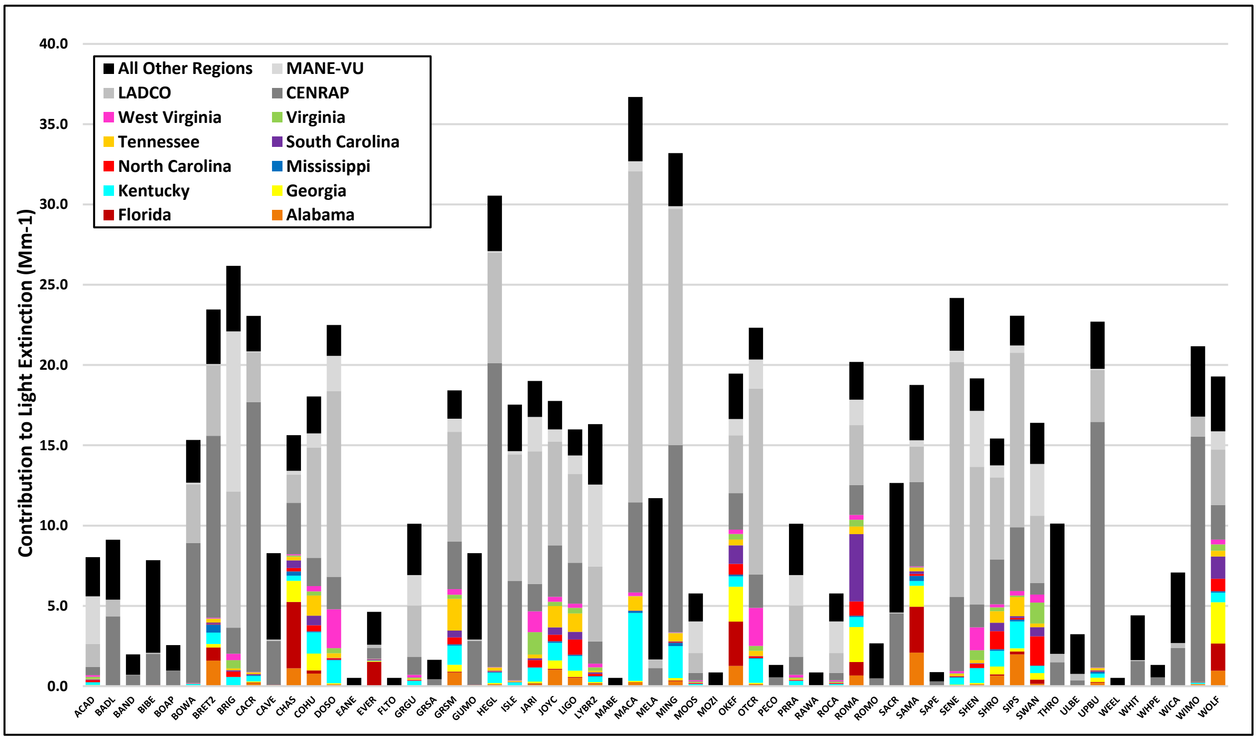

Figure 10-1: Relative contribution to sulfate and nitrate visibility impairment from SO_2 and NO_X emissions from all anthropogenic and natural sources

10.1.2 Source Contributions to Visibility Impairment

In evaluating controls needed to assess reasonable progress, MDEQ first evaluated whether any emissions sources met its source selection criteria. Next, MDEQ consulted with neighboring states to assess whether any Mississippi sources were reasonably anticipated to contribute to visibility impairment at any nearby Class I areas. No states contacted MDEQ with a request to perform a reasonable progress control analysis for any Mississippi sources. MDEQ also did not receive any letters from other states requesting that MDEQ select sources for an emissions control analysis. MDEQ and LDEQ discussed whether Louisiana had identified any Mississippi sources as impacting visibility at Louisiana's only Class I area, Breton Wilderness Area, and Louisiana confirmed they had not identified any Mississippi sources using the LDEQ source selection methodology. MDEQ evaluated whether any of its emissions sources met the PSAT 1.00% threshold for Class I areas outside of Mississippi. Because no Mississippi sources met this threshold, MDEQ selected two sources to evaluate for controls, with the evaluation discussed in Section 7.

10.2. Outreach

The VISTAS states, including Mississippi, participated in national conferences and consultation meetings with other states, RPOs, FLMs, and EPA throughout the SIP development process to share information. VISTAS held calls and webinars with FLMs, EPA, RPOs and their member states, and other stakeholders (industry and non-governmental organizations) to explain the overall analytical approach, methodologies, tools, and assumptions used during the SIP development process and considered their comments along the way. The chronology of these meetings and conferences is presented in Table 10-2.

Table 10-2: Summary of VISTAS Consultation Meetings and Calls

Date	Meetings and Calls	Participants
December 5-7, 2017	Denver, CO, National Regional Haze Meeting – VISTAS States gave several presentations	FLMs; EPA OAQPS[1], Region 3, Region 4; RPOs; various VISTAS agency attendees
January 31, 2018	Teleconference and VISTAS Presentation	FLMs, EPA Region 4
August 1, 2018	Teleconference and VISTAS Presentation	FLMs, EPA OAQPS, Region 3, Region 4
September 5, 2018	Teleconference and VISTAS Presentation	RPOs, CC[2]/TAWG[3]
June 3, 2019	Teleconference and VISTAS Presentation	FLMs; EPA OAQPS, Region 3, Region 4; CC/TAWG
October 28-30, 2019	St Louis, MO, National Regional Haze Meeting – VISTAS States gave presentations	FLMs; EPA OAQPS, Region 3, Region 4; RPOs; various VISTAS agency attendees
April 2, 2020	Teleconference and VISTAS Presentation	FLMs; EPA OAQPS, Region 3, Region 4; CC/TAWG
April 21, 2020	Webinar and VISTAS Presentation	RPOs, CC/TAWG

Date	Meetings and Calls	Participants
May 11, 2020	Webinar and VISTAS Presentation	FLMs; EPA OAQPS, Region 3, Region 4; CC/TAWG
May 20, 2020	Webinar and VISTAS Presentation	Stakeholders; FLMs; EPA OAQPS, Region 3, Region 4; RPOs; and member states, STAD, CC/TAWG
August 4, 2020	Webinar and VISTAS Presentation	FLMs; EPA OAQPS, Region 3, Region 4; RPOs and Member States; CC/TAWG
October 26, 2020	Fall 2020 EPA Region 4 and State Air Director's Call - Webinar and VISTAS Presentation	EPA Region 3, EPA Region 4

[1]Office of Air Quality Planning and Standards (OAQPS)
[2]VISTAS Coordinating Committee (CC)
[3]VISTAS Technical Advisory Work Group (TAWG)

Beginning in January 2018, VISTAS held the first of several formal consultation calls with EPA and the FLMs to review the methodologies used to evaluate source lists for four-factor analyses. The development of AoIs for each Class I area with the HYSPLIT model was presented to identify source regions for which additional controls might be considered and that are likely to have the greatest impact on each Class I area. Additionally, information was shared on how states identified specific facilities within the AoIs to be tagged by the CAMx photochemical model to further identify impacts associated with those facilities on each Class I area. Based on the results of these two analyses, each state agreed to evaluate reasonable control measures for sources that met or exceeded individual state thresholds for four-factor analyses. Each state would consider sources within their state and would identify sources in neighboring states for consideration. States acknowledged that the review process would differ among states since some Class I areas are projected to see visibility improvements near the uniform rate of progress while most Class I areas are projected to have greater improvements than the uniform rate of progress.

Subsequent calls were held with EPA, FLMs and stakeholders to share revised analyses of sources in their state and neighboring states for each Class I area, as well as their criteria for listing sources and their plans for further interstate consultation. Documentation of these calls can be found in Appendix F-3.

Additionally, MDEQ attended a National Regional Haze Conference in St. Louis, Missouri in October 2019 to discuss national and regional modeling to date and to plan next steps for submitting 2028 regional haze SIPs. MDEQ was part of a southeastern state breakout session with FLMs and EPA discussing the modeling and future expectations from all parties. MDEQ also regularly participated in CENRAP calls, which discussed issues specific to the Breton Wilderness Area located on the Chandeleur Island chain off the coast of Louisiana.

10.3. Federal Land Manager (FLM) Consultation

As required by 40 CFR §51.308(i), the regional haze SIP must include procedures for continuing consultation between the States and Federal Land Managers (FLMs) pertaining to visibility protection. The FLMs are comprised of these agencies:

- Fish and Wildlife Service (FWS), under U.S. Department of Interior
- National Park Service (NPS), under U.S. Department of Interior
- Forest Service (FS), under U.S. Department of Agriculture

The requirements for ongoing State and FLM consultation and how MDEQ will comply with the requirements are described in the following paragraphs.

- 40 CFR 51.308(i)(2) requires the State to provide the FLMs with an opportunity for consultation, in person and at least 60 days prior to holding a public hearing on a SIP revision. The consultation must include the opportunity for the FLMs to discuss their:
  - Assessment of visibility impairment in the Class I area; and
  - Recommendations on the development of the reasonable progress goal and on the development and implementation of strategies to address visibility impairment.

  Records of MDEQ consultations with the FLMs on this Regional Haze SIP are included in Appendices F-3o and G.

- 40 CFR 51.308(i)(3) requires the State to incorporate into any SIP or SIP revision a description of how it addressed comments provided by the FLMs. The comments on the SIP and the description of how they were addressed will be included in Appendix G.

- 40 CFR 51.308(i)(4) requires the plan (or plan revision) to include procedures for continuing consultation between the State and Federal Land Managers on the implementation of the visibility protection program, including development and review of implementation plan revisions and 5-year progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibility in mandatory Class I Federal areas. MDEQ will consult with the FLMs upon request as needed on any regional haze issues.

11. Comprehensive Periodic Implementation Plan Revisions

40 CFR 51.308(f) requires Mississippi to revise its regional haze SIP and submit a plan revision to the EPA by July 31, 2021, July 31, 2028, and every ten years thereafter. This plan is submitted in order to meet the July 31, 2021, requirement. In accordance with the requirements listed in 40 CFR 51.308(f) of the RHR, Mississippi commits to revising and submitting this regional haze SIP by July 31, 2028, and every ten years thereafter.

In addition, 40 CFR 51.308(g) requires periodic reports evaluating progress towards the RPGs established for each mandatory Class I area affected by the state. The periodic reports are due by January 31, 2025; July 31, 2033; and every ten years thereafter. Mississippi commits to meeting all of the requirements for 40 CFR 51.308(g), including revising and submitting a regional haze progress report by January 31, 2025; July 31, 2033; and every ten years thereafter.

The progress report will evaluate the progress made towards the RPG for each of the mandatory federal Class I areas located within a state and in each mandatory federal Class I area located outside of a state that may be affected by emissions from that state's sources. All requirements listed in 40 CFR 51.308(g) shall be addressed in the periodic report.

The requirements listed in 51.308(g) include the following:

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

(2) A summary of the emissions reductions achieved throughout the state through implementation of the measures described in paragraph 51.308(g)(1).

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

    (i) The current visibility conditions for the most impaired and clearest days;

    (ii) The difference between current visibility conditions for the most impaired and clearest days and baseline visibility conditions;

(iii) The change in visibility impairment for the most impaired and clearest days over the period since the period addressed in the most recent plan required under paragraph 51.308(f).

(4) An analysis tracking the change over the period since the period addressed in the most recent plan required under paragraph 51.308(f) in emissions of pollutants contributing to visibility impairment from all sources and activities within the state. Emissions changes should be identified by type of source or activity. With respect to all sources and activities, the analysis must extend at least through the most recent year for which the state has submitted emission inventory information to the Administrator in compliance with the triennial reporting requirements of subpart A of 40 CFR 51 as of a date six months preceding the required date of the progress report. With respect to sources that report directly to a centralized emissions data system operated by the Administrator, the analysis must extend through the most recent year for which the Administrator has provided a state-level summary of such reported data or an internet-based tool by which the state may obtain such a summary as of a date six months preceding the required date of the progress report. The state is not required to backcast previously reported emissions to be consistent with more recent emissions estimation procedures and may draw attention to actual or possible inconsistencies created by changes in estimation procedures.

(5) An assessment of any significant changes in anthropogenic emissions within or outside the state that have occurred since the period addressed in the most recent plan required under 40 CFR 51.308(f) including whether or not these changes in anthropogenic emissions were anticipated in that most recent plan and whether they have limited or impeded progress in reducing pollutant emissions and improving visibility.

(6) An assessment of whether the current implementation plan elements and strategies are sufficient to enable the state, or other states with mandatory Class I Federal areas affected by emissions from the state, to meet all established reasonable progress goals for the period covered by the most recent plan required under 40 CFR 51.308(f).

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

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

More specifically, the five-year Progress Report (due by January 31, 2025; July 31, 2033; and every 10 years thereafter) will examine the effect of emission reductions as well as seek to evaluate the effectiveness of emission management measures implemented. Therefore, this Progress Report will provide for a comparison of emission inventories, ultimately expressing the change in visibility for the most impaired and least impaired days over the past five years.

Moreover, due to the uncertainty of some measures, this Progress Report will also provide the opportunity to evaluate the overall effectiveness of proposed measures to reduce visibility impairment to include the effect of state and federal measures.

In keeping with the EPA's requirements and recommendations related to consultation, each five-year review will also enlist the support of appropriate state, local, and tribal air pollution control agencies as well as the corresponding FLMs.

12. Determination of the Adequacy of the Existing Plan

At the same time Mississippi is required to submit any progress reports to EPA, depending on the findings of the five-year progress report, Mississippi commits to taking one of the actions listed in 40 CFR 51.308(h). The findings of the five-year progress report will determine which action is appropriate and necessary. MDEQ is not required to address 51.308(h) in this comprehensive plan revision.

List of Possible Actions from 40 CFR 51.308(h):

(1) If Mississippi determines that the existing SIP requires no further substantive revision in order to achieve established goals, it will provide to the EPA a declaration that further revision of the SIP is not needed.

(2) If Mississippi determines that the existing SIP may be inadequate to ensure reasonable progress due to emissions from other states that participated in the regional planning process, it will provide notification to the EPA and collaborate with the states that participated in regional planning to address the SIP's deficiencies.

(3) If Mississippi determines that the current SIP may be inadequate to ensure reasonable progress due to emissions from another country, it will provide notification of such, along with available information making such a demonstration, to the EPA.

(4) If Mississippi determines that the existing SIP is inadequate to ensure reasonable progress due to emissions within the state, it will revise its SIP to address the plan's deficiencies within one year after submitting such notification to the EPA.

13. Progress Report

13.1. Background

On September 22, 2008, Mississippi submitted for approval its SIP for regional haze to the EPA Region 4. Subsequent to this submission, Mississippi amended its plan on May 9, 2011, and August 13, 2020.[71] Mississippi's Regional Haze Plan documents the State's long-term plan for improving visibility and demonstrating reasonable progress in Class I areas located outside of the State. The ultimate goal is to reach background visibility levels (natural conditions) in 156 Class I areas protected under EPA's Regional Haze Program. Mississippi has no Class I areas. The nearest Class I areas are Breton Wilderness Area (LA) and Sipsey Wilderness Area (AL).

40 CFR 51.308(g) of the regional haze rule requires that states report on the success of the long-term strategy at specific intervals. In a letter dated October 4, 2018 (received by EPA October 5, 2018), MDEQ submitted the first regional haze progress report to EPA for the period 2008-2013.

This progress report, in accordance with EPA's requirements, contained the following elements:

- Status of implementation of the control measures included in the original SIP;
- Summary of the emissions reductions achieved through the above-referenced control measures;
- Assessment of visibility conditions and changes for each Class I area located within the state;
- Analysis tracking the change over the past five years in emissions of pollutants contributing to visibility impairment from all sources and activities within Florida;
- Assessment of any significant changes in anthropogenic emissions within the past five years that have limited or impeded progress in reducing pollutant emissions and improving visibility;
- 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 reasonable progress goals; and

[71] Copies of Mississippi's Regional Haze and BART Plans are available at https://www.mdeq.ms.gov/air/regional-haze/.

- A review of the state's visibility monitoring strategy and any modifications to the strategy as necessary.

13.1.1. Mississippi's Long-term Strategy for Visibility Improvement

In Section 7.4 of Mississippi's Regional Haze Plan, atmospheric ammonium sulfate was identified as the largest contributor to visibility impairment in Class I areas throughout the southeastern United States during the baseline period. Emissions sensitivity modeling performed for VISTAS determined that the most effective ways to reduce ammonium sulfate were to reduce SO_2 emissions from EGUs and, with an important but smaller impact, to reduce SO_2 emissions from non-utility industrial point sources. SO_2 reductions from point sources were therefore identified as the focus of Mississippi's long-term strategy for visibility improvement.

The bar charts in Figure 13-1 show the speciated average light extinction for nearby Class I area Sipsey Wildlife Area in Alabama and demonstrate that sulfates have continued to be a significant contributor to light extinction since submittal of the last progress report, although the relative contribution from sulfates is decreasing over time. This is generally the same trend for the Breton Wildlife Area in Louisiana as well, as shown in Figure 2-7 provided by the Louisiana Department of Environmental Quality (LDEQ).

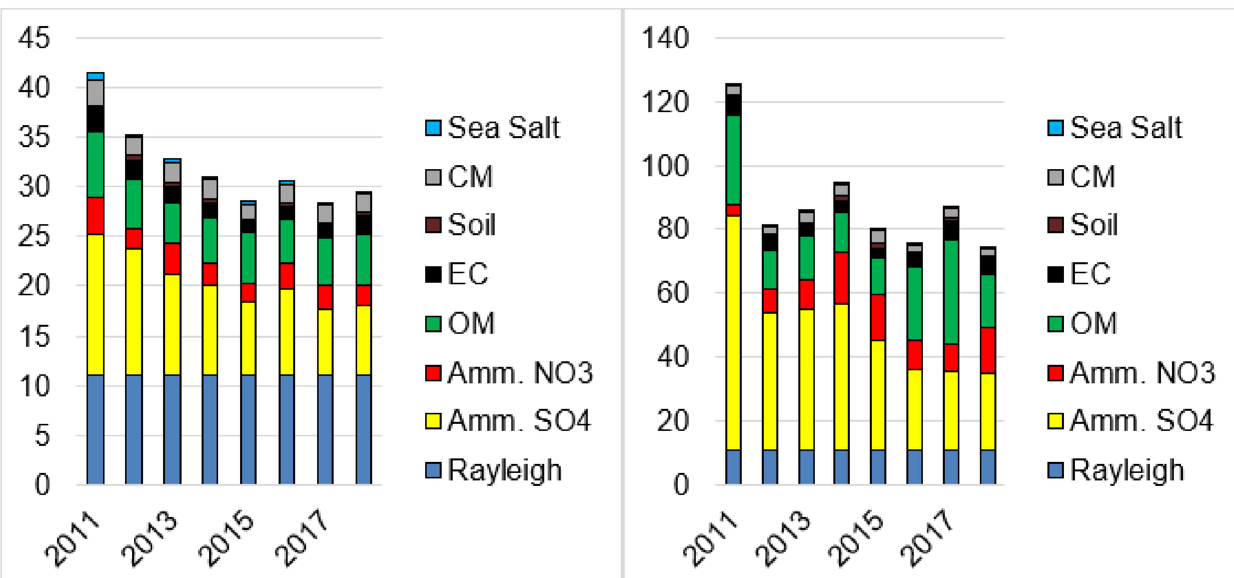

Figure 13-1: Annual Average Light Extinction for the 20% Worst Visibility Days (left) and the 20% Clearest Visibility Days (right) at Sipsey Wilderness Area

13.2. Requirements for the Periodic Progress Report

The requirements for periodic reports are outlined in 40 CFR 51.308(g). Each state must submit a report to EPA every five years evaluating the progress towards the reasonable progress goal for each Class I area located within the state and in each Class I area located outside the state which may be affected by emissions from within the state.

EPA's revised regional haze rule no longer requires the progress report to be a formal SIP submittal. At a minimum, the progress report must cover the first year not covered by the previously submitted progress report through the most recent year of data available prior to submission. Mississippi's previous progress report included data through the year 2013. Therefore, this progress report covers years since 2013. For the purposes of this periodic review (included as part of this regional haze plan revision), the most recent data available are used to highlight the progress made. This review includes NEI data through 2017, visibility data through 2018, and stationary source data through 2019 (generally) with data through 2021 provided in Table 13-6 for Mississippi EGUs.

40 CFR 51.308(f)(5) of the Regional Haze Rule requires that this regional haze plan revision address the progress report requirements of paragraphs 51.308(g)(1) through (5):

(1) A description of the status of implementation of all measures included in the SIP for achieving reasonable progress goals for Class I areas both within and outside the State.

(2) A summary of the emission reductions achieved throughout the State through implementation of the measures described in (1) above.

(3) For each Class I area within the State, the State must assess the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of five-year averages of these annual values:

    (i) The current visibility conditions for the most impaired and least impaired days;

    (ii) The difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions; and

    (iii) The change in visibility impairment for the most impaired and least impaired days over the past five years.

(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. The analysis must be based on the most recently updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable five-year period.

(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.

13.3. Status of Implementation of Control Measures

This section provides the status of implementation of the emission reduction measures that were included in the original regional haze SIP, as required by 40 CFR 51.308(g)(1), starting in the year 2014 to 2019. These measures include Federal programs, State requirements for EGUs, and State requirements for non-EGU point sources. As required by 40 CFR 51.308(g)(2), MDEQ has estimated the SO_2 emissions reductions achieved through 2019 from measures implemented by the State.

This section also describes other strategies that were not included in the regional haze SIP. At the time of the best and final inventory development process, these measures were not fully documented or had not yet been published in final form, and therefore the benefits of these measures were not included in the 2018 inventory. Emission reductions from these measures have helped each Class I area meet the 2018 RPGs set in those states' regional haze SIPs.

13.3.1. Emissions Reduction Measures Included in the Regional Haze SIP

Mississippi's regional haze SIP included the following types of measures for achieving RPGs for Class I areas potentially impacted by the State:

- Federal programs and
- State BART control measures

The federal and state emissions reduction strategies were included as inputs to the VISTAS modeling.[72] The current status of the implementation of these measures is summarized in the following paragraphs, and an estimate of the SO_2 emissions reductions achieved is presented.

13.3.1.1. Mississippi BART and Reasonable Progress

Reasonable Progress: Mississippi's Regional Haze Plan for the first period identified no sources to evaluate for a reasonable progress control analysis, and thus, there are no control measures that were adopted to demonstrate reasonable progress from the first period to report on under 40 CFR 51.308(g)(1) and 40 CFR 51.308(g)(2).

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[72] VISTAS states' BART and reasonable progress control measures were not modeled as part of the 2018 RPGs due to the timing of these control decisions vs completion of the 2018 RPG modeling. Mississippi's 2008 Regional Haze Plan identified no reasonable progress control measures.

BART:

- **EGUs:** Mississippi did not establish control measures for its seven BART-eligible EGU sources because, as explained in the August 13, 2020, final Mississippi BART SIP, six of the seven sources modeled visibility impacts below the State's BART contribution threshold, and the Plant Morrow's BART-eligible Units 1 and 2 were removed from service. Thus, none of the seven EGU sources were found subject to BART and as a result, there are no BART control measures to report on from these seven BART-eligible EGU sources.

- **Non-EGUs:** Two non-EGU sources were determined to be above the State's 0.5 dv BART contribution threshold, and therefore were found "subject to BART." These facilities were required to perform an engineering analysis containing their evaluation of potential BART options and proposed BART determinations. The two "subject to BART" facilities are the Chevron Pascagoula Refinery in Pascagoula, MS, and Mississippi Phosphates in Pascagoula, MS. Table 13-1 shows the controls put in place by these two facilities.[73] Table 7-27 from Section 7.8.2 demonstrates the resulting decrease in SO_2 emissions from the Chevron Pascagoula Refinery.

Table 13-1: Non-EGU BART Subject Facilities

FACILITY	EMISSIONS UNIT	EMISSION CONTROLS INCLUDED IN SIP	ESTIMATED TONS/YR REDUCED	REQUIRED CONTROL DATE	STATUS OF CONTROLS
Chevron, Pascagoula Refinery	f-1603/ FCC Regenerator	7-day average 50 ppmvd @ 0 vol% O_2 SO_2 limit and 365-day rolling 25 ppmvd @ 0 vol% O_2 SO_2 limit	1662	11/30/2008	Implemented September 2007
	F-2745/ SRU II	SCOT tail Gas System	1636	7/31/2007	Implemented February 2007
	F-2765/ SRU III	SCOT tail Gas System	1501	7/31/2007	Implemented February 2007
	Plant 38 - Flares 1-6	Flare Gas Recovery System	1882	12/01/2010	Implemented December 2008
Mississippi Phosphate Corporation	Sulfuric Acid Plants 1 & 2	3.0 lb SO_2/ ton acid produced	292	Five years after SIP approval	Facility ceased operations in December 2014 due to bankruptcy

[73] In its 2008 Regional Haze Plan, with respect to Chevron Refinery, MDEQ determined that the emissions controls and resulting reductions from the 2005 consent decree constitute BART. In its May 9, 2011, Regional Haze Supplement, with respect to Mississippi Phosphates, MDEQ determined that a recent BACT SO_2 determination (replacement of vanadium catalyst with cesium catalyst in the third and fourth converter passes with a permitted SO_2 limit of 3.0 lb of SO_2 per ton of sulfuric acid produced, not to exceed 225 lb/hr and 1700 tons/yr) meets BART for this source for the first period.

13.3.1.2. Federal and Other State Programs

The emissions reductions associated with the Federal and other State programs that are described in the following paragraphs were included in the VISTAS future year emissions estimates for the first planning period. Descriptions contain qualitative assessments of emissions reductions associated with each program, and where possible, quantitative assessments. In cases where delays or modification have altered emissions reduction estimates such that the original estimates of emissions are no longer accurate, information is also provided on the effects of these alterations.

13.3.1.2.1. Clean Air Interstate Rule

On May 12, 2005, EPA promulgated CAIR, which required reductions in emissions of NO_X and SO_2 from large EGUs fired by fossil fuels. Due to court rulings, CAIR was remanded to EPA to revise elements that were deemed unacceptable and was ultimately replaced by CSAPR. This was later updated through the CSAPR Update rule.

However, at the time that the states were developing their regional haze plans, challenges to CSAPR had left CAIR in place until residual issues were decided by the D.C. Circuit and EPA had resolved implementation issues. Therefore, states included CAIR in the regional haze SIP. The 2018 projected emissions used in the regional haze analysis reflect a modified IPM solution based on the state's best estimate of that year.

Although Mississippi was originally subject to CAIR for both SO_2 and NO_X, for purposes of evaluating Mississippi's impacts on regional haze from NO_X emission sources, Mississippi has replaced reliance on CAIR NO_X reductions with those NO_X reductions required by the CSAPR Update, discussed in greater detail in Section 7.2.1.1. Although different than the CAIR solution projected in the regional haze analysis, CSAPR and the CSAPR Update have continued reductions from large EGUs. Specifically, Mississippi's EGUs are subject to CSAPR for NO_x for the ozone season.

13.3.1.2.2. NO_X SIP Call

Phase I of the NO_X SIP Call was included in the regional haze SIP. This applies to certain EGUs and large non-EGUs, including large industrial boilers and turbines, and cement kilns. Those states affected by the NO_X SIP call in the VISTAS region have developed rules for the control of NO_X emissions that have been approved by the EPA. The NO_X SIP call has resulted in a significant reduction in NO_X emissions from large stationary combustion sources. For the first regional haze SIP, the emissions for NO_X SIP call-affected sources were capped at 2007 levels and carried forward to the 2009 and 2018 inventories. Mississippi is not subject to the NO_X SIP call.

13.3.1.2.3. Consent Agreements (TECO, VEPCO), Chevron Pascagoula Refinery, and Gulf Power Crist 7 Voluntary Agreement

Under a settlement agreement, Tampa Electric Company (TECO) converted units at the TECO Gannon Station Power Plant (now TECO Bayside Power Station) from coal to natural gas and installed permanent emissions-control equipment to meet stringent pollution limits.

Under a settlement agreement, Virginia Electric and Power Company (VEPCO) agreed to spend $1.2 billion by 2013 to eliminate 237,000 tons of SO_2 and NO_X emissions each year from eight coal-fired electricity generating plants in Virginia and West Virginia.

Under a 2002 voluntary agreement, Gulf Power upgraded its operation to significantly cut NO_X emissions at its Crist generating plant.

Under a 2005 settlement agreement, Chevron Refinery Pascagoula was required to significantly reduce emissions, particularly of SO_2 and NO_x. The major emissions points with reductions are two sulfur recovery units, the FCC regenerator, flares, and several boilers and heaters. The Chevron consent decree resulted in approximate emission reductions of 2,900 lb/hr of SO_2, 960 lb/hr of NO_x, and 40 lb/hr of PM_{10}, with a modeled visibility improvement of 2.99 dv at Breton. All of the reductions were in place by the end of 2011.

13.3.1.2.4. 1-hour Ozone SIPs (Atlanta/Birmingham/Northern Kentucky)

The regional haze SIP also included emissions reductions from 1-hour ozone SIPs submitted to EPA to demonstrate attainment of the 1-hour ozone NAAQS.[74] These SIPs require NO_X reductions from specific coal-fired power plants and address transportation plans in these cities (Atlanta, GA; Birmingham, AL; and Northern Kentucky, KY). These reductions further improve regional visibility.

13.3.1.2.5. 2007 Heavy-Duty Highway Rule (40 CFR Part 86, Subpart P)

In this regulation, EPA set a PM emissions standard for new heavy-duty engines of 0.01 g/bhp-hr, which took full effect for diesel engines in the 2007 model year. This rule also included standards for NO_X and non-methane hydrocarbons (NMHC) of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These diesel engine NO_X and NMHC standards were successfully phased in together between 2007 and 2010. The rule also required that sulfur in diesel fuel be reduced to

[74] 1-hour ozone SIPs referenced are: a) Atlanta, Georgia (Federal Register: June 15, 2005 (Volume 70, Number 114)); b) Birmingham, Alabama (March 12, 2004 (Volume 69, Number 49)); c) Northern Kentucky, Kentucky (Federal Register: September 16, 2004 (Volume 69, Number 179)).

facilitate the use of modern pollution-control technology on these trucks and buses. EPA required a 97% reduction in the sulfur content of highway diesel fuel, from levels of 500 ppm (low sulfur diesel) to 15 ppm (ultra-low sulfur diesel). These requirements were successfully implemented on the timeline in the regulation. This program applies to all areas of the country, including Mississippi, thus, more directly affecting nearby Class I areas.

13.3.1.2.6. Tier 2 Vehicle and Gasoline Sulfur Program (40 CFR Part 80 Subpart H; Part 85; Part 86)

EPA's Tier 2 fleet averaging program for onroad vehicles, modeled after the California Low Emission Vehicle (LEV) II standards, became effective in the 2005 model year. The Tier 2 program allows manufacturers to produce vehicles with emissions ranging from relatively dirty to very clean, but the mix of vehicles a manufacturer sells each year must have average NO_X emissions below a specified value. Mobile emissions continue to be reduced by this program as motorists replace older, more polluting vehicles with cleaner vehicles. The Tier 2 program applies nationwide, including Mississippi, and thus, has a more direct impact on nearby Class I areas.

13.3.1.2.7. Large Spark Ignition and Recreational Vehicle Rule

EPA has adopted new standards for emissions of NO_X, hydrocarbons (HC), and CO from several groups of previously unregulated non-road engines. Included in these are large industrial spark-ignition engines and recreational vehicles. Non-road spark-ignition engines are those powered by gasoline, liquid propane gas, or compressed natural gas rated over 19 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. These rules apply nationwide, including Mississippi.

13.3.1.2.8. Non-Road Mobile Diesel Emissions Program (40 CFR Part 89)

EPA adopted standards for emissions of NO_X, HC, and CO from several groups of non-road engines, including industrial spark-ignition engines and recreational non-road vehicles. Industrial spark-ignition engines power commercial and industrial applications and include 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. Non-road mobile emissions continue to benefit from this program as motorists replace older, more polluting non-road vehicles with cleaner vehicles.

The non-road diesel rule set standards that reduced emissions by more than 90% from non-road diesel equipment and, beginning in 2007, the rule reduced fuel sulfur levels by 99% from previous levels. The reduction in fuel sulfur levels applied to most non-road diesel fuel in 2010 and applied to fuel used in locomotives and marine vessels in 2012. This is a nationwide program and impacts Mississippi sources.

13.3.1.2.9. Maximum Achievable Control Technology Programs (40 CFR Part 63)

VISTAS applied controls to future year emissions estimates from various MACT regulations for VOC, SO_2, NO_X, and PM for source categories where controls were installed on or after 2002.

Table 13-2 describes the MACTs used as control strategies for the non-EGU point source emissions in the regional haze SIP. The table notes the pollutants for which controls were applied as well as the promulgation dates and the compliance dates for existing sources.

Table 13-2: MACT Source Categories

MACT Source Category	40CFR63 Subpart	Original Promulgation Date	Compliance Date (Existing Sources)	Pollutants Affected
Hazardous Waste Combustion (Phase I)	63(EEE), 261 and 270	9/30/99	9/30/03	PM
Portland Cement Manufacturing	LLL	6/14/99	6/10/02	PM
Secondary Aluminum Production	RRR	3/23/00	3/24/03	PM
Lime Manufacturing	AAAAA	1/5/04	1/5/07	PM, SO_2
Taconite Iron Ore Processing	RRRRR	10/30/03	10/30/06	PM, SO_2
Industrial Boilers, Institutional/ Commercial Boilers and Process Heaters	DDDDD	9/13/04	9/13/07	PM, SO_2
Reciprocating Internal Combustion Engines	ZZZZ	6/15/04	6/15/07	NO_X, VOC
Stationary Combustion Turbines	YYYY	3/5/04	3/5/04 (oil-fired) 3/9/22 (gas-fired)	CO, VOC

The Industrial/Commercial/Institutional (ICI) boiler MACT standard (40 CFR 63 Subpart DDDDD) was vacated by the U.S. Court of Appeals and remanded to EPA on June 8, 2007. VISTAS chose, however, to leave the emissions reductions associated with this regulation in place as the CAA required use of alternative control methodologies under Section 112(j) for uncontrolled source categories. The applied MACT control efficiencies were 4% for SO_2 and 40% for PM_{10} and $PM_{2.5}$ to account for the co-benefit from installation of acid gas scrubbers and other control equipment to reduce HAPs.

EPA finalized the revised ICI Boiler MACT on March 21, 2011. EPA subsequently reconsidered certain aspects of the rule and proposed changes on December 2, 2011. The rules were re-promulgated on January 31, 2013. The final compliance date for ICI boilers at major sources was 2016, with the option to request an additional year. EPA's estimate of nationwide

SO_2 emissions reductions from this rule is over 500,000 tons/year, as compared to an estimate of 113,000 tons/year in the analysis for the 2004 rule (78 FR 7138 and 69 FR 55218). On November 5, 2015, EPA finalized additional revisions to the Boiler MACT and projected that these updates would not significantly change the emissions reductions expected from the rule. It is, therefore, reasonable to conclude that the 2012 rule has brought about more SO_2 reductions in Mississippi than were modeled in Mississippi's Regional Haze Plan.

13.3.1.3. State EGU Control Measures

Emissions from EGUs have been regulated through state measures in North Carolina and Georgia, which were included in the regional haze SIP modeling. Reductions associated with these measures were used to estimate the 2018 visibility improvements at the VISTAS Class I areas.

13.3.1.3.1. North Carolina Clean Smokestacks Act

In June of 2002, the North Carolina General Assembly enacted the Clean Smokestacks Act (CSA), which required significant actual emissions reductions from coal-fired power plants in North Carolina. These reductions were included as part of the VISTAS 2018 Best and Final modeling effort. Under the CSA, power plants were required to reduce their NO_X emissions by 77% in 2009 and their SO_2 emission by 73% in 2013. Actions taken to date by facilities subject to these requirements comply with the provisions of the CSA, and compliance plans and schedules will allow these entities to achieve the emissions limitations set out by the Act. This program has been highly successful. In 2009, regulated entities emitted less than the 2013 system annual cap of 250,000 tons of SO_2 and less than the 2009 system annual cap of 56,000 tons of NO_X. In 2002, the sources subject to CSA emitted 459,643 tons of SO_2 and 142,770 tons of NO_X. In 2011, these sources emitted only 73,454 tons of SO_2 and 39,284 tons of NO_X, well below the Act's system caps.

This legislation established annual caps on both SO_2 and NO_X emissions for the two primary utility companies in North Carolina, Duke Energy and Progress Energy. Duke Energy and Progress Energy have produced emissions reductions beyond what was required which further improved regional visibility.

13.3.1.3.2. Georgia Multi-Pollutant Control for Electric Utility Steam Generating Units

Georgia rule 391-3-1.02(2)(sss), enacted in 2007, requires flue-gas desulphurization (FGD) and SCR controls on large coal-fired EGUs in Georgia. Reductions from this regulation were included as part of the VISTAS 2018 Best and Final modeling effort. These controls reduced SO_2 emissions from the affected emissions units by at least 95% and reduced NO_X emissions by approximately 85%. Control implementation dates vary by EGU, starting with December 31, 2008, and ending with December 31, 2015.

13.3.2. Emission Reduction Measures Not Included in the Regional Haze SIP

A number of regulations and requirements have been promulgated that were not included in Mississippi's original SIP submittal. These measures provided additional emission reductions to allow VISTAS Class I areas and neighboring Class I areas to VISTAS to meet their RPGs.

- The International Maritime Organization has strengthened the standards for sulfur in marine fuel (discussed in Section 7.2.1.4.4).
- New source performance standards (NSPS) for stationary compression ignition internal combustion engines and stationary spark ignition internal combustion engines, contained in 40 CFR Part 60 Subpart IIII and Subpart JJJJ, respectively, have generated a significant decrease in NO_X emissions from these sources.
- EPA's Mercury and Air Toxics Standards (discussed in Section 7.2.1.2) and the 2010 SO_2 NAAQS (discussed in Section 7.2.1.3) have further reduced emissions from EGUs.

13.4. Visibility Conditions

40 CFR 51.308(g)(3) requires the state to assess the visibility conditions for the most impaired and least impaired days expressed in terms of five-year averages. The visibility conditions that must be reviewed include: (1) the current visibility conditions; (2) the difference between current visibility conditions compared to the baseline; and (3) the change in visibility impairment for the most and least impaired days over the past five years. Since there are no Class I areas in Mississippi, a visibility assessment in accordance with 40 CFR 5 l .308(g)(3) is not required.

13.5. Emissions Analysis

This section includes an analysis tracking the change since 2013 in emissions of pollutants contributing to visibility impairment from all sources and activities within the state, as required by 40 CFR 51.308(g)(4). Because SO_2 was the significant pollutant contributing to visibility impairment during the first implementation period, the emissions analysis will focus mostly on SO_2 emissions. This section also includes an assessment of changes in anthropogenic emissions since 2013, as required by 40 CFR 51.308(g)(5).

13.5.1. Change in $PM_{2.5}$, NO_X, SO_2, Emissions from All Source Categories

There are six emissions inventory source categories: stationary point, area (non-point), non-road mobile, onroad mobile, fires, and biogenic sources.

- Stationary point sources are those sources that emit greater than a specified tonnage per year, with data provided at the facility level. Electricity generating utilities and industrial sources are the major categories for stationary point sources.

- Stationary area sources are those sources whose individual emissions are relatively small, but due to the large number of these sources, the collective emissions from the source category could be significant. These types of emissions are estimated on a countywide level.

- Non-road mobile sources are equipment that can move, but do not use the roadways (i.e., lawn mowers, construction equipment, marine vessels, railroad locomotives, aircraft). The emissions from these sources, like stationary area sources, are estimated on a countywide level.

- Onroad mobile sources are automobiles, trucks, and motorcycles that use the roadway system. The emissions from these sources are estimated by vehicle type and road type and are summed to the countywide level.

- Fire emissions include prescribed fire and wildfire emissions and can be summed to a countywide level or reported as a point source.

- Biogenic sources are natural sources like trees, crops, grasses and natural decay of plants. The biogenic emissions are not included in this review since they were held constant as part of the original regional haze SIP modeling and are not controllable emissions.

For the purpose of evaluating recent emissions changes and progress, Mississippi used the 2014 NEI, the 2017 NEI, and the state Annual Operating Report point source data collected each year. When available, data after 2017 is also used. For comparison purposes, the tables below include the 2018 emissions projected by VISTAS in the first regional haze SIP.

Table 13-3 shows how $PM_{2.5}$ emissions for each source category in Mississippi have changed. The table also includes the VISTAS 2018 emissions projections developed in the first planning period for comparison. Compared to the VISTAS 2018 emissions projections, $PM_{2.5}$ emissions were higher in the 2017 NEI for the onroad, area, and fire source categories. Fire source $PM_{2.5}$ emissions for 2017 NEI were 19,481 tons higher than projected by VISTAS for 2018, while point source $PM_{2.5}$ NEI emissions were 8,995 lower than projected. The overall $PM_{2.5}$ emissions across all categories in the 2017 NEI are about 24% higher than what VISTAS projected for 2018.

Table 13-3: $PM_{2.5}$ Emissions (tons) for the 2014 NEI, 2017 NEI, and 2018 VISTAS Inventories for Mississippi

$PM_{2.5}$ Sector	NEI 2014 (tpy)	NEI 2017 (tpy)	VISTAS 2018G4 (tpy)
Point	11,154	8,976	17,971
Area	51,131	63,146	53,222
Onroad	2,217	1,449	819
Non-Road	1,429	883	3,203
Fires	26,913	23,654	4,173
Total	**92,845**	**98,108**	**79,388**

Total NO_X emissions decreased from 2014 to 2017 overall and in all source categories except area sources. The 2017 NEI NO_X emissions for area, fires, and onroad categories are higher than the VISTAS 2018 projected emissions. The 2017 NEI emissions for the point source category are 39,142 tons less than the 2018 projections. The overall NO_X emissions from all categories for 2017 are approximately 10% higher than the 2018 projections.

Table 13-4: NO_X Emissions (tons) for the 2014 NEI, 2017 NEI, and 2018 VISTAS Inventories for Mississippi

NO_X Sector	NEI 2014 (tpy)	NEI 2017 (tpy)	VISTAS 2018G4 (tpy)
Point	53,280	43,645	82,787
Area	33,318	51,875	4,483
Onroad	79,571	53,037	30,619
Non-Road	14,517	9,086	28,842
Fires	6,156	5,372	1,073
Total	**186,842**	**163,015**	**147,805**

For SO_2 emissions (Table 13-5), point sources show the most significant decrease since 2014, and actual emissions from point sources are already almost 80% lower than the projected 2018 emissions. Overall, SO_2 emissions across all categories for 2017 are approximately 74% below the 2018 projections.

Table 13-5: SO_2 Emissions (tons) for the 2014 NEI, 2017 NEI, and 2018 VISTAS Inventories for Mississippi

SO_2 Sector	NEI 2014 (tpy)	NEI 2017 (tpy)	VISTAS 2018G4 (tpy)
Point	104,178	8,364	40,888
Area	925	1,421	746
Onroad	442	415	440
Non-Road	34	18	6,638
Fires	2,863	2,506	294
Total	**108,442**	**12,724**	**49,006**

Actual emissions reductions from the EGU sector have continued to decrease significantly due to installation of scrubbers and other controls on some of the larger power generation sources in Mississippi. Repowering or shifting to natural gas, as well as some reduced utilization of coal EGUs and increased utilization of natural gas EGUs has also significantly reduced emissions of SO_2. Table 13-6 below depicts the trends from 2014 to 2021 for units that report annual emissions to CAMD and are in Mississippi.

Table 13-6: Mississippi CAMD Emissions and Heat Input Data (Source: EPA CAMD Database)

Year	SO_2 Emissions (tpy)	Heat Input (MMBtu)	SO_2 Emissions Rate (lb/MMBtu)	NO_x Emissions (tpy)
2014	90,719	3.57E+08	0.509	20,173
2015	26,043	4.12E+08	0.126	12,001
2016	3,175	4.46E+08	0.014	12,740
2017	2,569	4.14E+08	0.012	12,180
2018	3,190	4.40E+08	0.015	13,126
2019	3,145	4.19E+08	0.015	13,867
2020	2,629	4.54E+08	0.012	13,311
2021	3,102	4.22E+08	0.015	12,142

Since 2014, heat input has remained fairly steady. The SO_2 emissions from these units decreased from 90,719 tons annually in 2014 to 3,102 tons annually in 2021, a decrease of nearly 97%. The average SO_2 emission rate from these units decreased from 0.509 lb/MMBtu in 2014 to 0.015 lb/MMBtu in 2021, a decrease of 97%. The reductions in emissions are not attributable to reduced demand for power. Instead, the significant emission reductions are attributable to the overall emissions rate decrease that is due to the installation of controls and the use of cleaner burning fuels. Over the same period, NO_X emissions decreased from 20,173 tpy to 12,142 tpy, a drop of 40%. Figure 13-2 shows the trends for units reporting to CAMD across all VISTAS states.

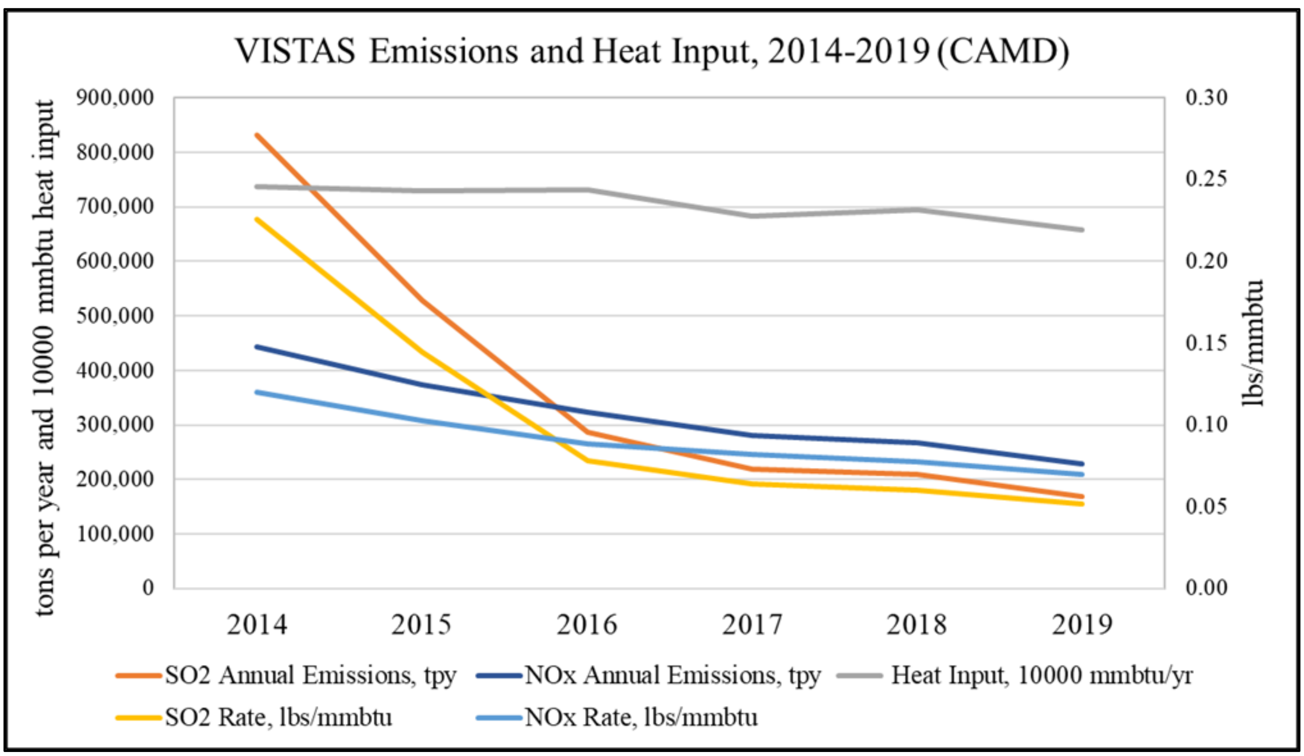

Figure 13-2: VISTAS CAMD Emissions and Heat Input Data *(source: EPA CAMD Database)*

Between 2014 and 2019, heat input to these units decreased approximately 11%. However, emissions from these units and the emission rates decreased significantly more than this. SO_2 emissions decreased from 831,079 to 169,013 tons annually, a decrease of 80%. The average SO_2 emission rate from these units decreased from 0.225 lb/MMBtu in 2014 to 0.051 lb/MMBtu in 2019, a decrease of 77%. Additional controls installed on certain units to meet the stringent requirements of the MATS rule has further reduced the emission rates of those units. Over the same period, NO_X emissions decreased from 442,412 tpy to 228,673 tpy, a drop of 48%.

The figures above reflect the fact that the reductions in SO_2 and NO_X are generally a result of permanent changes at EGUs through the use of control technology and fuel switching, not reductions in heat input. Thus, visibility improvements from reduced sulfate and nitrate contribution should continue into the future even if demand for power and heat input to these units may have moderate increases. In addition, market forces on coal EGUs have shifted these units from baseload operations to load following operations with increased usage of natural gas and renewable energy sources for electricity production.

13.5.2. Assessments of Changes in Anthropogenic Emissions

There does not appear to be any significant change in anthropogenic emissions within Mississippi or outside of the State that would limit or impede progress in reducing pollutant emissions or improving visibility. In particular, SO_2 emissions from point sources have significantly decreased since 2014. There have also been decreases in point source emissions of NO_X and $PM_{2.5}$ since 2014.

13.6. Conclusion

This progress report documents that all control measures outlined in Mississippi's regional haze SIP have been implemented. Reductions in SO_2 emissions have been significant and greater than VISTAS projected. Despite significant reduction in SO_2, sulfates continue to play a significant role in visibility impairment, especially for the most anthropogenically impaired days. As SO_2 emissions continue to drop in future planning periods, nitrates may begin to have a larger relative impact on regional haze. The next regional haze progress report is due by January 31, 2025, as required by 40 CFR 51.308(g) and will cover progress in the second implementation period.