AGENDA
STATE OF TENNESSEE
REGULAR MEETING
AIR POLLUTION CONTROL BOARD
Nashville Room, 3RD Floor Tennessee Tower
312 Rosa L. Parks Avenue
In Person and
Remote Access Via WebEx link

Wednesday, February 9, 2022
9:30 A.M.

	Item	Presenter	Page
1.	Roll Call		
2.	Bureau of Environment Update	Greg Young	
3.	Conflict of Interest	OGC	
4.	Approval of the January 12, 2022, Board Meeting Minutes		2
5.	Eastman Variance – Malfunction Reporting Board Order 22-004	Travis Blake	7
6.	Regional Haze SIP Board Order 22-002 1. Members of the Public Address the Board	Mark Reynolds	10
	General Business		
7.	Air Pollution Board Manual	Grant Ruhl	

The meeting will be held in compliance with Tennessee Code Annotated Section 8-44-108, as amended by Chapter 490 of the 1999 Public Acts of the Tennessee General Assembly. The meeting will be conducted permitting participation by electronic or other means of communication. Consequently, some members of the Tennessee Air Pollution Control Board are allowed to and may participate by electronic or other means of communication and may not be physically present at the announced location of the meeting.

Air Pollution Control Board
of the
State of Tennessee
Regular Meeting

On Wednesday January 12, 2022, at 9:30 A.M., the Air Pollution Control Board of the State of Tennessee, (hereinafter, referred to as the "Board"), began its meeting on the 3rd Floor of the Tennessee Tower in the Nashville Room. The following Board members were physically present.

Dr. Ronnè Adkins
Dr. Joshua Fu
Mr. Mike Haverstick
Dr. Shawn Hawkins
Mr. Richard Holland
Ms. Caitlin Jennings
Mayor Ken Moore
Ms. Amy Spann
Mr. Greer Tidwell
Mr. Jimmy West

The following Board members joined the meeting via WebEx

Dr. John Benitez
Dr. Chunrong Jia
Mr. Stephen Moore
Ms. Amy Spann
Mayor Larry Waters

Ms. Michelle Owenby, Director of Air Pollution Control, welcomed Board members and those attending via WebEx.

The first item on the agenda was to elect a Vice Chair for 2022. Mayor Larry Waters was nominated for Vice Chair by Mayor Moore and Mr. Tidwell seconded the nomination.

Mayor Waters accepted the nomination

The Technical Secretary called for a Roll Call:

Dr. Adkins	Yes	Dr. Benitez	Yes
Dr. Fu	Yes	Mr. Haverstick	Yes
Dr. Hawkins	Yes	Mr. Holland	Yes
Ms. Jennings	Yes	Dr. Jia	Yes
Mayor Moore	Yes	Mr. Moore	Yes
Ms. Spann	Yes	Mr. Tidwell	Yes
Mayor Waters	Yes	Mr. West	Yes

The nomination carried with fourteen (14) affirmative votes.

The Vice-Chair called the meeting to order and asked for a Roll Call and the response was as follows:

Dr. Adkins	Present	Dr. Benitez	WebEx
Dr. Fu	Present	Mr. Haverstick	Present
Dr. Hawkins	Present	Mr. Holland	Present
Ms. Jennings	Present	Dr. Jia	WebEx
Mayor Moore	Present	Mr. Moore	WebEx
Ms. Spann	WebEx	Mr. Tidwell	Present
Mayor Waters	WebEx	Mr. West	Present

Nine (9) Board members were present and Five (5) via WebEx.

Bill Miller with the Office of General Counsel (OGC) presented the board with the Conflict of Interest. Mr. Miller stated that a representative from OGC will report to the board at the next meeting to give count of how many Board members have a conflict of interest.

The next item on the agenda was the approval of the minutes with one correction from the November 10, 2021 Board meeting.

Mayor Moore made a motion to approve the minutes as amended and Dr. Fu seconded the motion.

The Vice-Chair asked for a Roll Call and the response was as follows:

Dr. Adkins	Yes	Dr. Benitez	Yes
Dr. Fu	Yes	Mr. Haverstick	Yes
Dr. Hawkins	Yes	Mr. Holland	Yes
Ms. Jennings	Yes	Dr. Jia	Yes
Mayor Moore	Yes	Mr. Moore	Yes
Ms. Spann	Yes	Mr. Tidwell	Yes
Mayor Waters	Yes	Mr. West	Yes

The November 10, 2021 minutes were approved as amended.

The motion carried with fourteen (14) affirmative votes.

Mr. Travis Blake with the Division of Air Pollution Control. presented the Tennessee Air Pollution Control Regulations 1200-03-27-.12 (NO_X SIP Call alternative monitoring provisions) to the Board for approval. Mr. Blake answered questions from the Board. Mr. Holland made a motion to approve, and Ms. Spann seconded the motion.

Dr. Adkins	Yes	Dr. Benitez	Yes
Dr. Fu	Yes	Mr. Haverstick	Yes
Dr. Hawkins	Yes	Mr. Holland	Yes
Ms. Jennings	Yes	Dr. Jia	Yes
Mayor Moore	Yes	Mr. Moore	Yes
Ms. Spann	Yes	Mr. Tidwell	Yes
Mayor Waters	Yes	Mr. West	Yes

The motion carried with fourteen (14) affirmative votes.

Mr. Travis Blake then presented the source-specific SIP revision. Board Order 22-003 (NO_X SIP Call alternative monitoring request for Domtar Paper Company) to the Board for approval. Mr. Blake answered questions from the Board.

Mayor Moore made a motion to approve, and Mr. Hawkins seconded the motion.

Dr. Adkins	Yes	Dr. Benitez	Yes
Dr. Fu	Yes	Mr. Haverstick	Yes
Dr. Hawkins	Yes	Mr. Holland	Yes
Ms. Jennings	Yes	Dr. Jia	Yes
Mayor Moore	Yes	Mr. Moore	Yes
Ms. Spann	Yes	Mr. Tidwell	Yes
Mayor Waters	Yes	Mr. West	Yes

The motion carried with fourteen (14) affirmative votes.

Mr. Marc Corrigan with the Division of Air Pollution Control presented for consideration an amendment to the Shelby County portion of the State Implementation Plan, or SIP Board Order 22-001.

On May 22, 2015, EPA issued a final rule to ensure states have plans in place that require sources across the country to follow air pollution rules during times when the facility is starting up or shutting down, or when a malfunction occurs, or "SSM". This required response from states is termed the “SSM SIP Call”.

The Tennessee Department of Environment and Conservation revised the Tennessee Rules and Regulations, Chapter 1200-3-20 titled “Limits on Emissions Due to Malfunctions, Startups, and Shutdowns” to resolve the issues that prompted EPA’s SSM SIP Call. On July 13, 2016, that regulatory revision was presented to this Board and approved as Tennessee’s response to EPA’s SSM SIP Call. These changes to Chapter 20 became effective for “State” Counties November 16, 2016.

Shelby County and the included municipalities began rulemaking to revise their local ordinances that incorporate Tennessee's Chapter 20 into its local ordinances.

Adoption by six of the eight jurisdictions in Shelby County has occurred. Final adoption is still pending for the City of Lakeland and the City of Memphis, although both areas have begun the process.

EPA posted on their website a Notice of Intent (NOI) to sue on May 10, 2021; the complaint claims 1) EPA failed to issue findings of failure to submit for areas that had not yet made submissions in response to the 2015 SSM SIP Call, e.g., Memphis/Shelby County, and 2) EPA failed to act on submissions made in response to the SIP Call, e.g., Tennessee.

A State Implementation Plan (SIP) revision was developed to revise the Shelby County portion of the SIP concerning SSM provisions and respond to EPA's SSM SIP Call. A public hearing was held on November 15, 2021 regarding the use of the incorporation of changes to Tennessee's Chapter 1200-03-20 in Shelby County, and all included municipalities, as the response to EPA's SSM SIP Call for Shelby County.

Two comments were received from EPA. The first regarded the evidence of adoption of Chapter 1200-03-20 into the air codes of the City of Memphis and the City of Lakeland. Shelby County has committed to seek approval of the ordinance update in those two remaining municipalities. The second comment regards section 1200-3-20-.06(5) in the State's rule as being inconsistent with and presents the same deficiencies noted in the proposed SSM SIP Call response from Tennessee. To address this, the Shelby County Pollution Control Section proposes to request approval of the adoption by reference of Tennessee's Chapter 1200-3-20 into the SIP for Shelby County and the included municipalities, with the exception of 1200-3-20-.06(5). No other comments were received.

On January 4, 2022, the US Environmental Protection Agency (EPA) found that certain state and local air pollution control agencies failed to submit State Implementation Plan (SIP) revisions to appropriately address excess emissions during periods of startup, shutdown, and malfunction. That Federal Register notice is out for publication and could be published any day. This notice will include a finding of failure to submit for Shelby County as well as about a dozen other state and local air agencies.

The Tennessee Air Pollution Control Board is being asked today to conditionally approve this response by Shelby County for submission to EPA as the Shelby County SSM SIP Call response provided that the two remaining areas, the City of Lakeland and the City of Memphis, submit the final adoption of Chapter 20 to TDEC APC as an amendment to be added to the SSM SIP Call response.

If approved by the Tennessee Air Pollution Control Board, we will amend Shelby County's SSM SIP Call response included in Attachment 1 of Board Order 22-001 when we receive documentation of adoption by the City of Memphis and the City of Lakeland and submit it to EPA for inclusion into the Shelby County portion of Tennessee's SIP. Mr. Corrigan answered questions form the board.

Dr. Fu made a motion to approve, and Mr. Haverstick seconded the motion.

Dr. Adkins	Yes	Dr. Benitez	Yes
Dr. Fu	Yes	Mr. Haverstick	Yes
Dr. Hawkins	Yes	Mr. Holland	Yes

Ms. Jennings	Yes	Dr. Jia	Yes
Mayor Moore	Yes	Mr. Moore	Yes
Ms. Spann	Yes	Mr. Tidwell	Abstained
Mayor Waters	Yes	Mr. West	Yes

The motion carried with thirteen (13) affirmative votes.

There being no further business to discuss before the Board, the meeting was adjourned at 10:20am.

____

(Signed) Michelle Owenby, Technical Secretary
Tennessee Air Pollution Control Board

Approved at Nashville, Tennessee on February 9, 2022

____

(Signed) Mayor Larry Waters, Vice-Chairman
Tennessee Air Pollution Control Board

____

(Signed) David Salyers, Chairman
Tennessee Air Pollution Control Board

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
BUREAU OF ENVIRONMENT
DIVISION OF AIR POLLUTION CONTROL

IN THE MATTER OF	)	
	)	
	)	
Eastman Chemical Company	)	Order Number: 22-004
(82-0003)	)	
	)	
	)	
Variance Request	)	

BOARD ORDER

The following matter came before the Tennessee Air Pollution Control Board on February 9, 2022.

On September 1, 2021, Eastman Chemical Company requested that the Technical Secretary renew an existing variance (Board Order 20-073, issued November 12, 2020) pursuant to Tennessee Code Annotated §68-201-118 from the applicability provisions of Tennessee Air Pollution Control Regulations 1200-03-20-.03 (Notice Required When Malfunction Occurs) for excess sulfur dioxide emissions.

This rule states that when an air contaminant source malfunctions in such a manner as to cause emissions in excess of an applicable standard or permit condition, the owner or operator must promptly notify the Technical Secretary of the malfunction within 24 hours and must provide a statement of all pertinent facts, including the estimated duration of the malfunction. The rule also requires the owner or operator to notify the Technical Secretary when the malfunction has been corrected. Notification is not required for:

- Violations of the visible emission standard (excluding visible emissions caused by hazardous air pollutants named in Chapter 1200-03-11) which occur for less than 20 minutes in one day (midnight to midnight); or

- Emissions from sources located in attainment and unclassified areas that are not designated as significantly impacting on a nonattainment area, provided that emissions in excess of the standards will not and do not occur over more than a 24-hour period (or will not recur over more than a 24-hour period) and no damage to property and or public health is anticipated.

Any malfunction that creates an imminent hazard to health must be reported by telephone immediately to the Division's Nashville office and to the State Civil Defense.

The variance request states that because Eastman's Tennessee Operations facility is located in an area classified as nonattainment for the sulfur dioxide National Ambient Air Quality Standard (NAAQS), the rule and related Title V Operating Permit conditions require prompt notification to the Technical Secretary on any event (malfunction or breakdown) that results in emissions of sulfur dioxide in excess of applicable emission standards. For facilities located in attainment areas, only excess emission events that occur for more than 24 hours (or recur over more than a 24-hour period) require notification. Due to the type of process, Eastman's Coal Gasification facility experiences several short-term events a year that result in excess sulfur dioxide emissions that require these notifications. Eastman believes these notifications serve no useful purpose and that the administrative burden for both Eastman and the Division should be relieved. Any such events will be reported in Eastman's Title V semiannual compliance reports.

Rule 1200-03-20-.03 was adopted in 1979 and revised several times prior to the adoption of a final rule in 1994. Prior to the implementation of the Title V Operating Permit program in Tennessee, this rule ensured that excess emissions events would be reported to the Division.

Because Title V Operating Permits require facilities to semiannually report all deviations from permit conditions, the requirements of 1200-03-20-.03 are made redundant. The Division believes that the notification requirements should remain for longer term malfunction events (greater than 24 hours), but requiring facilities in nonattainment areas to immediately report short-term exceedances places an unnecessary administrative burden upon the facility and the Division. The Technical Secretary supports the granting of this variance to Eastman Chemical Company, subject to the following stipulations:

1. During the time period of this variance, the notification requirements of Tennessee Air Pollution Control Regulations 1200-03-20-.03, and any permit condition implementing this regulation, shall not apply to malfunction events resulting in excess sulfur dioxide emissions, provided that:

    (a) Such events do not and will not occur over more than a 24-hour period (or will not recur over more than a 24-hour period);

    (b) No damage to property and or public health is anticipated; and

    (c) This variance shall not apply to any malfunction event(s) at emission sources 82-0003-01 (B-83 and B-253 powerhouses) or at emission source 82-0003-131 (B-325 powerhouse).

2. If notification is required for any malfunction event, prompt notification shall be provided by telephone to the Division's Nashville office within 24 hours of the malfunction. Any malfunction, regardless of duration, that creates an imminent hazard to health must be reported by telephone immediately to the Division's Nashville office and to the State Civil Defense.

3. This variance shall become effective on February 9, 2022.

4. This variance shall expire on February 8, 2023.

In consideration of the Technical Secretary's recommendation, the Board grants the Eastman Chemical Company variance request subject to the stipulations specified above. Entered and approved by the following Board Members on February 9, 2022.

Eastman Chemical Company
P.O. Box 511
Kingsport, Tennessee 37662

EASTMAN

September 1, 2021

ELECTRONIC DELIVERY
Ms. Michelle W. Owenby, Technical Secretary
TN Division of Air Pollution Control
William R. Snodgrass Building, TN Tower
312 Rosa Parks Avenue, 15th Floor
Nashville, TN 37423-1531

Subject: Petition for Renewal of Variance from Applicability of Rule 1200-3-20-.03 (Notice Required When Malfunction Occurs) for Excess Sulfur Dioxide Emissions

Dear Ms. Owenby:

Eastman Chemical Company (Eastman) hereby petitions the Technical Secretary of the Tennessee Division of Air Pollution Control to recommend the renewal of a variance (pursuant to Tennessee Code Annotated §68-201-118) from the Tennessee Air Pollution Control Board from the applicability of the provisions of Tennessee Rule 1200-3-20-.03 to events causing excess emissions of sulfur dioxide that occur less than 24 hours (or do not recur over more than a 24 hour period). This variance was previously approved in board order 20-073 which expires on November 11, 2021.

Because Eastman's Tennessee Operations facility is in an area classified as non-attainment for the sulfur dioxide National Ambient Air Quality Standard (NAAQS), the rule and related Title V Operating Permit conditions require prompt notification to the Technical Secretary on any event (malfunction or breakdown) that results in emissions of sulfur dioxide in excess of applicable emission standards. For facilities located in attainment areas, only excess emission events that occur for more than 24 hours (or recur over more than a 24 hour period) require notification.

Due to the type of process, Eastman's Coal Gasification facility experiences several short-term events a year that result in excess sulfur dioxide emissions that require these notifications. Eastman believes these notifications serve no useful purpose and that the administrative burden for both Eastman and the Division should be relieved. Any such events will be included in Eastman's semi-annual compliance reports.

The area is designated non-attainment due to normal (not excess) sulfur dioxide emissions from Eastman's coal-fired boilers. Projects have been completed to remedy the non-attainment by converting Eastman's largest coal-fired powerhouse boilers to natural gas combustion.

If you have any questions concerning this renewal request, please contact me at (423) 229-2412.

Sincerely,

Sharon Wellman

Sharon B. Wellman
Environmental Operations, Kingsport

ec: Travis Blake, TDAPC (travis.blake@tn.gov)

Regional Haze SIP

The Regional Haze SIP consists of the main narrative and Appendices A through I. The main narrative and part** of Appendix I are included in the Board packet. Appendix I includes the public comments and TDEC's response to comments. All of the Appendices can be found on the following website. This website also contains some spreadsheets that were used in the data analysis.

https://tncloud.tn.gov/owncloud/index.php/s/mPU1EUimUqkfW7f

The password is haze

** Appendix I-7 is not included in the Board packet. Appendix I-8 is included in the Board packet, but does not include the attachments.

Appendix I-1

Comments from

National Parks Conservation Association, Sierra Club, Tennessee Citizens for Wilderness Planning, Southern Environmental Law Center, Appalachian Voices, Center for Biological Diversity, Sowing Justice, Tennessee Interfaith Power and Light, Citizens Climate Coalition

December 10, 2021

Via electronic mail

Tennessee Department of Environment & Conservation

Air.Pollution.Control@tn.gov

Comments regarding draft regional haze state implementation plan

Dear Tennessee Department of Environment & Conservation,

We write today out of a shared value for clean air and the public lands that are protected under the Regional Haze Rule. TDEC has the opportunity right now to significantly improve its plan and reduce the amount of air pollution in beloved spaces like the Great Smoky Mountains, Mammoth Cave National Park, Joyce-Kilmer/Slickrock Wilderness Area and the other Class 1 areas across the region. Despite the great strides that have been made toward clean air over the years, the state of Tennessee still has work to do. The proposed regional haze plan fails to adequately reduce pollution and ensure continued reasonable progress. Overall, the plan falls short of the state's obligation to improve air quality for our parks, their visitors and local communities.

Despite the thousands of tons of controllable pollution from Tennessee's industrial sources including coal-fired power plants, chemical facilities, among others, and the many opportunities for cost-effective controls, TDEC improperly concludes that almost no new reductions in haze pollution are warranted. In its reliance on the Southeast regional planning organization (RPO) Visibility Improvement States and Tribal Association of the Southeast (VISTAS) work, TDEC improperly selected only two facilities to review and wrongly excluded many large polluting facilities in the state. Further, in the two sources that were reviewed, TDEC failed to analyze nitrogen oxides and particulate matter emissions. Critically, although TVA has already indicated to TDEC that it intends to retire the Kingston and Cumberland coal plants, the draft plan fails to take advantage of emissions reductions by locking in those retirements.

Even though sulfur dioxide emission-reducing measures were reviewed for the Eastman Chemical Company and Cumberland coal plant, the plan fails to require adequate pollution controls. In evaluating possible control options, the source operators overestimated the cost of pollution reduction technologies, leading to TDEC improperly concluding that reducing pollution isn't worth the cost. Furthermore, TDEC has not adequately responded to flaws identified by the National Park Service, or addressed any of the major emitters that they requested.

We ask that before finalizing this plan, TDEC please take the time to correct these harmful oversights. We urge TDEC to address the haze pollution from dirty coal plants by ensuring that TVA's commitment to retiring the Kingston and Cumberland coal plants by 2028 are made enforceable in the plan. In addition, cost-effective measures to reduce haze pollutants from Cumberland should be required until it is finally retired. We also ask that TDEC include the other major polluting sources that were previously identified by the National Park Service and the National Parks Conservation Association in the final haze plan. These include the TVA Gallatin plant, AGC Industries, O-N Minerals, Trelleborg Coated Systems, Signal Mountain Cement Company, Packaging Corporation of America, and Tennessee Gas Pipeline Company Stations 860 and 87. Lastly, we urge TDEC to address nitrogen oxide and particulate matter pollution at Eastman Chemical Company and to implement further, cost-effective controls there than are currently required in the draft plan.

If left unchanged, the state's plan will not comply with the Federal Clean Air Act and the United States Environmental Protection Agency's (EPA) Regional Haze Rule as it does little to limit haze-causing air pollution and fails to help restore naturally clean air. It is stated in TDEC's mission that it is your responsibility to enhance the quality of life for citizens of Tennessee and to be stewards of your natural environment. The same pollutants causing hazy skies are detrimental to the health of communities in the area and the millions of people who recreate in Tennessee's public lands, boosting the state's tourism revenue during their visits. Please do not overlook this opportunity to preserve viewsheds for future generations, keep tourism a viable industry in Tennessee, and protect the health of all who live here and enjoy Tennessee's treasured public lands.

Thank you,

National Parks Conservation Association

Sierra Club

Southern Environmental Law Center

Appalachian Voices

Center for Biological Diversity

Sowing Justice

Tennessee Citizens for Wilderness Planning

Tennessee Interfaith Power and Light

Citizens Climate Coalition

Appendix I-2

Comments from

Sierra Club

Tennessee Valley Resident Comments on
Regional Haze State Implementation Plan (SIP) for the Second Planning Period (2019-2028) under the authority of Tennessee Code Annotated, Section 68-201-105

Submitted via Sierra Club

The following document contains 201 signatures, 59 of which are accompanied by additional personal messages. These signatures indicate broad and diverse support for TDEC to act to clean up the haze in the Great Smoky Mountain National Park and Impacted Wilderness Areas.

The following spreadsheet contains names and contact information of people who signed the letter below:

TDEC must clean up the haze in the Great Smoky Mountain National Park and Impacted Wilderness Areas

I deeply value our parks and public lands and want to see them protected under the Regional Haze Rule. I am concerned that the Regional Haze plan proposed by TDEC will not amount to necessary pollution reductions and fails to make reasonable progress toward clean air to benefit the Great Smoky Mountains and Mammoth Cave National Parks, other regional wilderness areas, and the communities surrounding polluting facilities, like TVA coal plants.

Before finalizing this plan, I urge TDEC to include enforceable retirement of these old, polluting coal plants in the final haze plan and revisit the polluting sources requested by the Sierra Club. Please be true to your stated vision to safeguard the natural resources of Tennessee and make continued progress toward cleaner air by improving this plan.

Thank you for your consideration of these comments.

Full Name	City	State	Personal Message
Curtis Tomlin	Chattanooga	TN	ACT NOW!
Mary Lou Durham	Nashville	TN	As part of our critically important work to conserve the planet, the Regional Haze Rule is one of myriad small actions that help move our species toward sustainability on it. I urge you to insist on the enforceable retirement of Tennessee coal plants, Kingston and Cumberland, to be included in the proposed plan. To leave them out is to negate what can be positive action. Lip service to a good idea is not what is needed here, but actual comprehensive ruling!
Connie Stapleton	Hendersonville	TN	Choose health over greed!
Randal Graham	Knoxville	TN	Clean air in our mountains and surrounding areas is important enough to make TDEC require TVA to stop any haze pollution coming from their coal power plants.
Carolyn Heppel	Memphis	TN	Clean air, haze-free air is good for all of us and the environment. Let's polluting coal plants are not allowed to degrade our air which harms us, parks, and our communities.
Jerry Brown	Lewisburg	TN	Close em!
Brian H. Paddock	Baxter	TN	Do NO ignore TVA coal plants in your Haze Plan. TVA fossil fule burning threatens our forests and our lives by driving climate disruption. They need to be closed down ASAP.
Dennis Lynch	Memphis	TN	Finally, TVA MUST address the existential threat of the Climate Crisis. Every TVA action must reduce greenhouse gases This is serious!
Anne Grindle	Sewanee	TN	Forests are so valuable for the animals who depend upon them, as well as for the mental health of humans. Clean air makesnit easier to breathe and the views nicer!
Brenda Mcphail	Maryville	TN	Haze can contribute to unhealthy air consumption. It can result in lung disease, especially in those most vulnerable. Please help keep our air cleaner.
Candace Weddington	Murfreesboro	TN	I cherish my time in the state and National parks. I have cancer and I can?t be outside if the air quality is low. Please add the parks to this bill!
Hunter Sherwood	Oak Ridge	TN	I feel a comprehensive plan with commitments to close the TVA plants instead of rumored closures will help our communities become healthier. I now live fewer than five miles from one of the coal-burning plants and I see and feel the effects first hand. My decision to move closer to the plant was driven by the housing crisis. I couldn't afford to stay in Knoxville, so I am right outside of town and right next to the coal plant. I have a child and hope to have more. I am hopeful the pollution from the coal plant does not harm my child or future children, but I fear it will unless our society finds a way to furnish electricity without polluting the air.

Elizabeth Ramage	Nashville	TN	I have been worried about - and breathing - pollution from these coal plants for literally decades. It should have been limited and stopped many years ago, but there is no better time than NOW.
Courtney Shea	Knoxville	TN	I have taught natural resources law and have worked with Great Smoky Mountain National Park,Cumberland Gap National Park and Big South Fork National Park learning first hand the impact of coal fired plants on haze and acidity of air. TVA plants are the major source of both haze and acid rain--conclusively demonstrated by the improvement in air quality each time that a coal plant is retired. The State of Tennessee needs to hold them accountable for our physical health and for the economic health of our region.
Bethany & Joshua Johnson	Nashville	TN	I love the Smokey Mountains - and they don?t need more Smokey haze!
Debra Dunson	Spring Hill	TN	I personally suffer from respiratory illness caused by air pollution from fossil fuel combustion. Air pollution causes childhood asthma and premature deaths of adults. I am a chemist and understand the dangerous particulate and chemical species that are released from TVA's coal-fired plants. My childhood in Los Angeles, California, which was one of the smoggiest cities in the U.S., showed me firsthand the damage done to children's respiratory systems. There were times that my little brother turned blue from lack of oxygen during an asthma attack. Historically, I have observed the decline of the air quality in Tennessee. I lived in Nashville from 1977 through 1995 and returned to Middle Tennessee in 2018 to retire. My respiratory symptoms from the earlier period in Nashville were much milder compared with those I have now in Spring Hill. You must work for the good of all and address the polluted air entering Tennessee's national parks and wilderness areas.
Ann Strange	Knoxville	TN	I remember well those hot, humid, "hazy" days during East Tennessee's summers. That was pollution! There are fewer now because of closing TVA coal-fired plants. Keep us in blue skies!
Mountaine Mort Jonas	Liberty	TN	I visit the impacted areas regularly, and hope they are well-preserved for future generations!
Wilson & Suzanne Haizlip	Chattanooga	TN	I want Tennessee's parks and public lands to be protected under the Regional Haze Rules.I also want the RHP to be rigorous in its effort to reduce haze. I love TN's parks especially in east TN, I urge you to close old polluting coal plants in the final haze plan.
Susan Johnston	Nashville	TN	I want this state to be as beautiful for my grandchildren as it is now!

Katy Orrick	Oak Ridge	TN	I was so fortunate to be at Mt LeConte one evening when it was clear enough to see the Milky Way. That should happen much more ofter. I hike in the Smokies at least once a month and cherish those woods. Please protect them.
John Ioannou	Gallatin	TN	I will not be able to continue my support to the Republican Party if they do not work to close the coal plants. Please do not ignore the majority of people concerns.
Anne Carr	Nashville	TN	I'm astounded that TVA, perhaps the biggest polluter in our state, will be allowed to continue business as usual in terms of emissions that harm plants, wildlife, and humans. Please reconsider and seek to make sure the new requirements cover TVA coal plants in Tennessee.
Jacqueline Edmondson	Johnson City	TN	Immediately move toward Renewable energies and END tax-paid monies toward Fossil fuels NOW.
Erin White	Chattanooga	TN	It is unconscionable that we would continue to knowingly poison each other, and the plants, animals, and land on which we depend.
Matt Cutts	greeneville	TN	let us do this for our children and grandchildren thank you very much
Barbara Devaney	Nashville	TN	Let's do this. All citizens love and use our wonderful parks.
Laura Taylor	Murfreesboro	TN	Let's ensure that our children's future is secured in our beautiful state by getting rid of these harmful pollutants.
John Moses	Memphis	TN	Let's put our natural environment first! We depend on it! -Dan
Hiedi Tan	Knoxville	TN	Now is the time to do everything we can..before it is too late.
Charles Beck	Chattanooga	TN	Our Great Smokey Mountain parks need protecting. Please keep them clean and free from polution.
E Pyle	Nashville	TN	Our parks, national and more local, are worthy of protection. Help this protection.
Nancy Munro	Oak Ridge	TN	Our son had exercise-induced asthma growing up and air pollution may well have caused it as we lived downwind of the Kingston Steam Plant. Our children need clean air to grow up healthy!
Thomas Steffek	Memphis	TN	Over the years my wife and I have visited 80 parks and 100 other National sites. We want to continue our visits and save the parks for future generations. Air and water pollution will destroy this planet and there is no plan 'B'.
Donald Keyser	Johnson City	TN	Please be serious and include the worst polluters
Sarah Rabovsky	Nashville	TN	Please consider these efforts to protect our wilderness areas that are incredibly important to our state. Thank you.

Ann Logan	Franklin	TN	Please do what is right for all humans and creatures who breathe the air by revising the Regional Haze plan and including enforceable retirement of old, polluting coal plants as requested by those who care deeply about the health of our state and planet!
Veronica Cook	Chattanooga	TN	Stop poisoning our beautiful forests
Paul Bienhoff	Kingsport	TN	Suggest you spend some time at the museum at Grandfather Mountain, reviewing the exhibit about the impacts of acid rain and other airborne pollution - and the do the right thing regarding TVA's coal-fired plants.
Carley Wade	Mascot	TN	Thank you for doing what you can to clean up the air we breath.
Jeannie Hacker-Cerulean	Lupton City	TN	Thank you for taking action to help.
Katherine Barnett	Nashville	TN	Thank you for your consideration. Safeguarding our natural areas and air quality matters to me as an active Tennessean and also as a new mother. I hope for clean air for my son as he grows up in our beautiful state.
Joanne Logan	Antioch	TN	The ecosystems of these biodiversity gems will be harmed by these high levels of toxic pollutants. We must protect them!
Cris Corley	Lebanon	TN	The Gallatin Coal Plant continues to pollute the Cedar Glades of Lebanon, thousands of acres of natural area.
Belinda Hedge	Lenoir City	TN	The Smoky Mountains and its wildlife are one of the VERY FEW BIO DIVERSE lands left?TVA is slowly killing it all?KEEP TVA RESPONSIBLE
Jim Steitz	Gatlinburg	TN	There is no reason to exclude TVA coal plants from the TDEC regional haze rule, unless there is some unspoken understanding, withheld from the public, that TVA intends to continue operating Kingston and Cumberland beyond their stated closure dates. Given that these plants should have been closed yesterday on climate grounds alone, TDEC should write a pollution rule that commits to their closure by 2025 as TVA has indicated, with a prejudice toward earlier closure.
James Burks	Hendersonville	TN	This is just one variable in our climate crisis. Please act in the best interest of our citizens.
Maggie Conran	Nashville	TN	This is the only planet we?ve got. We need to clean it up before it?s too late!
Norma Morrison	Roan Mountain	TN	This issue matters to me because I want my children and grandchildren to enjoy our Tennessee lands as much as possible. Thank you for your service.
Barbara Gay	Nashville	TN	TVA has not had the best interests of the citizens of Tennessee in its decision-making. Please protect our beautiful state.
Mary Lasater	Franklin	TN	TVA needs to lead in this effort and support green power!

Susan B O'connor	Cookeville	TN	We have been to Clingman?s Dome when the awesome vista was obscured by haze. This is not only a health but an economic issue. Pollution effects tourism to our beautiful state.
Jeannine Horton	Greeneville	TN	We have some of the most prized forests and parks in the world! We also have some of the best recreation! It's long past time to protect the pollution that contributes to their destruction! We need clean energy and strict pollution regulations! We are better when we care for our Planet not just the economics of industry but also the economics of human, plant, animal and planet welfare! It's good for all and the generations to follow! We have a responsibility to steward these great gifts for humanity today and the future! This matters to me because I appreciate these great irreplaceable gifts!!!
Evelyn Leo	Kodak	TN	We have the most beautiful state and mtns but unfortunately it?s all being negatively impacted by the effects of the coal plants. Please address this in the new legislation
Dhana Schaal	Pleasant Shade	TN	We MUST preserve nature. Humans did the harm. Humans must undo the harm.
jim pfeiffer	Nashville	TN	We work with children every day, to improve their lives in Tennessee with STEM careers. Now is the time to act and the industry already agrees..........close the coal fired plants and stop the pollution it causes..........
richard Cesani	MEMPHIS	TN	we've only one planet, please don't kill it
Deborah Narrigan	Nashville	TN	You have the power to improve our air quality. Please retire the offending coal plants. Our health is in your hands.
Darik Barger	Telford	TN	you may like coal, but i like the sunshine - solar all the way!
Emily Graves	Memphis	TN	
Annie _		TN	
Chris Dacus	Bell Buckle	TN	
Christie Walters	Nashville	TN	
Vance Sterling	Tallassee	TN	
Cindy Whitt	Franklin	TN	
Alice Tym	Mcdnald	TN	
Laura Prestridge	Memphis	TN	
Melvin Hughes	Sparta	TN	
A M Thornbury	Hermitage	TN	
York Quillen	Knoxville	TN	
Brien Ostby		TN	

Jesse Gore	Nashville	TN
Mary Nell Thompson	Mary	TN
Linda Inness	Philadelphia	TN
Jeff Lewis	Henry	TN
Gloria Griffith	Mountain City	TN
Michael Dubrick	Knoxville	TN
carol buchman	MEMPHIS	TN
Gene Hughes	Gene	TN
Gayle Price	Hermitage	TN
Donna Duncan	Lebanon	TN
Chris Drumright	Murfreesboro	TN
Constance Barnes	Athens	TN
Eileen Gonzales	Cleveland	TN
Wilfred Post	Powell	TN
Larry Wenger	Cleveland	TN
Freddie Sykes	Tennessee Ridge	TN
Emily Robinson	Murfreesboro	TN
Russ Manning	Knoxville	TN
Emily Ellis	Knoxville	TN
Sonja Hunter	Lebanon	TN
Gerald Dooley	Kingston Springs	TN
Stan Jacobs		TN
Jeffry Stein	Nashville	TN
Ramil Abidi	Nashville	TN
Lisa Gordon	Murfreesboro	TN
Charlie Palmgren	Franklin	TN
Sarah Moss	Knoxville	TN
Van Bunch	Chattanooga	TN
Hiasaura Rubenstein	Nashville	TN
Melonee Oatsvall	Woodbury	TN
Shelby Hood	Franklin	TN
Steven Lipson	Nashville	TN
DAVID RIALL	Chattanooga	TN
David Johnson	Knoxville	TN

Craig Drew	chattanooga	TN
Jerry Brown	Lewisburg	TN
Ann Lucas	Mount Juliet	TN
Carmen Jones		TN
Jennifer Miller	Jennifer	TN
JoAnn McIntosh	Clarksville	TN
Stacey Nebel	Nashville	TN
Bruce Johnson	Johnson City	TN
Julie Johnson	Johnson City	TN
Katherine Crawford	Nashville	TN
Charles & Dinah Crow	Cumberland City	TN
Troy Bidwell	Knoxville	TN
Michael Friddell	Nashville	TN
Emilie Fauchet	Nashville	TN
Greg Loflin	Knoxville	TN
Hunter Sherwood	Knoxville	TN
Graham Marema	Norris	TN
Missy Harris	Nashville	TN
Mickey Sparkman	Nashville	TN
Ron Shrieves	Knoxville	TN
Donald Clark	Pleasant Hill	TN
Mary Reed	Lancing	TN
Matt Cutts	greeneville	TN
Gerald Thornton	Farragut	TN
Ann-Douglas Tycer	Brentwood	TN
Dyllan Becker	NASHVILLE	TN
Donna Brian	Knoxville	TN
Gayle Price	Nashville	TN
William Haney	Murfreesboro	TN
Gary Bowers	Nashville	TN
Van Bunch	Chattanooga	TN
Lelia Blizzard	Monteagle	TN
Gina Turner	Memphis	TN
Vera Pencheva	Nashville	TN

Curtis Tomlin	Chattanooga	TN
Laura Kramer	Hermitage	TN
Jason Elliot	Chattanooga	TN
Steven Morris	Sevierville	TN
Robert Sutton	Memphis	TN
Maureen May	Nashville	TN
Christopher Brooks	Knoxville	TN
Robin Woodruff	Knoxville	TN
John Rainey	38231	TN
Timothy Gaudin	Hixson	TN
Mark Klugiewicz	Jamestown	TN
Lewis Guess	Memphis	TN
Susan Johnston	Nashville	TN
Bobbie Hensley	GREENEVILLE	TN
Scott Banbury	Memphis	TN
Scott Banbury	Memphis	TN
Amy Kelly	Maryville	TN
Lynn Learch	Louisville	TN
Kate Moore	Knoxville	TN
John and Debbie Moore	Dickson	TN
Janice Fron	Burlison	TN
Windham Anne	Wartrace	TN
Diane Price	Antioch	TN
Helen Buckley	Chattanooga	TN
Eric Robinson	Memphis	TN
Linda Ledoux	Sevierville	TN
Ty Gorman	Greeneville	TN
Al Hansen	Crossville	TN
Amanda Adams	Nashville	TN
Adrienne Frey	Franklin	TN
Deborah Mangrum	DICKSON	TN
Sharghi Rahmanian	Knoxville	TN
Kellie Monahan	Franklin	TN
Elaine Vowell	Memphis	TN

Pamela Osborne	Memphis	TN
Robin Peeler	37918	TN
Ruth Jackson	Knoxville	TN
Elizabeth Ryan	Germantown	TN
Karen Terre	Memphis	TN
Heather Doncaster	Knoxville	TN
Alina Carrasquillo	Clarksville	TN
Herman Fletcher	Sevierville	TN
Richard Sacilotto	Chattanooga	TN
Al Hansen	Crossville	TN
Patsy McLaughlin	Germantown	TN
Michele Villeneuve	Kingsport	TN
Brady Watson	Knoxville	TN
David Bordenkircher	Nashville	TN
Eric Robinson	Memohis	TN
Scott Banbury	Memphis	TN
James Thoman	Hermitage	TN
Brianna Knisley	knoxville	TN
Mark Mundo	Sevierville	TN
Lisa Lundstrom	Fairview	TN
Margaret Davitt	Nashville	TN
Veronica Cox	Greeneville	TN
James Marziotti	Andersonville	TN
Susan Schuchard	37135	TN
DAVID RIALL	DAVID	TN
Robert Dornfeld	Athens	TN
Bobbie Hensley	GREENEVILLE	TN
Susan Thomas	Chattanooga	TN

Appendix I-3

Comments from

National Park Service

United States Department of the Interior

NATIONAL PARK SERVICE
Atlanta Federal Center
1924 Building
100 Alabama Street, SW
Atlanta, GA 30303

IN REPLY REFER TO:
10.D (SERO-NR)

December 2, 2021

Michelle Owenby
Director for Air Pollution Control
Tennessee Department of Environment and Conservation
312 Rosa L. Parks Avenue, 15th Floor,
Nashville, TN 37243

Dear Ms. Owenby,

Thank you for the opportunity to review and provide comments on the Tennessee pre-hearing draft Regional Haze State Implementation Plan (SIP) for the 2019–2028 planning period. The National Park Service (NPS) and the Tennessee Department of Environment and Conservation Division of Air Pollution Control (TDEC-APC) held a federal land manager (FLM) consultation meeting on August 24, 2021 followed by written comments on August 31, 2021. We appreciate the detailed responses to this consultation included in the October 21, 2021 pre-hearing draft SIP and now reiterate some of our recommendations. Detailed conclusions regarding the draft SIP are provided in the enclosure to this letter.

In summary, we find that significant opportunities for emission reductions are available that could improve the draft SIP. We recommend that TDEC-ACP:

1. Address NO_x emissions in reasonable progress determinations. As TDEC-ACP acknowledges in the response to NPS comments, ammonium nitrate is an increasingly important component of anthropogenic haze on the 20% most impaired days. This haze causing pollutant should be addressed in this round of regional haze planning.
2. Conduct four-factor analyses exploring both SO_2 and NO_x emission reduction opportunities for the seven facilities identified by the NPS in our consultation feedback. These facilities contribute to haze causing emissions affecting our Class I areas and should be considered in this planning period.
3. Implement the technically feasible and cost-effective measures that were evaluated in the draft SIP to improve SO_2 control efficiencies for the Cumberland and Tennessee Eastman facilities.

As we shared in our earlier feedback, the NPS appreciates that TDEC-ACP has developed a well-organized, detailed SIP, and engaged with the NPS during the FLM consultation period. We recognize the significant SO_2 and NO_x emission reductions and visibility improvements that Tennessee has achieved in the last decade. We also appreciate that TDEC-ACP has made several corrections to cost analyses for the Cumberland and Tennessee Eastman facilities, demonstrating a commitment to accurate cost effectiveness considerations.

Interior Region 2 • South Atlantic–Gulf
Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi
North Carolina, Puerto Rico, South Carolina, Tennessee, U.S. Virgin Islands

The NPS manages 48 of the 156 mandatory Class I areas across the country where visibility is an important attribute. NPS Class I areas affected by haze causing emissions from Tennessee include Great Smoky Mountains National Park, in Tennessee and North Carolina, as well as Mammoth Cave National Park, in Kentucky, and Shenandoah National Park, in Virginia. Haze can significantly diminish the visitor experience in these iconic parks that offer awe-inspiring vistas of ancient, rugged mountains; historic landscapes; diverse vegetation; and picturesque waterfalls.

We encourage Tennessee to take these opportunities to reduce haze causing emissions. The cumulative benefits of emission reductions from many sources are necessary to achieve the Clean Air Act and Regional Haze Rule goal to prevent future and remedy existing visibility impairment in Class I areas. TDEC-ACP analyses have identified emission reductions that would make further progress toward this goal. Tennessee has an opportunity to improve the effectiveness of their Regional Haze SIP by choosing to consider additional facilities, explore NOx emission reduction opportunities, and require cost-effective emission controls identified using the four statutory factors. These incremental steps are needed to advance reasonable progress goals.

We appreciate having the opportunity to review and comment on this important SIP and look forward to continued work with Tennessee for clean air and clear views. If you have questions, contact Denesia Cheek (denesia_cheek@nps.gov, 404-562-5809) or Melanie Peters (melanie_peters@nps.gov, 720-644-7632).

Sincerely,

Cassius M. Cash
Acting Regional Director

Enclosure

Enclosure 1

NATIONAL PARK SERVICE SUPPLEMENTAL COMMENTS ON TENNESSEE'S PRE-HEARING DRAFT REGIONAL HAZE SIP

This enclosure supplements our public comment letter and builds on technical feedback provided to the Tennessee Department of Environment and Conservation Division of Air Pollution Control (TDEC-APC) as part of federal land manager (FLM) consultation. This document specifically addresses TDEC-APC's response to our comments provided on August 31, 2021.

1. **TDEC-APC response to NPS comments on the exclusion of NO_x from the four-factor analyses and reasonable progress determinations:**

In their response to NPS and U.S. Forest Service comments, TDEC-APC acknowledged that the "relative contribution" of ammonium nitrate to visibility impairment has increased during the most-recent five-year period and concluded that "requiring additional NO_x controls on point sources in Tennessee would have little to no impact on improving visibility in the Great Smoky Mountains National Park." In their response to comments, TDEC-APC explains that the agency arrived at this conclusion for the following reasons:

- Sulfate is the dominant visibility impairing pollutant in Great Smoky Mountains NP.
- Based on the VISTAS source apportionment results, contributions to nitrate impairment from other states/regions exceed the contributions from Tennessee sources.
- TDEC-APC believes additional research is needed to understand which sources are contributing to the nitrate fraction both in Tennessee and out-of-state.

We agree that sulfate is the dominant anthropogenic visibility-impairing pollutant in Great Smoky Mountains NP *and* maintain that the nitrate contribution to impairment is also important. In Mammoth Cave NP, which is affected by emissions from Tennessee facilities (e.g., TVA Cumberland, see comments below), the contribution from nitrate to visibility impairment is similar to the sulfate contribution on the 20% Most-Impaired Days (MID) in the last of couple years. In 2018 the nitrate contribution to impairment in Mammoth Cave NP exceeded the sulfate contribution at 45% versus 37% of impairment, respectively.

The seven sources identified by the NPS for further analysis are significant regional sources of NO_x emissions. While other source sectors contribute to regional NO_x emissions, stationary point sources comprise approximately 31% of the total 2028 NO_x inventory. EPA has clarified that it "*generally expects that each state will analyze sulfur dioxide (SO_2) and nitrogen oxide (NO_x) in selecting sources and determining control measures*" (see the EPA July 8, 2021 Clarification Memorandum; hereinafter "Clarification Memo"). As described in our May 14, 2021 response to the VISTAS region states, the VISTAS source apportionment results used in the source selection process do not adequately account for the increasing contribution of ammonium nitrate on the 20% MID. Given this, the existing monitoring information should be used to conclude that NOx emissions should be evaluated in this planning period.

NO_x four-factor analyses for the seven sources recommended by the NPS would strengthen the Tennessee SIP. Under the CAA, final reasonable progress goals are to be established based on the four statutory factors and cannot be determined independent of the control technology analysis (See 82 FR 3078, 3091/3, January 10, 2017).

2. **<u>TDEC-APC Response to NPS comments on source selection</u>:**

The pre-hearing draft SIP states that the "*TDEC-APC stands by the analysis made in Sections 7.5 and 7.6. For both Class I areas located in Tennessee, the TDEC-APC believes the 1.00% threshold captures a reasonable set of sources of emissions to assess for determining what measures are necessary to make reasonable progress*." Tennessee maintains that their approach to source selection is appropriate for several reasons:

- Based on source apportionment results, stationary sources outside of Tennessee have a much higher impact on Class I areas in Tennessee than sources in the state.
- Significant progress has already been made in the Tennessee Class I areas. Accordingly, these areas are projected to be well below the uniform rate of progress (URP) and therefore, it is appropriate for TDEC-APC to select fewer sources if the Class I area is well below the URP.
- Given the differences in overall impairment between Class I areas, it is appropriate to select different thresholds for each area. TDEC-APC highlighted that "Great Smoky Mountains National Park still needs to achieve a much more significant reduction in emissions to achieve natural conditions as compared to other areas like the Everglades National Park. Tennessee recognized this challenge early on which is reflected in the significant improvement in visibility in the Class I areas in the state."

Section 2.1 of the EPA clarification memo notes that when applying a source selection methodology, "*states should focus on the in-state contribution to visibility impairment and not decline to select sources based on the fact that there are larger out-of-state contributors. What is reasonable will depend on the specific circumstances.* ***<u>We generally think that a threshold that captures only a small portion of a state's contribution to visibility impairment in Class I areas is more likely to be unreasonable</u>***."

The outcome of TDEC-APC's source selection process resulted in the evaluation of two sources for four-factor analysis, TVA Cumberland and Eastman Chemical. Based on the VISTAS PSAT results, these two sources account for 8.07% of Tennessee's projected 2028 contribution to impairment in Great Smoky Mountains. This is a small portion of *Tennessee's* contribution to impairment in Great Smoky Mountains NP. We continue to recommend that Tennessee select a larger portion of their in-state contribution to visibility impairment in the affected Class I areas.

EPA has consistently stated that the URP is not a “safe harbor” and should not be relied upon to decline selecting a reasonable number of sources for analysis or rejecting otherwise cost-effective control measures (See 82 FR 3078, 3091/3, January 10, 2017). We recognize Tennessee’s acknowledgement that a more significant reduction in emissions will be necessary to achieve natural conditions at Great Smoky Mountains NP relative to “cleaner” class I areas with much lower current impairment levels. (This is also the case for Mammoth Cave and Shenandoah NPs.)

Finally, in response to comments on the TVA Cumberland facility, TDEC-APC refers to their source-selection process to highlight why TVA Cumberland was selected. TVA Cumberland was selected for analysis because it exceeds the VISTAS 1% threshold at three USFS Class I areas (SIPS, SHRO, and LIGO) using the adjusted PSAT results. This example underscores our concern with the percent-of-total impact thresholds.

TVA Cumberland does not exceed the 1% threshold at any NPS Class I area even though Mammoth Cave is the second-most-impacted by TVA Cumberland emissions. Based on the absolute value adjusted PSAT results (in Mm^{-1}), Mammoth Cave has a modeled impact of 0.210 Mm^{-1} from TVA Cumberland (Sipsey Wilderness is the most impacted Class I area with a modeled impact of 0.242 Mm^{-1}). However, because Mammoth Cave NP has a much higher total EGU plus non-EGU impact (25.289 Mm^{-1} versus 16.370 Mm^{-1} at Sipsey, adjusted PSAT), TVA Cumberland’s impacts do not exceed the 1% threshold at the park. In fact, the absolute value of the adjusted TVA Cumberland impact at Mammoth Cave NP is nearly a third greater than the impact at Shining Rock Wilderness, but the percent-based impact is only 0.8% at Mammoth Cave vs. 1.32% at Shining Rock. This illustrates the fundamental problem with the 1% of total impact threshold, which is less protective of the more impacted Class I areas and misses important sources contributing to haze in the places that need the most improvement.

Facility	***Most Impacted USFS & NPS Class I Areas***	***Individual Source Impact (Mm-1 PSAT adjusted)***	***Total EGU + NonEGU Impact (Mm-1 PSAT adjusted)***	***Source Percent of Total Impact***
TVA Cumberland	SIPS	0.242	16.370	**1.48%**
	MACA	0.210	25.289	0.83%
	SHRO	0.162	12.313	**1.32%**
	LIGO	0.154	12.884	**1.20%**

3. **<u>TDEC-APC response to NPS source-specific four-factor analysis comments:</u>**

Tennessee responded to our source-specific feedback. For the two sources for which TDEC-APC required a four-factor analysis, the pre-hearing draft SIP notes the following:

- In response to the NPS comment regarding contingencies assumed in the Tennessee Eastman analysis, TDEC-APC notes in their response that the Control Cost Manual cannot disallow a specific approach.

- Tennessee did not apply a specific, bright-line cost metric to the cost analyses. Instead, TDEC-APC compared costs to average and maximum costs of previous BART and RP determinations compiled by VISTAS states and adjusted for inflation.
- The TDEC-APC took the FLM and EPA's comments on TVA's cost analysis into consideration and made adjustments, including the interest rate and contingency estimates (TDEC-APC did not adjust the equipment life assumptions). The recalculated the costs of compliance are documented in Appendix G-1g and G-2-f.
- For both facilities, TDEC-APC determined that the costs were too high to require additional control measures.
- Tennessee's review of the cost analyses resulted in the following revised cost estimates reported in the SIP:
    - TVA Cumberland (using the revised 3.25% interest rate and 15% contingency estimates):
        - Wall Ring Installation: $2,882/ton
        - Spray Headers Installation: $5,060/ton
    - Tennessee Eastman (using an 8% interest rate and 15-year equipment life)
        - Install DSI/FF for Boilers 21 & 22: $8,339/ton
        - Upgrade ESP to Fabric Filter for Boilers 23 & 24: $8,511/ton
        - Upgrade ESP to Fabric Filter for Boiler 30: $7,438.85/ton

We appreciate that TDEC-ACP has made several corrections to cost analyses for the Cumberland and Tennessee Eastman facilities, demonstrating a commitment to accurate cost effectiveness considerations. The TDEC-APC revised cost analysis for TVA Cumberland in make the costs associated with control even more cost effective.

In their scrubber upgrade analysis, TDEC-APC assumed a 10-year equipment life, based on pending retirement of the Cumberland units. These retirements should be federally enforceable if relied on to constrain the equipment life used in the cost analysis. Also as noted in TDEC-APC's response, these scrubbers were installed in 1995 and are 25+ years old. As such, it may be appropriate to take the age of the existing scrubbers into account when making this determination. When doing so, TDEC-APC should consider numerous examples of existing scrubbers operating well beyond the 30-year equipment life assumed for new scrubbers. Additionally, this points to the potential need to evaluate replacement of the aging scrubber system. Regardless, even with the 10-year equipment life assumption, the upgrades appear to be very cost-effective and should be implemented in this planning period.

The revised TDEC-APC cost estimates for Tennessee Eastman are within the cost thresholds being considered by other states in this round of regional haze planning. For example, Texas is using $5,000/ton, New Mexico $7,000/ton, and Colorado and Oregon $10,000/ton. NPS estimates, developed using CCM methods, are significantly lower:

- NPS cost estimates for Tennessee Eastman (using an 3.25% interest rate and 20-year equipment life)

- Install DSI/FF for Boilers 21 & 22: $5,955/ton
- Upgrade ESP to Fabric Filter for Boilers 23 & 24: $ 4,506/ton incremental cost of FF alone; $2,510/ton cost of new DSI + FF System
- Upgrade ESP to Fabric Filter for Boiler 30: $3,453/ton

The suggested control measures would result in substantial SO_2 reductions at this facility—approximately 3,524 TPY additional reductions based on NPS estimates. Given Tennessee Eastman's visibility impact in NPS Class I areas, we urge TDEC-APC to implement these options in this round of regional haze planning.

Appendix I-4

Comments from

U.S. Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303-3104

December 8, 2021

Michelle Walker Owenby, Director
Division of Air Pollution Control
Tennessee Department of Environment and Conservation (TDEC)
Tennessee Tower, 15th Floor
312 Rosa L. Parks Avenue
Nashville, Tennessee 37243-1102

Dear Ms. Owenby:

Thank you for your letter dated October 22, 2021, transmitting a prehearing package regarding the Regional Haze State Implementation Plan for the Second Implementation Period. This plan is the subject of a public hearing which was held December 1, 2021. The public comment period closes December 10, 2021. We have completed our review and offer the comments in the enclosure.

We look forward to continuing to work with you and your staff. If you have any questions, please contact Ms. Pepa Sassin, Chief, Air Regulatory Management Section at (404) 562-9075, or have your staff contact Ms. Pearlene Williams at (404) 562-9144.

Sincerely,

Lynorae Benjamin, Chief
Air Planning and Implementation Branch

Enclosures:
The U.S. Environmental Protection Agency (EPA) Prehearing Comments on Tennessee's Regional Haze Plan for the Second Period

cc:
Travis Blake, Division of Air Pollution Control, TDEC
Paul LaRock, Division of Air Pollution Control, TDEC

The U.S. Environmental Protection Agency (EPA) Prehearing Comments on Tennessee's Regional Haze Plan for the Second Period

** All page numbers refer to the state implementation plan (SIP) narrative unless specified otherwise.*

Key Comment

Interstate Consultation: Once state consultations have concluded with Georgia and Indiana, please document the final outcomes pursuant to 40 CFR 51.308(f)(2)(ii).

General Comments

1. **Federal Land Manager Consultation:** The EPA recommends including the referenced spreadsheet listed on pages 251 and 253 of the SIP narrative in the final plan. Also, the EPA is aware additional spreadsheets were provided by the National Park Service; the EPA recommends including those spreadsheets in the final plan.

2. **Eastman Chemical Company (Eastman):** The EPA recommends clarifying the permit terms for Eastman by adding "Combined" and "collectively" as follows: "Combined Sulfur dioxide (SO_2) emissions from Boilers 23 and 24 shall not collectively exceed 1,396 tons during any period of 12 consecutive months."

3. **Tennessee Valley Authority (TVA)-Cumberland:**

    a. The EPA recommends clarifying the explanation on page 247 of the SIP narrative and on page 16 of Appendix G-1g for use of a 10-year equipment life in the cost calculations and presenting this rationale consistently throughout the narrative and Appendix G-1. The EPA will work with the State to address this comment.
    b. The EPA recommends clarifying the text on page 19 of Appendix G-1g that the State is not relying on the projected shutdown dates for Units 1 and 2 at TVA-Cumberland for the four-factor analysis.
    c. The EPA recommends clarifying whether visibility benefits were considered in the conclusion in lines 4-6 on page 18 of Appendix G-1g. If visibility benefits were considered in the conclusion that additional sulfur dioxide control measures were found not cost effective at TVA-Cumberland, the EPA recommends considering the principles identified in Section 5.1 of the EPA's July 8, 2021, memorandum.[1]

[1] See pages 12 and 13 of the EPA's July 8, 2021, Memorandum, *Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period*.

Appendix I-5

Comments from

New Jersey Department of Environmental Protection

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
401 EAST STATE STREET
P.O. BOX 420, MAIL CODE 401-02
TRENTON, NEW JERSEY 08625
TEL: (609) 984-1484
www.nj.gov/dep/daq/

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

SHAWN M. LATOURETTE
Commissioner

FRANCIS C. STEITZ
Director

December 1, 2021

Submitted via email: Air.Pollution.Control@tn.gov

Mark Reynolds
Tennessee Department of Environment and Conservation
Division of Air Pollution Control
William R. Snodgrass Tennessee Tower, 15th Floor
312 Rosa L. Parks Avenue
Nashville, TN 37243

Dear Mr. Reynolds:

Thank you for providing the New Jersey Department of Environmental Protection (NJDEP) the opportunity to comment on Tennessee's pre-hearing draft Regional Haze State Implementation Plan (hereinafter, pre-hearing regional haze SIP) for the Second Planning Period (2019-2028), dated October 21, 2021. This pre-hearing regional haze SIP addresses visibility impacts in Tennessee's Class I areas: the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, which are also located in both North Carolina and Tennessee.

Emissions from Tennessee were identified as significantly contributing to visibility impairment at Class I areas in Mid-Atlantic/Northeast Visibility Union (MANE-VU), however, New Jersey's Class I area at the Brigantine Wilderness Area was not one of them. As a member of the Mid-Atlantic/Northeast Visibility Union (MANE-VU), NJDEP has reviewed Tennessee's pre-hearing regional haze SIP and is submitting comments in support of those being submitted by MANE-VU.

Tennessee must ensure that it addresses the enforceable measures necessary for reasonable progress presented in the MANE-VU Inter-RPO "Ask" in its final regional haze SIP for review and action by EPA. According to the federal Regional Haze rule (40 CFR § 51.308 (f)(2)(ii)(B)), "The State must consider the emission reduction measures identified by other States as being necessary to make reasonable progress in the mandatory Class I Federal area." NJDEP's comments are as follows:

Emission Reduction Measures Identified in the New Jersey and MANE-VU "Asks"

Tennessee's pre-hearing regional haze SIP does not adequately address New Jersey and MANE-VU's "Ask"[1] of upwind contributing states as required by 40 CFR § 51.308(f)(2)(ii)(A), "The State must demonstrate that it has included in its implementation plan all measures agreed to during state-to-state consultations or a regional planning process, or measures that will provide equivalent visibility improvement." New Jersey and MANE-VU's technical analysis identified emissions from Tennessee and other upwind states as reasonably anticipated to contribute to visibility impairment at multiple MANE-VU Class I areas. Based on this analysis, New Jersey and MANE-VU developed a "MANE-VU Ask" that was sent to Tennessee and the other identified states with five requests for consideration during the upwind states' second haze SIP planning effort. The Asks are discussed below:

Ask #1: Electric Generating Units (EGUs) >25 MW with installed controls, ensure that controls are run year-round.

Page 228 of Tennessee's prehearing regional haze SIP states, "As stated in Section 7.2.2.1, all of the coal-fired EGU's in Tennessee have SO_2 and NOx control devices, and these control devices are required to operate continuously." New Jersey acknowledges these efforts.

Ask #2: Emissions sources with 3.0 Mm-1 impact or greater at MANE-VU Class I areas, perform a four-factor analysis.

Ask #2 is not applicable to Tennessee.

Ask #3: Ultra-low sulfur fuel oil standard

Tennessee did not address this Ask. Tennessee should adopt an ultra-low fuel oil standard consistent with the New Jersey and MANE-VU Ask as part of its long-term strategy (LTS) or demonstrate in its SIP why it would not be reasonable to do so. For distillate oil, this would be essentially the equivalent of on-road diesel, which is already widely available. It should be noted that all MANE-VU states have successfully adopted low sulfur fuel oil standards.

Ask #4: EGUs and other large sources, pursue enforceable mechanisms to lock in lower emission rates.

New Jersey notes the efforts of regulated sources in Tennessee that have entered into enforceable consent agreements to reduce NOx and SO_2 emissions. A regulation should be adopted that requires all identified sources that burn coal to use low sulfur coal.

Ask #5: Encourage and promote energy efficiency and clean technologies

Tennessee stated in several places in their prehearing regional haze SIP that renewable energy contributed to the significant reductions in NOx and SO_2 emissions but did not provide any details on

[1] *Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) States Concerning a Course of Action in Contributing States Located Upwind of MANE-VU Toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028), August 25, 2017.*
(https://otcair.org/manevu/document.asp?fview=Formal%20Actions)

these efforts. New Jersey asks that Tennessee document in its prehearing regional haze SIP any measures or efforts being considered for energy efficiency and clean technologies.

Thank you for the opportunity to comment on Tennessee's pre-hearing regional haze SIP. If you have any questions regarding this letter or wish to discuss further, please do not hesitate to contact me at Sharon.Davis@dep.nj.gov.

Sincerely,

Sharon Davis

Sharon Davis, Chief
Bureau of Evaluation and Planning

c: (Email letter only)
Richard Ruvo, EPA Region 2
Caroline Freeman, EPA Region 4
Francis C. Steitz, NJDEP
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Judy Rand, NJDEP
Stella Oluwaseun-Apo, NJDEP

Appendix I-6

Comments from

MANE-VU

Mid-Atlantic/Northeast Visibility Union
MANE-VU

Reducing Regional Haze for Improved Visibility and Health
89 South Street, Suite 602 Boston, MA 02111
617-259-2005 otcair.org/manevu

December 1, 2021

Mark Reynolds
Tennessee Department of Environment and Conservation
Division of Air Pollution Control
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 15th Floor
Nashville, TN 37243 VIA Email

RE: Tennessee Regional Haze State Implementation Plan, Pre-Hearing Draft, October 21, 2021

Dear Mr. Reynolds:

The Mid-Atlantic/Northeast Visibility Union (MANE-VU) appreciates the opportunity to comment on the Tennessee Department of Environment and Conservation's (TN DEC's) pre-hearing draft Regional Haze State Implementation Plan (SIP) for the second implementation period dated October 21, 2021 (hereinafter, the pre-hearing draft). The pre-hearing draft is of interest to MANE-VU because MANE-VU identified Tennessee emissions as significantly contributing to visibility impairment at Class I areas in the region. MANE-VU's comments below relate to meeting the MANE-VU Inter-RPO Ask. An additional comment follows the Inter-RPO Ask discussion.

MANE-VU Ask

Ask #1: EGUs ≥ 25 MW with installed controls, ensure that controls are run year round.

Page 228 states "As stated in Section 7.2.2.1, all of the coal-fired EGU's in Tennessee have SO_2 and NOx control devices, and these control devices are required to operate continuously." MANE-VU notes these efforts.

Ask #2: For emissions sources having a 3.0 Mm^{-1} impact or greater at MANE-VU Class I areas, perform a four-factor analysis.

This Ask item is not applicable to Tennessee.

Ask #3: Adopt an ultra-low sulfur fuel oil standard

MANE-VU respectfully reaffirms its request that TN DEC adopt an ultra-low fuel oil standard as requested in the original MANE-VU Inter-RPO Ask and in

MANE-VU's letter to TN DEC dated February 17, 2021. Alternatively, TN DEC should document in its SIP why the adoption of such a standard is infeasible.

Ask #4: For EGUs and other large sources, pursue enforceable mechanisms to lock in lower emission rates.

MANE-VU notes the efforts of regulated sources in TN that have entered into enforceable consent agreements.

Ask #5: Encourage and promote energy efficiency and clean technologies

TN DEC stated in several places in its SIP that renewable energy contributed to significant reductions in SO_2 and NOx emissions, but TN DEC did not specifically document what these efforts consist of. MANE-VU asks that TN DEC document in its Regional Haze SIP any measures or efforts they are considering for energy efficiency and clean technologies. Rather than a focus on energy markets, this would be a discussion within TN DEC's haze SIP of the energy efficiency measures and clean energy programs under consideration, or currently operating, in Tennessee. Unlike MANE-VU's other Ask items, MANE-VU does not necessarily intend that these measures be enforceable or included as part of a state's long-term strategy. But because such programs can reduce emissions and therefore benefit visibility, MANE-VU is asking its upwind state partners to consider and report such measures in their haze SIPs.

Additional Comment

Section 10.3, Consultation with MANE-VU, Technical Analysis – Inventories, Modeling, and Evaluation, pages 225-228

TN DEC stated that the MANE-VU states' analysis used emission inventories that are outdated and inconsistent with the recent EPA regional haze modeling platform, and that the inventories do not fully reflect emission reductions expected from southeastern EGUs. TN DEC also stated that MANE-VU states used the CALPUFF model and the Q/d screening approach to identify contributions that they allege are significant, and that CALPUFF should not be used for transport distances greater than 300 km because there are serious conceptual concerns with the use of puff dispersion models for very long-range transport that can result in overestimations of surface concentrations by a factor of three to four.

Here, MANE-VU would like to simply re-iterate the remarks that it made in Section I of MANE-VU's February 17, 2021 letter to TN DEC, specifically that MANE-VU used a weight of evidence approach, consistent with EPA guidance, to determine which states are reasonably anticipated to contribute to visibility impairment at MANE-VU Class I areas. In the February 17, 2021 letter, MANE-VU explained:

> This approach is consistent with EPA's 2019 *Guidance on Regional Haze State Implementation Plans for the Second Implementation Period*, which states that "[a] variety of technical, quantitative approaches exist to assess which out-of-state Class I areas may be affected by aggregate emissions from a given state"; and "a state may use another reasonable approach (e.g., back trajectory-based approaches)."

> Consistent with this guidance, MANE-VU used several technical, quantitative methodologies as screening tools to identify states that are reasonably anticipated to contribute to visibility impairment at MANE-VU Class I areas. To account for uncertainties that may exist with any one analysis method, MANE-VU did not rely solely on the absolute magnitude of the contribution predicted by any one method, but rather used the results of each method to develop a relative ranking of state impacts in determining which states are reasonably anticipated to contribute to visibility impairment at MANE-VU Class I areas.

Thank you for your efforts and your consideration of these comments. If you would like further clarification or discussion on any of these comments, please contact the MANE-VU Lead Manager Paul Miller (pmiller@nescaum.org) or the Chairs of the MANE-VU Technical Support Committee: Sharon Davis of the New Jersey Department of Environmental Protection (sharon.davis@dep.nj.gov) and David Healy of the New Hampshire Department of Environmental Services (david.s.healy@des.nh.gov).

Sincerely,

/s/Sharon Davis, New Jersey Department of Environmental Protection
/s/David Healy, New Hampshire Department of Environmental Services
Co-Chairs, MANE-VU Technical Support Committee

Appendix I-8

Comments from

National Parks Conservation Association, Sierra Club, Tennessee Citizens for Wilderness Planning, and Coalition to Protect America's National Parks

(main narrative only without attachments)

December 10, 2021

Michelle Owenby
Director
Division of Air Pollution Control
Tennessee Department of Environment and Conservation
312 Rosa L. Parks Avenue, 15th Floor
Nashville, TN 37243

Comments submitted via email to: *Air.Pollution.Control@tn.gov*

Re: Conservation Organizations Comments on the Pre-Hearing Draft Tennessee Regional Haze State Implementation Plan

Dear Ms. Owensby,

The National Parks Conservation Association, Sierra Club, Tennessee Citizens for Wilderness Planning and Coalition to Protect America's National Parks ("Conservation Organizations") submit the following and attached comments regarding the Tennessee Department of Environmental and Conservation Division of Air Pollution Control's ("TDEC") Pre-Hearing Draft Tennessee Regional Haze State Implementation Plan ("Draft SIP") dated October 21, 2021. The Conservation Organizations appreciate the seven working day extension TDEC provided to submit comments on the Draft SIP.

National Parks Conservation Association ("NPCA") is a national organization whose mission is to protect and enhance America's National Parks for present and future generations. NPCA performs its work through advocacy and education. NPCA has over 1.64 million members and supporters nationwide, with more than 6,566 in the State of Tennessee, with its main office in Washington, D.C. and 24 regional and field offices. NPCA is active nation-wide in advocating for strong air quality requirements to protect our parks, including submission of petitions and comments relating to visibility issues, regional haze State Implementation Plans, climate change and mercury impacts on parks, and emissions from individual power plants and other sources of pollution affecting National Parks and communities. NPCA's members live near, work at, and recreate in all the national parks, including those directly affected by emissions from Tennessee's sources.

Sierra Club is a national nonprofit organization with 67 chapters and more than 830,000 members dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth's ecosystems and resources; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. The Sierra Club has long participated in Regional Haze rulemaking and litigation across the country in order to advocate for public health and our nation's national parks.

The **Coalition to Protect America's National Parks** (Coalition) is a non-profit organization composed of over 2,000 retired, former and current employees of the National Park Service (NPS). The Coalition studies, speaks, and acts for the preservation of America's National Park System. As a group, we collectively represent over 40,000 years of experience managing and protecting America's most precious and important natural, cultural, and historic resources.

As discussed in these comments, we have serious concerns regarding TDEC's Draft Regional Haze SIP for the Second Implementation Period. As detailed below, TDEC's Draft SIP will not result in reasonable progress towards improving visibility at the Class I areas its sources impact, including those located in Tennessee: Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Areas as well as Class I areas in neighboring states.

Despite the thousands of tons of controllable pollution from Tennessee sources including coal-fired powered plants, chemical facilities, cement kilns, among others, and the many opportunities for cost-effective controls, Tennessee improperly concludes that almost no new reductions in pollution are warranted. Indeed, while we support TDEC's evaluation of the two sources via the Four-Factor Analysis – Eastman Chemical Company and TVA Cumberland Fossil Plant – neither source was required to implement any additional controls or measures,[1] despite reasonable progress control options. Moreover, TDEC must also do Four-Factor Analyses for additional sources and to ensure pollution controls are required to cut emissions from the polluting sources.

[1] "Tennessee Regional Haze State Implementation Plan," Pre-Hearing Draft (Oct. 21, 2021), ("Draft SIP") Draft SIP Executive Summary at 5, https://www.tn.gov/content/dam/tn/environment/air/documents/publicnotices/APC_TN_SIP_Regional_Haze_Pre-Hearing_10212021.pdf.

According to NPCA's analysis of polluting sources in Tennessee, 65% of visibility impairing pollution comes from chemical plants, coal-fired power plants, and cement facilities,[2] including the following ten sources omitted from a Four-Factor Analysis by TDEC:

- TVA Kingston,
- TVA Gallatin,
- AGC Industries – Greenland Plant,
- O-N Minerals (Luttrell),
- Trelleborg Coated Systems U.S., INC,
- Signal Mountain Cement CO.,
- Packaging Corporation of America,
- Tennessee Gas Pipeline Company, Station 860, and
- Tennessee Gas Pipeline Company, Station 87.

To satisfy the Clean Air Act ("Act") and Regional Haze Rule ("RHR") TDEC must correct the flaws identified in these comments and in the attached technical reports by Joe Kordzi[3] and D. Howard Gebhart,[4, 5] including:

- Conducting a Four-Factor Analysis and requiring adequate pollution controls and enforceable SIP emission limits for the ten sources the National Park Service and NPCA identified and listed above;
- Setting enforceable retirements in the SIP for any source the state is counting on for pollution reduction to help achieve reasonable progress, including the Kingston and Cumberland TVA coal plants;
- Requiring the installation of reasonable progress control options (wall rings) at TVA Cumberland for an additional 719 tons reductions of SO_2 and evaluating control options for the NOx and PM emissions;
- Making the retirement of boilers 18, 19, and 20 at the Eastman Chemical Company enforceable as part of this SIP;
- Requiring Eastman Chemical Company to install SO_2 pollution controls on uncontrolled boilers 21 and 22 and evaluate measures to reduce the NOx and PM emissions from all the remaining boilers; and
- Thoroughly assessing environmental justice impacts (as EPA recommended).

Moreover, these comments also explain that TDEC's Draft SIP:

---

[2] NPCA Regional Haze Fact Sheet: Tennessee, https://drive.google.com/file/d/19YJcKzxPOUj9rGyxcK0wKodg-P6gvFwp/view (Exhibit 1) ("NPCA's Regional Haze Fact Sheet for Tennessee").
[3] Joe Kordzi, "A Review of the Tennessee Regional Haze State Implementation Plan" (Nov. 2021). Mr. Kordzi is an independent air quality consultant and engineer with extensive experience in the regional haze program. ("Kordzi Report") (Exhibit 2).
[4] D. Howard Gebhart, "Technical Review of VISTAS Visibility Modeling for the Second Round of Regional Haze State Implementation Plans" (May 2021). ("Gebhart May 2021 Report") (Exhibit 3)
[5] D. Howard Gebhart, "Technical Review of North Carolina Regional Haze State Implementation Plan Second Round of Regional Haze State Implementation Plans Supplemental Report" (Oct. 2021) ("Gebhart October 2021 Report") (Exhibit 4). Mr. Gebhart is an air quality meteorologist with 40 years of experience in air quality permitting, specializing in air dispersion modeling; and his CV is attached to his report.

- Fails to *first* evaluate whether additional emission reductions from sources are necessary via the Four-Factor Analysis reasonable progress determinations to ensure reasonable progress toward the Clean Air Act's visibility goal;
- Relies on alleged "on-the-books" emission reductions absent any enforceable requirement;
- Defers making Four-Factor Analysis determinations based on purported emission reductions from other programs;
- Relies on flawed modeling data and assumptions that are not secured via enforceable SIP requirements to predict that visibility will continue to improve in 2028; and
- Relies on flawed and incomplete consultations with the Federal Land Managers, other states and Regional Planning Organizations (RPOs).

The Clean Air Act requirements for Tennessee's Regional Haze Plan present a significant opportunity to not only improve the skies at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, which are located in both Tennessee and North Carolina as well as across the region's treasured public lands but also the air quality in communities across the state, including some of the most disproportionately affected by health harming pollution that can and must be abated. Despite the legal requirements necessary to ensure reasonable progress, TDEC's Draft SIP contains fundamental flaws and fails to propose any new emission reductions for its sources.

Our comments present these issues and offer detailed suggestions to ensure that the SIP Tennessee submits to EPA will be in line with the legal requirements of the Clean Air Act and federal regulations, and address visibility impairing emissions.

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I. Introduction and Background

Tennessee is home to two Class I areas: Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. These national parks and wilderness areas are iconic, treasured landscapes and Tennessee is rich in these resources.

Congress set aside these national parks and wilderness areas to protect our natural heritage for generations. Tennessee's protected areas also generate millions of dollars in tourism revenue, provide habitat for a range of species, and provide year-round recreational opportunities for residents. . Indeed Great Smoky Mountains is the most visited national park in the system with over 12 million visitors in 202 and generating $1.3 billion in economic benefits.[6] This and other special places are designated "Class I areas" under the Clean Air Act ("CAA") and as such, their air quality is entitled to the highest level of protection.

To improve air quality in our most treasured landscapes, Congress passed the visibility protection provisions of the Clean Air Act in 1977, establishing "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in the mandatory class I Federal areas which impairment results from manmade air pollution."[7] "Manmade air pollution" is defined as "air pollution which results directly or indirectly from human activities."[8] In order to protect Class I areas' "intrinsic beauty and historical and archeological treasures," the regional haze program establishes a national regulatory floor and requires states to design and implement programs to curb haze-causing emissions within their jurisdictions. Each state must submit for EPA review a SIP designed to make reasonable progress toward achieving natural visibility conditions.[9]

A regional haze SIP must provide "emissions limits, schedules of compliance and other measures as may be necessary to make reasonable progress towards meeting the national goal."[10] Two of the most critical features of a regional haze SIP are the requirements for installation of Best Available Retrofit Technology ("BART") limits on pollutant emissions *and a long-term strategy for making reasonable progress toward the national visibility goal*.[11] Although many states addressed the Clean Air Act's BART requirements in their initial regional haze plans, EPA's 2017 revisions to the RHR make clear that BART was not a once-and-done requirement. Indeed, states "will need" to reassess "BART-eligible sources that installed only moderately effective controls (or no controls at all)" for any additional technically-achievable controls in the second planning period.[12] The haze requirements in the Clean Air Act present an unparalleled

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[6] U.S. National Park Service, 2020 Economic Impact - Great Smoky Mountains National Park, https://www.nps.gov/grsm/learn/news/2020-economic-impact.htm (Exhibit 5).
[7] 42 U.S.C. § 7491(a)(1).
[8] *Id.* § 7491(g)(3).
[9] *Id.* § 7491(b)(2).
[10] 42 U.S.C. § 7491(b)(2).
[11] *Id.* § 7491(b)(2)(B); 40 C.F.R. § 51.308(d)(1)(i)(B).
[12] 82 Fed. Reg. 3078, 3,083 (Jan. 10, 2017); *see also id.* at 3,096 ("states must evaluate and reassess all elements required by 40 CFR 51.308(d)").

opportunity to protect and restore regional air quality by curbing visibility-impairing emissions from a variety of polluting sources.

Implementing the regional haze requirements promises benefits beyond improving views. Pollutants that cause visibility impairment also harm public health. For example, oxides of nitrogen ("NOx") are a precursor to ground-level ozone which is associated with respiratory disease and asthma attacks. NOx also reacts with ammonia, moisture and other compounds to form particulates that can cause and/or worsen respiratory diseases, aggravate heart disease, and lead to premature death. Similarly, sulfur dioxide ("SO_2") increases asthma symptoms, leads to increased hospital visits, and can also form particulates. NOx and SO_2 emissions also harm terrestrial and aquatic plants and animals through acid rain as well as through deposition of nitrates (which in turn cause ecosystem changes including eutrophication of mountain lakes).

Unfortunately, the promise is of natural visibility is unfulfilled because the air in most Class I areas, including in Tennessee's most treasured natural areas, remains polluted by industrial sources, including the sources identified in Table 1, which are covered in our comments.

Table 1. Sources Identified by NPCA and the National Park Service that Warrant Four-Factor Analysis and Emission Limitations in the SIP.[13, 14]

Source Name	Q (tons of NOx, PM_{10}, and SO_2)	Cumulative Q/d (Q/d>=5)	D (km) to nearest Class I area	Q/d	Nearest Class I Area	Number of Class I Areas Impacted (NPCA Analysis)[15]	Source Category
TVA Kingston	3176	421.5	60	53	GRSM[16]	16	Coal-powered electric

[13] The information in this Table is from the NPCA interactive map that provides users access to point and non-point source emissions data based on NPCA's assessment of publicly available information curated to identify sources and industrial sectors of concern to visibility in Class I area national parks and wilderness areas. The sources identified likely merit review by states to determine whether and what emission reduction options are feasible to achieve reasonable progress towards the restoration of natural visibility at Class I areas, and otherwise benefit progress toward clean air in all of our communities. The map lets one visualize the locations and details of emission sources, the level of emissions of different pollutants, and the Class I areas potentially affected by each source. The interactive map also provides information on emissions from oil and gas infrastructure such as wells, drilling rigs, compressor stations, pipelines, and refineries at the county level. Additional layers are available to visualize the 8-hour Ozone (2015) nonattainment areas as well as vulnerable populations by county density, including people of color and people living below the poverty line. https://npca.maps.arcgis.com/apps/MapSeries/index.html?appid=73a82ae150df4d5a8160a2275591e45d.

[14] *See,* Letter and Enclosure from Cassius M. Cash, Acting Regional Director, National Park Service – Atlanta, to Michelle Owenby, Director for Air Pollution Control, TDEC, (Dec. 2, 2021) (Exhibit 25) ("NPS December 2021 Letter").

[15] NPCA's Regional Haze Fact Sheet for Tennessee.

[16] Great Smokey Mountains National Park.

Source Name	Q (tons of NOx, PM_{10}, and SO_2)	Cumulative Q/d (Q/d>=5)	D (km) to nearest Class I area	Q/d	Nearest Class I Area	Number of Class I Areas Impacted (NPCA Analysis)[15]	Source Category
TVA Gallatin[17]	3036	116	92	33	MACA[18]	9	Coal-powered electric
AGC Industries – Greenland Plant	2690	161	84	32	GRSM	12	Glass Manufacturing
O-N Minerals (Luttrell)	527	15	27	9	GRSM	2	Lime Manufacturing
Trelleborg Coated Systems U.S., Inc	4690	421	46	103	GRSM	16	Rubber Product Manufacturing
Signal Mountain Cement CO.	1464	66	64	23	COHU[19]	6	Cement Manufacturing
Packaging Corporation of America	2312	63	105	22	SIPS[20]	7	Pulp and Paper Plant
Tennessee Gas Pipeline Company, Station 860	1511	29	168	9	SIPS	4	Oil and Gas Compressor Station
Tennessee Gas Pipeline Company, Station 87	1103	16	69	16	MACA	1	Oil and Gas Compressor Station

[17] Based on emissions from the 2014 NEI.
[18] Mammoth Cave National Park.
[19] Cohutta Wilderness.
[20] Sipsey Wilderness.

II. Requirements for Periodic Comprehensive Revisions for Regional Haze SIPs

A. Clean Air Act and Regional Haze Rule

In developing its long-term strategy, a state must consider its anthropogenic sources of visibility impairment and evaluate different emission reduction strategies including and beyond those prescribed by the BART provisions.[21] A state should consider "major and minor stationary sources, mobile sources and area sources."[22] At a minimum, a state must consider the following factors in developing its long-term strategy:

> (A) Emission reductions due to ongoing air pollution control programs, including measures to address reasonably attributable visibility impairment;
> (B) Measures to mitigate the impacts of construction activities;
> (C) Emissions limitations and schedules for compliance to achieve the reasonable progress goal;
> (D) Source retirement and replacement schedules;
> (E) Smoke management techniques for agriculture and forestry management purposes including plans as currently exist within the State for these purposes;
> (F) Enforceability of emission limitations and control measures; and
> (G) The anticipated net effect on visibility due to projected changes in point, area, and mobile emissions over the period addressed by the long-term strategy.[23]

Additionally, a 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.[24]

In developing its plan, the state must document the technical basis for the SIP, including monitoring data, modeling, and emission information, including the baseline emission inventory upon which its strategies are based.[25] All of this information is part of a state's revised SIP and subject to public notice and comment. A state's reasonable progress analysis must consider the four-factors identified in the Clean Air Act and regulations.[26]

EPA's 2017, Regional Haze Rule Amendments made clear that states are to first conduct the required Four-Factor Analysis for its sources, and then use the results from its Four-Factor

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[21] 40 C.F.R. § 51.308(f).
[22] *Id.* § 51.308(f)(2)(i).
[23] *Id.* § 51.308(f)(2)(iv).
[24] 40 C.F.R. § 51.308(f)(2)(i).
[25] *Id.*
[26] *See* CAA 169A(g)(1); 40 C.F.R. 51.308(f)(2)(i) ("the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected anthropogenic source of visibility impairment.")

Analyses and determinations to develop the reasonable progress goals.[27] Specifically, EPA explained in its final notice that it proposed, took and responded to comments and amended 40 C.F.R. § 51.308(f) to eliminate the cross-reference to 40 C.F.R. § 51.308(d) to "codify …[its] long-standing interpretation of the way in which the existing regulations were intended to operate" to track "the actual [SIP] planning sequence" as follows, thus, states are required to:

VII. [C]alculate baseline, current and natural visibility conditions, progress to date and the URP;
VIII. [D]evelop a long-term strategy for addressing regional haze by evaluating the four factors to determine what emission limits and other measures are necessary to make reasonable progress;
IX. [C]onduct regional-scale modeling of projected future emissions under the long-term strategies to establish RPGs and then compare those goals to the URP line; [FN73] and
X. [A]dopt a monitoring strategy and other measures to track future progress and ensure compliance.[28]

Moreover, in promulgating the RHR EPA stated that:

> The CAA requires states to determine what emission limitations, compliance schedules and other measures are necessary to make reasonable progress by considering the four factors. The CAA does not provide that states may then reject some control measures already determined to be reasonable if, in the aggregate, the controls are projected to result in too much or too little progress. Rather, the rate of progress that will be achieved by the emission reductions resulting from all reasonable control measures is, by definition, a reasonable rate of progress. … [I]f a state has reasonably selected a set of sources for analysis and has reasonably considered the four factors in determining what additional control measures are necessary to make reasonable progress, then the state's analytical obligations are complete if the resulting RPG for the most impaired days is below the URP line. *The URP is not a safe harbor*, however, and states may not subsequently reject control measures that they have already determined are reasonable.[29]

Thus, the key determinant in whether a state's "robust determination" obligation has been satisfied under Section 51.308(f)(3)(ii)(B) is not whether the Reasonable Progress Goal ("RPG") of a Class I Area is below that Class I Area's URP, but rather whether a state has considered and determined requirements to make reasonable progress based on the four-factors. A state must consider the four-factors *regardless* of the status of any Class I Area's RPG.

The state's SIP revisions must meet certain procedural and consultation requirements.[30] The state must consult with the Federal Land Manager(s) and look to the Federal Land Managers' expertise of the lands and knowledge of the way pollution harms them to guide the state to

[27] 82 Fed. Reg. at 3090-91.
[28] *Id.* at 3091.
[29] *See*, 82 Fed. Reg. at 3093 (emphasis added).
[30] For example, in addition to the RHR requirements, states must also follow the SIP processing requirements in 40 C.F.R. §§ 51.104, 51.102.

ensure SIPs do what they must to help restore natural skies.[31] The RHR also requires that in "developing any implementation plan (or plan revision) or progress report, the State must include a description of how it addressed any comments provided by the Federal Land Managers."[32]

The duty to ensure reasonable progress requirements are met for purposes of the SIP rests with the state. While VISTAS plays an important role in providing support in regional haze planning, the state is ultimately accountable for preparing, adopting, and submitting a compliant SIP to EPA. Further, as discussed more fully below, TDEC has an obligation to cite to the technical support documentation it proposes to rely on and use as part of its SIP revision.[33]

B. EPA's 2019 Guidance

Additionally, as you may know, in May 2020, NPCA shared the petition it submitted to the previous EPA Administrator - which sought reconsideration of the 2019 RH guidance - alongside a cover letter to Washington.[34] In addition to NPCA, Sierra Club, Natural Resources Defense Council, Western Environmental Law Center, Appalachian Mountain Club, Coalition to Protect America's National Parks, and Earthjustice, signed the petition for reconsideration. As of the date of this comment letter, EPA has not responded to the Petition. Until the current EPA Administration withdraws the illegal approaches in the 2019 guidance, we trust states will not follow it, instead adhering closely to the regulation itself and working to achieve the Clean Air Act goal of Class I visibility restored to natural conditions. The Petition explained that, as issued, the Final Guidance conflicts with this statutory objective, previous rulemaking and guidance; misdirects states as to how they can go about complying with their legal obligations to make reasonable progress towards restoring natural visibility to protected public lands; and otherwise fails to set expectations that comport with legal requirements for the second planning period.[35] The Petition includes a detailed analysis of the issues. As of the date of this comment letter, EPA has not responded to our Petition. Until the current EPA withdraws the illegal approaches in the 2019 guidance, we trust states will not follow it instead adhering closely to the regulation itself and work to achieve the Clean Air Act goal of Class I visibility restored to natural conditions.

TDEC's sole reliance on EPA's 2019 Guidance to evaluate the Four-Factor Analysis is misplaced.[36] In addition to relying on its illegal approaches, TDEC has failed to take into consideration EPA's more recent memorandum, which we discuss in the following Section.

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[31] 40 C.F.R. § 51.308(i).
[32] *Id.* § 51.308(i)(3).
[33] *See, e.g.,* 40 C.F.R. §§ 51.100, 51.102, 51.103, 51.104, 51.105 and Appendix V to Part 51.
[34] "Petition for Petition for Reconsideration of Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," submitted by National Parks Conservation Association, Sierra Club, Natural Resources Defense Council, Coalition to Protect America's National Parks, Appalachian Mountain Club, Western Environmental Law Center and Earthjustice, to former EPA Administrator Andrew Wheeler (May 8, 2020). ("Conservation Organizations Petition") (Exhibit 6).
[35] Further, we petitioned the prior Administrator to replace it with guidance that comports with the Clean Air Act ("CAA") and the Regional Haze Rule, 42 U.S.C. §§ 7491, 7492; 82 Fed. Reg. 3078 (Jan. 10, 2017); 71 Fed. Reg. 60,612 (Oct. 13, 2006); 70 Fed. Reg. 39,104 (July 6, 2005); 64 Fed. Reg. 35,714 (July 1, 1999), and aids states in making progress towards achieving the national goal of natural visibility conditions at all Class I areas. Conservation Organizations Petition at 1-2.
[36] Draft SIP at 205. (Where the TDEC explains that, EPA's 2019 Guidance "was used in evaluating the four statutory factors for the facilities in Tennessee selected for reasonable progress analysis…")

C. EPA's 2021 Clarification Memorandum

On July 9, 2021, EPA issued a memorandum titled, "Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period."[37] EPA's July 2021 Memo provides important information regarding development of SIPs for all states for the regional haze second planning period in response to questions and information EPA is receiving from states and stakeholders and clarifies and provides information on existing statutory and regulatory requirements.[38] Because EPA's Memo is directly relevant to — and in some cases, confirms — numerous flaws in the TDEC's proposed SIP, as explained below and in the attached technical reports, TDEC must reevaluate its proposed SIP. We strongly encourage TDEC to dedicate the resources and take the time necessary to carefully review and consider all the information in EPA's July 2021 Memo and develop supporting information and make necessary adjustments to its Draft SIP.

Particularly relevant here, EPA made clear that states must secure additional emission reductions that build on progress already achieved, there is an expectation that reductions are additive to ongoing and upcoming reductions under other CAA programs.[39] In evaluating sources for emission reductions, EPA emphasized that:

> Source selection is a critical step in states' analytical processes. All subsequent determinations of what constitutes reasonable progress flow from states' initial decisions regarding the universe of pollutants and sources they will consider for the second planning period. States cannot reasonably determine that they are making reasonable progress if they have not adequately considered the contributors to visibility impairment. Thus, while states have discretion to reasonably select sources, this analysis should be designed and conducted to ensure that source selection results in a set of pollutants and sources the evaluation of which has the potential to meaningfully reduce their contributions to visibility impairment.[40]

Thus, it is generally not reasonable to exclude from further evaluation larger sources of visibility-impairing pollution. Moreover, a state's obligation to consider the statutory reasonable progress factors for a particular source is not discharged simply because another source or another state has greater contributions to visibility impairment.[41] TDEC's identification of only two sources for Four-Factor Analysis is an example of such narrow-minded decision making.

In sum, EPA's July 2021 Memo unequivocally states that meaningful reductions are expected to make reasonable progress towards the national goal of restoring visibility – reductions in SO_2

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[37] EPA Memorandum from Peter Tsirigotis, Director, Office of Air Quality Planning and Standards, to Regional Air Division Directors, "Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period" (July 9, 2021) ("EPA July 2021 Memo"), https://www.epa.gov/visibility/clarifications-regarding-regional-haze-state-implementation-plans-second-implementation.
[38] *Id.*
[39] *Id.* at 2.
[40] *Id.* at 3.
[41] *Id.* at 7. Additionally, international emissions are not a justification for a state to ignore the Act's regional haze requirements.

and NOx, reductions in the biggest sources of impairment as well as relatively smaller contributors – reductions that are achievable looking across a full spectrum of options of emission reducing measures. That the ten sources identified by NPCA and the NPS are absent from TDEC's analysis and reduction requirements is notable, for example, and on its face at odds with the state's haze obligations. EPA's memo is responsive to observations of state process and must result in redirecting Tennessee towards compliance with the CAA or replacing its SIP with FIP. State efforts to avoid reductions – to assert that because visibility has improved, or due to implementation of another program, or because a source has some level of control – are not acceptable excuses and neither is ignoring requests of FLMs and other states to assess sources for reductions. Actual requirements for emission reductions are expected for a haze SIP to be approvable in the absence of rare circumstances and EPA's recent regional haze memo makes this abundantly clear.

E. If a Source is Unwilling to Conduct the Required RP Analysis, the Responsibility Must be Met by the State

The duty to ensure reasonable progress requirements are met for purposes of the SIP rests with the state, not the source. Therefore, if a source is unwilling to prepare the analysis, TDEC must conduct the analyses to inform its reasonable progress determination. It is TDEC's responsibility to independently review the draft Four-Factor Analysis submitted by a source. A state must not "rubber stamp" a source's analysis. If a source prepares an inaccurate, incomplete or undocumented Four-Factor Analysis, the state must either require the source to make the necessary corrections or make the corrections itself. Where a Four-Factor Analysis is required, TDEC must conduct the required Four-Factor Analysis for the source, including requirements for emission limitations and other measures based on the source's current operations. As discussed in these comments, TDEC must supplement its Draft SIP with Four-Factor Analysis for ten additional sources.

F. TDEC Cannot Rely on Unspecified Permit Provisions, Emission Reductions Must be Included in Practically Enforceable SIP Measures

TDEC cannot rely on unspecified permit provisions for emission reductions. The Clean Air Act requires states to submit implementation plans that "contain such emission limits, schedules of compliance and other measures as may be necessary to make reasonable progress toward meeting the national goal" of achieving natural visibility conditions at all Class I Areas.[42] The RHR requires that states must revise and update its regional haze SIP, and the "periodic comprehensive revisions must include the "enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress as determined pursuant to [51.308](f)(2)(i) through (iv)."[43] Furthermore, EPA's Guidance further explains these requirements:

> This provision requires SIPs to include enforceable emission limitations and/or other measures to address regional haze, deadlines for their implementation, and provisions to

[42] 42 U.S.C. §§ 7491(a)(1), (b)(2).
[43] 40 C.F.R. § 51.308(f)(2); 40 C.F.R. § 51.308(d)(3)(v)(F) (Enforceability of emission limitations and control measures).

make the measures practicably enforceable including averaging times, monitoring requirements, and record keeping and reporting requirements.[44]

Thus, EPA's Guidance recognizes EPA's long-standing position that while the SIP is the basis for demonstrating and ensuring state plans meet Regional Haze Rule requirements, state-issued permits must complement the SIP and SIP requirements.[45] State-issued permits must not frustrate SIP requirements.[46] For example, sources with PSD permits under Title I must not hold permits that allow emissions that conflict with SIP requirements.[47] Additionally, the Act's Title V operating permits collect and implement all the Act's requirements – including the requirements in the SIP – as applicable to the particular permittee. And sources with Title V permits must not hold such permits if they contain permit terms and conditions that conflict with the SIP and Clean Air Act SIP requirements.

As discussed in elsewhere in these comments, TDEC must revise its Draft SIP to identify and include permit terms and conditions in the SIP so that the emission limitations it proposes to rely on are practically enforceable for SIP purposes, following EPA's recent Memorandum.[48]

G. It is Inconsistent with the CAA's Requirements to Use Air Quality Modeling to Decide Reasonable Process Controls

As explained above the reasonable progress Four-Factor Analysis includes consideration of the following:

- Consider the costs of compliance,
- The time necessary for compliance,
- The energy and non-air quality environmental impacts of compliance, and
- The remaining useful life of any potentially affected sources.[49]

The Four-Factor Analysis is clearly bounded by the information collected under each of the factors. Air quality impacts, modeling results, and emission inventories are *not* information collected pursuant to any of the four factors. Therefore, to the extent a state adds an additional factor or factors to its Four-Factor Analysis the state's analysis is inconsistent with the Four-Factor Analysis requirement. As discussed in these comments, as part of its Draft SIP analysis TDEC uses visibility impacts to reject emission controls at several of the sources, and because visibility is *not* one of the four statutory factors, and EPA has expressly stated that consideration

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[44] "EPA Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," at 42-43 (Aug. 20, 2019), https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf. (While NPCA filed a Petition for Reconsideration regarding EPA's issuance of the 2019 Guidance, it does not dispute the information in the Guidance referenced here regarding enforceable limitations, which cite to the "General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990, 74 Fed. Reg. 13,498 (April 16, 1992).

[45] 74 Fed. Reg. 13,498, 13,568 (April 16, 1992).

[46] Furthermore, to the extent stationary source are granted permits by rule or other mechanisms, these other categories that allow construction and operation must also complement SIP requirements.

[47] Additionally, the proposed SIP revisions fail to contain source-specific "measures to mitigate the impacts of construction activities." 40 C.F.R. § 51.308(d)(3)(v)(B).

[48] EPA 2021 Clarification Memo at 11-12, 16; *see also*, EPA August 2019 Guidance at 42-43.

[49] 42 U.S.C. § 7491(g)(1); 40 C.F.R. § 51.308(f)(2)(i).

of visibility is not to be used as an offramp for reduction requirements, the State must not rely on it to exclude emission reducing measures from a source that otherwise satisfies the four statutory factors.

III. TDEC's Source Selection Methodology is Flawed

TDEC's source selection methodology – and its reliance on the faulty VISTAS work products – screens out nearly all sources of visibility-impairing pollution from consideration. EPA's July 2021 Memo makes clear that TDEC's source selection methodology is flawed and cannot be approved by EPA. States must secure additional emission reductions that build on progress already achieved; EPA's expectation is that reductions add to ongoing and upcoming reductions under other CAA programs.[50] In evaluating sources for emission reductions, EPA emphasized that:

> Source selection is a critical step in states' analytical processes. All subsequent determinations of what constitutes reasonable progress flow from states' initial decisions regarding the universe of pollutants and sources they will consider for the second planning period. States cannot reasonably determine that they are making reasonable progress if they have not adequately considered the contributors to visibility impairment. Thus, while states have discretion to reasonably select sources, this analysis should be designed and conducted to ensure that source selection results in a set of pollutants and sources the evaluation of which has the potential to meaningfully reduce their contributions to visibility impairment.[51]

Therefore, it is generally not reasonable to exclude from further evaluation of larger sources of visibility-impairing pollution. As discussed in these comments, while TDEC notified other states of concerns with specific sources in those states, TDEC basically dropped its concerns and accepted whatever the responding state sent in reply, including two states that failed to reply to TDEC. The result of TDEC's faulty screening methodology is that TDEC selected only two sources for a Four-Factor Analysis.

A. Significant Flaws in VISTAS Regional Haze CAMx Modeling and Methods

As explained in the May 12, 2021, letter to the Air Division Directors of the VISTAS states, we commissioned an expert modeler to better understand the VISTAS approach and found fatal problems with the VISTAS modeling inputs and methods as well as the approach recommended to Southeastern states.[52] TDEC followed the VISTAS approach in its Draft SIP, and thus as explained below and in the attached expert exhibits incorporated by reference to our comments, EPA cannot approve Tennessee's proposed SIP. While the Kordzi Report offers an example of a lower threshold, it is an example and not a recommended approach.

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[50] EPA July 2021 Memo at 2.
[51] *Id.* at 3.
[52] We incorporate by reference to these comment the Letter from Stephanie Kodish, NPCA, Leslie Griffith, SELC, and David Rogers, Sierra Club to VISTAS State Air Directors, "Significant Flaws in VISTAS Regional Haze CAMx Modeling and Methods; Recommendations to Develop Compliant State Implementation Plans" (May 12, 2021) (Exhibit 7).

1. Summary of VISTAS Flawed Modeling Input and Methodology Used to Identify Sources

NPCA's commissioned independent review revealed that the VISTAS modeling effort suffers from four fatal approvability flaws summarized in Table 2 and further discussed below.

Table 2. Summary of VISTAS II CAMx Modeling Flaws and Consequences

	Flawed Modeling Inputs and Methods	Consequences of Reliance on VISTAS Inputs By States in Preparing SIPs
1	Inaccurately reflects sulfate concentrations in the Southeast U.S.	Would excuse heavy sulfur dioxide (SO_2) polluters from review.
2	Used Electric Generating Unit (EGU) emission profiles from 2011 to project the EGUs emissions in 2028, inaccurately assuming that EGUs will operate in 2028 as they did in 2011.	Would fail to identify EGUs that must be analyzed for emission reductions because the model results do not accurately reflect the actual/most recent EGUs' contributions to visibility impairment.
3	Used outdated monitoring data that does not represent the dramatic shift in nitrate contribution to visibility impairment in the Southeast over the last 5-10 years. This shift was not reflected in future predictions.	Would erroneously exclude problematic sources from review and avoid emission controls for large NO_X emitting sources because the modeling inputs failed to properly identify EGUs and other point sources with large NO_X emissions as contributing to Class I area visibility impairment.
4	Used high thresholds and unnecessary filters to select sources to analyze for emission reducing measures.	Would result in an unreasonably low number of industrial sources selected by each state for an emission control reasonable progress Four-Factor Analysis.

2. VISTAS' High Thresholds and Flawed Methodology Excluded Polluting Sources that Should be Addressed and Considered for Emission Reducing SIP Measures

By relying on the flawed VISTAS modeling to select which polluting sources to review for emission reductions, the Southeastern states are poised to ignore hundreds of significant emission sources. According to NPCA's analysis, by solely relying on the VISTAS' approach Tennessee:

- Selected only two point sources affecting Class I sites. In contrast, together NPCA and the Federal Land Managers identified a total of nine major industrial facilities in Tennessee that likely degrade visibility in 23 regional Class I Areas;[53]

- Failed to require any further emission reduction measures from the two selected facilities;

- Would allow more than 11,000 tons of NO_X and 4,000 tons of SO_2 emissions from major industrial sources to continue dirtying the air in our national parks and wilderness areas and communities;[54] and

- Ignores the fact that many of these major sources are where many people live below the poverty line.

TDEC must revise its SIP to the extent it proposes to rely on these and other flawed methods discussed in these comments and in the May 12, 2021 letter and expert reports.

B. TDEC's Reliance on VISTAS Flawed Approach Unreasonably Excluded Sources

In its proposed SIP, TDEC relied on the VISTAS approach, explaining that: for Class I areas in Tennessee, a total of nine facilities exceeded the ≥1.00% PSAT threshold for sulfate only but only two of these facilities (*i.e.,* Eastman Chemical Company and TVA Cumberland Fossil Plant) are located in Tennessee, and the TDEC requested Four-Factor Analyses from those two facilities for the reduction of SO_2 emissions.[55]

As discussed in detail in the Gebhart and Kordzi expert reports, there are numerous issues with TDEC's source selection methodology. For example:

- TDEC fails to address important contributors to visibility impairment at Tennessee's Class I areas and as such, fails to generate "reasonable progress" toward the national goal of achieving natural visibility conditions.[56]

- TDEC must assess nitrate.[57] While we agree that "SO_2 from point sources is the dominant source category at Great Smoky Mountains National Park (49.54%) and Joyce

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[53] TVA Kingston, TVA Gallatin, AGC Industries – Greenland Plant, O-N Minerals (Luttrell), Trelleborg Coated Systems U.S., INC, Signal Mountain Cement CO., Packaging Corporation of America, Tennessee Gas Pipeline Company, Station 860, Tennessee Gas Pipeline Company, and Station 87. NPCA and the FLMs identified these sources, some of the same sources and some different.
[54] Emissions data was obtained from EPA's 2017 National Emissions Inventory (NEI) and EPA's 2019 Air Markets Data Program (AMPD) for power plants.
[55] Draft SIP at 197-198.
[56] Gebhart October 2021 Report at 1-3.
[57] Kordzi Report at 2.

Kilmer-Slickrock Wilderness Area (63.84%)"[58] As discussed in the Gebhart October 2021 Report, VISTAS modeling used monitoring data from 2009-2013 for analyzing visibility impacts in the Class I areas. This approach is flawed because the nitrate contribution to visibility impairment have shifted since the 2009-2013 period in the southeast Class I areas.[59] According to recent observations (2014-2018), the nitrate contribution to visibility impairment in the Southeastern region has doubled and, in some areas, tripled as compared to the 2009-2013 period that VISTAS used.[60] TDEC must not use the VISTAS modeling results, which used outdated and erroneous nitrate contribution to visibility impairment not representative of current levels, which would exclude from review sources emitting NO_X, particularly coal-fired EGUs and point sources with large NO_X emissions. Following such an approach in the SIP would allow these significant polluters to increase nitrates harming Class I areas.

- The 2028 projected emissions that TDEC relies on to rule out selecting coal-fired power plants are based on unsecured future assumptions. Notably, TDEC relies on projections that show reduced emissions that are not assured. If TDEC intends to keep relying on these assumptions, it needs to make them a reality by incorporating retirements or other process changes into the SIP as enforceable requirements.

- TDEC must fully explain its decision to base its source selection on projected 2028 emissions instead of actual emissions.

- The Fractional Bias Analysis developed by VISTAS and presented by Tennessee was flawed as it was predicated on the unsubstantiated assumption that the PSAT modeling results were a true and accurate representation of the existing visibility impairment at Tennessee's Class I areas.[61] Additionally, use of the fractional bias calculation approach is suspect because when comparing the model's output to observed values, VISTAS' approach did not use monitored or measured values for the observed values, and instead used the Area of Influence (AoI) values.[62] The "AoI values are not known values and are simply other predicted values…"[63]

- TDEC does not provide a reasoned basis for using a 1.00% PSAT threshold for selecting facilities and its assertion that "…the VISTAS screening approach results in a reasonable number of sources that can be evaluated…"[64] is incorrect as it only identifies two sources in Tennessee.

[58] Draft SIP at 170, 171.
[59] Gebhart October 2021 Report at 7.
[60] *Id.*
[61] Gebhart October 2021 Report at 3-5
[62] *Id.* at 3-6.
[63] *Id.* at 10.
[64] Draft SIP at 197.

- TDEC's reply to the FLM's criticism of its source selection strategy is inadequate.[65]

TDEC must either require that the sources prepare or conduct its own Four-Factor Analysis for SO_2 and NO_X for the following:

- TVA Kingston,
- TVA Gallatin,
- AGC Industries – Greenland Plant,
- O-N Minerals (Luttrell),
- Trelleborg Coated Systems U.S., INC,
- Signal Mountain Cement CO.,
- Packaging Corporation of America,
- Tennessee Gas Pipeline Company, Station 860, and
- Tennessee Gas Pipeline Company, Station 87.

IV. TDEC Wrongly Exempted EGUs from the Four-Factor Analysis Requirement and Must Require Retirements and Controls for NO_X and SO_2

The RP and technical analyses must be based on accurate information that is consistent with the Act and EPA's implementing regulations. As discussed in the attached report by Joe Kordzi, and fully incorporated by reference into these comments, TDEC's proposed analyses rely on inflated cost effectiveness analysis by using incorrect information for:

- Interest rate,
- Equipment life,
- Control efficiency,
- Retrofit, and
- Other factors.

TDEC has not conducted an independent assessment of the cost analyses information submitted by the sources. Furthermore, the Draft SIP unreasonably screened sources, such as Kingston, from the required Four-Factor Analysis based on faulty assumptions regarding the effectiveness of current controls, and does not require sources to support suggested assumptions and proposed conclusions.

Any final Regional Haze Plan that TDEC submits must incorporate emission limits and control measures necessary to ensure the emission reductions TDEC projects from TVA's coal-fired power plants are enforceable. In particular, the proposed forthcoming retirements of the Kingston and Cumberland Fossil Plants should be incorporated as enforceable retirements in the Final Plan.

[65] *Id.*

The Kingston Fossil Plant is a nine-unit, 1.4 gigawatt coal-fired power plant. It is a major source of haze-causing pollutants, including SO_2 and NOx. Indeed, in just the first nine months of 2021, Kingston has emitted 1758 and 974 tons of SO_2 and NOx, respectively; projecting linearly, this puts Kingston on pace to emit at least 2300 tons of SO_2 and nearly 1300 tons of NOx by the end of the year.[66]

Table 3: Kingston SO_2 and NOx Emissions, 2015-2021[67]

Year	SO_2 (tons)	NOx (tons)
2015	1,471.938	1,488.886
2016	2,453.093	2,098.242
2017	1,998.67	1,692.322
2018	1,327.411	1,157.929
2019	1,917.432	1,258.843
2020	872.785	696.432
2021	2,343.663 (projected)	1,298.379 (projected)

TDEC initially considered Kingston' pollution to be above the threshold TDEC employed to trigger a reasonable progress analysis, [68] but revised that assessment after TVA sent it a letter suggesting that perhaps emissions from Kingston might be lower than projected, in part because TVA proposed retiring the plant's various units by 2033.[69] Instead of analyzing emissions from the plant, TDEC now claims that "TVA is planning on retiring all of the units at TVA Kingston by 2033" and that as a result "[TDEC] does not think it is necessary to conduct a reasonable progress analysis for TVA Kingston."[70]

TVA's Cumberland Fossil Plant is a two-unit, 2.5 gigawatt coal-fired power plant. Like Kingston, it is an enormous source of haze-causing pollutants, having emitted over 3,800 tons of NOx and almost 7,800 tons of SO_2 in just the first nine months of 2021. Linearly scaling these emissions through the rest of the year results in projected emissions of more than 10,000 tons of SO_2 and over 5,000 tons of NOx—pollution amounts consistent with the pre-pandemic highs of 2015 and 2016.

[66] Data taken from U.S. EPA, Air Markets Program Database, *at* https://ampd.epa.gov/ampd/.
[67] *Id.* Data for total 2021 emissions projected from data available for January-September 2021 by multiplying by 4/3.
[68] Draft Plan at 198 ("Initial PSAT results showed that TVA Kingston was above the 1.00% PSAT threshold for Great Smoky Mountains National Park, Joyce Kilmer-Slickrock Wilderness Area, and Cohutta Wilderness Area.")
[69] *Id.*
[70] Draft Plan at 249.

Table 4: Cumberland SO_2 and NOx Emissions, 2015-2021[71]

Year	SO_2 (tons)	NOx (tons)
2015	8,849.548	5,257.178
2016	10,123.3	4,779.066
2017	6,649.123	3,378.59
2018	7,407.751	4,299.594
2019	7,208.88	3,918.538
2020	7,177.595	3,917.291
2021	10,359.36 (projected)	5,126.96 (projected)

However, despite TDEC recognizing that Cumberland's emissions are likely to *increase* in the future ("Cumberland is expected to be dispatched more frequently in the future . . . 2028 SO_2 and NOX values are much higher than 2017, 2018, and 2019 values"[72]) and purporting to conduct a Four-Factor Analysis,[73] TDEC concluded in its Draft Plan that it would not require Cumberland to reduce its emissions of haze-causing pollutants.[74] TDEC did so at least in part by "not[ing] TVA's pending retirement of Cumberland's units between 2026 and 2033."[75]

TVA's Gallatin Fossil Plant consists of four coal-fired units totaling collectively over 1.2 gigawatts of generating capacity. Gallatin emits vast quantities of SO_2: from 2016-2020, Gallatin emitted an average of 1,422 tons of SO_2 per year (including the very low operation year of 2020 in which the relatively low quantity of 1,038 tons was emitted).[76] Indeed, in just the first nine months of 2021, Gallatin emitted 1,460 tons of SO_2, and is projected to emit 1,946 tons by the end of the year.[77]

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[71] Data taken from U.S. EPA, Air Markets Program Database, *at* https://ampd.epa.gov/ampd/. Data for total 2021 emissions projected from data available for January-September 2021 by multiplying by 4/3.
[72] Draft Plan at 200.
[73] *Id.*
[74] *Id.* at 206 ("TDEC-APC reviewed the analysis and is making a formal declaration that additional SO_2 reductions at Cumberland Fossil Plant are not needed during this Regional Haze SIP review period.")
[75] *Id.* at 261.
[76] Data taken from U.S. EPA, Air Markets Program Database, *at* https://ampd.epa.gov/ampd/.
[77] *Id.* Data for total 2021 emissions projected from data available for January-September 2021 by multiplying by 4/3.

Table 5: Gallatin SO_2 Emissions, 2015-2021[78]

Year	SO_2 (tons)
2015	12315.81
2016	1400.618
2017	1111.682
2018	1828.168
2019	1734.902
2020	1038.319
2021	1945.999 (projected)

Excluding the aberrant year of 2020 from a five year average yields an annual emissions average figure for Gallatin in excess of 1,500 tons of SO_2. Nonetheless, TDEC appears to have excluded Gallatin from further analysis by assuming that Gallatin would emit only 1,116 tons of SO_2 in 2028.

TDEC accordingly avoids controlling or even fully analyzing Regional Haze pollution from these three facilities on the theory that the pollution will go away without action on the part of TDEC. But this approach is contrary to the requirements of the Regional Haze Rule and the Clean Air Act, for four main reasons.

First, to the extent that TDEC declines to evaluate additional pollution controls for any source based on that source's planned retirement or decline in utilization, Tennessee must incorporate those operating parameters or assumptions as enforceable limitations in the second planning period SIP. The Clean Air Act requires that "[e]ach state implementation plan . . . shall" include "enforceable limitations and other control measures" as necessary to "meet the applicable requirements" of the Act. 42 U.S.C. § 7410(a)(2)(A). The Regional Haze Rule similarly requires each state to include "enforceable emission limitations" as necessary to ensure reasonable progress toward the national visibility goal. Moreover, where a source plans to permanently cease operations or projects that future operating parameters (e.g., limited hours of operation or capacity utilization) will differ from past practice, and if this projection is relied upon to determine whether additional pollution controls are necessary to ensure reasonable progress, then the state "must" make those parameters or assumptions into enforceable limitations. Underscoring this requirement of enforceability, reasonable progress goals (RPGs) adopted by a state with a Class I area must be based only on emission controls measures that have been adopted and are enforceable. Because TDEC explicitly relies on "planned" or "proposed" EGU retirements as part of its long-term strategy to ensure reasonable progress, the agency must, at a minimum, make those retirement decisions federally enforceable with compliance deadlines for retirement by the end of the second planning period, 2028.

[78] *Id.*

Second, even where a facility has an enforceable closure date, TDEC is obligated to consider whether there are cost-effective control measures that could be implemented in the meantime. Once again, EPA's July 2021 Clarification Memo is instructive. There, the agency made clear that in evaluating reasonable progress for all sources, states should consider the "full range of potentially reasonable options for reducing emissions . . . may be able to achieve greater control efficiencies, and, therefore, lower emission rates, using their existing measures." As discussed below, there are some types of control measures that are likely to be cost-effective even within shorter time-frames.

Third, as the Clarification Memo again makes clear, a state's reasonable progress goals are a function of the emission reduction measures "in states' long-term strategies, as well as other measures required under the CAA (that have compliance dates on or before the end of 2028)." In its Draft Plan, TDEC improperly relies on emission reductions that will not take place during the planning period, and for which the agency admits that it has not quantified the benefits.

Fourth, TDEC relies heavily on market conditions and TVA's projections for its view that coal pollution will decline, at least at Kingston and Gallatin. But for both plants, TDEC's future assumed emissions levels are significantly below current emission levels and are inconsistent with emissions data trends. Indeed, just this year, gas prices have increased and TVA coal EGUs have increased their output as the utilities shift away from gas-burning generation, with all three facilities emitting at some of their highest levels in five years. Moreover, even if the trends were towards decreasing emissions, relying on unenforceable market trends is simply at odds with Clean Air Act and Regional Haze Rule requirements mandating enforceable provisions to assure compliance with the reasonable progress provisions.

Finally, TDEC has ignored apparent cost-effective emissions reductions Gallatin could achieve. As detailed in the Kordzi Report details, by comparing the theoretical uncontrolled SO_2 inlet to the monitored SO_2 outlet,[79] it is readily demonstrated that scrubber efficacy varies wildly at Gallatin. Indeed, from 2016 – 2020, the Gallatin scrubber systems have underperformed and have exhibited erratic behavior, with typical monthly efficiency percentages ranging from the low 80s to high 90s; similar irregularities in SCR operation and efficacy are apparent from emissions data.[80] Considering that the systems are already installed and have demonstrated the ability to achieve higher efficiencies, it is likely that substantial gains can be achieved very cost-effectively with little to no capital costs, by simply running the systems more efficiently and continuously and/or using more reagent. Consequently, TDEC must require that a Four-Factor Analysis be performed with the goal of investigating the optimization of the Gallatin scrubber and SCR systems.

[79] *See* the file "TN EGU emissions.xlsx." (Included as an attachment to the Kordzi Report)
[80] *See* Kordzi Report at 26-27.

V. TDEC's Proposed Analyses for the Non-EGUs are Inconsistent with the Clean Air Act and Regional Haze Rule Requirements

A. Eastman Chemical Company

Eastman Chemical Company is located in Kingsport and produces a "broad range of chemicals, fibers and plastics found in products such as paint, adhesives, textiles, sports bottles, pharmaceuticals, medical devices and much more."[81] TDEC's Draft SIP provides the following explanation regarding this source, its analyses and the Draft SIP plans:

- During the first implementation period, the Regional Haze Rule required states to determine best available retrofit technology (BART) for certain facilities. Four BART sources in Tennessee were subjected to BART limitations. Two of the four BART sources (Alcoa and DuPont) have shut down and their permits have been surrendered since the first SIP was submitted. Permit limitations for the remaining two sources (Eastman Chemical Company and TVA Cumberland) are still in effect.[82]
- Eastman Chemical repowered five coal-fired boilers to natural gas with the last repower occurring in October 2018. As a result, projected 2028 SO_2 value is lower than 2017 and 2018 emissions. Eastman also added temporary SO_2 controls on two boilers on June 1, 2019. Therefore, projected 2028 SO_2 value is higher than 2019 emissions. This facility, including the two boilers with temporary SO_2 controls, is subject to four-factor analysis requirements.[83]
- It is one of three sources that TDEC required to submit a Four-Factor Analysis for SO_2.[84]
- The source submitted reasonable progress analyses for B-83 Boilers 18 through 24 and B-325 Boiler 30 on August 13, 2020, and TDEC reviewed the analyses and concluded that reasonable progress for Eastman Chemical Company is the permanent shutdown of B-83 Boilers 18, 19, and 20 and the installation of permanent dry sorbent injection (without upgrading the existing ESPs) on Boilers 23 and 24.[85]
- As result of its analysis, TDEC's Draft SIP includes draft Title V permit limitations for several boilers,[86] and through its SIP revision, TDEC is proposing to incorporate into the regulatory portion of Tennessee's SIP at 40 C.F.R. § 52.5220, table (d), the source-specific SO_2 emission limits and permit conditions contained in Appendix G-2g.[87]

Initially, it's important to point out that while TDEC suggests that selecting Eastman Chemical Company and TVA Cumberland for reasonable progress analysis "captures a meaningful portion

[81] Eastman, https://www.eastman.com/Company/Worldwide/our_sites/Pages/UnitedStates_Tennessee.aspx.
[82] Draft SIP Executive Summary at 5.
[83] Draft SIP at 199-200.
[84] Draft SIP Executive Summary at 6.
[85] Draft SIP at 205.
[86] Draft SIP Executive Summary at 6.
[87] Draft SIP at 206.

of the Tennessee's total contribution to visibility impairment to Class I areas,"[88] this assertion is contrary to the information provided by the NPS during the consultation process. While we agree that these sources are rightly subject to a reasonable progress analysis, these two sources alone are insufficient. As the NPS explained based on the VISTAS PSAT results, the two sources that TDEC picked for four-factor analyses, TVA Cumberland and Eastman Chemical, "account for 8.07% of Tennessee's projected 2028 contribution to impairment in Great Smoky Mountains NP and 1.88% of the total projected 2028 EGU plus non-EGU impairment in the park. This is a small portion of Tennessee's contribution to impairment in Great Smoky Mountains NP."[89]

Second, contrary to the SIP documentation requirements, Eastman's Four-Factor Analysis merely "listed what they consider representative emissions from some of their units, but none have provided any documentation for those figures. Nor has Eastman provided information in the SIP that completely lists the units in the SIP and their respective emissions for the last five years. This information is essential in order to identify which units should be reviewed and properly conduct a valid four-factor analysis."[90]

TDEC has a legal obligation to submit a SIP that complies with the Clean Air Act and the Regional Haze Rule, which require the state to support any control determination with robust technical analysis, and importantly, the underlying data necessary to conduct that analysis.[91] In issuing the 2017 Regional Haze Rule revision, EPA made clear that the state is required to "document the technical basis, including modeling, monitoring, cost, engineering, and emissions information, on which the State is relying to determine the emission reduction measures that are necessary to make reasonable progress in each mandatory Class I area it affects."[92] Even the seriously flawed 2019 Guidance makes clear that, to meet the requirements of the Regional Haze Rule, "every source-specific cost estimate used to support an analysis of control measures must be documented in the SIP."[93] The Regional Haze Rule's requirement that states document the technical basis for their control determinations makes sense. Indeed, if the state fails to document the technical basis for a source's four-factor analysis, neither the state, EPA, nor the public can rationally review, evaluate, or verify that control analysis. In short, because TDEC does not have source-specific emission data for Eastman in the Draft SIP, the SIP fails to meet the informational requirements of the Regional Haze Rule. Furthermore, TDEC cannot rationally approve the four-factor analyses because the agency does not have, and therefore could not verify, the cost-effectiveness analyses that necessarily rely on that emissions data. Indeed, cost effectiveness is generally a function of the cost of emission reduction technology and the

[88] Draft SIP at 183 ("Eastman Chemical Company (47163-3982311) impacts five Class I areas (two inside Tennessee and three outside Tennessee). TVA Cumberland impacts four Class I areas (all four outside Tennessee). Eastman Chemical Company and TVA Cumberland's projected 2028 SO_2 emissions are 6,420 TPY and 8,427 TPY, respectively. The TDEC-APC believes that by selecting these two facilities for reasonable progress analysis this captures a meaningful portion of the Tennessee's total contribution to visibility impairment to Class I areas.")
[89] Kordzi Report at 11, citing NPS comments.
[90] Kordzi Report at 1.
[91] 40 C.F.R. § 51.308(f)(2).
[92] 82 Fed. Reg. at 3,126.
[93] Guidance on Regional Haze State Implementation Plans for the Second Implementation Period at 32.

pollution reductions achieved with the adoption of those controls. Without verifying a source's emissions, it is impossible to verify the accuracy of the resulting cost-effectiveness analysis.[94, 95]

1. TDEC Impermissibly Exempts Eastman's NOx Emissions from the Required Four-Factor Analysis

TDEC's request to Eastman did not require that the source prepare a Four-Factor NOx Analysis. This is despite substantial emissions from this source and EPA's clear direction that states are to consider both SO2 and NOx at a minimum.[96] According to the EPA's 2017 National Emissions Inventory (NEI), Eastman SO_2 and NOx emissions were 10,747 tons per year and 6,586 tons per year, respectively. In addition, while not discussed specifically in its Draft SIP, TDEC appears to have excluded Eastman's NOx emission from the required Four-Factor Analysis based on its reliance on the VISTAS modeling. As discussed earlier in these comments, VISTA modeling used outdated monitoring data that does not represent the dramatic shift in nitrate contribution to visibility impair in the Southeast over the last five to 10 years. Moreover, this shift was not reflected in future year predictions. For these reasons, TDEC must require and include a Four-Factor Analysis in its SIP for the NOx emissions from Eastman.[97]

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[94] Additionally, EPA cannot approve the proposed SIP because the state failed to include that information in the record, as required under the Regional Haze Rule, it is impossible for the public or EPA to independently review or verify the emission data underlying the control analyses that are in the SIP. EPA has an independent obligation to ensure that the State's analysis complies with the Clean Air Act. *See Alaska Dep't of Envtl. Conservation v. EPA*, 540 U.S. 461, 485 (2004) (upholding EPA's interpretation of the Clean Air Act as authorizing EPA to "review permits to ensure that a State's BACT determination is reasonably moored to the Act's provisions"); *North Dakota v. EPA*, 730 F.3d 750, 761 (8th Cir. 2013) (extending the holding of Alaska Dep't of Envtl. Conservation to EPA's role under the haze provisions of the Clean Air Act); *Oklahoma v. EPA*, 723 F.3d 1201, 1208 (10th Cir. 2013) ("Given that the statute mandates that the EPA must ensure SIPs comply with the statute, we fail to see how the EPA would be without the authority to review BART determinations for compliance with the guidelines."). Here, EPA cannot possibly discharge its obligation to ensure that TDEC's ultimate determinations for its sources are "reasonably moored to the Act's provisions," *Alaska Dep't of Envtl. Conservation,* 540 U.S. at 485, because the basic emission data necessary to any four-factor analysis for those sources is not in the record. EPA cannot approve a plan when the federal agency is unable to verify the accuracy of the data on which the plan is based.

[95] Moreover, EPA cannot approve TDEC's proposed SIP because the Clean Air Act requires that EPA place in the public rulemaking docket the data on which the proposed rule relies. Specifically, the Act requires that a proposed rule include a summary of the "factual data on which the proposed rule is based," 42 U.S.C. § 7607(d)(3)(A), and such "data . . . on which the proposed rule relies shall be included in the docket on the date of publication of the proposed rule." *Id.* § 7607(d)(3). Here, EPA will necessarily be unable to satisfy those procedural requirements because TDEC failed to include that information in the SIP record itself. By failing to include emission data critical to the underlying rulemaking in the record, TDEC has created a situation in which EPA cannot lawfully approve the rule. *See* 42 U.S.C. § 7607(d)(3); *cf. Kennecott Corp. v. EPA*, 684 F.2d 1007, 1018 (D.C. Cir. 1982) ("If that argument be factually based, the financial analyses clearly form a basis for the regulations and should properly have been included in the docket. In all events, absence of those documents, or of comparable materials showing the nature and scope of its prior practice, makes impossible any meaningful comment on the merits of EPA's assertions."). Because TDEC failed to include that necessary information in record, EPA must reject the SIP and, after supplementing the record with the missing data, will ultimately need to issue a lawful federal implementation plan.

[96] EPA 2021 Clarification Memo at 4-5.

[97] Notably, TDEC failed to provide the requested NOx emission data to commenters, which prevented commenters from submitting more meaningful comments.

2. Overarching Issues Regarding Eastman's Four-Factor Analysis for SO_2

We next turn to our comments on TDEC's review of Eastman's Four-Factor Analysis. There are three overarching issues, TDEC must address:

- Remove owner's costs if they were included in Eastman's Four-Factor Analyses;[98]
- Present unit-specific emission history;[99] and
- Require cost documentation.[100]

3. TDEC Must Include a Four-Factor Analysis for Boiler 31.

TDEC must include a Four-Factor Analysis for Boiler 31. Eastman indicated Boiler 31 has an efficiency of greater than 92%, but failed to provide documentation to support its claim.[101] The control technology in use at Boiler 31 – spray dryer absorber technology – has long been capable of minimally achieving 95% control efficiency.[102] Therefore, TDEC must ensure that a Four-Factor Analysis is performed and "that Boiler 31 be assessed for optimization or upgrade."[103]

4. TDEC Must Correct the Flaws in the Boiler 30 Four-Factor Analysis

Eastman's Four-Factor Analysis for Boiler 30 included updating its SDA with a fabric filter, and as explained in detail in the Kordzi Report, there are a number of flaws with its approach, including the following, which TDEC must correct:[104]

- Eliminate the charge for escalation of #1,797,553 because it is not allowed under the Control Cost Manual.[105]
- Adjust the excessive and unrealistic contingency costs, consistent with the Control Cost Manual.[106]
- Require that Eastman explain and document the "Construction Indirects" cost of \$3,595,990, which is not defined, not part of the Control Cost Manual, and "suspicious in that it is exactly the same number as the total labor cost, which itself is the total of 7 separate items."[107]
- Require that Eastman document the current SDA efficiency of 70%, and rather accept Eastman's assertion that adding a baghouse will increase the SDA efficiency to 92%, must require that Eastman assume 95% control, unless documentation is provided to

[98] Kordzi Report at 28.
[99] Kordzi Report at 28-29.
[100] Kordzi Report at 29.
[101] Kordzi Report at 29.
[102] Kordzi Report at 29, citing 82 Fed. Reg. 925 (Jan. 4, 2017). Note that as installed on industrial boilers SDA technology is essentially the same as installed on EGUs and can therefore be expected to perform similarly. *Also see,* https://www.babcock.com/home/products/spray-dryer-absorber-sda/:
[103] Kordzi Report at 29.
[104] Kordzi Report at 29-32
[105] Kordzi Report at 29.
[106] Kordzi Report at 30.
[107] *Id.*

the contrary. As the Kordzi Report indicates, SDA systems are routinely capable of 95% efficiency.[108]

- Require that Eastman use an equipment life of 30 years, along with TDEC's correction to the Eastman interest rate (3.25% instead of 8.5%).[109]

As explained in the Kordzi Report, "[t]he Eastman Boiler 30 baghouse cost-effectiveness calculation was corrected by removing escalation, adjusting contingency to 10%, increasing the SDA efficiency to 95%, lowering the interest rate to 3.25%, and increasing the equipment life to 30 years. The following is that calculation:"[110]

Table 6. Revised Eastman Boiler 30 Baghouse Cost-Effectiveness[111]

Cost Item	Eastman	Revised
Total Direct Capital Costs (TDC)	$14,575,000	$14,575,000
Construction Indirects	$3,592,990	$3,592,990
Engineering	$1,816,799	$1,816,799
Construction Coordination	$2,477,750	$2,477,750
Eastman Labor and travel	$583,000	$583,000
Contingency (30% Eastman, 10% Revised)	$6,913,662	$2,304,554
Escalation	$1,797,552	$0
Total Indirect Capital Costs	$17,181,753	$10,775,093
Total Capital Investment (TCI)	$31,756,753	$25,350,093
Maintenance Labor and Materials (3% of TCI)	$952,703	$760,503
Parasitic Energy Costs	$50,000	$50,000
Lime	-$142,101	-$142,101
Total Direct Annual Cost (TDAC)	$860,602	$668,402
Overhead	$571,622	$456,302
Administrative Costs (4% of TCI)	$1,270,270	$1,014,004
Interest Rate (%)	8.5	3.25
Equipment Life (years)	15	30
Capital Recovery Factor (CRF)	0.1204	0.0527
Indirect Annual Costs (TCI x CRF)	$3,824,163	$1,335,486
Total Indirect Annual Cost (TIAC)	$5,666,055	$2,805,792
Total Annual Costs (TDAC + TIAC)	$6,526,657	$3,474,194
SO_2 at Current 70% Control (tons)	1,136	1,136
Current Estimated SDA Efficiency (%)	70	70
SDA Efficiency with baghouse	92	95
Incremental SO_2 Reduction (tons)	833	947
Cost-effectiveness ($/ton)	$7,834	$3,670

[108] *Id.*
[109] *Id.*
[110] *Id.* at 31.
[111] *Id.* at 31-32.

As stated in the Kordzi Report, "[t]hus, making the adjustments and corrections discussed above lowers Eastman's inflated baghouse cost-effectiveness from $7,834/ton to $3,792/ton. In addition, removing the questionable "construction indirects [sic] cost" discussed above would further improve the cost effectiveness to $3,083/ton. In either case, this control must be required by TDEC."[112]

5. TDEC Must Correct the Flaws in the Boilers 23 and 24 Four-Factor Analysis

Similar to the above comments, there are numerous flaws with the Four-Factor Analysis for Boilers 23 and 24, which evaluate upgrading the planned DSI systems with a fabric filter.[113] TDEC must correct the following flaws:

- TDEC must require that Eastman document its assertion that due to a lack of available space, in order to install baghouses to the planned DSI systems, the baghouses would have to replace the ESPs, which would significantly increase the construction costs."[114]
- TDEC must require that Eastman revise its apparent doubling of "some of the cost items for installing a baghouse on Boiler 30 in its cost analysis for installing baghouses on Boilers 23 and 24."[115] As explained in the Kordzi Report, doubling of some costs (e.g., engineering and construction coordination) is not justified, and these two figures should be cut in half.[116]
- TDEC must require that Eastman explain and document the "Construction Indirects" cost of $6,878,936, which is not defined, not part of the Control Cost Manual, and suspicious in that it is exactly the same number as the total labor cost, which itself is the total of 7 separate items.[117]
- TDEC must not allow a contingency of 30%, rather a contingency of 10% can be used.[118]
- TDEC must adjust Eastman's interest rate and equipment life from 8.5% to 3.25% and 15 years to 30 years.[119]

As explained in the Kordzi Report, "[t]he Eastman Boilers 23 and 24 baghouse cost-effectiveness calculation was corrected by removing escalation, adjusting contingency to 10%, halving the engineering and construction coordination costs, lowering the interest rate to 3.25%, and increasing the equipment life to 30 years. The following is that calculation:"[120]

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[112] Kordzi Report at 32.
[113] *Id.*
[114] *Id.*
[115] *Id.*
[116] *Id.*
[117] *Id.* at 32-33.
[118] *Id.* at 33.
[119] *Id.*
[120] *Id.* at 33-34.

Table 7. Revised Eastman Boilers 23 and 24 Baghouse Cost-Effectiveness

Cost Item	Eastman	Revised
Total Direct Capital Costs (TDC)	$27,904,472	$27,904,472
Construction Indirects	$6,878,936	$6,878,936
Engineering	$3,478,341	$1,739,171
Construction Coordination	$4,743,760	$2,371,880
Eastman Labor and travel	$1,116,179	$1,116,179
Contingency	$13,236,506	$4,001,064
Escalation	$3,441,492	$0
Total Indirect Capital Costs	$32,895,214	$16,107,229
Total Capital Investment (TCI)	$60,799,686	$44,011,701
Maintenance Labor and Materials (3% of TCI)	$1,823,991	$1,320,351
Parasitic Energy Costs	$50,000	$50,000
Lime	-$1,188,000	-$1,188,000
Total Direct Annual Cost (TDAC)	$685,991	$182,351
Overhead	$1,094,394	$792,211
Administrative Costs (4% of TCI)	$2,431,987	$1,760,468
Interest Rate (%)	8.5	3.25
Equipment Life (years)	15	30
Capital Recovery Factor (CRF)	0.1204	0.0527
Indirect Annual Costs (TCI x CRF)	$7,321,526	$2,318,612
Total Indirect Annual Cost (TIAC)	$10,847,908	$4,871,291
Total Annual Costs (TDAC + TIAC)	$11,533,899	$5,053,642
Uncontrolled SO_2 without DSI (tons)	4,270	4,270
DSI Efficiency with current ESP (%)	60	60
DSI Efficiency with Baghouse (%)	90	90
Incremental SO_2 Reduction (tons)	1,281	1,281
Cost-effectiveness ($/ton)	$9,004	$3,945

As Kordzi explains, “Thus, making the adjustments and corrections discussed above lowers Eastman’s inflated baghouse cost-effectiveness from $9,004/ton to $3,945/ton. In addition, removing the questionable “construction indirects [sic] cost” discussed above would further improve the cost effectiveness to $3,114/ton. In either case, this control must be required by TDEC.”[121]

6. TDEC Must Correct the Flaws in the Boilers 21 and 22 Four-Factor Analysis

Eastman’s Four-Factor Analysis for Boilers 21 and 22 included updating the planned DSI systems with a fabric filter, and as explained in detail in the Kordzi Report, there are a number of flaws with its approach, including the following:

[121] *Id.* at 34.

- TDEC must require documentation of Eastman's assertions regarding lack of room for wet scrubbing technologies; and require consideration of other technologies with smaller footprints that can also be configured to obviate the need for discharge.[122]
- TDEC must require documentation for Eastman's assertions regarding capacity factors.[123]
- TDEC must require documentation for Eastman's assertions regarding cost-effectiveness, and fixed capital costs.[124]
- TDEC must require documentation for Eastman's use of a "complexity factor," which was used to scale costs from Boilers 23 and 24 to Boilers 21 and 22.[125] Moreover, as detailed in the Kordzi Report, Eastman's apparent attempt to use "The Rule of Six-Tenths" is flawed as its direct capital costs is far in excess of what would be expected by the use of this rule.[126] TDEC must also require that Eastman explain the apparent discrepancies with these cost estimates.[127]

As explained in the Kordzi Report, because of the scaling approach used by Eastman, it is not possible to calculate an adjusted figure that complies with the Control Cost Manual.[128] Nevertheless,

> It is expected that based on the adjustments made to Eastman's other cost-effectiveness calculations discussed herein, a DSI with baghouses installation for Boilers 21 and 22 would also be cost-effective. It is possible that a scrubber would also be cost-effective. TDEC must require that Eastman provide more documentation for its calculation, address the issues discussed herein, and revise its cost-effectiveness calculation.[129]

B. TDEC's High Source Selection Threshold and Erroneous Methodology Eliminated Six Sources it Must Consider

Due to TDEC's unreasonably high source selection threshold and erroneous methodology, TDEC eliminated the following six sources from the Four-Factor Analysis requirement. We ask TDEC to conduct a Four-Factor Analysis for each of these facilities and propose a reasonable progress determination that will reduce visibility impairing emissions from this set of sources.

1. AGC Industries Greenland Plant

AGC Industries Greenland Plant is a float glass manufacturing plant located in Greenland. The source has two furnaces and one coater. As shown in Table 1 above, the AGC Industries Greenland plant has a cumulative Q/d value of 161 based on 2017 emissions. According to NPCA's analysis, emissions from this source potentially impacts 12 Class I areas, including the

[122] *Id.* at 34
[123] *Id.*
[124] *Id.*
[125] *Id.*
[126] *Id.*
[127] *Id.*
[128] *Id.* at 35.
[129] *Id.* at 36.

Great Smokey Mountains National Park, located approximately 84 km from the source. TDEC does not discuss this source in its Draft SIP. We urge TDEC to conduct a Four-Factor Analysis for the AGC Industries Greenland Plant and have included for its consideration in the Exhibits to these comments the Expert Report prepared by Steven Klafka, P.E. BCEE, Environmental Engineer, Wingra Engineering, S.C, for a glass plant in Washington State, "The Four-Factor Reasonable Progress Analysis for Ardagh Glass" and consider whether it should be applied to the AGC Industries Greenland Plant.[130]

2. Trelleborg Coated Systems US, Inc.

The Trelleborg Coated Systems US, Inc. Plant is a rubber product manufacturing operation located in Morristown in Hamblen County. As shown in Table 1 above, the source has a cumulative Q/d value of 421 based on 2017 emissions. According to NPCA's analysis, emissions from this source potentially impacts 16 Class I areas, including the Great Smokey Mountains National Park, located approximately 46 km from the source. TDEC does not discuss this source in its Draft SIP. Notably for this source, the Q/d value results almost entirely from its PM 2.5 emissions of 4,688.3 tons, as reported to EPA's 2017 NEI.[131] It appears it was not considered in either the AoI or PSAT analyses because its emissions are due to PM 2.5, and TDEC erroneously only considered NOx and SO_2 emissions in its source selection strategy.[132]

3. Signal Mountain Cement Co. dba Buzzi Unicem USA

The Signal Mountain Cement Co. plant is a cement manufacturing plant located in Chattanooga. As shown in Table 1 above, source has a cumulative Q/d value of 66 based on 2017 emissions. According to NPCA's analysis, emissions from this source potentially impacts six Class I areas, including the Cohutta Wilderness, located approximately 66 km from the source. With the exception of presenting emission inventory information,[133] TDEC does not discuss this source in its Draft SIP.

In developing and evaluating the Four-Factor Analysis for the Signal Mountain Cement Co., we suggest TDEC evaluate the control option of installing catalytic ceramic filters at the cement kiln, which several vendors offer and claim can achieve 90% or greater control of NOx.[134] Recently, cost assessments for the use of a ceramic catalytic filtration system was done for the GCC Pueblo Cement Plant in Colorado and the Holcim - Florence Cement Plant also in Colorado,[135] and TDEC should consider whether that assessment should be applied at the Signal Mountain plant.

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[130] Steven Klafka, P.E. BCEE, Environmental Engineer, Wingra Engineering, S.C, "The Four-Factor Reasonable Progress Analysis for Ardagh Glass" (Jan. 27, 2021). (Exhibit 8)
[131] Kordzi Report at 10.
[132] *Id.*
[133] Draft SIP at 203.
[134] Klafka, Steve, Wingra Engineering, GCC Rio Grande – Pueblo Cement Plant, Four-Factor Reasonable Progress Analysis (Sept. 23, 2021) (Exhibit 9); Klafka, Steve, Wingra Engineering, Holcim - Florence Cement Plant Florence, Colorado Four-Factor Reasonable Progress Analysis (Sept. 30, 2021) (Exhibit 10).
[135] *Id.*

4. *Packaging Corporation of America*

The Packaging Corporation of America Plant is a pulp and paper plant located in Counce, which is in Hardin county. As shown in Table 1 above, the source has a cumulative Q/d value of 63 based on 2017 emissions. According to NPCA's analysis, emissions from this source potentially impacts seven Class I areas, including the Sipsey Wilderness, located approximately 105 km from the source. With the exception of presenting emission inventory information,[136] TDEC does not discuss this source in its Draft SIP.

5. *Tennessee Gas Pipeline Company, L.L.C. Compressor Stations*

For both of the Tennessee Gas Pipeline Company's Compressor Stations, TDEC must ensure that Four-Factor Analyses are prepared. In evaluating controls at the compressor stations, we include with these comments the report prepared for NPCA "Oil and Gas Sector Reasonable Progress Four-Factor Analysis of Controls for Five Source Categories," and suggest TDEC review its analyses and consider whether it should be applied to the Four-Factor Analyses for the compressor stations.[137]

a) *Tennessee Gas Pipeline Company, L.L.C.: Compressor Station 860*

The Tennessee Gas Pipeline Company, L.L.C., Station 860 Plant is a compressor station located in Centerville. As shown in Table 1 above, the source has a cumulative Q/d value of 29 based on 2017 emissions. According to NPCA's analysis, emissions from this source potentially impacts four Class I areas, including the Sipsey Wilderness, located approximately 168 km from the source. TDEC erroneously dismissed this source stating that even considering recent NOx emissions from this source, "this facility does not significantly contribute to visibility impairment at any Class I area."[138]

b) *Tennessee Gas Pipeline Company, L.L.C.: Compressor Station 87*

The Tennessee Gas Pipeline Company, L.L.C., Station 87 Plant is a compressor station located in Portland. As shown in Table 1 above, the source has a cumulative Q/d value of 16 based on 2017 emissions. According to NPCA's analysis, emissions from this source potentially impacts one Class I area, the Mammoth Cave National Park, located approximately 69 km from the source. With the exception of presenting emission inventory information,[139] TDEC does not discuss this source in its Draft SIP.

6. *O-N Minerals (Luttrell)*

The O-N Minerals is a lime manufacturing plant located in Luttrell. As shown in Table 1 above, the source has a cumulative Q/d value of 15 based on 2017 emissions. According to NPCA's

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[136] Draft SIP at 202, 203.
[137] Vicki Stamper and Megan Williams, "Oil and Gas Sector Reasonable Progress Four-Factor Analysis of Controls for Five Source Categories" (March 6, 2020). (Exhibit 11)
[138] Draft SIP at 200.
[139] *Id.* at 203

analysis, emissions from this source potentially impacts two Class I areas, including the Mammoth Cave National Park, located approximately 27 km from the source. With the exception of presenting emission inventory information,[140] TDEC does not discuss this source in its Draft SIP.

VI. TDEC's Consultations Were Flawed and Incomplete

EPA's regulations require that each applicable implementation plan for a State in which any mandatory Class I Federal area is located, contains such emission limits, schedules of compliance and other measures as may be necessary to make reasonable progress toward meeting the national goal.[141] The Clean Air Act further requires states to determine the measures necessary to make reasonable progress towards preventing future, and remedying existing, anthropogenic visibility impairment in all Class I areas.[142]202 Thus, "Congress was clear that both downwind states (*i.e.*, "a State in which any [mandatory Class I Federal] area . . . is located) and upwind states (*i.e.*, "a State the emissions from which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area") must revise their SIPs to include measures that will make reasonable progress at all affected Class I areas."[143]

"This consultation obligation is a key element of the regional haze program. Congress, the states, the courts and the EPA have long recognized that regional haze is a regional problem that requires regional solutions. *Vermont v. Thomas*, 850 F.2d 99, 101 (2d Cir. 1988)."[144] Congress intended this provision of the Clean Air Act to "equalize the positions of the States with respect to interstate pollution," (S. Rep. No. 95-127, at 41 (1977)) and EPA's interpretation of this requirement accomplishes this goal by ensuring that downwind states can seek recourse from EPA if an upwind state is not doing enough to address visibility transport.[145]

In developing a long-term strategy for regional haze, EPA's regulation 40 C.F.R. § 51.308(f)(2) requires that a state take three distinct steps: consultation; demonstration; and consideration. Specifically, the regulation requires:

> (ii) The State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress.
> (A) The State must demonstrate that it has included in its implementation plan all measures agreed to during state-to-state consultations or a regional planning process, or measures that will provide equivalent visibility improvement.
> (B) The State must consider the emission reduction measures identified by other States for their sources as being necessary to make reasonable progress in the mandatory Class I Federal area.[146]

[140] *Id.* at 204.
[141] 42 U.S.C. § 7491(b)(2).
[142] *Id*. § 7491(a)(1).
[143] 82 Fed. Reg. at 3,094.
[144] *Id.* at 3,085.
[145] *Id.*
[146] 40 C.F.R. § 51.308(f)(2) (emphasis added); *see also*, 64 Fed. Reg. 35,765, 35,735 (July 1, 1999) (In conducting the four-factor analysis, EPA explained that "…the State must consult with other States which are anticipated to

"Where the State has emissions that are reasonably anticipated to contribute to visibility impairment in any mandatory Class I Federal area located in another State or States, the State must consult with the other State(s) in order to develop coordinated emission management strategies."[147] Moreover, plan revisions:

> [M]ust provide procedures for continuing consultation between the State … on the implementation of the visibility protection program required by this subpart, including development and review of implementation plan revisions and progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibility in mandatory Class I Federal areas.[148]

In its 2017 amendments to the Regional Haze Rule, EPA explained that "states *must* exchange their four-factor analyses and the associated technical information that was developed in the course of devising their long-term strategies. This information includes modeling, monitoring and emissions data and cost and feasibility studies."[149] In the event of a recalcitrant state, "[t]o the extent that one state does not provide another other state with these analyses and information, or to the extent that the analyses or information are materially deficient, the latter state should document this fact so that the EPA can assess whether the former state has failed to meaningfully comply with the consultation requirements."[150]

Finally, "[i]f a State contains sources which are reasonably anticipated to contribute to visibility impairment in a mandatory Class I Federal area in another State" that has established reasonable progress goals that are slower than the Uniform Rate of Progress, "the State must demonstrate that there are no additional emission reduction measures for anthropogenic sources or groups of sources in the State."[151] To that end, 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."[152] In any event, "[a]ll substantive interstate consultations must be documented."[153]

A. TDEC's Interstate Consultations Were Flawed and Incomplete

TDEC's consultation with other states is flawed and incomplete. TDEC selected two sources in other VISTAS states (*i.e.,* Ga Power Company - Plant Bowen (Georgia) and Tennessee Valley Authority (TVA) - Shawnee Fossil Plant in Kentucky),[154] and TDEC contacted those States on October 23, 2020 and asked them to perform a reasonable progress analysis.[155] TDEC selected five sources outside the VISTAS states (*i.e.,* Gibson (Indiana), Indiana Michigan Power DBA AEP

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contribute to visibility impairment in the Class I area under consideration … any such State must consult with other States before submitting its long-term strategy to EPA.").

147 40 C.F.R. § 51.308(f)(3)(i).

148 40 C.F.R. § 51.308(f)(4).

149 82 Fed. Reg. at 3,088 (emphasis added).

150 *Id.*

151 40 C.F.R. § 51.308(f)(3)(ii)(B).

152 *Id.*

153 40 C.F.R. § 51.308(f)(2)(ii)(C).

154 Draft SIP at 197.

155 *Id.* at 198.

Rockport (Indiana), Duke Energy Ohio, Wm. H. Zimmer Station (Ohio), General James M. Gavin Power Plant (Ohio), and Genon NE Mgmt CO/Keystone Sta (Pennsylvania).[156] TDEC sent these three States letters on June 22, 2020, asking them to perform reasonable progress analysis for the identified sources.[157]

For the states TDEC did hear from and what information we found for the states that did not respond, there is nothing in the Draft SIP that demonstrates TDEC conducted an independent evaluation of what it received and found from the other states. Instead, TDEC sums up its state-to-state consultations by saying it "agrees with all of the decisions made by other state agencies concerning the emission sources …"[158] As the agency responsible for developing and implementing the Act's regional haze requirements in the first instance, TDEC must perform its duties and review and consider the information it receives. As explained below, lacking the independent engineering review, TDEC's Draft SIP is incomplete and must be supplemented with the missing analysis before submittal to EPA.

1. Neither Indiana nor Georgia Responded to TDEC's Request for Four-Factor Analyses

Initially, we point out that neither Georgia nor Indiana responded to TDEC's letters sent more than a year ago. Additionally, there's nothing in the Draft SIP to suggest that TDEC followed-up with the non-responsive states and/or elevated to Tennessee's senior agency officials to obtain their assistance in obtaining responses from Georgia and Indiana for the three EGUs: Georgia Power Company – Plant Bowen, Georgia[159] and the Gibson and Indiana Michigan Power sources in Indiana that are of a concern to TDEC.[160]

a. Georgia: Georgia Power Company – Plant Bowen

The Draft SIP indicates for the Bowen source in Georgia, the SIP says "[n]o response yet." TDEC's SIP is incomplete and it must not accept the lack of a response from Georgia. Instead it must ensure that the Four-Factor Analysis is conducted for the Georgia Power Company's Plant Bowen.

b. Indiana: Gibson Plant and Indiana Michigan Power

For the two Indiana sources that TDEC is concerned about, TDEC's Draft SIP includes an excerpt from Indiana's draft Regional Haze SIP where Indiana proposed to summarily ignore all the EGUs based on the reasoning[161] that it is inconsistent with the regulations and EPA's

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[156] *Id.* at 198, Appendix F.
[157] *Id.* at 198-199.
[158] *Id.* at 218.
[159] *Id.* at 220,
[160] *Id*. at 220-221.
[161] Indiana Department of Environmental Management's draft Regional Haze SIP (September 2021), at section 7.4 ("Indiana surmises the EGU sector was evaluated in great detail for the first implementation period of the RH Rule. Based on industry-wide emission control measures mandated by strict regulations and far less reliance on coal over the past decade or more due to alternative power generation; numerous shutdowns and fuel conversions of boilers has occurred to which tens of thousands of tons of NOx and SO_2 emissions have been reduced in just Indiana alone.

statements.[162] Indiana did not perform the required Four-Factor Analysis. Moreover, the NPS comments explain that Indiana's assertions that the Indiana EGUs were evaluated in great detail for the first RH implementation period are not supported by the record.[163] Indeed, as the Kordzi Report explains, Indiana's EGUs were subject to the Clean Air Interstate Rule (CAIR) and its successor, the Cross-State Air Pollution Rule (CSAPR).[164] Under CAIR/CSAPR, individual EGUs were not evaluated for their contribution to haze in individual Class I areas as the rule was concerned with the health-based standards rather than regional haze.[165] Thus, neither *the* Gibson plant nor Indiana Michigan Power were subject to a BART analysis and requirements. Instead, as Indiana explained in its first-round SIP:

> IDEM identified several EGUs subject to BART. However, as provided by the federal rule, IDEM assumed NO_x and SO_2 BART requirements are met by the participation of these sources in the CAIR NO_x and SO_2 trading program.[166]

Regardless of the validity of this statement, and we do not believe it is correct, even if Indiana had satisfied BART requirements for its round 1 regional haze SIP by relying on CAIR/CSAPR that does not exclude the state from reviewing these sources under reasonable progress for the *second* planning period. EPA's 2019 Guidance makes plain and is reinforced by the Clarification Memo that BART sources are not to be categorically excused from reasonable progress analysis and requirements and where, as here, such sources continue to contribute significantly to visibility impairment they must be subject to emission reducing measures.[167] As more deeply addressed in the comments Conservation Organizations submitted to Indiana on its haze SIP articulate, reasonable progress measures should be required of both the Gibson plant and Indiana Michigan Power.[168]

The five-unit, 3,646 megawatt (MW) Gibson coal burning plant is one of the largest coal-burning facilities in the world.[169] While all five Gibson units have SCRs, these SCRs are underperforming, as demonstrated in the Kordzi Report for Indiana.[170] "Therefore, IDEM should

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Emission trends for both NOx and SO_2 have shown dramatic decreases in emissions and as a result, IDEM is not requiring four-factor analyses for its EGUs."), *id.* at 221.

[162] Conservation Organizations Comments on Indiana Department of Environmental Management's Proposed Regional Haze State Implementation Plan ("Proposed SIP") for Second Implementation Period, submitted by Sierra Club, National Parks Conservation Association, The Coalition to Protect America's National Parks, Just Transition Northwest Indiana, Hoosier Environmental Council, Izaak Walton League, and Save the Dunes (Nov. 15, 2021) (Exhibit 12).

[163] Kordzi Report at 37, citing Appendix K to the Indiana Regional Haze SIP, at pdf 5.

[164] Kordzi Report at 37.

[165] *Id.*

[166] *Id.,* citing Indiana Regional Haze State Implementation Plan, Developed by: The Indiana Department of Environmental Management (Nov. 2010) at 52.

[167] EPA 2019 Regional Haze Guidance at 24; EPA 2021 Clarification Memo at 14

[168] Sierra Club, National Parks Conservation Association, The Coalition to Protect America's National Parks, Just Transition Northwest Indiana, Hoosier Environmental Council, Izaak Walton League, and Save the Dunes Comments on Indiana Department of Environmental Management's Proposed Regional Haze State Implementation Plan for Second Implementation Period (Nov. 15, 2021) ("Conservation Organizations Comments on Indiana Draft SIP"); Joe Kordzi, "A Review of the Indiana Regional Haze State Implementation Plan" (Nov. 2021) (Exhibit 13) ("Kordzi Report for Indiana").

[169] *Id.* at 21.

[170] Kordzi Report for Indiana at 11-12.

require that the Gibson Units 1-5 undergo four-factor analyses for upgrades to their SCR systems. Considering that the systems are already installed, it is likely that substantial pollution reductions can be achieved very cost-effectively with little to no capital costs, by simply running the SCR systems more efficiently, more frequently, and/or using more reagent."[171]

The FGD systems at Gibson Units 1-5 appear to be able to achieve 95% reduction of SO_2 on a continuous basis, though the units sporadically depart from that removal efficiency level.[172] IDEM should perform a four-factor analysis to determine if requiring a mandatory 95% removal requirement as an enforceable limit would be cost-effective. Because these FGD systems are already in operation and Gibson generally achieves this removal efficiency for most hours already, such a binding, enforceable limit is almost certainly cost-effective.[173]

Furthermore, as discussed elsewhere in these comments, CSAPR does little to drive EGU emission reductions.

TDEC's SIP is incomplete and it must not accept the lack of a response from Indiana. Instead it must ensure that the Four-Factor Analyses are conducted for the Gibson plant and Indiana Michigan Power. Furthermore, there is nothing in the Draft SIP that indicates TDEC comments on Indiana's Draft SIP proposal, an action they should have taken given their concern about emissions from Indiana's sources and the lack of Indiana's proposed actions on those sources.

2. Pennsylvania and Ohio EGUs Must Optimize or Upgrade their Controls

a) Pennsylvania: Genon NE Mgmt Co / Keystone Generating Station

TDEC's SIP is incomplete with regard to an analysis of potential controls at the Keystone Generating Station. TDEC's Draft SIP explains that it requested that Pennsylvania perform a Four-Factor Analysis on the Keystone Generating Station.[174] Pennsylvania's response is that it had the source perform a reasonable progress analysis.[175] The source's analysis asserted that emissions of SO_2 and NO_x from Units 1 and 2 at the Station are already well controlled by wet FGD and SCR and that substantial SO_2 and NO_X emission reductions have already been achieved with the existing emission controls.[176] The source concluded that, for Keystone Generating Station's Units 1 and 2, no additional controls are needed in order for PA DEP to meet their reasonable progress goal for the Second Decadal Review.[177] Apparently PA DEP accepted the sources analysis and proposed conclusion that no additional controls are needed.

As explained in the Kordzi Report, both PA DEP and TDEC failed to identify and require upgrades at this source. The Keystone Generating Station, Units 1 and 2 are equipped with

[171] Conservation Organizations Comments on Indiana Draft SIP at 21, citing Kordzi Report for Indiana at 11.
[172] Conservation Organizations Comments on Indiana Draft SIP at 21.
[173] *Id.*
[174] Draft SIP at 221.
[175] *Id.*
[176] *Id.*
[177] *Id.*

underperforming wet scrubbers.[178] Keystone states that inlet Continuous Emission Monitors (CEMs) to the wet scrubbers indicate SO_2 control efficiencies of 90.7% and 92.7% for Units 1 and 2, respectively[179] and as the Kordzi Report explains, a modern wet scrubber system should be able to continuously operate at 98% efficiency. Furthermore while Keystone asserts there may be an increase in mercury from the use of dibasic acid (a common wet scrubber upgrade), this assertion is unfounded because there are newer more efficient additives available that neither the source nor TDEC and PA DEP considered.[180] Nevertheless, the scrubber upgrades Keystone does consider, consisting of simply running one more level of recycle pumps, are very cost-effective at $413/ton and must be required by PA DEP. As the Kordzi Report concludes, there are likely other upgrades that are also cost-effective and TDEC must request that Pennsylvania require the Four-Factor Analysis, upgrades to these scrubbers, and include enforceable emission limitations in its SIP.

For NOx emissions, while Units 1 and 2 are also equipped with SCR systems, Keystone asserts that "[o]ptimization of the existing SCR systems will be addressed as part of the forthcoming case-by-case NOx RACT analysis."[181] An upcoming RACT analysis is not an offramp to the Act's RH requirements that apply now. As discussed in elsewhere in these comments, other CAA permit and other requirements are in addition to, not in lieu of the RH requirements. Moreover, a RACT analysis would apply different factors and result in a different and likely less stringent outcome. Therefore, TDEC must request that Pennsylvania require the Four-Factor Analysis for Units 1 and 2, including optimization options, and include enforceable emission limitations in its SIP.

b) Ohio: Gavin Power Plant

Regarding the Gavin Power Plant, Ohio relied on Gavin's assertion that the existing wet scrubbing and SCR systems have been upgraded as much as possible and so did not require a Four-Factor Analysis for upgrades to those systems. [182] However, it appears from an analysis done of the Gavin scrubber performance (similar to those performed in this report) that the Gavin SO_2 removal performance is fairly erratic, and there does not seem to be any indication of a clear performance improvement following the mid-2020 scrubber improvements that Gavin described. Gavin's SCR units are operated very erratically and are currently underperforming despite performing much better during 2009 – 2012.[183] Consequently, TDEC should request that Ohio require that Gavin be required to perform Four-Factor Analyses to investigate upgrades to its scrubber and SCR systems.

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[178] Kordzi Report at 37, citing information contained in the report entitled, "Four Factor Analysis for Regional Haze, Second Decadal Review, Keystone Generating Station Units 1 and 2, AECOM, Revised (Rev.02) (Feb. 11, 2021).
[179] *Id*. at 6.
[180] Kordzi Report at 37, citing *see e.g.*, https://www.power-eng.com/emissions/coal-fired-power-m-o-enhancing-wet-limestone-scrubber-efficiency/ (Exhibit 14).
[181] Kordzi Report at 37, citing "Four Factor Analysis for Regional Haze, Second Decadal Review, Keystone Generating Station Units 1 and 2, AECOM, Revised (Rev.02)" (Feb. 11, 201), at 11.
[182] SO_2 Four-Factor Analysis Regional Haze Rule Second Decadal Review, General James M. Gavin Power Plant Units 1 and 2, AECOM Project Number: 60645830, Revision 1 (March 31, 2021).
[183] A more detailed analysis of Gavin's scrubber and SCR performance was provided in separate comments to Ohio, *see* Joe Kordzi, "A Review of the Ohio Regional Haze State Implementation Plan" at 14 (June 2021) (Exhibit 15).

3. Tennessee's Consultations with Georgia, Alabama, and North Carolina on Tennessee Source Impacts are Flawed and Incomplete

TDEC also consulted with Georgia, Alabama, and North Carolina about specific sources in Tennessee, however, its approach towards receiving and addressing these state concerns is problematic and unjustified. Instead TDEC summarily proposes to dismiss the impacts from Tennessee's sources as follows:

> [T]here are no sources in Tennessee 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 is slower than the URP.[184]

Which as discussed elsewhere in these comments, TDEC's proposal to use the URP as a safe harbor in this manner, is not allowed.

B. TDEC's Consultation With the Federal Land Managers is Flawed and Incomplete[185]

The Clean Air Act and the Regional Haze Rule require states to consult with the Federal Land Managers that oversee the Class I Areas impacted by a state's sources.[186] Specifically, the state "must provide the Federal Land Manager with an opportunity for consultation, in person at a point early enough in the State's policy analyses of its long-term strategy emission reduction obligation so that information and recommendations provided by the Federal Land Manager can *meaningfully inform* the State's decisions on the long-term strategy."[187] The "consultation must be early enough for state officials to meaningfully consider the views expressed by the FLMs."[188] The rule further requires states to provide for "continuing consultation" between the state and the Federal Land Manager, and to meaningfully address the FLM's comments in the proposed SIP.[189] Thus, the FLM consultation process is not a mere box checking exercise; instead, it is a mandatory, iterative process, requiring the state to meaningfully consider and incorporate into the SIP the concerns of the agencies responsible for managing the Class I resources impacted by pollution from the state.

Because the FLMs' role is to manage their resources – including air quality – TDEC should meaningfully consider and adapt its SIP measures to reflect comments and suggestions from the FLMs. Indeed, the Department of Interior's FLM agencies have engineers and air quality specialists uniquely qualified with years of experience reviewing and commenting on the draft RH SIPs, including TDEC's.

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184 Draft SIP at 211.
185 *Id.* at 229-264, Appendix H-1.
186 42 U.S.C. § 7491(d); 40 C.F.R. § 51.308(i)(2).
187 40 C.F.R. § 51.308(i)(2) (emphasis added).
188 EPA, Responses to Comments at 445, Protection of Visibility: Amendments to Requirements for State Plans; Proposed Rule (81 Fed. Reg. 26,942 (May 4, 2016), Docket No. EPA-HQ-OAR-2015-0531 (Dec. 2016) ("Regional Haze Rule Revision Response to Comment").
189 40 C.F.R. § 51.308(i)(2); Regional Haze Rule Revision Response to Comment at 445.

TDEC has neither meaningfully considered nor adapted its proposed SIP to respond to the FLMs' recommendations, and the plan therefore fails to satisfy the text or the intent of the Regional Haze Rule's consultation requirements. Indeed, many of TDEC's responses were non-responsive and failed to provide a rational or lawful explanation[190] and/or inconsistent with the legal CAA and RHR requirements. For example, FLMs assert that TDEC must:

- Either include as enforceable SIP limitations operating scenarios for emission units that represent a reduced capacity (*i.e.,* a reduced number of operating hours per year and pollution control equipment efficiency used to designate a unit as "effectively controlled") or perform a Four-Factor Analysis for TVA Kingston. .
- Not use its unsupported assertion "that visibility improvements will occur at a lower RP cost" to reject cost effective of controls at TVA Cumberland."[191]
- Not reject limitations to reduce emissions where the costs estimated by the companies are "within the bounds of cost thresholds selected by other states in this round of RH planning."[192]
- Not use a "weight of evidence" analysis to supplant the statutorily required Four-Factor Analysis for TVA Kingston.[193]
- Not rely on Eastman Chemical Company's assertions in the cost effectiveness analysis where there is no supporting documentation.[194]
- Not rely on a NEPA planning document for 2028 emissions at TVA Kingston – despite publication of those emissions in a Federal Register – because TDEC has not proposed enforceable SIP limitations under the CAA.
- Not ignore the USFS comment and use an unrepresentative and outdated year (*i.e.,* 2011) for prescribed fire emissions, because reliance on those data results in RPGs that do not represent historical and recent fire and fuels management.[195] Use of the nonrepresentative emission inventory data undercuts emissions by VISTAS states by up to fifty percent and is also inconsistent with the RHR that provides for adjustment of the RPGs to account for prescribed fire.[196]

Indeed, as the NPS' December 3, 2021 letter to TDEC explained:

> NPS Class I areas affected by haze causing emissions from Tennessee include Great Smoky Mountains National Park, in Tennessee and North Carolina, as well as Mammoth

[190] For example, the TDEC's response to the FLM's detailed comments on TVA Gallatin (e.g., emission control equipment has not been optimized, reliance on a ten-year-old Consent Decree that was not used for RH RP compliance is misplaced because "Controls installed because of CAA violations and associated civil penalties should not preclude an analysis of the facility to comply with reasonable progress requirements under the regional haze rule") was merely, "As indicated in section 10.4.3, the maximum AoI sulfate + nitrate facility contribution for TVA-Gallatin is 0.695%, which is well below the AoI threshold used to determine which facilities were chosen for PSAT modeling and thus considered for four-factor analysis." Draft SIP at 262.
[191] Draft SIP at 260.
[192] *Id.* at 259. (regarding cost of controls at Eastman Chemical Company).
[193] *Id.* at 261.
[194] *Id.* at 261. (regarding cost of contingencies).
[195] *Id.* at 263. (comment from the USFS).
[196] *Id.*

> Cave National Park, in Kentucky, and Shenandoah National Park, in Virginia. Haze can significantly diminish the visitor experience in these iconic parks that offer awe-inspiring vistas of ancient, rugged mountains; historic landscapes; diverse vegetation; and picturesque waterfalls.[197]

The NPS "encourage[d] Tennessee to take these opportunities to reduce haze causing emissions" explaining that "[t]he cumulative benefits of emission reductions from many sources are necessary to achieve the Clean Air Act and Regional Haze Rule goal to prevent future and remedy existing visibility impairment in Class I areas."[198] Further commenting that:

> Tennessee has an opportunity to improve the effectiveness of their Regional Haze SIP by choosing to consider additional facilities, explore NOx emission reduction opportunities, and require cost-effective emission controls identified using the four statutory factors. *These incremental steps are needed to advance reasonable progress goals.*[199]

Furthermore, the enclosed detailed comments to the NPS' letter provide supplement comments on the Draft SIP, further addressing TDEC's responses to the NPS comments it provided on August 31, 2021. Notably, the NPS cites to EPA's 2021 Clarification Memo and the need for TDEC to conduct the NOx Four-Factor Analysis for the sources the NPS identified.[200] The NPS also cites EPA's 2021 Clarification Memo to refute TDEC's analysis for source selection.[201] Finally, the NPS continues to urge TDEC to follow the Control Cost Manual and consider the cost thresholds established by Oregon and Colorado, and explains that given Eastman's and Cumberland's "visibility impact[s] in NPS Class I areas, we urge TDEC-APC to implement these options in this round of regional haze planning."[202]

To comply with the letter and purpose of the regulation, TDEC must meaningfully evaluate and incorporate the FLM's comments in a proposed SIP and provide the public an opportunity to comment.

C. TDEC Did Not Respond to RPO MANE-VU's Request

Regarding the MANE-VU Ask for operation of control equipment at

> Electric Generating Units (EGUs) with a nameplate capacity larger than or equal to 25 MW with already installed NO_X and/or SO_2 controls - ensure the most effective use of control technologies on a year-round basis to consistently minimize emissions of haze precursors, or obtain equivalent alternative emission reductions.[203]

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[197] NPS December 2021 Letter at 2.
[198] *Id.*
[199] *Id.*
[200] *Id.* Enclosure at 1-2.
[201] *Id.* at 2-3.
[202] *Id.* at 5.
[203] *See* Letter from Heidi Hales to Michele Owenby (Feb. 17, 2021), Appendix F-4f.

MANE-VU specifically requested that in order to address this issue, TDEC list all of the EGU emission reductions it notes have occurred, and "how these emissions reductions meet the MANE-VU Inter-RPO Ask."[204] As explained in detail in the Kordzi Report, there are many instances in which EGUs have installed advanced SO_2 and NOx controls such as scrubber and SCR systems, but are not running those controls in an optimized manner.[205] Thus, the Four-Factor Analyses would require optimization or upgrading these controls, which would likely result in very cost-effective reductions.[206] TDEC's Draft SIP lacks any analysis and consideration of the MANE-VU Ask. Instead, TDEC relies on its flawed modeling analysis and unenforceable emission inventory to erroneously avoid controls on its sources.[207] EPA's July 2021 Memo unequivocally states that meaningful reductions are expected to make reasonable progress towards the national goal of restoring visibility – reductions in SO_2 and NOx, reductions in the biggest sources of impairment *as well as relatively smaller contributors* – reductions that are achievable looking across a full spectrum of options of emission reducing measures. It is therefore unreasonable for TDEC to categorically discount cost effective controls at its smaller contributors. TDEC must include an analysis of the EGUs with 25 MW or larger and associated control requirements.

VII. TDEC's Draft SIP Does Not Contain Provisions to Ensure Emission Limitations are Permanent and Enforceable and That Its Permits *Complement* the Act's Reasonable Progress Requirements

The CAA requires states to submit implementation plans that "contain such emission limits, schedules of compliance and other measures as may be necessary to make reasonable progress toward meeting the national goal" of achieving natural visibility conditions at all Class I Areas.[208] The RHR requires that states must revise and update their regional haze SIPs, and the "periodic comprehensive revisions must include the "enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress as determined pursuant to [51.308](f)(2)(i) through (iv)."[209] The emission limitations and other requirements of the RHR must be adopted into the SIP. Furthermore, under the RHR, RPGs adopted by a state with a Class I area must be based only on emission controls measures that have been adopted and are enforceable in the SIP.[210]

There are several issues with TDEC's proposed approach. First, its Draft SIP explains that its RPGs are based on modeling results, which does meet the RHR requirement that the RPGs are based on enforceable SIP measures. Second, TDEC does not propose including final permit conditions in the SIP; rather, it proposes relying on provisions in a *draft* Title V permit for Eastman Chemical Company,[211] which does not fulfill the legal requirements. Consistent with

[204] Draft SIP at 224-229..
[205] Kordzi Report at 36.
[206] *Id.*
[207] Draft SIP at 228-229. (referencing letters sent back-and-forth between the two states). TDEC's suggestion that delayed schedules provides a reason to avoid the required meaningfully analysis and response is also misplaced. *id.* at 225.
[208] 42 U.S.C. §§ 7491(a)(1), (b)(2).
[209] 40 C.F.R. § 51.308(f)(2); 40 C.F.R. § 51.308(d)(3)(v)(F)(Enforceability of emission limitations and control measures).
[210] 40 C.F.R. § 51.308(f)(3).
[211] Draft SIP at 206.

EPA's longstanding positions regarding enforceable SIP provisions, EPA's 2019 Guidance explains the requirements in 40 C.F.R. § 51.308(d)(3)(v)(F), which:

> [R]equires SIPs to include enforceable emission limitations and/or other measures to address regional haze, deadlines for their implementation, and provisions to make the measures practicably enforceable including averaging times, monitoring requirements, and record keeping and reporting requirements.[212]

In proposing to include provisions from a *draft* permit, TDEC must go through additional process before those permit conditions are final. Thus, the draft permit provisions cannot be relied on as enforceable requirements and as such it is the Four-Factor Analysis that must determine the emission limits and SIP requirements. TDEC can integrate those limits and include EPA-approvable the monitoring, recordkeeping and reporting requirements into the permit.

Moreover, the conditions in the draft permit are not consistent with the requirements. The permit must contain short-term 30-day emission limitations.[213] For the retirement provision, there are no requirements for notification, certification of closure, and surrender of construction permits.[214]

Third, the reasonable progress requirements apply to all sources, thus TDEC must not rely on existing permits to allow sources to avoid the Four-Factor Analysis because there is no off-ramp for sources that hold permits.[215] EPA's Guidance recognizes EPA's long-standing position that while the SIP is the basis for demonstrating and ensuring state plans meet the regional haze requirements, state-issued permits must complement the SIP and SIP requirements.[216] State-issued permits must not frustrate SIP requirements.[217] For example, sources with PSD permits under Title I must not hold permits that allow emissions that conflict with SIP requirements.[218] Additionally, the Act's Title V operating permits collect and implement all the Act's requirements – including the requirements in the SIP – as applicable to the particular permittee. Furthermore, Title V permits are only good for a period of five years and may expire under

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[212] "EPA Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," (Aug. 20, 2019), at 42-43, https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf. (While NPCA filed a Petition for Reconsideration regarding EPA's issuance of the 2019 Guidance (Exhibit 6), it does not dispute the information in the Guidance referenced here regarding enforceable limitations, which cite to EPA's longstanding statements found in the "General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990, 74 Fed. Reg. 13498 (April 16, 1992).

[213] The draft permit includes an annual limit "Sulfur dioxide (SO2) emissions from Boilers 23 and 24 shall not exceed 1,396 tons during any period of 12 consecutive months. The first 12-month period subject to this limit shall begin on January 1, 2022 and shall end on December 31, 2022." Appendix G-2g at pdf 55.

[214] *Id.,* "The permittee shall permanently cease operation of Boilers 18, 19, and 20 no later than December 31, 2028."

[215] *See, e.g.,* Draft SIP at 114 (emission limits in a Title V permit for Resolute); (proposing to allow an unnamed BART-eligible source that received a permit during the first RH planning period, to also avoid an RP analysis), *id.* at 278; (proposing to rely on surrender of only Title V and not the underlying SIP construction permits for source shut downs), *id.* at 279.

[216] 74 Fed. Reg. 13498, 13568 (April 16, 1992).

[217] Furthermore, to the extent stationary source are granted permits by rule or other mechanisms, these other categories of state approval mechanisms that allow construction, operation and increases in emissions must also complement SIP requirements.

[218] Additionally, the proposed SIP revisions fail to contain source-specific "measures to mitigate the impacts of construction activities." 40 C.F.R. § 51.308(d)(3)(v)(B).

certain conditions. There is no assurance that Title V permit terms and conditions will be permanent since they may lapse. It is not enough that the Title V permits are reviewable by U.S. EPA, Title V permits are *not* part of the SIP and approved through EPA's SIP process. Finally, Title V permits must not hold such permits if they contain permit terms and conditions that conflict with the SIP and CAA requirements, which could happen here because TDEC proposes to process the proposed Title V permit for the Eastman Chemical Company after the SIP is adopted.

Fourth, TDEC's Draft SIP lacks the required "enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress" and would allow the companies to modify operations, increase emissions that impact Class I areas for many years without first meeting reasonable progress emission limitations and other necessary requirements. Contrary to the requirement to ensure permits complement the SIP, TDEC's proposed SIP mentions the permits and does not contain the enforceable emissions limitations, monitoring, recordkeeping and reporting requirements consistent with the statements in the Draft SIP and assumptions used in preparing and generating the 2028 emission inventory.

VIII. TDEC's Long-Term Strategy is Inconsistent with the Legal Requirements

A. TDEC Must First Conduct the Required Four-Factor Analysis and then Develop the Reasonable Progress Goals

TDEC's draft long-term strategy sets reasonable progress goals based on the VISTAS modeling results *before* and *in lieu of* conducting the required Four-Factor Analysis – it has impermissibly reversed the order of the requirements.[219] The RPGs are not to be developed before the Four-Factor Analyses but as a result of the Four-Factor Analyses.[220] TDEC must first conduct the Four-Factor Analyses, determine measures for reducing visibility impairing emissions based on the Act's Four-Factor Analysis and then use the results to develop proposed revisions to the RPGs.

B. The Public was Not Provided an Opportunity to Review and Comment on the VISTAS Emission Inventories and Modeling

While the VISTAS states may have agreed on the modeling (and presumably the emission inventory development) compiled or completed by VISTAS, the public was not provided an opportunity to review and comment on the assumptions that went into the emission inventories or the modeling. Indeed, statements in the Draft SIP that circumvent the SIP public notice and comment requirements are of significant concern to commenters. For example, TDEC explains that "[t]he [VISTAS] states collectively accept the conclusions of these [technical] analyses for use in evaluating reasonable progress."[221] TDEC presents its Draft SIP and the myriad of VISTAS assumptions upon which it is based as a *fait accompli*, suggesting that the VISTAS screening methodology to select sources and VISTAS modeling it relied on to set its RPGs are

[219] Draft SIP at 209-211.
[220] *See, e.g.*, 82 Fed. Reg. at 3090-91.
[221] Draft SIP at 218.

complete and done. TDEC's statements that suggest it has already determined the contents of the Final SIP it will submit to EPA are contrary to the Act's requirements for public notice and comment. Furthermore, TDEC's description of the outreach it conducted to various parties does not replace the State's required public notice and comment process,[222] nor supplant EPA's ultimate legal responsibility to also provide for public notice and comment before it makes its final decision to approve or disapprove Tennessee's SIP. Thus, TDEC must meaningfully consider all comments and revise the Draft SIP accordingly.

While TDEC provides *some* of the underlying RPO information in the Draft SIP package for the public to review, the public was not provided access to all the underlying VISTAS' technical documents. This is contrary to the regional haze regulations that require the long-term strategy to:

> [D]ocument the technical basis, including modeling, monitoring and emissions information, on which the State is relying to determine its apportionment of emission reduction obligations necessary for achieving reasonable progress in each mandatory Class I Federal area it affects.[223]

As part of its proposed SIP revisions, TDEC must not only follow the requirements in the RHR, but also the requirements for preparation, adoption and submittal of SIPs.[224] TDEC has an obligation to make transparent and cite to (and provide weblinks to) the technical support documentation it proposes to rely on and use as part of its SIP revision (*e.g.*, such regional planning organization technical analyses) and provide the public with the opportunity to comment on such analyses. Thus, TDEC must cite to and provide weblinks to the VISTAS' documentation and analysis for all the emissions information, monitoring and modeling.[225]

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[222] *Id.* at 222-224.
[223] 40 C.F.R. § 51.308(d)(3)(iii).
[224] 40 C.F.R. §§ 51.100, 51.102, 51.103, 51.104, 51.105 and Appendix V to Part 51.
[225] 40 C.F.R. Part 51, Appendix V ¶ 2.2 Technical Support. "(a) Identification of all regulated pollutants affected by the plan. (b) Identification of the locations of affected sources including the EPA attainment/nonattainment designation of the locations and the status of the attainment plan for the affected areas(s). (c) Quantification of the changes in plan allowable emissions from the affected sources; estimates of changes in current actual emissions from affected sources or, where appropriate, quantification of changes in actual emissions from affected sources through calculations of the differences between certain baseline levels and allowable emissions anticipated as a result of the revision. (d) The State's demonstration that the national ambient air quality standards, prevention of significant deterioration increments, reasonable further progress demonstration, and *visibility*, as applicable, are protected if the plan is approved and implemented. …. (e) Modeling information required to support the proposed revision, including input data, output data, models used, justification of model selections, ambient monitoring data used, meteorological data used, justification for use of offsite data (where used), modes of models used, assumptions, and other information relevant to the determination of adequacy of the modeling analysis. (f) Evidence, where necessary, that emission limitations are based on *continuous* emission reduction technology. (g) Evidence that the plan contains emission limitations, work practice standards and recordkeeping/reporting requirements, where necessary, to ensure emission levels. (h) Compliance/enforcement strategies, including how compliance will be determined in practice. (i) Special economic and technological justifications required by any applicable EPA policies, or an explanation of why such justifications are not necessary."

C. TDEC Must Not Rely on Unquantified and Unenforceable Statements in Its SIP

Tennessee's long-term strategy relies on emission reductions associated with the following laundry list of items and explains that they "are included in the 2028 future year estimates upon which the RPGs are based."[226] Additional sources included in Table 3 below are those where TDEC's Draft SIP provides an explanation for "[l]arge differences (greater than 1,000 tpy) between 2028 and 2017/18/19 emissions,"[227] which TDEC offers as additional proof of emission reductions by 2028. While TDEC's efforts to compile the list of 31 sources, source categories and other programs are laudable – without the required documentation and practically enforceable SIP provisions – they are meaningless. As discussed elsewhere in these comments and also highlighted in the below Table, there are numerous issues with TDEC's Draft SIP attempting to take credit for the following, including lack of quantification in the Draft SIP for emission reductions from the various rules.

Table 3. Non-Quantified and Unenforceable Assertions Regarding Emission Reductions

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
1	**Coal-fired power plant retirements must be clearly documented in the SIP**	Coal-fired units at the TVA Allen coal plant closed in 2018.[228] It is unclear what emission reductions, if any, TDEC accounts for in the Draft SIP from these closures. If TDEC want to take credit, it must provide documentation in its SIP.
		TVA John Sevier coal-fired units were closed in 2012.[229] It is unclear what emission reductions, if any, TDEC accounts for in the Draft SIP from these closures. If TDEC want to take credit, it must provide documentation in its SIP.
		TVA Johnsonville coal-fired units were shut down in 2017. [230] It is unclear what emission reductions, if any, TDEC accounts for in the Draft SIP from these closures. If TDEC want to take credit, it must provide documentation in its SIP.

[226] Draft SIP at 97.
[227] *Id.* at 199-201.
[228] *Id.* at 102. Furthermore, the Draft SIP lacks evidence of the described retirement, merely noting that "[t]he coal-fired units were retired on March 31, 2018."
[229] *Id.* The Draft SIP notes that the TVA John Sevier plant is not permitted to burn coal, *id.* at 228, but those permit provisions are not proposed for inclusion in the SIP and must be.
[230] *Id.* The Draft SIP notes that the TVA Johnsonville plant is not permitted to burn coal, *id.* at 228, but those permit provisions are not proposed for inclusion in the SIP and must be.

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
		TVA Cumberland, retirement of both coal-fired units.[231] TDEC should incorporate the Cumberland unit retirements into the SIP rather than relying on projections.
		TVA Kingston, retirement of ten coal-fired units.[232] TDEC should incorporate the Kingston unit retirements into the SIP rather than relying on projections.
		TVA Bull Run coal-fired units will be shut down, per the TVA's board effective 2023.[233] It is unclear what emission reductions, if any, TDEC accounts for in the Draft SIP from these closures. If TDEC want to take credit, it must provide documentation – as we;; as a retirement requirement – in its SIP.
2	**TDEC must not merely rely on TVA consent decree requirements for emission controls and monitoring, those provisions must be in the SIP.** **Additionally, as discussed elsewhere in these comments, where coal-fired units are re-powered with natural gas, TDEC's reliance on retirements for those units would be misplaced and need to be accurately reflected in the RH SIP.** Where the SIP includes retirements, any repowering scenarios are subject to RH requirements, including SIP public notice and comment, amongst other Clean Air Act requirements. Notably, one of the other Clean Air Act requirements such a proposed SIP amendment where the source with assumed shut downs proposed	TVA Allen natural gas combined cycle plant (equipped with SCR controls).[236] TVA John Sevier natural gas combined cycle plant.[237] TVA Johnsonville plant, which consists of twenty natural gas or oil-fired combustion turbines, four natural gas preheaters, a combined heat and power (CHP) unit that provides steam to an off-site customer, and two natural gas auxiliary boilers that are backup steam generators for the CHP unit.[238] TVA Gallatin coal plant SCRs and FGD controls.[239]

[231] *Id.* ("On May 11, 2021 (86 Federal Register 25933), the TVA proposed the retirement of one unit at TVA Cumberland as early as 2026 but no later than 2030, and the remaining unit as early as 2028 but no later than 2033.")
[232] *Id.* ("On June 15, 2021 (86 Federal Register 31780), the TVA proposed the retirement of three units at TVA Kingston as early as 2026, but no later than 2031, and the remaining six units as early as 2027, but no later than 2033.")
[233] *Id.* ("…on February 14, 2019, the TVA Board of Directors approved the retirement of the TVA Bull Run coal plant in Anderson County, which would take place as early as 2023.")
[236] Draft SIP at 102.
[237] *Id.*
[238] *Id.*
[239] *Id.*

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
	to transitions to gas would be subject to is the anti-backsliding provisions. [234, 235]	
3	**Documentation to support alleged reductions from EPA programs must be included** Enforceable requirements from an existing EPA program must be fully documented, with specifics including projected emissions to be reduced through	Mercury and Air Toxics Standard (MATS) Rule.[240] Cross State Air Pollution Rule (CSAPR).[241] Onroad and Non-Road Programs.[242] 2007 Heavy-Duty Highway Rule[243]

[234] Moreover, contrary to its apparent plans, TDEC must not rely on the Consent Decree terms for compliance of continuous operation of all SO_2 and NOx control devices, those requirements must be in the SIP. *id.* at 102

[235] Section 110(l) of the Clean Air Act prohibits EPA from approving an implementation plan revision if the revision would "interfere with any applicable requirement concerning attainment and reasonable further progress … or any other applicable requirement of this chapter." 42 U.S.C. § 7410(l); *see also El Comite Para El Bienestar de Earlimart v. EPA*, 786 F.3d 688, 692 (9th Cir. 2015). This provision is designed to ensure that air-quality improvements are not reversed through regulatory actions to weaken pollution limits. This anti-backsliding provision would to existing BART and forthcoming RP determinations, including provisions specific to the TVA's plants, as the Act's "applicable requirement[s]" include the regional haze program's BART/RP requirements. *See Oklahoma v. EPA*., 723 F.3d 1201, 1204, 1207 (10th Cir. 2013). Indeed, Courts have routinely upheld EPA interpretations of Section 110(l) as preventing implementation plan revisions that would increase overall air pollution limits or worsen air quality. *See WildEarth Guardians v. EPA*, 759 F.3d 1064, 1074 (9th Cir. 2014) (a haze plan that "weakens or removes any pollution controls" would violate Section 110(l)); *see also Indiana v. EPA*, 796 F.3d 803, 812 (7th Cir. 2015) (noting that EPA allows "emissions-increasing SIP revisions" if a state "identif[ies] substitute emissions reductions such that net emissions are not increasing."); A*la. Envtl. Council v. EPA*, 711 F.3d 1277, 1293 (11th Cir. 2013) (Section 110(l) "permit[s] approval of [a] SIP revision 'unless the agency finds it will make air quality worse'" or increase emissions) (quotation and citation omitted); *Kentucky Resources Council v. EPA*, 467 F.3d 986, 995 (6th Cir. 2006) (Section 110(l) allows the agency to approve a plan revision that weakened some existing control measures while strengthening others, but only "[a]s long as actual emissions in the air are not increased" and "air quality [is not] worse[ned]"). Should Ecology must either remove or provide an adequate demonstration under Section 110(l) of the Clean Air Act.

[240] *Id.* at 99. ("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.")

[241] *Id.*

[242] *Id.* ("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.")

[243] *Id.* at 100 ("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 NOx 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

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
	implementation of each program through 2028 as relevant to Tennessee's sources and sectors.	Tier 3 Motor Vehicle Emissions and Fuel Standards.[244]
		Non-Road Diesel Emissions Programs/Rule.[245]
		Emission Control Area Designation and Commercial Marine Vessels.[246]
		Various Federal Maximum Achievable Control Technology (MACT) regulations.[247]
4	**Future emission reductions must be known** TDEC's suggestion that "further reductions may be necessary at certain point sources"[248] must not be relied on because future potential emission reductions are not quantifiable and enforceable.	2010 SO_2 NAAQS.[249]
5	**Consent agreement provisions must be included in the SIPs**	Consent Agreement with Lehigh Cement Company in Alabama.[250]

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.")

[244] *Id.* ("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 NOx 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.")

[245] *Id.* ("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.")

[246] *Id.* ("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,47 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.")

[247] *Id.* Executive Summary at 4.

[248] *Id.*

[249] Draft SIP at 99.

[250] *Id.* at 101. ("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 NOx and SO_2 and applies to facilities located in several states, including Alabama.")

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
	TDEC's suggestion that it can rely on "consent agreements [that] also impose specific controls …[and] were included in this [SIP] inventory development process." The Draft SIP neither provides full citations nor includes the consent decrees for the public to review. The consent decrees were not negotiated to resolve RH RP violations. There is no evidence that the consent decree emission limitations are included or proposed to be included in SIPs.	Consent Agreement with Virginia Electric and Power Company (VEPCO).[251] Consent Agreement with Anchor Glass Container.[252]
6	**Documentation to support alleged reductions from other state programs must be included,**	Georgia Rule 391-3-1-.02(2)(sss) "Multi-Pollutant Control for Electric Utility Generating Units."[253]

[251] *Id.* ("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.")
[252] *Id.* ("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.")
[253] *Id.* ("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 NOx 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%, NOx emissions by approximately 85%, and mercury emissions by approximately 79%.")

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
	including documentation the program is in the SIP It is unclear what additional emission reductions will occur during the second planning period from programs with requirements from years in the first planning period (*i.e.,* 2009, 2013, and 2015). Moreover, the Draft SIP does not indicate whether these programs are part of other states' SIPs, which they must be to be included in Tennessee's RH SIP.	North Carolina Clean Smokestacks Act.[254]
7	**Mere mention in the SIP narrative of existing state permits is inadequate** Permit conditions with emission limitations for these sources are not proposed to be part of the RH SIP, despite emission reductions, and thus the emissions are not enforceable via the SIP. Furthermore, including these permit provisions into the SIP reflect	Nissan North America, Inc.[255] Resolute FP US Inc.[256] Holston Army Ammunition Plant.[257] TDEC apparently relies in some manner on a construction permit issued in 2018 for the 2028 SO_2 emission projections.[258]

[254] *Id.* ("Under the North Carolina Clean Smokestacks Act, coal-fired power plants in North Carolina were required to achieve a 77% cut in NOx emissions by 2009 and a 73% cut in SO_2 emissions by 2013.")

[255] *Id.* at 113-114 ("Nissan North America, Inc. (Facility ID# 75-0155) is an automobile manufacturing operation located in Rutherford County, Tennessee. The facility operated three coal and natural gas-fired boilers to produce steam for their operations. The boilers had a capacity of 119.85 MMBTU/hr heat input. The facility was issued a construction permit on October 31, 2012, allowing the construction of three natural gas-fired boilers that replaced the three coal and natural gas-fired boilers. This permit limits the total emissions from the new natural gas boilers to no more than 22.2 tpy of NOx and 4.38 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal and natural gas-fired boilers in 2013. Table 7-2 provides the boiler emissions of NOx and SO_2 from this facility.")

[256] *Id.* at 114 ("Resolute FP US Inc. (Facility ID# 54-0012) is a kraft pulp and paper mill located in McMinn County, Tennessee. The facility operates three boilers, which are allowed to burn coal, natural gas, and fuel oil. The boilers have a total capacity of 1,134 MMBTU/hr heat input. The current Title V permit limits the total emissions from the three boilers to no more than 2,214 tpy of NOx and 4,562 tpy of SO_2. These are the same limits contained in the consent decree that the facility agreed to in 2010. Prior to the consent decree, the permit limits for the three boilers were 3,189 tpy for NOx and 18,803 tpy of SO_2. The facility has not burned coal since 2010, and their actual emissions are well below their allowable permit limits. Table 7-3 provides the emissions of NOx and SO_2 from the entire facility."); Executive Summary at 5 (This source was required to submit a reasonable progress analysis during the first planning period because TDEC found it was significantly contributing to visibility impairment and require those sources to undergo a reasonable progress analysis. However, based on review of the analyses, the source was not required to implement any additional controls or measures.)

[257] *Id.* at 114-115 ("Holston Army Ammunition Plant (Facility ID# 37-0028) is military explosives manufacturer located in Hawkins County, Tennessee. The facility operates four coal-fired boilers with two natural gas-fired burners. The boilers and burners have a total capacity of 839.2 MMBTU/hr heat input. The facility was issued a construction permit on October 18, 2018, allowing the construction of four natural gas-fired boilers that will replace the four coal-fired boilers and two natural gas-fired burners. Each new boiler has a capacity of 327 MMBTU/hr when burning natural gas and a capacity of 310 MMBTU/hr when burning fuel oil. This permit limits the total emissions from the new natural gas boilers to no more than 0.2 lb NOx/MMBtu, 0.8 lb SO_2/MMBtu, and 6.4 tpy of SO_2. Low-NOx burners and selective catalytic reduction will be used to control NOx emissions from each boiler. The capacity factor for fuel oil is limited to 3.8%.")

[258] *Id.* at 200.

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
	existing limits and existing controls – no new emission reductions are proposed.	Tate and Lyle.[259]
		Cargill Corn Milling.[260]
		East Tennessee State University (ETSU).[261]
		University of Tennessee.[262]
		Vanderbilt University.[263]
8	**SIP does not include provisions to address anticipated emission increases**	Memphis International Airport. TDEC's Draft SIP explains that the airport and its NOx emissions are anticipated to grow.[264]
9	**Ignoring inconsistencies between actual emissions and emissions used in the SIP inventory**	Tennessee Gas Pipeline (Station 860).[265] TDEC explains that this source "has a projected 2028 NO_X value that is lower

[259] *Id.* at 115 ("Tate and Lyle (Facility ID# 53-0081) is corn wet milling and alcohol production facility located in Loudon County, Tennessee. The facility operated two coal-fired boilers and one natural gas-fired boiler. Each coal-fired boiler had a capacity of 290 MMBTU/hr heat input, and the natural gas-fired boiler has a capacity of 180 MMBTU/hr. The facility was issued a construction permit on September 9, 2015, which limited the two coal-fired boilers to burning natural gas only and also derated the boilers to 94 MMBTU/hr. This permit also includes the natural gas-fired boiler, which remained at a capacity of 180 MMBTU/hr and is allowed to burn fuel oil and fermentation byproducts. This permit limits the total emissions from the three boilers to no more than 78.7 tpy of NOx and 71.6 tpy of SO_2. Additionally, the facility was issued two construction permits for two new natural gas cogeneration units. These two permits limit total SO_2 to 3.0 tpy and total NOx to 382.6 tpy.")

[260] *Id.* at 115-116 ("Cargill Corn Milling is a corn milling operation located in Shelby County, Tennessee. This facility has undergone operational changes that have significantly reduced their emissions. The facility operated two coal-fired boilers. Each boiler had a capacity of 247 MMBTU/hr heat input. In 2015, the coal-fired boiler were replaced with natural gas-fired boilers, which have a capacity of 75 and 95 MMBTU/hr heat input. The current permit limits the fuel to natural gas only. In addition to the change from coal to natural gas boilers, the facility permanently shut down several processes, which reduced emissions.")

[261] *Id.* at 116 ("ETSU (Facility ID# 90-0029) is a state university located in Washington County, Tennessee. The facility operated three coal-fired boilers. Each boiler had a capacity of 37.5 MMBTU/hr heat input. The facility was issued two construction permits on September 16, 2016, allowing the construction of two natural gas-fired boilers that replaced the three coal-fired boilers. These permits limit the total emissions from the new natural gas boilers to no more than 17.7 tpy of NOx and 0.22 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal-fired boilers in 2017.")

[262] *Id.* ("The University of Tennessee (Facility ID# 47-0018) is a state university located in Knox County, Tennessee. The facility operated three coal-fired boilers. Each boiler had a capacity of 99 MMBTU/hr heat input. The facility was issued a construction permit on July 9, 2014, allowing the construction of two natural gas-fired boilers that replaced the two coal-fired boilers. The third coal-fired boiler was converted to natural gas. All three natural gas boilers are allowed to burn a limited amount of No. 2 Fuel oil. This permit limits the total emissions from the three natural gas boilers to no more than 97.2 tpy of NOx and 53.3 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal-fired boilers in 2015.")

[263] *Id*. at 117 ("Vanderbilt University (Facility ID# 70-0039) is a private university located in Davidson County, Tennessee. The facility operated four coal, natural gas, and fuel oil-fired boilers. The boilers had a combined capacity of 442 MMBTU/hr heat input. The facility was issued a construction permit on March 31, 2014, allowing the construction of two natural gas and fuel oil-fired boilers that replaced the four coal, natural gas, and fuel oil-fired boilers. This permit limits the total emissions from the new natural gas and fuel oil-fired boilers to no more than 42.6 tpy of NOx and 44.7 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal, natural gas, and fuel oil-fired boilers in 2014.")

[264] *Id.* at 200.

[265] *Id.* at 200.

	Description of Approvability Issue	Where the Issue Arises in TDEC's Draft SIP
	TDEC proposal to ignore the higher actual emissions based on its flawed screening analysis is misplaced.	than 2017, 2018, and 2019 values. However, even at the highest emission rate (2018), the maximum visibility contribution to any Class I area would be below the threshold used to select sources for reasonable progress analysis…"[266]

Furthermore, while TDEC offers that:

> There are some facilities where the most recent 2017, 2018, and/or 2019 emissions are significantly higher than the 2028 emissions used in the modeling and for the selection of sources for reasonable progress analysis, all of these differences, except for Tennessee Gas Pipeline, are due to *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…[267]

… the Draft SIP fails to contain practically enforceable emission limitations reflecting the retirements, operational or process changes, or installation of air pollution controls. Thus, the public has no assurance that Tennessee's 2028 emission inventory projection upon which these assumptions and assertions are based will be realized. TDEC must not rely on these alleged emission reductions for purposes of the RH SIP unless there are enforceable provisions in the SIP.

Moreover, to enable the public to evaluate these assumed but not required emission reductions and increases, where it has not done so, TDEC must provide a baseline emissions inventory for these various source categories and sources.

D. TDEC Wrongly Suggests Existing Emission Trading Programs and EPA Programs Not Yet Proposed Will Continue to Reduce Visibility Impairing Pollutants

TDEC's proposal to rely on existing emission trading programs and upcoming EPA actions is misplaced.[268] Regarding EGU's covered by CSAPR and the other emission trading programs, TDEC should not rely on that program to drive emission reductions for several reasons. First, several of Tennessee's EGUs have historically demonstrated they are capable of better emission control than they are currently displaying.[269] Second, there does not appear to be any economic incentive from CSAPR that would cause EGUs to either run their existing controls at their full performance potential, or to install new controls.[270] Furthermore, as the Draft SIP explains, "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."[271] TDEC cannot rely on revised budgets that do not

[266] *Id.* at 200.
[267] *Id.* at 201 (emphasis added).
[268] Draft SIP at 98.
[269] Kordzi Report at 3.
[270] *Id.*
[271] Draft SIP at 98.

yet exist. Furthermore, contrary to the RHR requirements that emission limitations apply for the entire year, the CSAPR requirements only apply during the ozone season. Therefore, it is premature and impermissible for TDEC to suggest it will rely on these emission reductions.

E. It is Inconsistent with Clean Air Act's Requirements to Use Visibility as a Fifth Factor to Decide Reasonable Progress Controls

Because TDEC's Draft SIP relies on visibility impacts to reject emission controls, it is at odds with the plain language of the CAA.[272] Because visibility is not one of the four statutory factors, the State cannot rely on visibility impacts to exclude emission reducing measures from sources that otherwise satisfy the four statutory factors.

The Act explicitly identifies that the RP analysis is done based on four factors:

1. The costs of compliance,
2. The time necessary for compliance,
3. The energy and non-air quality environmental impacts of compliance, and
4. The remaining useful life of any potentially affected sources.

The plain language of the Act clearly bounds the information for each of the factors. Therefore, where TDEC's existing and future RP analyses considers information outside the bounds of these factors (*e.g.*, air quality impacts, modeling results, and emission inventories) it is inconsistent with the Act's Four-Factor Analysis.[273] Additionally, to the extent TDEC suggests that while it did not consider visibility in the RP analysis, it did (or will) include visibility as additional weight-of-evidence in its decision-making. This approach is inconsistent with the Act and TDEC must remove consideration of visibility in selecting emission controls from its SIP analyses.

F. TDEC's Reliance on the "Glide Path" and Its Methodology to Adjust the RPGs for Class I Areas within Tennessee Violates the Clean Air Act and Regional Haze Rule

1. TDEC Erroneously Proposes to Rely on the Glide Path

TDEC attempts to justify deferring any further emission reductions for nearly every major source in the state by pointing out that Class I areas appear to be trending below these area's glide path or URP, which it states is sufficient to achieve reasonable progress.[274] TDEC's Draft SIP

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[272] TDEC used visibility to reject controls for TVA Cumberland, *see* Appendix G-1 at PDF 61.
[273] The RH program takes air quality impacts into consideration in selecting which sources are evaluated for the RP Four-Factor Analysis, and to apply that same metric twice is not consistent with how Congress designed the program.
[274] *See, e.g.*, Draft SIP at Executive Summary a 6, 7 ("At both Class I areas in Tennessee, visibility improvements on the 20% most impaired days are expected to be better than the uniform rate of progress glidepath by 2028 based on the control programs in Tennessee's LTS."); *id.* at 38-39; *id.* at 209-211 ("RPGs for Class I Areas within Tennessee").

explains that visibility at Tennessee's Class I areas has been steadily improving from 2000 to 2018 according to actual monitoring data.[275] Indeed, Section 7 of TDEC's Draft SIP sets about to answer the following question:

> Assuming implementation of existing federal and state air regulatory requirements in Tennessee and the VISTAS region, how much visibility improvement, compared to the glide path, is expected at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area by 2028?[276]

TDEC's SIP further presents information from VISTAS model results for the 2028 inventory compared to the URP glide paths for Tennessee Class I Areas.[277] Based on the significantly flawed VISTAS modeling, TDEC suggests that "[a]t Great Smoky Mountains National Park, visibility improvements on the 20% most impaired days are expected to be significantly better than the uniform rate of progress glide path by 2028."[278] TDEC also asserts that "[f]or most [Class I] areas, visibility improvements are well ahead of the timeline noted on the URP"[279] and that "the RPGs will be at least as stringent as the expected glide path prediction for Great Smoky Mountains National Park and Joyce Kilmer Slickrock Wilderness Area."[280]

EPA has made clear, however, that meeting or exceeding the URP does *no*t obviate the need for states to conduct a robust analysis and make a technical demonstration that additional controls or emission reductions are not reasonable. "[A]n evaluation of the four statutory factors is required . . . regardless of the Class I area's position on the glidepath . . . . the URP does not establish a 'safe harbor' for the state in setting its progress goals."[281] Rather, states must "determine what emission limitations, compliance schedules and other measures are necessary to make reasonable progress by considering the four factors" and must not reject "control measures determined to be reasonable" based on the degree of progress.[282]

Furthermore, contrary to TDEC's Draft SIP, it is not correct to suggest that the SIP is approvable because the RPGs will be at least as stringent as the expected glide path, that is not the test EPA's rule requires. TDEC's is further mistaken to suggest that:

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[275] Draft SIP Executive Summary at 8.
[276] Draft SIP at 97.
[277] Draft SIP at 133-137.
[278] *Id.* at 134.
[279] *Id.* at 135.
[280] *Id.* at 211.
[281] 81 Fed. Reg. 66,331, 66,631 (Sept. 27, 2016); *see also* 81 Fed. Reg. 296, 326 (Jan. 5, 2016) (determining, as part of the reasonable progress federal implementation plan for Texas, "the uniform rate of progress is not a 'safe harbor' under the Regional Haze Rule."); EPA, Responses to Comments at 120, Promulgation of Air Quality Implementation Plans; State of Texas; Regional Haze and Interstate Visibility Transport Federal Implementation Plan: Best Available Retrofit Technology and Interstate Transport Provisions, EPA Docket No. EPA-R06-OAR-2016-6011 (June 2020) ("EPA has repeatedly and consistently taken the position that meeting a specific reasonable progress goal is not, itself, a "safe harbor," and does not relieve the state of the obligation to consider additional measures for reasonable progress. If it is reasonable to make more progress than the URP, a state must do so, as EPA explained in the 1999 Regional Haze Rule) (citing 64 Fed. Reg. at 35732); *see also* 81 Fed. Reg. at 66,370 ("EPA's longstanding interpretation of the Regional Haze Rule is that 'the URP does not establish a 'safe harbor' for the state in setting its progress goals.") (quoting 79 Fed. Reg. 74,818, 74,834)).
[282] 82 Fed. Reg. at 3093; *see also* 81 Fed. Reg. at 66,631.

> [T]here are no sources in Tennessee 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 is slower than the URP.[283]

Again, TDEC's suggestion that the RPGs being under the glide path is a safe harbor in inappropriate. Indeed, in its July 8, 2021 Memo, EPA reiterated that the uniform rate of progress is "not a safe harbor," and that it is not appropriate to reject cost-effective emission reductions on the basis that visibility in a particular Class I area is on the glide path. Instead, states are required to "evaluate and determine emission reduction measures that are necessary to make reasonable progress *by considering the four statutory factors*."[284]

2. TDEC Must Not Revise the RPGs Based on Projected Modeling That is Not Based on Enforceable SIP Requirement[285]

TDEC's proposed RPGs are inconsistent with the legal requirements for several reasons. First, TDEC's Draft SIP proposes to rely on the VISTAS baseline 2028 modeling to set its RPGs.[286] The emission inventory inputs in VISTAS modeling are neither enforceable via SIP emissions limitations nor do they represent recent actual emissions. Furthermore, not only is the VISTAS baseline modeling significantly flawed, but as discussed elsewhere in our comments, it uses methodology that is inconsistent with the RHR. Second, TDEC must not propose its RPGs until it first conducts the required Four-Factor Analyses for *all* the required sources, establishes emission limits in the SIP, and uses those limitations to set the goals. Indeed, the Regional Haze Rule explicitly requires Tennessee to make meaningful reductions to ensure reasonable progress towards the national goal of restoring visibility. As discussed above, commenters conclude that at a minimum there are control measures available that likely satisfy the four factors and therefore should be required at sources both evaluated and excluded by TDEC. Third, TDEC's draft proposal to defer controls that satisfy the Four-Factor Analysis to another planning period, simply because Class I areas are on the glidepath, is contrary to the Clean Air Act and the Regional Haze Rule.

TDEC's "glide path" rationale is also misplaced because the agency failed to evaluate and apply the results of the Clean Air Act's reasonable progress analyses in determining whether emission reductions may be necessary to ensure reasonable progress towards natural visibility in each Class I area that Tennessee's sources affect, as required by the Regional Haze Rule.[287] Although TDEC identified six sources in other states and represents that "[t]hese analyses showed some emission reductions," contrary to the RHR, TDEC proposes to rely on the VISTAS baseline

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[283] Draft SIP at 211.
[284] EPA July 2021 Memo at 15-16 (emphasis added).
[285] Draft SIP at 209-212
[286] *Id.* at 210.
[287] *See* 40 C.F.R. § 51.308(f)(2) ("Each State must submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I Federal area within the State *and for each mandatory Class I Federal area located outside the State that may be affected by emissions from the State*.") (emphasis added); *id*. § 51.308(f)(3)(ii)(A)-(B).

2028 modeling and "not to adjust the RPGs beyond that quantified in the baseline 2028 modeling."[288]

G. TDEC Should Disclose Emission Inventory Projections and Identify Measures Needed to Prevent Future Impairment of Visibility

The Regional Haze program requires states to adopt measures to prevent future visibility impairment as well as to address existing visibility impairment.[289] TDEC's draft regional haze SIP revision lacks an accurate analysis of 2028 emission inventory projections and future source development, thus the public has no information to assess whether emissions from specific source categories are projected to increase between 2011 and 2028 as seen in other states (*e.g.,* anticipated new development in the State, ammonia emissions from nonroad sources, visibility-impairing pollutants from oil and gas and others). TDEC must analyze future emission inventory projections, explain what these emissions sources are within the state and discuss the programs it has in place to address any potential future increases in emissions. Importantly, TDEC must evaluate the measures that may be needed to prevent any currently projected future increases in visibility-impairing emissions from these source categories. Moreover, as TDEC develops permit modifications for existing sources and permits for new sources, it must take regional haze implications into consideration – these requirements should be discussed and committed to in the State's SIP. For example, TDEC's Draft SIP explains that TDEC-APC received a modeling protocol for TVA's proposed installation of ten new simple-cycle natural gas combustion turbines and shut down of sixteen of the existing simple-cycle units at its Johnsonville plant, and despite the fact that TVA's proposed emission increases will be 101.2 tpy for NOx, 57.6 tpy for PM, and 5.2 tpy for SO_2,[290] TDEC neither explains not commits to take regional haze reasonable progress requirements into consideration. The RH RP requirements apply and work in conjunction with permitting requirements, and TDEC must not defer until the next RH SIP update or planning period to address emission increases.

H. TDEC Must Establish and Provide a Basis for A Cost Effectiveness Threshold

EPA's regional haze guidance and regulations require that the SIP "explain why the selected [cost] threshold is appropriate for that purpose and consistent with the requirements to make reasonable progress."[291] Of significant concern to commenters is that TDEC's Draft SIP lacks the justification for a cost reasonableness threshold because it did not use a cost threshold.[292] For example, for TVA Cumberland "the cost of compliance for the different control options were compared [by TDEC] to cost statistics that were compiled for facilities that had previously implement BART and reasonable progress controls."[293] Similarly, TDEC did not use a cost threshold for Eastman Chemical Company. As the NPS explained for Eastman, "[i]nstead, the

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[288] Draft SIP at 210.
[289] *See*, 42 U.S.C. § 7491(a)(1)); 40 C.F.R. § 51.300(a).
[290] Draft SIP at 102.
[291] EPA, Guidance on Regional Haze State Implementation Plans for the Second Implementation Period at 39.
[292] Draft SIP at 274, which the NPS also points out.
[293] *Id.* (The NPS explained that, "TVA's analysis states that retirement in 2035 would represent less than ten years of remaining life after additional controls would be installed. All control options identified for TVA Cumberland were deferred to a future review period based on cost, which includes the energy impacts and remaining useful life. The lowest-cost control option (installation of wall rings) is 4.9 times higher than the median cost identified by VISTAS for similar options and 3.2 times higher than the average value.")

cost of compliance for the different control options were compared to cost statistics that were compiled for facilities that had previously implemented BART and reasonable progress controls. Reasonable progress for this facility is based on the planned shutdowns of B-83 Boilers 18 through 20 and the installation of dry sorbent injection (without upgrading the existing ESPs) on Boilers 23 and 24. For all other reductions considered in the analysis, the cost was considered too high compared to comparable projects."[294]

Additionally, we point out that the States of Colorado and Oregon recently indicated that they are each "is using $10,000 per ton of regional haze pollutant as the nominal cost threshold to determine cost effective control strategies for Round 2 RP."[295]

As explained in EPA's Guidance, TDEC must provide a basis for and establish the cost effectiveness threshold upon which the State bases its decision, including an explanation of why the cost effectiveness threshold is appropriate and consistent with the requirement to make reasonable progress.[296]

I. Retirements Relied On to Justify No Control and No Upgrades Must be Reflected as Enforceable SIP Measures

Where TDEC is relying on retirements or operation changes to justify a no control and no upgrade option, it must make those changes enforceable as SIP measures. To the extent that a state declines to evaluate additional pollution controls for any source based on that source's planned retirement or decline in utilization, it must incorporate those operating parameters or assumptions as enforceable limitations in the second planning period SIP. The Clean Air Act requires that "[e]ach state implementation plan . . . *shall*" include "enforceable limitations and other control measures" as necessary to "meet the applicable requirements" of the Act.[297] The Regional Haze Rule similarly requires each state to include "enforceable emission limitations" as necessary to ensure reasonable progress toward the national visibility goal.[298] Moreover, where a source plans to permanently cease operations or projects that future operating parameters (*e.g.*, limited hours of operation or capacity utilization) will differ from past practice, and if this projection affects whether additional pollution controls are cost-effective or necessary to ensure reasonable progress, then the state "must" make those parameters or assumptions into enforceable limitations.[299]

[294] *Id.* at 248.
[295] "Prehearing Statement of the Colorado Department of Public Health and Environmental, Air Pollution Control Division," *In the Matter of Proposed Revisions to Regulation No 23* (Oct. 7, 2021) at 7, (further explaining that "[t]his threshold is applied to the individual pollutants in the control strategy analyses, specifically NOx, PM, and SO_2. This threshold value is an increase from Round 1 and reflects the fact that with each successive round of planning, less costly and easier to implement strategies have already been adopted. Colorado has maintained this threshold throughout the planning process despite the fact that each of the Class I areas in Colorado is below the URP for 2028.") (Exhibit 16); "Oregon Regional Haze State Implementation Plan, For the period 2018 – 2028," (Aug. 27, 2021 Public Notice Draft) (Exhibit 17).
[296] EPA 2019 Regional Haze Guidance at 38, 39; *see* 40 CFR 51.308(f)(2)).
[297] 42 U.S.C. § 7410(a)(2)(A). (emphasis added)
[298] *See generally* 40 C.F.R. § 51.308(d)(3).
[299] *See* 40 C.F.R. pt. 51, App. Y § (IV)D.4.d.2.

J. TDEC Ignores and the SIP Lacks Controls for Nitrate Contributions from Point Sources at Class I Areas

TDEC's Draft SIP does not consider controls on nitrate contributions from point sources at Class I Areas. As discussed in these comments, in the Gebhart Report, and expressed by the NPS, nitrate contributions from point sources at Class I Areas that Tennessee impacts are not insignificant.[300] There are many opportunities for TDEC to control NOx from the same point sources of interest for SO_2 emissions. For example, for EGUs there are many NOx control opportunities that simply involve the optimization of or upgrades to existing controls, such as upgrading EGU combustion controls, SCR systems, or SNCR systems. Many of these types of controls have historically been found to be very cost-effective because they involve relatively low to no additional capital costs.[301]

Indeed, EPA's recent Clarification Memo establishes an expectation that states will minimally consider SO_2 and NOx, absent strong documentation such consideration would be unreasonable.[302] As explained in the Kordzi Report, "it would have been relatively easy to identify opportunities to reduce NOx, making NOx consideration more than reasonable. TDEC must include NOx in its overall visibility strategy and (the problems relating to its use and interpretation of PSAT aside) require all sources that underwent Four-Factor Analyses to do so for both SO_2 and NOx. In addition, TDEC must, regardless of the Area of Influence (AoI) and PSAT results and/or their interpretation, take advantage of the low hanging fruit presented to them and assessed EGUs for SCR system upgrades. These upgrades are very likely to be very cost-effective and TDEC must include NO_X emission limitations in the SIP."[303]

TDEC must require a complete and fully document Four-Factor NO_X Analyses for the ten sources, independently review the analyses, filling in gaps where necessary, and then establish practically enforceable emission limitations in the SIP reflecting reasonable progress controls.

K. TDEC's Description of Anticipated Additional Emissions Reductions is Misplaced

TDEC identifies areas where it anticipates additional SO_2 and NOx emission reductions that represents information available since VISTAS conducted the modeling analyses for the 2028 RPGs:

(1) In-State reasonable progress evaluation reductions; and

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300 Kordzi Report at 6; Gebhart October Report at 2, 3; *see also,* Letter from the NPS to TDEC (Dec. 2, 2021) (Explaining that the NPS found that significant opportunities for emission reductions are available that could improve the Draft SIP, and the NPS recommended that TDEC-ACP: "Address NOx emissions in reasonable progress determinations. As TDEC-ACP acknowledges in the response to NPS comments, ammonium nitrate is an increasingly important component of anthropogenic haze on the 20% most impaired days. This haze causing pollutant should be addressed in this round of regional haze planning.") (Exhibit 25)

301 *Id.*

302 EPA 2021 Clarification Memo at 4-5.

303 Kordzi Report at 7.

(2) Out of state reasonable progress evaluation reductions.[304]

There are several flaws with TDEC's approach including this analysis in its proposed SIP and suggesting that the above reductions "will help to ensure that the Tennessee Class I areas will meet these projected RPGs and that additional visibility improvement is likely."[305] First, emission reductions that will occur as a result of the Four-Factor Analysis conducted for Eastman Chemical Company, must be included in setting the RPGs, not tacked on as an afterthought as TDEC suggests. Second, contrary to TDEC's explanation in its Draft SIP, communications from other states do not show anticipated reductions.

IX. TDEC's Assertion that it Lacks Adequate Resources Is Not a Valid Reason to Avoid the Act's Requirements

TDEC's apparent assertion that it lacks the time, personnel and funding resources to develop a complete regional haze SIP does not excuse it from the Act's requirements.[306] The Act and implementing regulations require that states have adequate resources and authority, indeed states are required to certify to EPA in each SIP submission and periodically for infrastructure SIPs that they have such resources and authorities.[307] Alternatively, if TDEC finalizes its proposed determination that it lacks the resources necessary to develop a complete [and potentially approvable] SIP, then it must follow in the footsteps of Montana and notify EPA that Tennessee will defer to EPA's development and implementation a regional haze FIP on their behalf.[308]

X. TDEC Should Analyze Environmental Justice Impacts of its Regional Haze SIP, and Should Ensure the SIP Will Reduce Emissions and Minimize Harms to Disproportionately Impacted Communities

TDEC has both state and federal obligations to meaningfully consider and advance environmental justice in its regional haze SIP. Unfortunately, the Draft SIP's summary of what an environmental justice analysis entails falls short of these commitments.

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[304] Issues regarding TDEC's discussion of CSAPR are discussed above and in the attached Kordzi Expert Report submitted with the Conservation Organizations Comments to Indiana, Exhibit 13 at 8-10.
[305] *Id.*
[306] *See, e.g*., Draft SIP at 145, 175, 197.
[307] 42 U.S.C. §§ 7410(a)(2)(J), 7410(a)(2)(D)(i), 7410(a)(2)(D)(ii), 7410(a)(2)(E)(i); 40 C.F.R. part 51, Appendix V; *see, e.g.,* EPA's application of Act's requirements when Wyoming asserted it lacked of authority to impose RP requirements, 79 Fed. Reg. 5032 (Jan. 30, 2014).
[308] 77 Fed. Reg. 23,988 (April 20, 2012) (EPA's proposed FIP, explained that "[o]n June 19, 2006, Montana submitted a letter to us signifying that the State would be discontinuing its efforts to revise the visibility control plan that would have incorporated provisions of the Regional Haze Rule. The State acknowledged with this letter that EPA would make a finding of failure to submit and thus promulgate additional federal rules to address the requirements of the Regional Haze Rule, including BART. In response to the State's decision EPA made a finding of SIP inadequacy on January 15, 2009 (74 FR 2392), determining that Montana failed to submit a SIP that addressed any of the required regional haze SIP elements of 40 CFR 51.308."); 77 Fed. Reg. 57,864 (Sept. 18, 2012) (EPA's final FIP).

A. Environmental Justice Communities in Tennessee

Sources that harm the air in our treasured Class I areas such as TVA Cumberland, Trelleborg Coated Systems, Signal Mountain Cement, O-N Minerals Company, Packaging Corporation of America, and Tennessee Gas Pipeline Company, Station 860 also negatively affect several vulnerable communities in Tennessee such as those in Chattanooga, Luttrell, Cumberland, and Morristown cities as well as those in Hardin and Hickman counties where many people live below the poverty line. By evaluating these vulnerable communities and counties, we believe TDEC will identify emission-reducing options that if required will improve air quality and help achieve reasonable progress in this round of regional haze rulemaking. Historically, conservation and environmental work has concerned itself with protecting nature from people and has thus "siloed" its work (*e.g*., mainstream conservation vs. environmental justice.) While this siloed approach has led to the protection of many vulnerable habitats, it ignores the reality that people live in concert with and are a part of nature; to protect one and not the other is a job half done. By considering viewshed protection and environmental justice at the same time, we can collectively begin to dismantle the silos that exist in conservation and environmental work and chart a new path forward.

B. Environmental Justice in Tennessee

TDEC's website has a significant amount of information about environmental justice and the agency's responsibilities and authorities.[309] Indeed, citing EPA's definition of environmental justice, TDEC explains that it "strives for the fair and equitable treatment of every community in its practices as agency decisions and actions have the potential to involve and impact underserved or environmentally overburdened communities."[310] TDEC includes concrete examples of the types of activities it conducts that could implicate EJ concerns, including those that cover this Draft SIP.[311]

TDEC describes in detail its responsibilities related to environmental justice as follows:

> TDEC strives to be fair to everyone in its actions, decisions, and responsibilities, and in so doing, accomplish EJ. The concept of EJ is guided by principles of nondiscrimination. TDEC, as a recipient of federal funds, adheres to nondiscrimination requirements under Title VI of the Civil Rights Act of 1964. In addition, TDEC has public participation requirements under state law.
>
> These nondiscrimination and public participation requirements mean that one of TDEC's most important obligations is ensuring equal access to public participation and public engagement opportunities. In some cases, TDEC may deem it appropriate to go above and beyond what is required by law when there is an action that is anticipated to be controversial, face significant

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[309] TDEC, "Environmental Justice FAQs," https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice/environmental-justice-faqs.html. (Exhibit 18)
[310] TDEC, "What is Environmental Justice," https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice/environmental-justice-faqs.html. (Exhibit 19)
[311] TDEC, "What are TDEC's responsibilities related to environmental justice" ("…rulemaking … Formal and informal public participation opportunities … Involvement as a stakeholder in disagreements, disputes, or complaints relating to the environment, natural resources, and EJ concerns … Distribution of technical and financial assistance," (Exhibit 20) (see also responsibilities under Title VI of the Civil Rights Act of 1964, https://www.epa.gov/environmentaljustice/title-vi-and-environmental-justice))

community opposition, or impact a community that is environmentally overburdened. TDEC could enhance public engagement opportunities in these circumstances through:

> · Undertaking early and proactive discussions with community leaders, nonprofits, local, state and federal agencies, elected officials, and the private sector;
>
> · Ensuring that engagement opportunities are broadcast through a variety of means including those that are most likely to reach the community members most impacted by the decision;
>
> · Providing multiple means for community members to participate in public meetings and hearings, such as in-person, videoconference, and phone;
>
> · Educating interested stakeholders on TDEC's roles and responsibilities as related to the action/activity; and
>
> · Ensuring that comments can be submitted through many methods.

Building and maintaining open lines of communication with community leaders is critical to the success of equitable public engagement. Any enhanced community engagement, however, must be conducted in a manner consistent with the rights of the regulated community to evenhanded enforcement and timely review of permit applications.[312]

Suggesting it lacks explicit authority, TDEC does offer that:

> TDEC staff engage proactively with underserved or environmentally overburdened communities, regulated entities, and relevant local, state, and federal government entities to set expectations, retain open lines of communication, and meaningfully attempt to consider EJ concerns within the agency's decision-making framework and authorities when there are agency actions that impact those communities.[313]

Moreover, TDEC goes into great length to present its obligations under Title VI as a recipient of federal funds.[314] For example, explaining that:

> TDEC is required to comply with Title VI of the Civil Rights Act of 1964 which says that TDEC may not discriminate on the basis of race, color, or national origin while providing services, benefits, or programs. Title VI includes two other requirements: providing language assistance to those who are limited English proficient (LEP) and supporting environmental justice. If TDEC or its sub-recipients are found to be in violation of Title VI, then federal agencies can suspend or terminate federal funding to TDEC and its programs. At this time, federal funds constitute about 20-25 percent of TDEC's operating budget. Title VI is a statutory and regulatory requirement at the federal and state level.[315]

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[312] *Id.*
[313] *Id.*
[314] TDEC, "Title VI and Environmental Justice," https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice/policy-title-vi-faqs.html#collapse3ad187e9702241c687af159bb3f68593-10 (Exhibit 21).
[315] *Id.*

TDEC provides additional information to the public regarding Title VI.[316, 317]

C. Consideration of Environmental Justice to Comply with Executive Orders

There are additional legal grounds for considering environmental justice when determining reasonable progress controls. Under the CAA, states are permitted to include in a SIP measures that are authorized by state law but go beyond the minimum requirements of federal law.[318] Ultimately, EPA will review the Final Haze Plan that Tennessee submits, and EPA will be required to ensure that its action on Tennessee's Haze Plan addresses any disproportionate environmental impacts of the pollution that contributes to haze. Executive Orders in place since 1994, require federal executive agencies such as EPA to:

> [M]ake achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations"[319]

On January 27, 2021, the current Administration signed "Executive Order on Tackling the Climate Crisis at Home and Abroad."[320] The new Executive Order on climate change and environmental justice amended the 1994 Order and provides that:

> It is the policy of [this] Administration to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; … protects public health … delivers environmental justice …[and that] … [s]uccessfully meeting these challenges will require the Federal Government to pursue such a coordinated approach from planning to implementation, coupled with substantive engagement by stakeholders, including State, local, and Tribal governments.[321]

Tennessee can facilitate EPA's compliance with these Executive Orders by considering environmental justice in its SIP submission.

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[316] *Id.*

[317] TDEC, Title VI Compliance Report and Implementation Plan, Fiscal Year 2019-2020 (Revised Feb. 2021), https://www.tn.gov/content/dam/tn/environment/sustainable-practices/title-vi-and-environmental-justice/opsp_title-vi-compliance-report-and-implementation-plan-fy-2019-2020.pdf. (Exhibit 22)

[318] *See Union Elec. Co v. EPA*, 427 U.S. 246, 265 (1976) ("States may submit implementation plans more stringent than federal law requires and . . . the Administrator must approve such plans if they meet the minimum requirements of s 110(a)(2)."); *Ariz. Pub. Serv. Co. v. EPA*, 562 F.3d 1116, 1126 (10th Cir. 2009) (quoting *Union Elec. Co.*, 427 U.S. at 265) ("In sum, the key criterion in determining the adequacy of any plan is attainment and maintenance of the national air standards . . . 'States may submit implementation plans more stringent than federal law requires and [ ] the [EPA] must approve such plans if they meet the minimum [Clean Air Act] requirements of § 110(a)(2).'"); *BCCA Appeal Group v. EPA*, 355 F.3d 817, 826 n. 6 (5th Cir. 2003) ("Because the states can adopt more stringent air pollution control measures than federal law requires, the EPA is empowered to disapprove state plans only when they fall below the level of stringency required by federal law.")

[319] Exec. Order No. 12898, § 1-101, 59 Fed. Reg. 7629 (Feb. 16, 1994), as amended by Exec. Order No. 12948, 60 Fed. Reg. 6381 (Feb. 1, 1995).

[320] Exec. Order No. 14008, 86 Fed. Reg. 7619 (Jan. 27, 2021).

[321] *Id.* at § 201.

D. EPA's Regional Haze Guidance and Clarification Memo for the Second Implementation Period

EPA's 2021 Clarification Memo directs states to take into consideration environmental justice concerns and impacts in issuing any SIP revision for the second planning period.[322] EPA's 2019 Regional Haze Guidance for the Second Planning Period specifies, "States may also consider any beneficial non-air quality environmental impacts."[323] This includes consideration of environmental justice in keeping with other agency policies. For example, EPA also pointed to another agency program that states could rely upon for guidance in interpreting how to apply the non-air quality environmental impacts standard:[324]

> When there are significant potential non-air environmental impacts, characterizing those impacts will usually be very source- and place-specific. Other EPA guidance intended for use in environmental impact assessments under the National Environmental Policy Act may be informative, but not obligatory to follow, in this task.

Additionally, a collection of EPA policies and guidance related to the National Environmental Policy Act ("NEPA") is available at https://www.epa.gov/nepa/national-environmental-policy-act-policies-and-guidance. One of these policies concerns Environmental Justice.[325] TDEC should consider these sources of information in conducting a meaningful environmental justice analysis.

E. EPA has a Repository of Material Available for Considering Environmental Justice

In addition to the NEPA guidance materials referenced above, EPA provides a wealth of additional material.[326] The most important aspect of assessing Environmental Justice is to identify the areas where people are most vulnerable or likely to be exposed to different types of pollution. EPA's EJSCREEN tool can assist in that task. It uses standard and nationally consistent data to highlight places that may have higher environmental burdens and vulnerable populations.[327]

F. EPA Must Consider Environmental Justice

As occurred in the first planning period, if a state fails to submit its SIP on time, or if EPA finds that all or part of a state's SIP does not satisfy the Regional Haze regulations, then EPA must promulgate its own Federal Implementation Plan to cover the SIP's inadequacy ("FIP"). Should EPA promulgate a FIP that reconsiders a state's Four-Factor Analysis, it is completely free to

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[322] EPA July 2021 Memo at 16.
[323] EPA 2019 RH Guidance at 49.
[324] *Id.* at 33.
[325] *See*, EPA Environmental Justice Guidance for National Environmental Policy Act Reviews, https://www.epa.gov/nepa/environmental-justice-guidance-national-environmental-policy-act-reviews.
[326] *See,* EPA: Learn About Environmental Justice, https://www.epa.gov/environmentaljustice/learn-about-environmental-justice (Exhibit 23).
[327] *See*, EPA EJSCREEN: Environmental Justice Screening and Mapping Tool, Additional Resources and Tools Related to EJSCREEN, https://www.epa.gov/ejscreen/additional-resources-and-tools-related-ejscreen.

reconsider any aspect of that state' analysis. The two Presidential Executive Orders referenced above require that federal agencies integrate Environmental Justice principles into their decision-making. EPA has a lead role in coordinating these efforts, and recently EPA Administrator Regan directed all EPA offices to clearly integrate environmental justice considerations into their plans and actions.[328] Consequently, should EPA promulgate a FIP, it has an obligation to integrate Environmental Justice principles into its decision-making. The non-air quality environmental impacts of compliance portion of the third factor, is a pathway for doing so.

G. TDEC Must Consider Environmental Justice under Title VI of the Civil Rights Act

As EPA must consider Environmental Justice, so must TDEC and all other entities that accept Federal funding. Under Title VI of the Civil Rights Act of 1964, "no person shall, on the ground of race, color, national origin, sex, age or disability be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity…". TDEC has an obligation to ensure the fair treatment of communities that have been environmentally impacted by sources of pollution. That means going beyond the current analysis conducted to inform the "meaningful involvement" of impacted communities; environmental justice also requires the "fair treatment" of these communities in the development and implementation of agency programs and activities, including those related to the SIP.

TDEC should conduct a thorough analysis of the current and potential effects to impacted communities from sources considered in the SIP as well as those facilities identified by commenters and other stakeholders but not reviewed by TDEC. By not conducting this analysis and including the benefits of projected decline in emissions to these communities in their determination of the included emission sources, TDEC is not fulfilling its obligations under the law. Moreover, the state is making a mockery of Title VI by not using the SIP requirements to bring about the co-benefits of stronger reductions measures and reduce harms based on continued emissions.

H. TDEC's Efforts on Environmental Justice Are Inadequate

While we appreciate TDEC has programs and statement on its website regarding its commitment to environmental justice analysis, TDEC's Draft SIP lacks any consideration of environmental justice. Consistent with legal requirements and government efficiency, we urge TDEC to take impacts to its EJ communities from sources, like the ones we have expressed for the TVA Cumberland, Trelleborg Coated Systems, Signal Mountain Cement, O-N Minerals Company, Packaging Corporation of America, and Tennessee Gas Pipeline Company, Station 860 sources, into consideration as it evaluates all sources that impact regional haze.

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[328] *See*, EPA News Release, EPA Administrator Announces Agency Actions to Advance Environmental Justice, *Administrator Regan Directs Agency to Take Steps to Better Serve Historically Marginalized Communities* (April 7, 2021), https://www.epa.gov/newsreleases/epa-administrator-announces-agency-actions-advance-environmental-justice (Exhibit 24).

Conclusion

We appreciate TDEC's consideration of these comments and ask the agency to revise its SIP accordingly. Please do not hesitate to contact us with any questions.

Sincerely,

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Phil Perry, Deputy Assistant Commissioner, Office of Air Quality, Indian Department of Environmental Management
Robert Hodanbosi, Director, Ohio EPA – Division of Air Pollution Control
Mark Hammond, Director, Bureau of Air Quality, Pennsylvania Department of Environmental Protection

Enclosures

List of Exhibits

1. NPCA Regional Haze Fact Sheet: Tennessee, https://drive.google.com/file/d/19YJcKzxPOUj9rGyxcK0wKodg-P6gvFwp/view.
2. Joe Kordzi, "A Review of the Tennessee Regional Haze State Implementation Plan" (Nov. 2021), including Attachment "TN EGU Emissions."
3. D. Howard Gebhart, "Technical Review of VISTAS Visibility Modeling for the Second Round of Regional Haze State Implementation Plans" (May 2021), including Attachment "Gebhart Resume Final 2020."
4. D. Howard Gebhart, "Technical Review of North Carolina Regional Haze State Implementation Plan Second Round of Regional Haze State Implementation Plans Supplemental Report" (Oct. 2021).
5. NPS, 2020 Economic Impact - Great Smoky Mountains National Park (June 29, 2021), https://www.nps.gov/grsm/learn/news/2020-economic-impact.htm.
6. "Petition for Petition for Reconsideration of Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," submitted by National Parks Conservation Association, Sierra Club, Natural Resources Defense Council, Coalition to Protect America's National Parks, Appalachian Mountain Club, Western Environmental Law Center and Earthjustice, to former EPA Administrator Andrew Wheeler (May 8, 2020).
7. Letter from Stephanie Kodish, NPCA, Leslie Griffith, SELC, and David Rogers, Sierra Club to VISTAS State Air Directors, "Significant Flaws in VISTAS Regional Haze CAMx Modeling and Methods; Recommendations to Develop Compliant State Implementation Plans" (May 12, 2021).
8. Steven Klafka, P.E. BCEE, Environmental Engineer, Wingra Engineering, S.C, "The Four-Factor Reasonable Progress Analysis for Ardagh Glass" (Jan. 27, 2021).
9. Klafka, Steve, Wingra Engineering, GCC Rio Grande – Pueblo Cement Plant, Four-Factor Reasonable Progress Analysis (Sept. 23, 2021).
10. Klafka, Steve, Wingra Engineering, Holcim - Florence Cement Plant Florence, Colorado Four-Factor Reasonable Progress Analysis (Sept. 30, 2021).
11. Vicki Stamper and Megan Williams, "Oil and Gas Sector Reasonable Progress Four-Factor Analysis of Controls for Five Source Categories" (March 6, 2020).
12. Sierra Club, National Parks Conservation Association, The Coalition to Protect America's National Parks, Just Transition Northwest Indiana, Hoosier Environmental Council, Izaak Walton League, and Save the Dunes Comments on Indiana Department of Environmental Management's Proposed Regional Haze State Implementation Plan ("Proposed SIP") for Second Implementation Period (Nov. 15, 2021).
13. Joe Kordzi, "A Review of the Indiana Regional Haze State Implementation Plan" (Nov. 2021).
14. Brad Buecker and Ron Rosinski, "Coal-Fired Power M&P: Enhancing Wet-Limestone Scrubber Efficiency," Power Engineering (Feb. 8, 2019), https://www.power-eng.com/emissions/coal-fired-power-m-o-enhancing-wet-limestone-scrubber-efficiency/.
15. Joe Kordzi, "A Review of the Ohio Regional Haze State Implementation Plan") (June 2021).

16. Prehearing Statement of the Colorado Department of Public Health and Environmental, Air Pollution Control Division," *In the Matter of Proposed Revisions to Regulation No 23* (Oct. 7, 2021).
17. "Oregon Regional Haze State Implementation Plan, For the period 2018 – 2028," (Aug. 27, 2021 Public Notice Draft).
18. TDEC, "Environmental Justice FAQs," https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice/environmental-justice-faqs.html.
19. TDEC, "What is Environmental Justice," https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice/environmental-justice-faqs.html.
20. TDEC, "What are TDEC's responsibilities related to environmental justice," https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice/environmental-justice-faqs.html.
21. TDEC, Title VI and Environmental Justice, https://www.tn.gov/environment/program-areas/opsp-policy-and-sustainable-practices/opsp-title-vi-and-environmental-justice.html.
22. TDEC, Title VI Compliance Report and Implementation Plan, Fiscal Year 2019-2020 (Revised Feb. 2021), https://www.tn.gov/content/dam/tn/environment/sustainable-practices/title-vi-and-environmental-justice/opsp_title-vi-compliance-report-and-implementation-plan-fy-2019-2020.pdf.
23. EPA: Learn About Environmental Justice, https://www.epa.gov/environmentaljustice/learn-about-environmental-justice.
24. EPA News Release, EPA Administrator Announces Agency Actions to Advance Environmental Justice, *Administrator Regan Directs Agency to Take Steps to Better Serve Historically Marginalized Communities* (April 7, 2021), https://www.epa.gov/newsreleases/epa-administrator-announces-agency-actions-advance-environmental-justice.
25. Letter and Enclosure from Cassius M. Cash, Acting Regional Director, National Park Service – Atlanta, to Michelle Owenby, Director for Air Pollution Control, TDEC, (Dec. 2, 2021), including Enclosure "NPS-TN_RH-SIP-Feedback_11.16.2021."

Appendix I-9

Public Hearing

Appendix I-9a: Public Notice

Appendix I-9b: Public Hearing Summary

Appendix I-9c: Response to Comments

Appendix I-9a

Public Notice

NOTICE OF HEARING

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL
WILLIAM R. SNODGRASS TENNESSEE TOWER
312 ROSA L. PARKS AVENUE, 15th FLOOR
NASHVILLE, TENNESSEE 37243
PHONE: (615) 532-0554
FAX: (615) 532-0614

NOTICE IS HEREBY GIVEN, the Division of Air Pollution Control will hold a public hearing pursuant to Tennessee Code Annotated, Section 68-201-105:

Date:	December 1, 2021
Time:	9:00 AM Central Time
Location:	William R. Snodgrass Tennessee Tower 312 Rosa L. Parks Avenue, 15th Floor Nashville, Tennessee 37243 Conference room 15A

Alternate Hearing Option:

Method 1: You may also join electronically.
Join by going to this link:

https://tn.webex.com/tn/j.php?MTID=m3c85056cbb40ac0b7fee29cc4fe6d966

Meeting number (access code): 2300 248 4338

Meeting password: Jnq55Vb9Ytr

Method 2: Join by phone

+1-415-655-0001 US Toll
Global call-in numbers

Meeting number (access code): 2300 248 4338

There will be a public hearing before the Technical Secretary of the Tennessee Air Pollution Control Board to consider the pre-hearing draft Regional Haze State Implementation Plan (SIP) for the Second Planning Period (2019-2028) under the authority of Tennessee Code Annotated, Section 68-201-105.

The hearing will be conducted as prescribed by the Uniform Administrative Procedures Act, Tennessee Code Annotated, Section 4-5-201 et. seq. and will take place at the date, time and location indicated above.

The public hearing has been called to consider the pre-hearing draft Regional Haze SIP for the Second Planning Period (2019-2028). This pre-hearing draft SIP was prepared in accordance with the Federal Regional Haze Rule provisions specified in 40 CFR 51.308(f) and the U.S. Environmental Protection Agency's guidance for implementing the rule to comply with Section 169 of the Clean Air Act, as amended in 1990. This SIP also contains the second five-year progress report covering the period 2014 through 2018 as required in 40 CFR 51.308(g) of the Regional Haze Rule. The Regional Haze Rule requires states to develop programs to assure reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from manmade air pollution. Tennessee's Class I Federal areas (see 40 CFR 81.428) include the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, which are located in both North Carolina and Tennessee.

All persons interested will be allowed to present testimony to the hearing officer regarding the Regional Haze SIP. Anyone desiring to make oral comments at this public hearing should prepare a written copy of their comments to submit to the hearing officer at the hearing. The hearing officer may limit the length of oral comments in order to allow all parties an opportunity to speak, and will require that all comments be relevant to the proposed SIP revision. Written statements not presented at the hearing will only be considered part of the record if received by close of business (4:30 PM Central) on December 1, 2021, at office of the Division of Air Pollution Control at the address provided above. Comments may also be submitted via e-mail to Air.Pollution.Control@tn.gov .

Individuals with disabilities who wish to participate in the hearing (or review the file record) should contact TDEC to discuss any auxiliary aids or services needed to facilitate participation. Contact may be in person, by writing, telephone, or other means, and should be made no less than ten working days prior to December 1, 2021, to allow time to provide such aid or services. Contact the ADA Coordinator (866-253-5827) for further information. Hearing impaired callers may use the Tennessee Relay Service (800- 848-0298).

If it is hard for you to read, speak, or understand English, TDEC may be able to provide translation or interpretation services free of charge. Please contact Lida Warden at (615) 532-0554 for more information.

If you have any questions about the Regional Haze SIP, you may contact Mark Reynolds by phone at (615) 532-0559 or by email at mark.a.reynolds@tn.gov. Materials concerning the proposed action are available at https://www.tn.gov/environment/ppo-public-participation/ppo-public-participation/ppo-air.html. The appendices for the pre-hearing draft Regional Haze SIP can be accessed at the following website: https://tncloud.tn.gov/owncloud/index.php/s/mPU1EUimUqkfW7f (The password is haze).

NOTICE OF HEARING

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL
WILLIAM R. SNODGRASS TENNESSEE TOWER
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PHONE: (615) 532-0554
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Location:	William R. Snodgrass Tennessee Tower 312 Rosa L. Parks Avenue, 15th Floor Nashville, Tennessee 37243 Conference room 15A

Alternate Hearing Option:

Method 1: You may also join electronically.
Join by going to this link:

https://tn.webex.com/tn/j.php?MTID=m3c85056cbb40ac0b7fee29cc4fe6d966

Meeting number (access code): 2300 248 4338

Meeting password: Jnq55Vb9Ytr

Method 2: Join by phone

+1-415-655-0001 US Toll
Global call-in numbers

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All persons interested will be allowed to present testimony to the hearing officer regarding the Regional Haze SIP. Anyone desiring to make oral comments at this public hearing should prepare a written copy of their comments to submit to the hearing officer at the hearing. The hearing officer may limit the length of oral comments in order to allow all parties an opportunity to speak, and will require that all comments be relevant to the proposed SIP revision. Written statements not presented at the hearing will only be considered part of the record if received by close of business (4:30 PM Central) on December 10, 2021, at office of the Division of Air Pollution Control at the address provided above. Comments may also be submitted via e-mail to Air.Pollution.Control@tn.gov .

Individuals with disabilities who wish to participate in the hearing (or review the file record) should contact TDEC to discuss any auxiliary aids or services needed to facilitate participation. Contact may be in person, by writing, telephone, or other means, and should be made no less than ten working days prior to December 1, 2021, to allow time to provide such aid or services. Contact the ADA Coordinator (866-253-5827) for further information. Hearing impaired callers may use the Tennessee Relay Service (800- 848-0298).

If it is hard for you to read, speak, or understand English, TDEC may be able to provide translation or interpretation services free of charge. Please contact Lida Warden at (615) 532-0554 for more information.

If you have any questions about the Regional Haze SIP, you may contact Mark Reynolds by phone at (615) 532-0559 or by email at mark.a.reynolds@tn.gov. Materials concerning the proposed action are available at https://www.tn.gov/environment/ppo-public-participation/ppo-public-participation/ppo-air.html. The appendices for the pre-hearing draft Regional Haze SIP can be accessed at the following website: https://tncloud.tn.gov/owncloud/index.php/s/mPU1EUimUqkfW7f (The password is haze).

Appendix I-9b

Public Hearing Summary

Public Hearing Summary

Public Hearing for the Regional Haze State Implementation Plan (SIP)
Date of Public Hearing: December 1, 2021

Pursuant to 40 CFR 51.102, the Tennessee Department of Environment and Conservation-Air Pollution Control Division held a public hearing and allowed opportunity to comment on a proposed revision to Tennessee's Regional Haze State Implementation Plan (SIP) under the Clean Air Act. This proposed SIP revision addresses regional haze in Tennessee's mandatory federal Class I areas and nearby Class I areas for the second implementation period of the U.S. Environmental Protection Agency's regional haze rule.

The TDEC-APC held the public hearing on December 1, 2021 at 9:00 am at the Tennessee Tower, 15th Floor, Conference Room A, 312 Rosa L. Parks Avenue, Nashville, Tennessee 37243. Individuals were able to attend the public hearing in person or virtually through Webex and by telephone.

Seventeen individuals attended the public hearing either in person, via Webex, or by telephone. The following is a list of individuals that attended the public hearing.

Name	Affiliation
Don Barger	
Lilly Anderson	NPCA
Mary Peyton Wall	South Carolina Department of Health and Environmental Control
Michele Notarianni	EPA Region 4
Scott Banbury	Sierra Club
Todd Shrewsbury	West Virginia Department of Environmental Protection
Trey Bussey	
Tracy Palmer Stanton	TVA
Amy Kelly	Sierra Club
JoAnn McIntosh	
Katie	
Kent Minault	Sierra Club
Jim Renfro	National Park Service
Marie Brown	
Jonathan Jernigan	
Andrea Stacey	National Park Service
Emily Jones	NPCA

Paul LaRock, Environmental Manager in the Division of Air Pollution Control, introduced Mark Reynolds, Environmental Consultant in the Division of Air Pollution Control. Mr. Reynolds gave a brief presentation of the Regional Haze SIP.

Mr. LaRock then opened the Public Hearing with the following statement:

I would like to call this hearing to order. It is 9:14 a.m. on Wednesday December 1, 2021. We are in Conference 15A, at the William R. Snodgrass Tennessee Tower, 312 Rosa L. Parks Ave, Nashville, Tennessee. My name is Paul LaRock. I am an Environmental Manager in the Division of Air Pollution Control and will serve as the Hearing Officer for this hearing. This hearing is being held under the authority of the Tennessee Air Pollution Control Board. This meeting is also accessible remotely via WebEx video conferencing.

This public hearing has been called to consider the pre-hearing draft Regional Haze State Implementation Plan for the Second Planning Period (2019-2028). This pre-hearing draft SIP was prepared in accordance with the Federal Regional Haze Rule provisions specified in 40 CFR 51.308(f) and the U.S. Environmental Protection Agency's guidance for implementing the rule to comply with Section 169 of the Clean Air Act, as amended in 1990. This SIP also contains the second five-year progress report covering the period 2014 through 2018 as required in 40 CFR 51.308(g) of the Regional Haze Rule. The Regional Haze Rule requires states to develop programs to assure reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from manmade air pollution. Tennessee's Class I Federal areas include the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, which are located in both North Carolina and Tennessee.

I want to emphasize that we are not here to debate any information presented, but to listen and document comments regarding the draft document and only answer questions for clarification purposes. Written statements or transcripts of comments will be considered as a part of this record if received in the office of the Technical Secretary, Tennessee Air Pollution Control Division, 15th Floor William R. Snodgrass Tennessee Tower, 312 Rosa L. Parks Avenue, Nashville, Tennessee 37243 by close of business December 10, 2021. Formal responses to comments will not be made at this hearing but will be part of the final report. Materials concerning the proposed actions have been made available for the duration of the comment period at the Tennessee Department of Environment and Conservation Public Participation web-page and for public inspection during normal working hours at the office of the Technical Secretary. A copy of these notices will be made a permanent part of the record.

The proceedings of this hearing are being recorded and copies of the hearing record will be available for the cost of reproduction. Requests for such copies should be sent to the Technical Secretary at the previously mentioned address. Verbal or written testimony, either for or against matters under discussion, may be presented at this hearing. Compilers of the testimony presented at this hearing reserve the right to include extensive or bulky testimony by reference only. Is there anyone her who would like to make comments regarding the proposed rule changes under consideration?

The following is a transcript of the oral comments that were made during the public hearing.

Commenter: Scott Banbury, Sierra Club

Comment:

I'm the conservation program coordinator for the Tennessee Chapter of the Sierra Club represent more than 8,000 dues paying members as well as some 50,000 supporters in the State of Tennessee. We really appreciate you extending the comment period to December 10 we have a lot of our volunteers and experts working on making substantive comments that will be submitted electronically. In addition, we reached out to our members and we now have over 200 members that have signed on to a petition that is the statement that I am about to read into the record. In addition to this petition that people joined many people submitted individual comments that will be submitted electronically so that you can see what their individual concerns were. The petition that they signed on to reads

I deeply value our parks and public lands and want to see them protected under the Regional Haze Rule. I am concerned that the Regional Haze plan proposed by TDEC will not amount to necessary pollution reductions and fails to make reasonable progress toward clean air to benefit the Great Smoky Mountains, Mammoth Cave National Parks, Joyce-Kilmer Slick Rock Wilderness Area, Cohutta Wilderness Area in Georgia, other regional wilderness areas, and fails to protect the communities surrounding polluting facilities, like TVA coal plants. Before finalizing this plan, I urge TDEC to include enforceable retirement of these old, polluting coal plants in the final haze plan and revisit the polluting sources requested by the Sierra Club. Please be true to your stated vision to safeguard the natural resources of Tennessee and make continued progress toward cleaner air by improving this plan.

That's what our members signed on to so far. We also have concerns that we're making a lot of assumptions on retirements occurring with TVA plant and also some of privately operated boiler units at various industries in Tennessee including Eastman. We really would like to see something in this plan that makes that enforceable especially in light of shifting costs in energy industry. A lot of these retirements are being driven by financial concerns with coal going forward and with natural gas prices rising, coal is becoming a little bit more favored by some of the utilities across the United States and around the world. We would like to see that these retirements are actually enforceable in this plan. And with that we will be submitting much more detailed technical comments

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Commenter: Emily Jones, NPCA

Comment: Ms. Jones commented verbally during the hearing and submitted written comments. Ms. Jones' written comments are at the end of this document.

Commenter: Kent Minault, Sierra Club

Comment:
I have several brief comments on the study and proposed plan. I think it is absolutely correct. For the plan not to indicate that new reductions in haze pollution from coal-fired power plants are not warranted. To continue a policy of nonaction in relationship to coal plants in the state is to ignore both public health impacts and continuing deterioration of our climate. The study focuses on visibility impairment, but those are not the sole problem. Haze basically means combustion and combustion is a threat to the climate. TDEC study focuses on sulfur dioxide and NO_X with minimal consideration of particulate matter, but particulate matter is a serious health hazard and a major pollutant. The study appears to ignore the issue of hazards to the public and dangers to the climate, which are two fundamental consequences of haze. TDEC charts progress in making our air look better; we are grateful for that progress, but the TDEC study needs to include climate and health impacts before serious

recommendations can be made. Particularly we need to have coal plant retirements mandated in the plan.

Commenter: Lilly Anderson, NPCA

Comment: Ms. Anderson commented verbally during the hearing and submitted written comments. Ms. Anderson's written comments are at the end of this document.

Commenter: Amy Kelly, Sierra Club

Comment:
I'm a seventh generation Tennessean and I'm from Kingsport. I currently live in Maryville, Tennessee. I want to thank you for this opportunity to speak to you today virtually since I am currently quarantined. I also want to thank you for engaging the public in this very important process. I speak today as someone who has been personally and severely affected by uncontrolled pollution. I grew up next to Eastman Chemical Company which is currently recognized as the chief emitting source for Tennessee's only county that is in nonattainment for air quality standards. How has this affected me? I had chronic asthma as a child and underwent many trips to the hospital for breathing treatments. Many of my neighborhood playmates suffered the same illness. What I came to learn later is our inability to breathe as children was caused by the sulfur dioxide and nitrous oxide released into the air with very little control much of which is due to the burning of coal. I am currently unable to live in my hometown because of the air quality. EPA rules like regional haze provide opportunities for states like Tennessee to address uncontrolled pollution that affects millions of people like me with the added benefit of demonstrating our stewardship of the biodiverse Great Smoky Mountains National Park that others travel from all across the world to enjoy. The regions parks are economic drivers as much as the unchecked industries that are harming them. Despite the great strides that have been made to clean the air over the years the state of Tennessee has proposed a Regional Haze plan that does not adequately reduce pollution falling short on the state's obligation to improve air quality for our parks and communities. Despite the thousands of tons of controllable pollution from Tennessee sources including coal fired power plants, chemical facilities like Eastman, cement kilns and many other opportunities for cost effective controls. Tennessee improperly concludes that almost no new reductions in pollution are warranted. The Tennessee plan only selected two facilities to review and wrongly excluded several large polluting facilities in the state and omitted nitrogen oxides and particulate matter emissions from review. Even though Tennessee conducted a review of sulfur dioxide emission reducing measures for the Eastman Chemical plant and the TVA Cumberland coal plant, Tennessee did not require adequate pollution controls or make the announced retirements enforceable. Tennessee also failed to evaluate emission reducing measures for nitrous oxides and particulate matter from both facilities despite the high level of emissions. Moreover the source operators overestimated the costs of the controls evaluated and the state relied upon these to reduce the pollution and decided the cost was not worth it. Today I'm asking that TDEC set enforceable retirements for any source the state is counting on for pollution reduction to help achieve reasonable progress including Kingston and Cumberland TVA coal plants. I'm asking that the state require installation of cost effective control options for wall rings at TVA Cumberland for an additional 719 ton reduction of sulfur dioxide and evaluate control options for nitrogen oxides and particulate matter emissions. I'm asking that TDEC make the retirement of boilers 18, 19, and 20 at Eastman Chemical Company enforceable as part of this plan. I'm asking that TDEC require Eastman Chemical Company to install sulfur dioxide pollution

controls in uncontrolled boilers 21 and 22 and address the nitrogen oxide and particulate matter emissions from all the remaining boilers. I'm asking that TDEC thoroughly access environmental justice impacts which were not included. I now work with Sierra Club who has over 20,000 members and supporters in Tennessee. I am proud that Sierra Club was part of the 2011 consent decree that Mr. Reynolds noted that caused the most dramatic decrease in emissions. As an organization we are focused on building a future in Tennessee that goes beyond coal and other polluting fossil fuels. Ensuring that TDEC includes enforceable retirements for what TVA has already determined are old polluting coal plants would demonstrate that TDEC is serious about meeting its commitments to clean air in Tennessee and to our neighboring states. Thank you again for the opportunity to comment and I appreciate all the work that TDEC does and I will submit these comments in writing

---

Commenter: Don Barger

Comment: Mr. Barger commented verbally during the hearing and submitted written comments. Mr. Barger's written comments are at the end of this document.

Written Comments of Emily Jones, Southeast Regional Director, NPCA

Good morning and thank you for the opportunity to provide input on Tennessee's regional haze plan. My name is Emily Jones, and I am here to today to speak on behalf of the National Parks Conservation Association (NPCA). I am the Southeast Regional Director for NPCA , our Regional office is on Walnut Street in Knoxville Tennessee–NPCA is a national, nonpartisan, nonprofit organization that has 1.6 million supporters across the country. 31,000 NPCA members and supporters live in Tennessee.

As a 6th generation Tennessean, I know and love Tennessee's iconic and treasured public lands and I have spent 20 years of my life dedicated to their protection. NPCA advocates for the well-being of national parks and other Class I areas, including Great Smoky Mountains and Mammoth Cave National Parks and the Joyce-Kilmer/Slickrock Wilderness Area. In 2019, park visitors spent an estimated $717 million in local gateway regions in Tennessee. These visits support nearly 10,000 jobs and deliver $996 million in economic output.

In addition to these enormous economic benefits, parks are also an important source of respite and rejuvenation for visitors and locals alike and contribute to a higher quality of life for Tennesseans – but ensuring clear views for future generations and keeping these places healthy is essential for these benefits to continue. And reducing haze pollution will provide numerous additional benefits such as healthier air for nearby communities and visitors, reducing pollutants driving climate change, and protecting sensitive ecosystems.

Left as-is, Tennessee's haze plan will not deliver sufficient pollution reductions to qualify as reasonable progress toward clean air goals. Tennessee's choice to use only the VISTAS modeling to select pollution sources is problematic because VISTAS relied on outdated data, set unreasonably high thresholds, ignored nitrogen oxides and particulate matter and severely downplayed the impact that power plant emissions have on visibility.

TDEC thus overlooked numerous major sources of haze pollution and ended up choosing only two to review - Eastman Chemical Company and TVA's Cumberland Coal Plant. And even though TDEC

reviewed those two, you've still improperly concluded – due to overestimation of the cost of the controls that were evaluated – that almost no new reductions in pollution are warranted or worth the costs at these facilities.
Sixty-five percent of our states' haze emissions come from many chemical plants, coal-fired power plants, and cement facilities, most of which TDEC ignored.

The National Park Service and NPCA identified additional facilities that must be addressed in the final plan. These sources include TVA's Kingston and Gallatin Coal Plants, AGC Industries glass manufacturing, O-N Minerals lime facility, Trelleborg rubber manufacturer, Signal Mountain Cement Company, Packaging Corporation of America pulp & paper in Hardin, and Tennessee Gas Pipeline Stations 860 and 87.

Without further controls on these major haze polluters, more than 11,000 tons of nitrogen oxides and 4,000 tons of sulfur dioxide will continue to be released into our air. TDEC should make significant changes to the regional haze plan to comply with the Clean Air Act. Specifically, TDEC needs to go back and analyze the major sources of pollution that have been overlooked that I just mentioned. Enforceable retirement dates of 2028 for TVA's Kingston and Cumberland coal plants should also be included and until Cumberland is retired, installation of wall rings are cost-effective controls for sulfur dioxide.

Eastman Chemical also needs to install sulfur dioxide controls on boilers 21 and 22, and retirement of boilers 18, 19, and 20 should be enforceable through this plan. Lastly, nitrogen oxides and particulate matter controls must be reviewed for both Cumberland and Eastman. Visitors to our Class I areas deserve to experience clear views and local communities deserve to breathe clean air. We urge TDEC to stay true to its stated mission of enhancing the quality of life for citizens of Tennessee and stewarding our state's natural environment by improving the regional haze plan so that it abides by the Clean Air Act and makes notable continued progress toward cleaner air. Thank you for your time.

Written Comments of Lilly Anderson, NPCA

Hello, my name is Lilly Anderson, I am the Southeast Clean Air Coordinator for the National Parks Conservation Association. Thank you for this opportunity to comment on Tennessee's Regional Haze plan. I'm commenting both as an advocate with NPCA, and as someone who loves to spend time recreating in the smoky mountains and surrounding areas. Every year, my family and I meet in the Smokies to spend time together camping, hiking, and reconnecting with these ancient Appalachian mountains as the backdrop. Public lands like these hold a special place in my heart, and I have seen firsthand through my work in national parks and national forests across the country the horrible damage that haze pollution can have - on people's experiences in parks, their health and on those who rely on public lands tourism for their livelihood.

I'll focus my comments on the areas where the proposed plan falls short in meeting the goals of the program. If left unchanged, the state's plan will not comply with the Clean Air Act and the Regional Haze Rule as it does not make reasonable progress and does little to continue reducing pollution from Tennessee sources harming Class I areas. It is critical that TDEC produce a strong haze plan this planning period. Specifically, we urge you to take the time necessary to remedy the places that are out of alignment with EPA's Clarification Memo issued in July

1. The Clarification Memo says that States must secure *additional emission reductions* that build on progress already achieved.

Yet TDEC improperly concludes that almost no new reductions are warranted despite the tens of thousands of tons of controllable haze pollution through cost-effective controls.
• In addition, source selection thresholds should be set to capture "a meaningful portion of the state's total contribution to visibility impairing Class I areas."

NPCA identified 25 sources of visibility-polluting facilities affecting Class 1 areas, and TDEC chose only 2 sources to evaluate because of its reliance on the exceptionally high thresholds set through the VISTAS approach, completely omitting some of Tennessee's largest polluters.

2. Second, EPA expects states to consider BOTH sulfur dioxide (SO_2) and nitrogen oxides (NO_x); Again, due to reliance on the flawed VISTAS approach, TDEC has erroneously omitted NO_x pollution in its entire analysis.

3. Third, the clarification memo states that sources identified by Federal Land Managers must be considered. The National Park Service identified seven sources that they want addressed in the SIP, yet the current draft only addresses two of those sources.

4. Fourth, the memo states that "Source shutdowns relied on to forgo a four-factor analysis or to shorten the remaining useful life of a source must be included in the SIP." Tennessee is relying on TVA Kingston's proposed retirements of all units by 2033. TDEC must make those retirement dates enforceable in the SIP.

5. Fifth, Tennessee is required to address sources that are identified by other states as impairing visibility in their Class 1 areas. Missouri, Georgia, and North Carolina requested that TDEC address Eastman Chemical Company and TVA Cumberland. The current SIP does not adequately consider nor require changes or controls to these sources.

6. Finally, EPA encourages states to consider "equity and environmental justice impacts". TDEC has not conducted any kind of environmental justice screen or considered disproportionate impacts in source selection or in emission control evaluation. Sources that pollute scenic views also negatively affect vulnerable communities in Tennessee, where many people live below the poverty line. TDEC must revisit the plan to include environmental justice considerations.

That concludes my comments, thank you for your time and to the TDEC staff for all their hard work, we look forward to reviewing improvements to this plan

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Written Comments of Don Barger

Good morning, I'm Don Barger and I am providing my input today as an individual, a citizen and a resident of Tennessee, not representing any organization or interests. That said, I am speaking from my personal experience of having served for 27 years as Southeast Regional Director of the National Parks Conservation Association (NPCA) in Knoxville and having served for 10 years of that time as a participant in the Southern Appalachian Mountains Initiative (SAMI) working with utilities, State and federal

agencies, and other stakeholders to pursue regionally collaborative strategies to implement the emission reductions needed to meet the promises of the Clean Air Act to the American people.
The Clean Air Act is working and it was designed by Congress to be a Work In Progress. From my perspective, it is both disappointing and unacceptable that the State's proposed SIP fails to continue that progress.

The goal of the Regional Haze provisions of the Clean Air Act is to eliminate all human-induced visibility impairment in Class 1 Areas like Great Smoky Mountains National Park by the year 2064. The statute requires that regulatory actions such as this State Implementation Plan make "reasonable progress" toward that goal. The State of Tennessee's proposed SIP does not do that.

Information and analyses provided to you by NPCA, the Sierra Club and by the National Park Service demonstrates, conclusively I believe, that the State's proposed plan fails to use current data as the baseline for progress, ignores the changing composition of haze-inducing constituents in the air, ignores the majority of sources creating those emissions, and attempts to rest on the laurels of reductions made largely by TVA in compliance with a 2011 Consent Decree to a decade of litigation. From that experience, I can tell you that, if the State is counting on reductions from the planned retirements of the Kingston or Cumberland coal plants, the plan must contain enforceable retirement dates for those facilities and calculations of any emissions proposed to replace them. The same would apply to industrial sources.

In addition, it used to be that our haziest days were all in the summer. For the last few years, we're seeing more and more of the haziest days in the cooler seasons which means that your models are missing a lot of the nitrate pollution that is increasingly a lot of the problem.

This proposal is based on VISTAS data from 2011, the same year that TVA began the court-enforceable reductions at 54 of its 59 coal-fired boilers. The SIP cannot be based on numbers from 10 years ago about what happened in the 10 years before that. It has to be based on where we are now and where we need to be 10 years from now and 10 years after that. Failing that will most likely mean failing to meet the statutory requirement to eliminate haze-causing pollution.

The National Park Service, the agency responsible for protecting our national parks, has identified 256 sources regionally that are potential sources of visibility impairment in our southeastern national parks. The modelling used by VISTAS and relied on by the State identified only 33 potential sources in the entire 10-state region. Tennessee chose to review only 2 of those and then determined that there were almost no additional reductions needed. Status quo is not reasonable and it's not progress.

The emissions reduction glide path, or so-called Uniform Rate of Progress, is in fact not "uniform" and was never intended to be. When Regional Haze was discussed in SAMI over twenty years ago, we knew that the focus on major sources meant that we would reach an "inflection point" on our glide path to eliminate the emissions that cause regional haze. TVA power plants were certainly the politically-palatable, low-hanging-fruit, bang-for-the-buck first targets to get substantial emission reductions, but we all knew that we would soon need to deal with industrial and other smaller sources which cumulatively are now an increasing component of the problem. Emission reductions to stay on the glide path to clean air are going to be increasingly harder to achieve making it much more important to continue reasonable progress at this phase of implementation.

When Congress created the National Park System in 1916, they gave the parks the highest level of protection of any public lands in America. And the mission statement in the Organic Act defining the protection these places require begins with the words “conserve the scenery”. After TVA began the implementation of our Settlement Agreement and Consent Decree, people in Knoxville who knew of my involvement in that case would stop me on the street to tell me about the moment that they looked up, crested a hill, or visited a familiar place and were jolted by the sense of place of beginning to see their mountains again. In 1916, Congress made it the mission of the National Park Service; the 1977 amendments to the Clean Air Act made it your mission, too, and we’ve given ourselves almost a century to make it happen. Half of that time has already passed and we still have a long way to go. It is not “unreasonable” to expect progress; it’s the law.

In closing, I urge the State to correct the deficiencies identified by the National Park Service and in the NPCA report and comments before proceeding. If the State is unwilling to correct the deficiencies in this plan, EPA will need to replace them with provisions that reflect the reasonable progress required by the Clean Air Act.

I appreciate the opportunity to comment, especially safely by video, and will submit my written testimony before the deadline. Thank you.

Paul LaRock ended the Public Hearing with the following statement:

Is there anyone else here who would like to make an oral comment for the hearing record?

Written statements not presented at the hearings will only be considered part of the records if received by 4:30 p.m. Friday December 10, 2021 at the office of the Technical Secretary, Air Pollution Control Division, 15th Floor William R. Snodgrass Tennessee Tower, 312 Rosa L. Parks Avenue, Nashville, TN 37243. Since there are no further comments for the hearing record, the hearing is adjourned. (9:47 am Wednesday December 1, 2021)

Appendix I-9c

Response to Comments

TN Department of Environment & Conservation

January 24, 2022

Response to Comments

Public Notice and start of comment period: October 21, 2021
Date of Public Hearing: December 1, 2021
End of Comment Period: December 10, 2021

Public Hearing for the Regional Haze State Implementation Plan

The Tennessee Department of Environment and Conservation, Air Pollution Control Division (TDEC-APC) appreciates everyone's attendance and participation at the public hearing on December 1, 2021. The purpose of this public hearing was to hear comments on the Division's proposed Regional Haze State Implementation Plan.

The public hearing started with Paul LaRock, with TDEC-APC's Regulatory Development Section, reading an opening statement. Then, attendees were asked if they would like to make comments for the record. Six people made oral comments for the record. Additionally, numerous individuals and organizations submitted written comments. In this document, the TDEC-APC responds to the comments made during the public hearing and submitted in writing.

Comment:
The TDEC-APC received comments regarding NO_X emissions and nitrates. Commenters state that due to reliance on the flawed VISTAS approach, TDEC has erroneously omitted NO_X pollution in its entire analysis. VISTAS relied on outdated data. Another commenter stated that TDEC ignores and the SIP lacks controls for nitrate contributions from point sources at Class I areas. Another commenter stated that the proposed plan fails to use the current baseline and ignores the changing composition of haze-inducing constituents into the air.

Response:
TDEC-APC evaluated the appropriate and available data to develop the projected reasonable progress goals (RPGs) for 2028, taking into consideration all relevant emissions. TDEC-APC concluded that ammonium sulfate is the dominant pollutant impacting visibility at Tennessee Class I areas, followed by organic carbon and ammonium nitrate. States are required to establish RPGs

for each mandatory Class I Federal area located within the state. The long-term strategy (LTS) and RPGs must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least impaired days over the same period. 40 C.F.R. 51.308(f)(3)(i). For the Great Smoky Mountains National Park (GSMNP), Figure 10-1 compares the relative particle contributions to light extinction for the five-year average of 2009 – 2013 and 2015 – 2019 measured by IMPROVE monitors for the 20% most impaired days. When preparing the projected RPG for 2028, based on EPA's modeling guidance, the species-specific RRF was applied to the 2009 – 2013 average measured by the monitor for the Great Smoky Mountains National Park. Comparison of these five-year periods show that while total impairment has declined significantly in the Great Smoky Mountains National Park, the relative percentage of PM species contributions has also changed somewhat. The relative ammonium nitrate and organic carbon contributions have increased from the first to the second five-year period for the Great Smoky Mountains National Park. During the 2015 – 2019 period, the ammonium nitrate and organic carbon contributions are equal for the Great Smoky Mountains National Park. However, during the 2015 – 2019 period, ammonium sulfate continues to be the dominant visibility impairing species at the Great Smoky Mountains National Park.

For the Great Smoky Mountains National Park, Figure 10-2 shows particle contributions to light extinction from 2011 through 2019 for the 20% most impaired days. For the Great Smoky Mountains National Park, ammonium nitrate levels increased in 2017 and 2018 but returned to 2015 levels in 2019. It is unclear why the ammonium nitrate contribution to total impairment has fluctuated in recent years and further research is needed to understand the factors contributing (e.g., emission sources, weather, and meteorology) to the nitrate fraction at this Class I area.

Figure 10-3 compares the five-year average of 2009 – 2013 and 2015 – 2019 for ammonium sulfate and ammonium nitrate contributions to visibility impairment for all Class I areas in the VISTAS region. These data clearly show that although ammonium nitrate contributions have increased slightly for some Class I areas, ammonium sulfate remains as the dominant visibility impairment species through 2019.

Table 10-8 shows the number of days where nitrate exceeded sulfate concentrations. The commenters note that use of 2011 as the basis for the 20% most impaired days does not reflect current trends. Although the days and seasons that make up the 20% most impaired days have shifted somewhat from 2011 to 2016 – 2019, the total number of days that are dominated by sulfate still exceeds the total number of days dominated by nitrate for each year. For example, 23 days of IMPROVE monitoring data make up the 20% most impaired days for the Great Smoky Mountains National Park. In 2011, all 23 days were dominated by sulfate. In 2016, 2017, 2018, and 2019 the total number of days where nitrate exceeded sulfate impairment were 1, 3, 7, and 5 days, respectively. This illustrates that sulfate is still the dominant visibility impairing pollutant for the Great Smoky Mountains National Park for this second planning period. Additional research will be needed to understand why nitrate contributions are fluctuating from year to year and shifting between seasons within a given year. This fluctuation does not necessarily mean that the higher nitrate fractions are associated with EGU and non-EGU point sources. Regardless, once additional data and trends can be gathered and evaluated, TDEC-APC will evaluate nitrate and sulfite impairment again in preparation for the next implementation period. Because IMPROVE monitoring data from GSMNP is used to represent visibility impairment at Joyce Kilmer-Slickrock Wilderness Area (see Section 1.4), the discussion of the IMPROVE monitoring data for the GSMNP also applies to the Joyce Kilmer-Slickrock Wilderness Area, except where noted.

For Tennessee, Figures 10-4 and 10-5 show statewide sector-level contributions to total emissions for SO_2 and NO_X, respectively. The 2011 and 2028 emissions are from the modeling platform used for modeling RPGs for Class I areas in Tennessee. The 2017 emissions are from the 2017 National Emissions Inventory (NEI). Table 10-9 summarizes the emissions by the major source categories [i.e., mobile (onroad and nonroad), stationary point (all point sources), and miscellaneous (includes predominately prescribed fires and wildfires)]. From 2011 – 2017, SO_2 and NO_X emissions have been reduced by 71% and 37%, respectively. From 2017 – 2028, SO_2 and NO_X emissions are projected to decline an additional 49% and 33%, respectively, due to federal and state control programs. Point sources that combust coal and oil containing sulfur (EGUs and non-EGUs) and industries that emit SO_2 (e.g., pulp and paper) are the major sources of SO_2 emissions and, therefore, can be easily linked to sulfate contributions at Class I areas. However, NO_X emissions are associated with fuel combustion in both the mobile and stationary source sectors. Unlike SO_2, it is difficult to identify the specific sources of NO_X that contribute to nitrate at an IMPROVE monitor on a given day of the year. For Tennessee, in 2017, highway (on-road) and off-highway (nonroad) vehicles considered together account for about 69% of total statewide emissions for all sectors.

Section 7.4 (Relative Contributions to Visibility Impairment: Pollutants, Source Categories, and Geographic Areas) of this SIP presents the PSAT modeling results for 2028 for the most impaired days for Class I areas in the VISTAS region. Figure 7-30 (2028 Nitrate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas) shows that contributions to nitrate impairment from the CENRAP, LADCO, and MANE-VU sources, as well as the sum contributions from the other VISTAS states, are significantly larger than contributions from Tennessee sources. Figure 7-34 (2028 Contribution to Light Extinction on the 20% Most Impaired Days at Great Smoky Mountains) shows that in 2028 the nitrate contribution is associated primarily with mobile (on-road and nonroad) and nonpoint stationary sources and point sources (EGU and non-EGU) outside of Tennessee. As shown in the right-most two columns in this figure, nitrate contributions from point sources (EGU or non-EGU) in Tennessee are negligible. Requiring additional NO_x controls on point sources in Tennessee would have little to no impact on improving visibility in the Great Smoky Mountains National Park.

The TDEC-APC reviewed all available IMPROVE monitoring data for the Great Smoky Mountains National Park during the development of this SIP. Both SO_2 and NO_x emissions sources (both stationary and mobile) were analyzed during the AoI and PSAT modeling work to consider in the source selection step. The TDEC-APC also considered the flexibilities provided to the states in deciding how to prioritize pollutants and emission sources for improving visibility during the second planning period as documented in EPA's 2019 regional haze guidance. In so doing, for the second planning period, the TDEC-APC concluded that ammonium sulfate is the dominant pollutant followed by organic carbon and ammonium nitrate.

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.

About 18 months after VISTAS started its modeling using the 2011 platform, EPA released a new platform with a 2016 base year and then decided to conduct regional haze modeling for 2028 using the 2016 platform. The EPA modeling used 2016 meteorology and calculated RRFs (percent reduction between 2016 and 2028), which were applied to 2014 – 2017 IMPROVE data to calculate RPGs for 2028. Figure 10-6 compares the projected speciated modeling results from the EPA and VISTAS modeling for the Great Smoky Mountains National Park. The 2028 visibility impairment projection for the 20% most impaired days is generally similar, not only the sum of all the pollutants -- the RPG -- but also how much visibility impairment comes from each species. A common takeaway from both model projections is ammonium sulfate is expected to remain the dominant pollutant through 2028, and by a factor of 4 or greater, over ammonium nitrate at the Great Smoky Mountains National Park in Tennessee. It is also worth noting that VISTAS' projected total light extinction for 2028 is lower than EPA's projected 2028 visibility at the Great Smoky Mountains National Park (which is due to differences in the emission projections and size of the modeling domains). However, this analysis demonstrates that sulfate remains the dominant pollutant and will remain so over the coming planning period, whether 2011 or 2016 meteorology, and associated 20% most impaired days, are used.

The TDEC-APC analyzed visibility impairment per ton of sulfate and nitrate emissions, respectively, at all Tennessee facilities selected for reasonable progress analysis (see Table 7-40), as well as all facilities outside of Tennessee selected by the TDEC-APC for reasonable progress analysis (see Tables 7-41 and 7-42). The visibility impairment per ton of emissions for sulfate was compared against the same for nitrate as a ratio as follows:

$$ratio(facility, Class\ I\ area) = \frac{\left[\frac{Sulfate\ Visibility\ Impairment\ in\ Mm-1}{2028\ SO2\ Emissions\ in\ tpy}\right]}{\left[\frac{Nitrate\ Visibility\ Impairment\ in\ Mm-1}{2028\ NOx\ Emissions\ in\ tpy}\right]}$$

The sulfate to nitrate ratios by facility to the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area are shown in Table 10-10 (the cells with "N/A" indicate a nitrate PSAT visibility impact of zero associated with NO_x emissions). Visibility impacts from sulfate as a function of Mm^{-1} per ton are universally higher than the same for nitrate, and range between 2.6 to 96.6. These results indicate that reducing one ton of SO_2 has a significantly higher impact on improving visibility at these Class I areas rather than controlling one ton of NO_x supporting the TDEC-APC's decision, in part, to focus on requesting facilities to perform four-factor analyses on only SO_2 emissions for this second planning period.

The IMPROVE monitoring data shows that ammonium sulfate continues to be the dominant visibility impairing species at the Great Smoky Mountains National Park. Tables 7-13 and 7-14 show that point sources of SO_2 have the highest contribution of any sector to visibility impairment on the 20% most impaired days at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. Additionally, during the source selection process, there were no facilities that exceeded the 1.00% PSAT threshold for NO_X; whereas there were numerous facilities that exceeded the 1.00% PSAT threshold for SO_2. The TDEC-APC believes that its LTS and RPG provide for improvement in visibility for the most impaired days and ensure no degradation in visibility for the clearest days.

The regional haze planning process is iterative (with SIPs due every 10 years and progress reports due every 5 years) which provides an opportunity to further evaluate source contributions and meteorological conditions that contribute to the nitrate concentrations on specific days at each Class I area. The TDEC-APC believes that further research is needed to understand what emission sources and meteorology conditions are contributing to the variability in the nitrate from 2016 – 2019. Further research is also needed to understand what emission sources and meteorology conditions are contributing to the organic carbon fraction as well. The 2028 PSAT modeling completed for this SIP indicates that EGUs and non-EGU facilities in Tennessee have an insignificant contribution to the ammonium nitrate fraction at Class I areas in Tennessee. The modeling suggests that mobile sources in-state and out-of-state and point sources located out-of-state are the main contributors to the nitrate fraction. The data evaluation, extensive considerations of all relevant factors and modeling discussed in this response all support TDEC-APC's approach and RPG for this implementation period.

Comment:

The TDEC-APC received comments regarding source selection for reasonable progress analysis. Commenters state that TDEC-APC used a high threshold for the PSAT contribution and only chose two facilities for reasonable progress analysis. Section 2.1 of the EPA clarification memo notes that when applying a source selection methodology, "*states should focus on the in-state contribution to visibility impairment and not decline to select sources based on the fact that there are larger out-of-state contributors. What is reasonable will depend on the specific circumstances. We generally think that a threshold that captures only a small portion of a state's contribution to visibility impairment in Class I areas is more likely to be unreasonable*." Based on the VISTAS PSAT results, TVA Cumberland and Eastman Chemical account for 8.07% of Tennessee's projected 2028 contribution to impairment in Great Smoky Mountains. This is a small portion of Tennessee's contribution to impairment in Great Smoky Mountains NP. EPA has consistently stated that the URP is not a "safe harbor" and should not be relied upon to decline selecting a reasonable number of sources for analysis or rejecting otherwise cost-effective control measures. Commenters cite TVA Cumberland's impact on Mammoth Cave NP as an example of the fundamental problem with the 1% of total impact threshold, which is less protective of the more impacted Class I areas and misses important sources contributing to haze in the places that need the most improvement. TDEC-APC also received a comment that the use of the VISTAS modeling "downplayed the impact that power plant emissions have on visibility."

Response:

The TDEC-APC has taken its own approach to source selection that complies with the regional haze rule (RHR) and EPA guidance. In 40 CFR 51.308(f)(2)(i), the RHR states that "the State should consider evaluating major and minor stationary sources or groups of sources, mobile sources, and area sources." TDEC-ACP's approach does recognize the significant progress Tennessee has and is expected to achieve in the future toward improving visibility in its Class I areas which is consistent with EPA's August 20, 2019, guidance. Regarding the selection of sources for analysis (Step 3), EPA states:

> Page 5, Table 1: *Select the emission sources for which an analysis of emission control measures will be completed in the second implementation period and explain the bases for these selections. For the purpose of this source selection step, a state may consider estimated visibility impacts (or surrogate metrics for visibility impacts), the four statutory factors, the five required factors listed in section 51.308(f)(2)(iv), and other factors that are reasonable to consider.*
>
> Page 9: "*A key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period. Instead, a state may reasonably select a set of sources for an analysis of control measures. The guidance that an analysis of control measures is not required for every source in each implementation period is based on CAA section 169A(b)(2), which requires each SIP to contain emission limits, schedules of compliance, and other measures as may be necessary to make reasonable progress, but …does not provide direction*

regarding the particular sources or source categories to which such emission limits, etc., must apply. Selecting a set of sources for analysis of control measures in each implementation period is also consistent with the Regional Haze Rule, which sets up an iterative planning process and anticipates that a state may not need to analyze control measures for all its sources in a given SIP revision. Specifically, section 51.308(f)(2)(i) of the Regional Haze Rule requires a SIP to include a description of the criteria the state has used to determine the sources or groups of sources it evaluated for potential controls. Accordingly, it is reasonable and permissible for a state to distribute its own analytical work, and the compliance expenditures of source owners, over time by addressing some sources in the second implementation period and other sources in later periods. For the sources that are not selected for an analysis of control measures for purposes of the second implementation period, it may be appropriate for a state to consider whether measures for such sources are necessary to make reasonable progress in later implementation periods."

Consistent with the RHR and EPA guidance, the TDEC-APC followed a process (documented in Sections 7.5 and 7.6) for narrowing the list of sources to consider in selection for a four-factor analysis. In so doing, the TDEC-APC relied on the latest available tools (i.e., PSAT) to understand source impacts on visibility impairment in each Class I area. From the comparison of AoI to PSAT modeling of stationary sources, it became apparent that the AoI methodology overstates impacts close to Class I areas (i.e., <100 Km) and understates impacts associated with stationary sources located further away (i.e., >100 Km) from Class I areas.

As discussed in Section 7.2.2.1, the TVA consent decree finalized in 2011 required shut downs, new controls, and a switch from coal to natural gas at certain EGU facilities. From 2008 to 2019, there was a 94.6% reduction in SO_2 emissions and a 90.3% reduction in NO_x emissions from TVA's coal and natural gas plants in Tennessee. This action along with significant SO_2 and NO_x emission reductions from federal and state measures implemented during this timeframe has significantly improved visibility throughout Tennessee and border states. These actions have led to the situation that exists today where, as demonstrated from the PSAT modeling, stationary sources outside of Tennessee have a much higher impact on Class I areas in Tennessee than sources in the state. The TDEC-APC selected facilities for a reasonable progress/four-factor analysis if the facility's PSAT contribution was ≥1.00% for sulfate or nitrate. This threshold identified 7 out-of-state facilities in 5 states and 2 Tennessee facilities for reasonable progress/four-factor analysis. Given that this is a "regional" program, the TDEC-APC determined that selection of a total of 9 facilities impacting Tennessee Class I areas is reasonable and that it is important to engage with the 5 states where facilities with some of the highest impacts on Class I areas in Tennessee are located.

As stated in Section 7.6.2 of the SIP, Eastman Chemical Company impacts five Class I areas (two inside Tennessee and three outside Tennessee). TVA Cumberland impacts four Class I areas (all four outside Tennessee). Eastman Chemical Company and TVA Cumberland's projected 2028 SO_2 emissions are 6,420 TPY and 8,427 TPY, respectively. The TDEC-APC believes that by selecting these two facilities for reasonable progress analysis this captures a meaningful portion of the Tennessee's total contribution to visibility impairment to Class I areas. TDEC-APC is not aware of how the commenter determined that these two facilities account for 8.07% of Tennessee's projected 2028 contribution to impairment in Great Smoky Mountains National Park. As can be seen when comparing the projected 2028 SO_2 emissions from these sources to the total projected 2028 SO_2 emissions from all of Tennessee shown in Table 7-9, these two sources represent 62%of the total projected SO_2 emissions from the state. While TDEC-APC did not use this metric when selecting sources for four-factor analysis and there is no requirement in the RHR to select sources that equal or exceed a certain percentage of the state's emissions, the fact that these two sources represent the majority of the SO_2 emissions from the entire state provide further evidence that TDEC-APC's source selection process captures a meaningful portion of Tennessee's total contribution to visibility impairment to Class I areas.

Comment:

The TDEC-APC received comments regarding additional facilities for reasonable progress analysis. The commenters identified additional facilities that they thought should undergo a reasonable progress analysis in the SIP. These sources include TVA Kingston, TVA Gallatin, AGC Industries, O-N Minerals, Trelleborg rubber manufacturer, Signal Mountain Cement Company, Packaging Corporation of America, and Tennessee Gas Pipeline Stations 860 and 87. Additionally, commenters thought that TVA Cumberland and Eastman Chemical Company should undergo a reasonable progress analysis for NO_X in addition to SO_2.

Response:

The TDEC-APC's source selection analysis, included in Sections 7.5 and 7.6 of the SIP, is consistent with both the RHR and EPA guidance. In 40 CFR §51.308(f)(2)(i), the RHR states that "the State should consider evaluating major and minor stationary sources or groups of sources, mobile sources, and area sources." EPA's guidance states that

> *A key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period. Instead, a state may reasonably select a set of sources for an analysis of control measures*.

Based on TDEC-APC's analysis, nine facilities were identified to evaluate additional controls for reasonable progress for Tennessee's Class I areas and Class I areas outside Tennessee that are impacted by Tennessee facilities. For both Class I areas located in Tennessee, the TDEC-APC believes the 1.00% threshold captures a reasonable set of sources of emissions to assess for determining what measures are necessary to make reasonable progress. Two of the nine facilities are located in Tennessee and the other seven are in nearby states. The two Tennessee facilities are TVA Cumberland and Eastman Chemical Company. The TDEC-APC believes that by selecting these two Tennessee facilities for reasonable progress analysis this captures a meaningful portion of the Tennessee's total contribution to visibility impairment to Class I areas.

TVA Cumberland

TVA Cumberland was above the 3.0% AoI threshold so it was chosen for PSAT modeling. Table 7-32 and Table 7-33 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-32, the highest adjusted sulfate PSAT results were 1.56%, 1.38%, 1.26%, and 1.01% for Sipsey Wilderness Area, Shining Rock Wilderness Area, Linville Gorge Wilderness Area, and Breton Wilderness Area, respectively. The sulfate PSAT results were above the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Thus, the TDEC-APC requested that TVA Cumberland perform an SO_2 reasonable progress analysis. (It should be noted that the adjusted sulfate PSAT results were below 1.00% for Tennessee's two Class I areas: 0.61% for Joyce Kilmer-Slickrock Wilderness area and 0.60% for Great Smoky Mountains National Park.) As shown in the Table 7-33, the highest adjusted nitrate PSAT results were 0.18%, 0.17%, and 0.13% for Sipsey Wilderness Area, Mammoth Cave National Park, and Mingo Wilderness Area, respectively. The adjusted nitrate PSAT result for Tennessee's Class I areas, Joyce Kilmer-Slickrock Wilderness Area and Great Smoky Mountains National Part were only 0.05% and 0.04%, respectively, of the total nitrate impact on each Class I area. The nitrate PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed as reasonably anticipated to contribute to visibility impairment[1] at a Class I area. Therefore, the TDEC-APC did not request TVA Cumberland to perform a NOx reasonable progress analysis.

Eastman Chemical Company

Eastman Chemical Company was above the 3.0% AoI threshold so it was chosen for PSAT modeling. Table 7-30 and Table 7-31 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-30, the highest adjusted sulfate PSAT results were 4.26%, 1.37%, 1.31%, 1.29%, and 1.09% for Linville Gorge Wilderness Area, Joyce Kilmer Slick-Rock Wilderness Area, Cohutta Wilderness Area, Great Smoky Mountain National Park, and Shining Rock Wilderness Area, respectively. The sulfate PSAT results were above the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Thus, the TDEC-APC requested that Eastman Chemical Company perform an SO_2 reasonable progress analysis. As

[1] TDEC-APC has used the phrase "significantly contributing to visibility impairment" throughout the regional haze SIP and this response to comments document. This phrase is synonymous with the phrase "reasonably anticipated to contribute to visibility impairment" in 40 CFR 51.308(f)(2)(ii).

shown in the Table 7-31, the highest adjusted nitrate PSAT results were 0.11%, 0.10%, and 0.05% for Linville Gorge Wilderness Area, Cohutta Wilderness Area, and Great Smoky Mountains National Park, respectively. The adjusted nitrate PSAT result for Tennessee's other Class I area, Joyce Kilmer-Slickrock Wilderness Area, was only 0.02% of the total nitrate impact on that Class I area. The nitrate PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC did not request Eastman Chemical Company to perform a NOx reasonable progress analysis.

TVA Kingston

TVA Kingston was above the 3.0% AoI threshold so it was chosen for PSAT modeling. As discussed in Section 7.6.4 of the SIP, and Appendix G-1, the projected 2028 emissions for TVA Kingston were revised based on TVA's Strategic Power Supply Plan projections. Table 7-34 and Table 7-35 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-34, the highest adjusted sulfate PSAT results were 0.41%, 0.40%, and 0.35% for Joyce Kilmer Slick-Rock Wilderness Area, Great Smoky Mountains National Park, and Cohutta Wilderness Area, respectively. As shown in the Table 7-35, the highest adjusted nitrate PSAT results were 0.033%, 0.027%, and 0.020% for Joyce Kilmer Slick-Rock Wilderness Area, Great Smoky Mountains National Park, and Cohutta Wilderness Area, respectively. These PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC did not conduct a reasonable progress analysis for TVA Kingston. The TDEC-APC has consulted with EPA Region 4 and has concluded that a reasonable progress analysis is not warranted given TDEC-APC's conclusion that the source's impacts fall below the State's source selection threshold under the State's selection methodology. The rationale for not requiring enforceable SIP limits is described in detail in Appendix G-1h. Although TDEC-APC did not use it as a factor in determining whether or not to require a reasonable progress analysis, TVA is planning on retiring all of the units at TVA Kingston by 2033.

TVA Gallatin, O-N Minerals, AGC Industries, Packaging Corporation of America (PCA), Trelleborg, Signal Mountain Cement Company, and Tennessee Gas Pipeline Stations 860 and 87

These eight facilities were below the 3.0% AoI threshold that was used as a cutoff to determine which facilities would be chosen for PSAT modeling. None of these facilities were even above 2.0%. From the table below, the highest AoI sulfate + nitrate facility contributions are as follows: TVA Gallatin at 0.695%, O-N Minerals at 0.377%, and AGC Industries (now Cardinal FG Company) at 1.98%, PCA at 1.05%, Signal Mountain Cement at 0.313%, Tennessee Gas Pipeline Station 860 at 0.103%, Tennessee Gas Pipeline Station 87 at 0.015%, and Trelleborg at 0.00088%. Therefore, the TDEC-APC does not think it is necessary to conduct a reasonable progress analysis for any of these eight facilities. (It should be noted that, as explained in section 7.6.3 of the SIP, comparison of AoI and PSAT contributions found that AoI results are generally three times higher than PSAT results when the facility is less than 100 km from the Class 1 area. AGC Industries is 94.7 km from the Lynnville Gorge Wilderness area.)

AoI Sulfate + Nitrate Facility Contributions to Visibility Impairment on the 20% Most Impaired days for 3 Tennessee Facilities

	Great Smoky Mountains NP	Joyce Kilmer-Slick Rock Wilderness Area	Sipsey Wilderness Area	Mammoth Cave NP	Cohutta Wilderness Area	Linville Gorge Wilderness Area	Shining Rock Wilderness Area
TVA Gallatin	0.424%	0.339%	**0.695%**	0.596%	0.418%	0.0703%	0.0922%
O-N Minerals	**0.377%**	0.237%	0.00823%	0.00162%	0.0604%	0.0613%	0.0565%
AGC Industries	0.672%	0.504%	0.00373%	0.00644%	0.190%	**1.98%**	0.487%
PCA	0.0299%	0.075%	**1.05%**	0.048%	0.049%	0.016%	0.015%
Signal Mnt. Cement	0.0445%	0.056%	0.038%	0.048%	**0.313%**	0.0023%	0.017%
TN Gas 860	0.0032%	0.0047%	**0.103%**	0.0048%	0.012%	0.00099%	0.0013%
TN Gas 87	0.0063%	0.0091%	**0.015%**	0.051%	0.0029%	0.00069%	0.00089%
Trelleborg	**0.00088%**	0.00081%	0.000019%	0.000013%	0.000097%	0.00013%	0.00054%

Comment:

The TDEC-APC received comments regarding environmental justice. Commenters state that EPA encourages states to consider "equity and environmental justice impacts". TDEC has not conducted any kind of environmental justice screen or considered disproportionate impacts in source selection or in emission control evaluation. Sources that pollute scenic views also negatively affect vulnerable communities in Tennessee, where many people live below the poverty line. TDEC must revisit the plan to include environmental justice considerations.

Response:

The requirements of the RHR are that Tennessee address regional haze in each mandatory Class I Federal area located within Tennessee and in each mandatory Class I Federal area located outside Tennessee that may be affected by emissions from within the State. As required by the RHR, Tennessee's LTS and the RPGs 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.

Although EPA's July 2021 regional haze guidance "encourages" states to consider whether there may be environmental justice impacts when developing the regional haze plan, it does not include specific instructions on how environmental justice should be included when evaluating visibility impacts on Class I areas in regional haze plans. There are no provisions in either section 169A of the Clean Air Act (pertaining to Visibility protection for Federal Class I areas) or in EPA's RHR at 40 CFR 51.308 pertaining to environmental justice.

For the sources in Tennessee that were selected for analysis, Tennessee's regional haze SIP requires that new permit limits be incorporated into the SIP requiring Eastman Chemical Company to meet more stringent requirements representing reasonable progress. Emission limits contained in Tennessee's Regional Haze SIP will provide air quality benefits to the area around Eastman Chemical Company in addition to the visibility benefits at Federal Class I areas. As discussed in the Regional Haze Plan in Section 7.2.4, emissions of SO_2 and NO_X in Tennessee are expected to continue to decrease through 2028, ensuring improved air quality in Class I areas as well as the rest of the state.

Comment:

The TDEC-APC received comments regarding TVA facility retirements. Commenters state that the EPA memo states that "source shutdowns relied on to forgo a four-factor analysis or to shorten the remaining useful life of a source must be included in the SIP." They state that Tennessee is relying on TVA Kingston's proposed retirements of all units by 2033. TDEC must make those retirement dates enforceable in the SIP. They state that if the State is counting on reductions from the planned retirements of the Kingston or Cumberland coal plants, the plan must contain enforceable retirement dates for those facilities and calculations of any emissions proposed to replace them. Other commenters stated that if TDEC relied on projections that showed reduced emissions or a decline in utilization, that such assumptions should be incorporated into the SIP as enforceable requirements.

Response:

The TDEC-APC required a four-factor analysis of TVA Cumberland. In evaluation of the four-factor analysis, TDEC-APC did not rely on the source shutdowns to shorten the remaining useful life of TVA Cumberland. Instead, TDEC-APC reviewed the question of scrubber life with U.S. EPA. The equipment life identified in the four-factor analysis may be based on either the remaining useful life of the existing scrubbers to which upgrades would be added or the expected life of the scrubber upgrade controls based on prior precedent. As noted on page 19 of Appendix G-1g, the TDEC-APC is relying upon the remaining useful life of the scrubbers as the basis for the 10-year equipment life given that their age is greater than 25 years. TVA is retrofitting an existing scrubber and not installing a new scrubber. As TDEC-APC indicated in the four-factor analysis, the 30-year scrubber life appears to represent the life of a new unit, not a retrofitted unit.

The TDEC-APC did not rely on the source shutdowns to forgo a four-factor analysis for TVA Kingston. TVA Kingston was above the 3.0% AoI threshold so it was chosen for PSAT modeling. As discussed in Section 7.6.4 of the SIP, and Appendix G-1, the projected 2028 emissions for TVA Kingston were revised based on TVA's Strategic Power Supply Plan projections. Table 7-34 and Table 7-35 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-34, the highest adjusted sulfate PSAT results were 0.41%, 0.40%, and 0.35% for Joyce Kilmer Slick-Rock Wilderness Area, Great Smoky Mountains National Park, and Cohutta Wilderness Area, respectively. As shown in the Table 7-35, the highest adjusted nitrate PSAT results were 0.033%, 0.027%, and 0.020% for Joyce Kilmer Slick-Rock Wilderness Area, Great Smoky Mountains National Park, and Cohutta Wilderness Area, respectively. These PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC has concluded that it is not necessary to conduct a reasonable progress analysis for TVA Kingston based on the fact it was not determined to significantly impact a Class I area in this implementation period. The rationale for not requiring enforceable SIP limits is described in detail in Appendix G-1h.

Comment:

The TDEC-APC received comments regarding Eastman Chemical Company boiler retirements. Commenters state that the retirement of boilers 18, 19, and 20 at Eastman Chemical Company should be made enforceable.

Response:

Through the Regional Haze SIP, the TDEC-APC is requiring the permanent shutdown of boilers 18, 19, and 20 at Eastman Chemical Company. Appendix G-2g contains the permit conditions that require the shutdown. The TDEC-APC is proposing to incorporate into the regulatory portion of Tennessee's SIP at 40 CFR 52.5220, table (d), the source-specific permit conditions contained in Appendix G-2g.

Comment:

The TDEC-APC received comments regarding particulate matter. Commenter state that particulate matter is not addressed in the plan.

Response:

As detailed in Section 2 of the SIP, sulfates are the most important contributor to visibility impairment and fine particle mass on the 20% most impaired and 20% clearest visibility days at all the Tennessee Class I areas. Particulate matter from industrial sources comes, in part, from the incomplete combustion of fossil fuels and is categorized as elemental carbon. Elemental Carbon (EC) is shown as light absorbing carbon (LAC) in the figures in Section 2. The primary source of EC emissions include agriculture, prescribed, wildland, and wildfires and incomplete combustion of fossil fuels. EC is a comparatively minor contributor to visibility impairment. Particulate matter may also be categorized as coarse mass, soil, and sea salt. 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. Soil fine particles are minor contributors to visibility impairment at most southeastern sites on most days. Sea salt (NaCl) is observed at the coastal sites. Sea salt levels do not contribute significantly to visibility on the 20% most impaired visibility days at either Great Smoky Mountain National Park or the Joyce Kilmer-Slickrock Wilderness Area.

Comment:

The TDEC-APC received comments regarding the MANE-VU Ask. Commenters state that they believe Tennessee must address the MANE-VU Inter-RPO Ask since MANE-VU identified Tennessee emissions as significantly contributing to visibility impairment at Class I areas in the MANE-VU region.

Response:

In a letter dated January 13, 2021, TDEC-APC responded to the MANE-VU Ask letter dated August 25, 2017. The MANE-VU Ask identified emissions from Tennessee as reasonably anticipated to contribute to visibility impairment in MANE-VU Class I areas. This was based on MANE-VU's data that showed Tennessee contributed greater than or equal to 2% of the visibility impairment to a Class I area and had an average mass impact of over 1% (0.01 microgram per cubic meter). In 40 CFR §51.308(f)(2)(ii). the RHR states that the "State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress." Additionally, in 40 CFR §51.308(f)(2)(ii)(C), the RHR states that "(in) any situation in which a State cannot agree with another State on the emission reduction measures necessary to make reasonable progress in a mandatory Class I Federal area, the State must describe the actions taken to resolve the disagreement." As stated in Section 7 of the SIP, VISTAS used CAMx and PSAT to evaluate statewide contributions of emissions to visibility impairment in Class I areas. In the January 13, 2021, letter, TDEC-APC provided the PSAT results in Table 10-5 of the SIP, which show that Tennessee's total sulfate and nitrate contribution to visibility impairment in 2028 is at or below 0.24% for the 20% most impaired days and at or below 0.03% for the 20% clearest days for all of the MANE-VU Class I areas. Thus, the TDEC-APC believes that Tennessee emissions are not reasonably anticipated to contribute to visibility impairment in any MANE-VU Class I area since the total sulfate and nitrate contributions are significantly below the 2% contribution threshold that the MANE-VU states used to identify upwind states as contributing to visibility impairment in MANE-VU Class I areas. TDEC-APC concluded its letter by stating that it believes that MANE-VU's screening methodologies are less accurate in several areas and overstate upwind contributions to downwind state Class I areas, and TDEC-APC will not be taking the measures outlined in the MANE-VU Ask. The TDEC-APC does not agree with MANE-VU's conclusion that emissions from Tennessee are reasonably anticipated to contribute to visibility impairment in the Class I areas in MANE-VU.

Although there is a disagreement between the TDEC-APC and MANE-VU regarding whether Tennessee’s emissions are reasonably anticipated to contribute to visibility in Class I areas in MAIN-VU, the coal-fired EGU’s in Tennessee are already satisfying two of the strategies (#1 and #4) in MANE-VU’s August 17, 2017, Ask letter. As stated in Section 7.2.2.1 of the SIP, all of the coal-fired EGU’s in Tennessee have SO_2 and NO_X control devices, and these control devices are required to operate continuously. The coal-fired EGU’s that have switched to natural gas (which includes TVA Allen, TVA John Sevier, and TVA Johnsonville) are not permitted to burn coal. The TDEC-APC notes that there were no Tennessee facilities identified in strategy #2 in MANE-VU’s August 17, 2017, Ask letter. The TDEC-APC participated in MANE-VU's consultation calls and reviewed the technical information supporting MANE-VU's conclusions, and VISTAS invited MANE-VU to the VISTAS’ consultation calls. The TDEC-APC tried to resolve the disagreement with MANE-VU by way of the VISTAS letter dated January 27, 2018, and the TDEC-APC letter dated January 13, 2021. The TDEC-APC has followed the procedures in 40 CFR §51.308(f)(2)(ii)(C) to attempt to resolve the disagreement with MANE-VU.

Comment:

The TDEC-APC received comments regarding interstate consultation. Commenters state that Tennessee is required to address sources that are identified by other states as impairing visibility in their Class 1 areas. Missouri, Georgia, Alabama, and North Carolina requested that TDEC address Eastman Chemical Company and TVA Cumberland. The current SIP does not adequately consider nor require changes or controls to these sources.

Response:

In 40 CFR §51.308(f)(2)(ii), the RHR states that the “State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress.” The TDEC-APC did receive letters from Missouri, Georgia, and North Carolina. As detailed in Section 10.1.2, Missouri requested a reasonable progress analysis for TVA Cumberland, Georgia requested a reasonable progress analysis for Eastman Chemical Company, Alabama requested a reasonable progress analysis for TVA Cumberland, and North Carolina requested a reasonable progress analysis for Eastman Chemical Company and TVA Cumberland. The TDEC-APC required a reasonable progress analysis from Eastman Chemical Company and TVA Cumberland, and both companies submitted the analyses. The TDEC-APC reviewed the reasonable progress analyses and the results of that review are in Section 7.8 and Appendices G-1 and G-2. For Eastman Chemical Company, TDEC-APC reviewed the analyses and concluded that reasonable progress is the permanent shutdown of B-83 Boilers 18, 19, and 20 and the installation of permanent dry sorbent injection (without upgrading the existing ESPs) on Boilers 23 and 24. For TVA Cumberland, TDEC-APC reviewed the analysis and made a formal determination that additional SO_2 reductions are not needed during this implementation period.

Comment:

The TDEC-APC received comments regarding interstate consultation with Pennsylvania and Ohio. The commenters state that there is nothing in the Draft SIP that demonstrates TDEC conducted an independent evaluation of what it received and found from the other states. As the agency responsible for developing and implementing the Act's regional haze requirements in the first instance, TDEC must perform its duties and review and consider the information it receives. Lacking the independent engineering review, TDEC's Draft SIP is incomplete and must be supplemented with the missing analysis before submittal to EPA.

Response:

In 40 CFR §51.308(f)(2)(ii), the RHR states that the "State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated emission management strategies containing the emission reductions necessary to make reasonable progress." The TDEC-APC reviewed the information submitted by Pennsylvania (for Genon NE Mgmt Co/Keystone Station) and Ohio (for General James M. Gavin Power Plant and Duke Energy Wm. Zimmer Station). As stated in Section 10.1, the TDEC-APC agrees with all of the decisions made by other state agencies concerning the emission sources. On December 27, 2021, the TDEC-APC received an email from Ohio EPA, which provided an update on their SIP including the two facilities mentioned above. This information has been added to the Tennessee SIP.

Comment:

The TDEC-APC received comments regarding consultation with the Federal Land Managers (FLMs). The commenters state that TDEC should meaningfully consider and adapt its SIP measures to reflect comments and suggestions from the FLMs.

Response:

The RHR at 40 CFR 51.308(i)(2) requires states to provide FLMs an opportunity for consultation at a point early enough in the stated LTS development so that information provided by the FLM can meaningfully inform the state's decisions on the LTS. Both VISTAS and the state of Tennessee provided multiple opportunities for the FLM to provide information regarding the development of TDEC-APC's LTS. The VISTAS states, including Tennessee, 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. A detailed list of these meetings and calls can be found in Section 10.2 of the SIP.

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 reasonable progress analyses. Each state would consider sources within their state and would identify sources in neighboring states for consideration.

Early in 2021, the TDEC-APC shared the reasonable progress analyses of Eastman Chemical Company and TVA Cumberland with the EPA and FLMs. The EPA and FLMs made comments on the analyses. The TDEC-APC meaningfully considered these comments. The TDEC-APC made adjustments to the cost calculations based on the comments received from the EPA and FLMs. The TDEC-APC sent a draft SIP to the NPS, FS, and FWS on July 2, 2021, to start the mandatory consultation required by 40 CFR Section 51.308(i)(2). On August 24, 2021, the TDEC-APC and NPS had a conference call to discuss the NPS comments on the draft SIP. EPA, FS, and FWS were also on the call. On August 31, 2021, the NPS sent their written comments to the TDEC-APC. On August 31, 2021, the FS sent their written comments to the TDEC-APC. The FWS did not send any written comments to the TDEC-APC. The complete set of NPS and FS comments is included in Appendix H-1. The TDEC-APC meaningfully considered these comments and responded to the FLM comments in Section 10.4 of the SIP.

Comment:

The TDEC-APC received comments regarding reasonable progress. Commenters state that the plan fails to make reasonable progress.

Response:

The TDEC-APC disagrees with the commenters. The TDEC-APC believes that reasonable progress is being made as evidenced by the 2028 RPG's. The regional haze regulation under 40 CFR 51.308(f)(2) requires states to submit an LTS 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 LTS must include the enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress. The LTS is detailed in Section 7. The LTS includes federal control programs, which impact onroad and off road engines, industrial and EGU facilities. The federal programs include CSAPR, MATS, 2010 SO_2 NAAQS, heavy-duty highway rule, Tier 3 motor vehicle emissions and fuel standards, non-road diesel emissions programs, and commercial marine vessels standards. Also, the LTS includes state programs, including the North Carolina Clean Smokestacks Act and the Georgia Multipollutant Control for Electric Utility Steam Generating Units rule. As detailed in Section 7.2.2.1, TVA's coal and natural gas emissions of SO_2 and NO_X in Tennessee have decreased by 94.6% and 90.3%, respectively, between 2008 and 2019, in large part due to the 2011 consent decree. Additionally, the reasonable progress analysis of Eastman Chemical Company will result in implementing additional controls by 2028 that would decrease SO_2 emissions at this facility by 2,608 tons per year, which represents a 41% reduction from the projected 2028 SO_2 emissions used in the 2028 visibility modeling.

The rule at 40 CFR 51.308(f)(3) requires states to establish RPGs in units of dv 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. Table 8-1 provides the RPGs for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area on the 20% most impaired days. The RPGs are well below the Uniform Rate of Progress (URP) value. In fact, the RPGs are 20 years ahead of schedule since the 2028 RPGs are below the 2048 URP value. Table 8-2 shows that projected visibility on the 20% clearest days will not degrade but rather will improve significantly by 2028. Therefore, TDEC-APC believes reasonable progress has been adequately demonstration in the SIP, consistent with the RHR and EPA guidance.

Comment:

The TDEC-APC received comments regarding air pollution in Kingsport, Tennessee. The commenter stated that they are an asthma sufferer and are unable to live in Kingsport due to the air pollution. The commenter stated that there are large SO_2 and NO_X emissions from Eastman Chemical Company's boilers, and the area is designated as nonattainment.

Response:

The RHR requires states to develop programs to assure reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from manmade air pollution. While the Regional Haze program's implementation may result in decreased emissions from sources that also contribute to impacts on human health, the focus of the Regional Haze program is to address visibility in Class I areas. Part of Sullivan County is designated as nonattainment for SO_2. In addition to addressing the Eastman Chemical facility in the SIP under the Regional Haze program, TDEC-APC is working with Eastman Chemical Company to put additional limits in place so that the area can come back into attainment status through the development of an attainment SIP. The TDEC-APC operates several air monitors in Sullivan County to track the current air quality. The TDEC-APC would like to emphasize that the efforts to bring Sullivan County back into attainment for SO_2 are a separate issue from the Regional Haze SIP, which focuses on visibility in Class I Federal areas.

Comment:

The TDEC-APC received comments regarding health impacts and dangers to the climate. The commenter stated that haze basically means combustion and combustion is a threat to the climate. TDEC study focuses on sulfur dioxide and NO_X with minimal consideration of particulate matter, but particulate matter is a serious health hazard and a major pollutant. The study appears to ignore the issue of hazards to the public and dangers to the climate, which are two fundamental consequences of haze. The TDEC study needs to include climate and health impacts before serious recommendations can be made. Particularly we need to have coal plant retirements mandated in the plan.

Response:

The EPA has set National Ambient Air Quality Standards (NAAQS) for six common air pollutants (also known as "criteria air pollutants"). These pollutants are O_3, $PM_{2.5}$, SO_2, NO_2, CO, and Pb. The NAAQS are set at a level to protect human health. The State of Tennessee is in attainment with all of the NAAQS, expect for a part of Sullivan County that is in nonattainment for SO_2. The TDEC acknowledges that excessive ambient levels of SO_2, NO_X and PM are harmful to human health. However, the focus of the Regional Haze Program is on visibility at Class I areas, not human health effects from criteria pollutants. The Regional Haze SIP is not the appropriate mechanism to address the health effects caused by SO_2, NO_X, and PM, although TDEC-APC acknowledges that the implementation of the program may result in emissions reductions of constituents that also impact public health.

The commenter used the phrase “danger to the climate”. The TDEC-APC assumes the commenter was referring to climate change. The Regional Haze Program addresses visibility in Class I federal areas. Neither the RHR or associated EPA guidance require consideration of climate change in development of state plans. Therefore, it is not the appropriate mechanism to address greenhouse gases and climate change.

Comment:

The TDEC-APC received comments regarding interstate consultation from the Environmental Protection Agency (EPA) and others. The EPA stated that once state consultations have concluded with Georgia and Indiana, please document the final outcomes pursuant to 40 CFR 51.308(f)(2)(ii).

Response:

Indiana

On June 22, 2020, in accordance with the requirements of 308(f)(2)(ii), VISTAS sent a letter, on behalf of Tennessee and other states, to Mr. Keith Baugues, Assistant Commissioner of IDEM's Office of Air Quality, requesting: 1) that the Indiana Department of Environmental Management (IDEM) review VISTAS projected 2028 emissions for two facilities (Gibson and Indiana Michigan Power DBA American Electric Power Rockport Generating Station (Rockport)) that significantly impact visibility impairment for the two Class I Areas that are located within Tennessee (as well as Indianapolis Power & Light Petersburg, which significantly impacts Class I Areas located in other VISTAS states) and, if IDEM is aware of any significantly different emission estimate projections, to provide revised estimates, and 2) unless revised 2028 emission estimates are provided to indicate otherwise, that IDEM conduct, or require the sources to conduct, four-factor analyses for these sources or provide the rational for IDEM's determination that four-factor analyses are not warranted. On November 4, 2021, the TDEC-APC sent a letter to IDEM commenting on Indiana's Draft Regional Haze SIP reiterating the request to include four factor analyses for both the Gibson and Rockport power plants or, alternatively, include an "effectively controlled" analysis or anticipated shutdown information for the facilities.

In a letter to VISTAS dated December 22, 2021, IDEM stated that they are not requiring 4-factor analyses from Indiana's EGU's, including Gibson and Rockport. In their letter, IDEM states that "IDEM is intently evaluating other emission sectors for this second implementation period to determine their visibility impacts on Class I areas. IDEM will conduct a review of all its emission sources, with focus on the EGU sector, for its January 31, 2025, progress report; pursuant to 40 CFR 51.308(g). IDEM will evaluate EGUs for the third implementation period of the RH rule, as necessary, to be submitted in 2028." Additionally, IDEM cites the EPA's 2019 Guidance that states a "key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period." IDEM submitted their final Regional Haze SIP to EPA on December 30, 2021.

To support their decision, IDEM included a 33-page document supporting its position that their decision not to conduct four-factor analyses for Indiana's EGU's meets its regional haze obligations to surrounding states with Class I areas. Included in this document are:

- An analysis of the downward trend in NO_x and SO_2 emissions from EGUs due to shutdowns, fuel conversions, pollution control device upgrades, and new add-on controls between 2007 and 2019
- Additional projected emission reductions by 2028 (including the retirement of Gibson Unit 4, the installation of enhanced dry sorbent injection (for SO_2 control) and selective catalytic reduction (for NO_x control) at Rockport Units 1 and 2, and the eventual retirement of Rockport Unit 1)
- Expected retirements of additional EGUs beyond 2028 (including Gibson Units 1, 2, 3, and 5)
- LADCO source apportion modeling results which shows that the visibility impact resulting from NOx and SO2 emissions from the Rockport power plant was 0.8% and of the total light extinction at Great Smoky Mountains National Park[2] and the Gibson power plant was 0.5% (It should be noted that the percent of total light extinction at a Class I area is different from the percent of point source sulfate and nitrate light extension metric used by TDEC-APC, and the rest of the VISTAS states, in its source selection process.)
- A discussion of the federal and state regulations that govern interstate transport of NOx and SO2 emission from EGUs

While IDEM did not conduct the analyses requested by TDEC-APC, the EPA guidance does provide states with the flexibility in determining which facilities to evaluate during each implementation period. Therefore, TDEC-APC defers to IDEM regarding their decision to evaluate EGUs during a later implementation period.

Georgia

On December 16, 2021, the TDEC-APC contacted the Georgia Environmental Protection Division (EPD) regarding TDEC-APC's request to conduct a reasonable progress analysis for Georgia Power Company-Plant Bowen. The Georgia EPD responded by providing the most recent reasonable progress analysis that was conducted for Georgia Power Company-Plant Bowen. The Georgia EPD has yet to propose its Regional Haze SIP revision for the second planning period.

Comment:

The TDEC-APC received comments regarding Federal Land Manager consultation from EPA. The EPA recommends including the referenced spreadsheet listed on pages 251 and 253 of the SIP narrative in the final plan. Also, EPA is aware additional spreadsheets were provided by the National Park Service; EPA recommends including those spreadsheets in the final plan.

[2] Since the Joyce Kilmer-Slickrock Wilderness Area does not have a visibility monitor, LADCO used the Great Smoky Mountains visibility monitor as a surrogate for Joyce Kilmer-Slickrock.

Response:
The TDEC-APC intends to submit the referenced FLM spreadsheets with the final SIP.

Comment:
The TDEC-APC received comments regarding Eastman Chemical Company from EPA. The EPA recommends clarifying the permit terms for Eastman by adding "Combined" and "collectively" as follows: "Combined Sulfur dioxide (SO_2) emissions from Boilers 23 and 24 shall not collectively exceed 1,396 tons during any period of 12 consecutive months."

Response:
The TDEC-APC revised the permit terms for Eastman Chemical Company as suggested by EPA.

Comment:
The TDEC-APC received comments regarding TVA Cumberland from EPA. The EPA recommends clarifying the explanation on page 247 of the SIP narrative and on page 16 of Appendix G-1g for use of a 10-year equipment life in the cost calculations and presenting this rationale consistently throughout the narrative and Appendix G-1. The EPA stated that they will work with the State to address this comment. The EPA recommends clarifying the text on page 19 of Appendix G-1g that the State is not relying on the projected shutdown dates for Units 1 and 2 at TVA-Cumberland for the four-factor analysis. The EPA recommends clarifying whether visibility benefits were considered in the conclusion in lines 4-6 on page 18 of Appendix G-1g. If visibility benefits were considered in the conclusion that additional sulfur dioxide control measures were found not cost effective at TVA-Cumberland, the EPA recommends considering the principles identified in Section 5.1 of the EPA's July 8, 2021, memorandum (pages 12 and 13).

Response:
The TDEC-APC clarified the explanation for the use of a 10-year equipment life in the four-factor analysis for Cumberland Fossil Plant (Appendix G1). The four-factor analysis was revised to clarify that TDEC-APC is not relying on the projected shutdown dates for Units 1 and 2 at TVA-Cumberland to shorten the remaining useful life of the scrubbers. The TDEC-APC also revised the four-factor analysis to clarify that the State did not consider the visibility benefits information to determine whether additional controls would be required during this Regional Haze SIP review period.

Comment:
The TDEC-APC received comments regarding TVA Cumberland from the National Park Service (NPS). The NPS stated that they appreciate that TDEC-APC has made several corrections to cost

analyses for the TVA Cumberland facility, demonstrating a commitment to accurate cost effectiveness considerations. The TDEC-APC revised cost analysis for TVA Cumberland in make the costs associated with control even more cost effective. In their scrubber upgrade analysis, TDEC-APC assumed a 10-year equipment life, based on pending retirement of the Cumberland units. These retirements should be federally enforceable if relied on to constrain the equipment life used in the cost analysis.

<u>Response:</u>
The TDEC-APC did not use the proposed retirement to constrain the equipment life in the cost analysis. The proposed retirement date and the remaining useful life of the scrubbers are not the same issue. The remaining useful life of the scrubbers is based on the installation date and the useful life specified in EPA's *Air Pollution Control Cost Manual.* The proposed shutdown of Cumberland would not shorten the remaining useful life of the control devices. Because the remaining useful life of the scrubber is not based on the proposed retirement date of the facility[3], an enforceable shutdown date is not required. However, it is reasonable to consider the retirement date when addressing NPS's subsequent comment (looking beyond the 30-year useful life of the scrubber), and Tennessee does not believe that a federally enforceable retirement date is appropriate in that case.

TVA's *Environmental Impact Statement for Cumberland Fossil Plant Retirement* (86 FR 25933) states that the first Cumberland boiler may retire as early as 2026, but TVA must take specific actions to ensure the reliability of the power grid. These actions include the construction of approximately 1,450 MW of replacement generation prior to retirement of the first unit and evaluation of the type and amount of other replacement generation, if any, that will be needed to make up for the remaining lost capacity. The EIS states that TVA is also required to elicit and prioritize the values and concerns of stakeholders; formulate, evaluate, and compare alternatives; provide opportunities for public review and comment; and ensure that TVA's evaluation of potential retirement and replacement energy generation reflects a full range of stakeholder input. The EIS demonstrates a commitment to the retirement of Cumberland Fossil Plant, but the specific issues identified in the EIS introduce additional uncertainty into the retirement date[4].

<u>Comment:</u>
The TDEC-APC received comments regarding TVA Cumberland from NPS. Also as noted in TDEC-APC's response, the TVA Cumberland scrubbers were installed in 1995 and are 25+ years old. As such, it may be appropriate to take the age of the existing scrubbers into account when

[3] The scrubbers at Cumberland began operation in 1995, and the manual specifies a 30-year equipment life for scrubbers.

[4] In contrast, Eastman Chemical Company was able to provide a definite retirement date for three coal-fired boilers (B-83 Boilers 18, 19, and 20), and a federally enforceable retirement date was included in the proposed SIP.

making this determination. When doing so, TDEC-APC should consider numerous examples of existing scrubbers operating well beyond the 30-year equipment life assumed for new scrubbers. Additionally, this points to the potential need to evaluate replacement of the aging scrubber system.

Response:
The TDEC-APC agrees that the useful life established in EPA's cost manual may not correspond with actual operating experience but *extension* of the useful life beyond 30 years is not appropriate at this juncture, given the possible retirement of the facility.

Comment:
The TDEC-APC received comments regarding TVA Cumberland from NPS. NPS states that even with the 10-year equipment life assumption, the upgrades appear to be very cost-effective and should be implemented in this planning period.

Response:
TVA's four-factor analysis noted that sources would not be expected to begin implementing controls until after a SIP has been approved by EPA. TVA also noted that additional time would be required for design, permitting, procurement, installation, and startup of the new controls. Any implementation schedule would need to account for a unit's planned outage to accommodate regional electricity demands and be coordinated with the maintenance shutdowns of other regionally affected utilities. Given these constraints, implementation of upgrades to the Cumberland scrubbers would provide little useful benefit prior to the end of the control device's useful life.

Comment:
The TDEC-APC received comments regarding Eastman Chemical Company from NPS. NPS states that the revised TDEC-APC cost estimates for Tennessee Eastman are within the cost thresholds being considered by other states in this round of regional haze planning. For example, Texas is using $5,000/ton, New Mexico $7,000/ton, and Colorado and Oregon $10,000/ton. NPS estimates, developed using CCM methods, are significantly lower:

- NPS cost estimates for Tennessee Eastman (using an 3.25% interest rate and 20-year equipment life)
    - Install DSI/FF for Boilers 21 & 22: $5,955/ton
    - Upgrade ESP to Fabric Filter for Boilers 23 & 24: $ 4,506/ton incremental cost of FF alone; $2,510/ton cost of new DSI + FF System
    - Upgrade ESP to Fabric Filter for Boiler 30: $3,453/ton

The suggested control measures would result in substantial SO_2 reductions at this facility—approximately 3,524 TPY additional reductions based on NPS estimates. Given Tennessee Eastman's visibility impact in NPS Class I areas, we urge TDEC-APC to implement these options in this round of regional haze planning.

Response:

As TDEC-APC noted during the interagency consultation period, the TDEC-APC compared the costs identified in each four-factor analysis to average and maximum costs (adjusted for inflation) compiled by VISTAS states for a range of control technologies. When the TDEC-APC compared the control options for Eastman Chemical and Cumberland Fossil Plant with cost information for similar source categories, the cost effectiveness did not justify the implementation of these control technologies during the current planning period. The TDEC-APC also noted that substantial reductions in SO_2 and NO_X emissions occurred in Tennessee and other VISTAS states between 2008 and 2020. Those reductions were not part of the four factors that were considered for each control option, but the TDEC-APC continues to believe that the decrease in emissions provides additional weight of evidence for the use of a lower cost threshold than recommended by NPS.

VISTAS States, Change in SO_2 and NO_X Emissions, 2008 to 2020						
	SO_2 Emissions (tons)		**NO_X Emissions (tons)**		**% Change**	
State	**2008**	**2020**	**2008**	**2020**	**SO_2 Emissions**	**NO_X Emissions**
AL	357,547	3,278	112,614	13,753	-99.1%	-87.8%
FL	263,952	15,259	153,466	29,632	-94.2%	-80.7%
GA	514,539	6,940	105,894	13,328	-98.7%	-87.4%
KY	344,356	37,977	157,847	28,605	-89.0%	-81.9%
MS	65,236	2,629	41,918	13,237	-96.0%	-68.4%
NC	227,030	9,823	54,652	21,502	-95.7%	-60.7%
SC	157,618	4,962	42,916	8,056	-96.9%	-81.2%
TN	208,069	9,349	85,543	6,849	-95.5%	-92.0%
VA	125,985	1,507	43,017	7,068	-98.8%	-83.6%
WV	301,574	31,787	97,331	28,474	-89.5%	-70.7%

In general, the TDEC-APC cannot assess the cost thresholds that NPS identified for Texas, New Mexico, Colorado, and Oregon because we do not know why those states would have identified specific thresholds. The TDEC-APC reviewed the Acid Rain Program data for these states and found that three of the four states had lower 2020 SO_2 emissions than Tennessee (Colorado's emissions were roughly equivalent) but higher NO_X emissions. However, the overall VISTAS SO_2 reductions were much higher (i. e., the VISTAS states started with much higher emissions), and we believe that the comparison supports our conclusion above, that a lower cost threshold is reasonable for Tennessee.

States Identified by NPS, 2008 to 2020 Change in SO_2 and NO_X Emissions						
	SO_2 Emissions (tons)		NO_X Emissions (tons)		% Change	
State	2008	2020	2008	2020	SO_2 Emissions	NO_X Emissions
CO	56,721	9,082	62,312	16,736	-84.0%	-73.1%
NM	22,241	3,142	69,094	12,624	-85.9%	-81.7%
OR	11,376	2,632	9,638	2,535	-76.9%	-73.7%
TX	484,260	130,309	158,033	81,300	-73.1%	-48.6%

Comment:

The TDEC-APC received comments regarding 2028 emissions. The commenter requested that the TDEC-APC explain its decision to base source selection on projected 2028 emissions instead of actual emissions and must compare how the suite of selected sources compares with a selection based on historical emissions. Commenters state that the SIP lacks analysis for 2028 emissions inventory projections and future source development.

Response:

TDEC-APC's decision to base source selection on projected 2028 emissions is consistent with EPA guidance. EPA's August 2019 regional haze guidance, on page 17, indicates that states may use estimated 2028 emissions to estimate visibility impacts when selecting sources, rather than recent year emissions. The TDEC-APC did compare the 2028 projected emissions to historical emissions in Section 7.6.5 of the SIP and addressed significant differences. In the periodic progress report due on January 31, 2025, the TDEC-APC will be required to assess emissions trends and any significant changes in anthropogenic emissions within or outside Tennessee and to reassess the 2028 projected emissions compared to historical emissions. If there are any significant emissions changes, such as anticipated emissions reductions that do not occur or unanticipated emissions increases, the TDEC-APC is required to assess whether these changes impede progress on visibility improvement, determine whether the SIP is adequate, and revise the SIP if necessary.

Regarding analysis of emissions inventory projections and future source development, the source selection and analysis were based on 2028 emissions; therefore, any future source development and subsequent emissions increases or decreases are already taken into account in the modeling and source selection process. Emissions for 2028 were developed considering growth and known or estimated emissions changes due to existing regulations, as described in Appendix B-2a. Section

7.2.4 of the Regional Haze Plan shows the change in emissions by source category between the baseline year of 2011 and projected 2028 emissions.

Comment:

The TDEC-APC received comments regarding emissions data. The commenters request that the TDEC-APC provide unit-level NO_X, SO_2, and PM emissions of all point sources for the last five years.

Response:

Regarding unit-level point source emissions for the last five years, the RHR does not require that the SIP include five years of unit-level point source data. The TDEC-APC 2011 and 2028 modeling runs, however, do include unit-level point source data. A summary of the point source data can be found in Appendix B.

Comment:

The TDEC-APC received comments regarding the fractional bias metric. Commenters state that any facilities the TDEC-APC eliminated from consideration based on the AOI vs. PSAT fractional bias metric (discussed in Section 7.6.3 of the Regional Haze Plan) should be re-examined.

Response:

The fractional bias metric normally compares predicted values with observed values, the AoI calculations and PSAT modeled values are sensitivities for which observations are not available. PSAT is considered the most accurate tool available for evaluating source impacts at receptors. Therefore, PSAT modeled values are treated as the "observed" values and the AoI calculations are treated as the "predicted" values. The fractional bias metric allows for a comparison between PSAT and AoI and shows how well the AoI results match the PSAT modeled values. As detailed in Section 7.6.3 of the SIP, the data from the fractional bias metric calculation support the statement that for sources within 100 km of a Class I area, the AoI calculation will be at least three times higher than the PSAT modeled value. Therefore, these data support eliminating McGhee Tyson Airport from consideration. As discussed in Section 7.6.1, there were also several other reasons McGhee Tyson Airport was eliminated from consideration.

Comment:

The TDEC-APC received comments regarding EPA regional haze guidance memoranda indicating that states should not follow the August 2019 guidance, and that the Department should carefully review and consider the July 2021 guidance and adjust the SIP accordingly.

Response:
There is no language in EPA's July 2021 guidance that suggests states should not follow the August 2019 guidance. The TDEC-APC has reviewed and considered all final EPA regional haze guidance, including the August 2019 guidance and July 2021 guidance, in developing the final SIP. The TDEC-APC has made efforts, including considerable consultation with EPA, to ensure that the SIP meets the requirements of the RHR.

Comment:
The TDEC-APC received comments regarding modeling. The commenters state that the VISTAS modeling inaccurately reflects sulfate concentrations in the Southeast U.S. Commenters state that the modeling uses EGU emissions profiles from 2011 to project the EGU emissions in 2028, inaccurately assuming that EGUs will operate in 2028 as they did in 2011.

Response:
Regarding sulfate concentrations in the VISTAS modeling, as discussed in Section 6.5 of the SIP, 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 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 underprediction of sulfates, and will not lead to an under-estimation of source contributions.

Regarding the EGU emission profiles, as discussed in Appendix B-2b, the VISTAS approach of maintaining a temporal pattern in 2028 that is consistent with the base year (2011) prevents fabricated emissions increases or decreases between the two years simply as a result of the temporal profile. This is the same approach that EPA uses to project 2028 EGU emissions. In addition, the TDEC-APC reviewed and updated EGU 2028 emissions using the best available information on expected future operations. The TDEC-APC explains large differences between recent actual emissions and projected 2028 emissions in Section 7.6.5 of the SIP.

Comment:
The TDEC-APC received comments regarding Eastman's cost calculations. The commenters state that Eastman indicates on pdf page 48 of Appendix G-2f, that owner's costs were possibly included in the indirect costs for all of the controls reviewed. This is a disallowed cost under the Control Cost Manual methodology, which states "owner's costs and AFUDC costs are capital cost items

that are not included in the EPA Control Cost Manual methodology, and thus are not included in the total capital investment (TCI) estimates in this section." Specific items in the indirect costs that would fall under the category of costs Eastman lists for owner's costs could not be identified. However, TDEC should require that Eastman remove any imbedded costs that are related to owner's costs.

<u>Response:</u>

Section 1, Chapter 2 of EPA's *Air Pollution Control Cost Manual* (Cost Estimation: Concepts and Methodology, November 2017) identifies indirect installation costs as follows:

> Indirect installation costs include such costs as engineering costs; construction and field expenses (i.e., costs for construction supervisory personnel, office personnel, rental of temporary offices, etc.); contractor fees (for construction and engineering firms involved in the project); start-up and performance test costs (to get the control system running and to verify that it meets performance guarantees); and contingencies.

Eastman's source-specific cost estimate was based on a study performed by Black and Veatch, which used information obtained from vendor quotes, the consultant's in-house database, publicly available cost data, and technical papers to develop the indirect cost estimate. Eastman's four-factor analysis identifies the following indirect capital costs: construction indirects, engineering, construction coordination, Eastman labor and travel, contingency, and escalation. The enumerated costs identified in Eastman's four-factor analysis are consistent with the indirect installation costs identified in the Manual.

The commenter correctly notes that the Black and Veatch study that underlies Eastman's costs includes a description of various "typical" owner's costs that might be included in the indirect costs. Section 5, Chapter 1 of EPA's *Air Pollution Control Cost Manual* (Wet and Dry Scrubbers for Acid Gas Control, April 2021), which states that owner's costs are inconsistent with the overnight cost method that is a key basis for the *Control Cost Manual* methodology and are not included in the TCI estimates in the referenced section or in other chapters of the Manual. In its response to comments (recommendation that EPA allow companies to include AFUDC and owner's costs when estimating TCI, especially for projects requiring significant capital and construction time), EPA addressed owner's costs as follows:

> For *<u>owner's costs, those costs are often already part of the indirect installation costs</u>* that are to be calculated in the Control Cost Manual cost methodology. For example, start up and permitting costs, which are often considered as costs incurred by the owner in a typical EPC project that are not turnkey in nature, are items included in the indirect installation costs. Land is often included in owner's costs, and that is a separate item within the estimation of capital cost as defined in the Control Cost Manual's methodology. Thus, the inclusion of owner's costs in a

> capital cost estimate may double-count costs already accounted for in the Manual's cost methodology. *Any inclusion of owner's costs in a cost estimate that is to follow this methodology must be carefully defined to avoid double-counting*.

EPA's response indicates that the *Air Pollution Control Cost Manual* does not disallow the use of owner's costs *per se* but requires such costs to be sufficiently defined so that costs are not double counted.

Comment:

The TDEC-APC received comments regarding Eastman's cost data. The commenters state that TDEC must demand better cost data documentation. TDEC has a legal obligation to submit a SIP that complies with the Clean Air Act and the Regional Haze Rule, which require the state to support any control determination with robust technical analysis, and importantly, the underlying data necessary to conduct that analysis. With the exception of cost figures generated by EPA cost algorithms, TDEC has accepted all capital and operating cost figures submitted by facilities. Eastman indicates that its costs are based on "vendor/engineering study estimate." TDEC must review any documents associated with those estimates, including any vendor quotes and/or engineering estimates.

Response:

The TDEC-APC has reviewed and considered all data submitted relative to costs of compliance consistent with the RHR. In 40 CFR 51.308(f)(2)(i), the RHR states that,

> "The State must evaluate and determine the emission reduction measures that are necessary to make reasonable progress by considering the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected anthropogenic source of visibility impairment."

The RHR does not mandate the level of details that must be provided for the cost calculations. The EPA's 2019 Regional Haze Guidance recommends that EPA's Air Pollution Control Cost Manual be used for determining costs. The EPA's Guidance does allow for alternative approaches to cost calculations. The TDEC-APC believes that the Eastman cost calculations are more accurate than the EPA's Air Pollution Control Cost Manual since they are based on an engineering study that is site specific to Eastman. During the consultation period, the TDEC-APC received comments from the EPA and FLM's on Eastman's cost calculations and made revisions to the cost calculations.

Comment:

The TDEC-APC received comments regarding Eastman's draft permit. The commenters state that TDEC's draft SIP does not contain provisions to ensure emissions limitations are permanent and enforceable and that its permits complement the Act's reasonable progress requirements. First, its Draft SIP explains that its RPGs are based on modeling results, which does meet the RHR requirement that the RPGs are based on enforceable SIP measures. Second, TDEC does not propose including final permit conditions in the SIP; rather, it proposes relying on provisions in a draft Title V permit for Eastman Chemical Company which does not fulfill the legal requirements. The permit must contain short-term 30-day emissions limitations. Third, the reasonable progress requirements apply to all sources, thus TDEC must not rely on existing permits to allow sources to avoid the Four-Factor Analysis because there is no off-ramp for sources that hold permits. Fourth, TDEC's Draft SIP lacks the required "enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress" and would allow the companies to modify operations, increase emissions that impact Class I areas for many years without first meeting reasonable progress emission limitations and other necessary requirements.

Response:

TDEC-APC has consulted with EPA Region 4 to determine which emissions limits must be made permanent and enforceable as part of the Regional Haze SIP. As a result, the Eastman Chemical Company permit has been included. The SIP permit will be finalized prior to submittal of the SIP to EPA. This permit is not a Title V permit and will not expire. The limits in the SIP permit cannot be changed unless a SIP revision is submitted. The RHR does not specify how an emissions limit must be configured for reasonable progress, but the permit establishes a 12-month rolling total emission limit for Boilers 23 and 24, for which (after the first year of operation) compliance will be demonstrated monthly based on the monitoring requirements specified in the permit.

Comment:

The TDEC-APC received comments regarding Eastman's Boiler 31. The commenters state that TDEC must include a Four-Factor Analysis for Boiler 31. Eastman indicated Boiler 31 has an efficiency of greater than 92% but failed to provide documentation to support its claim.

Response:

In 40 CFR 51.308(f)(2)(i), the RHR states that "the State should consider evaluating major and minor stationary sources or groups of sources, mobile sources, and area sources." EPA's August 20, 2019, guidance provides states flexibility in selecting sources for four-factor analysis: "a state may reasonably select a set of sources for an analysis of control measures". This flexibility applies not only when selecting which facilities to analyze but also which emissions sources within chosen facilities to analyze. The Eastman Chemical Company facility contains dozens of sulfur dioxide emitting sources. As indicated in TDEC-APC's May 15, 2020, letter to Eastman Chemical

Company, TDEC directed Eastman to conduct four-factor analyses on the higher sulfur dioxide emitting sources at the facility, B-83 Boilers 21 through 24 and B-325 Boiler 30. On August 13, 2020, Eastman Chemical Company not only submitted four-factor analysis for all five of these emissions sources, but also informed TDEC that Eastman plans to cease operation of Boilers 18, 19, and 20, before the end of 2028. The TDEC-APC reviewed the 2019 and 2020 Title V semiannual reports for Boiler 31, which report 30-day rolling average emissions rates (lb/MMBtu) and 30-day rolling average control efficiencies (% removal). These reports indicate that the SDA/FF typically achieves 30-day average control efficiencies of 93-95% and SO_2 emission rates of 0.06-0.08 lb/MMBtu[5]. Boiler 31 is the best controlled and lowest sulfur dioxide emitting coal-fired boiler at the facility. Therefore, it is reasonable for TDEC-APC not to require a four-factor analysis for this emission unit, consistent with the RHR and EPA guidance.

Comment:

The TDEC-APC received comments regarding Eastman's Boiler 30. The commenters state that the TDEC must correct the following flaws in the Boiler 30 four-factor analysis: Eliminate the charge for escalation of $1,797,553 because it is not allowed under the Control Cost Manual. Adjust the excessive and unrealistic contingency costs, consistent with the Control Cost Manual. Require that Eastman explain and document the "Construction Indirects" cost of $3,595,990, which is not defined, not part of the Control Cost Manual, and "suspicious in that it is exactly the same number as the total labor cost, which itself is the total of 7 separate items." Require that Eastman document the current SDA efficiency of 70%, and rather than accepting Eastman's assertion that adding a baghouse will increase the SDA efficiency to 92%, must require that Eastman assume 95% control, unless documentation is provided to the contrary. Require that Eastman use an equipment life of 30 years, along with TDEC's correction to the Eastman interest rate (3.25% instead of 8.5%).

Response:

Escalation: As the TDEC-APC noted in our FLM consultation, the Cost Control Manual is a guidance document that cannot prescribe or disallow a specific approach. The TDEC-APC believes that Eastman's approach is acceptable given ongoing concerns related to raw material price increases. For example, the Bureau of Labor Statistics September 10, 2021, news release (available online at https://www.bls.gov/news.release/pdf/ppi.pdf) states:

> *The Bureau of Labor Statistics' "Producer Price Index for final demand" less foods, energy, and trade services moved up 0.3 percent in August after increasing 0.9 percent in July. For the 12 months ended in August, the index for final demand*

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[5] These ranges are observational in nature, and the TDEC-APC did not calculate average values or perform other statistical analyses.

less foods, energy, and trade services rose 6.3 percent, the largest advance since 12-month data were first calculated in August 2014.

Thus, the TDEC-APC declined to remove the escalation from the cost estimate.

Construction Indirects: For a study-level estimate such as the one used to develop Eastman's costs, there is nothing unusual or suspicious about estimating a cost category from another one. In this case, indirect costs (overhead, labor, utilities, and other items not directly tied to a specific part of the construction project) were estimated from the labor associated with the direct capital cost. The TDEC-APC corrected an error in this updated four factor analysis because Eastman made an error in adding up the labor costs in the original submittal. The correction improved the cost effectiveness by about $10/ton.

Control Efficiency: Eastman's Title V semiannual reports include an NSPS D report for Boiler 30 and an NSPS Db report for Boiler 31. Boiler 30 typically achieves an SO_2 emission rate of 0.3 to 0.4 lb/MMBtu (30-day rolling average). The typical uncontrolled SO_2 emission rate would be in the range of 1.9 lb/MMBtu (estimated from Eastman's reported emission rate for B-83), so the control efficiency of the SDA/ESP would be somewhat higher (79-85%) than reported by Eastman. Thus, Eastman's 70% efficiency may, by starting at a lower baseline, overestimate the amount of available reduction and underestimate the total cost per ton. TDEC-APC has already concluded that for the purposes of determining reasonable progress for the second regional haze implementation period, that upgrading the control device for Boiler 30 is not cost efficient. Therefore, increasing the existing control efficiency from the assumed 70% to a higher level would even be less cost efficient. See TDEC-APC's response to comments pertaining to Boiler 31 regarding the estimated control efficiency for a spray dryer absorber.

Interest Rate: The 2017 revision to the *EPA Air Pollution Control Cost* Manual distinguishes between the nominal interest rate, (the actual borrowing cost faced by a private firm) and the real interest rate (the time value of money, which includes the effect of inflation). For private costs, the manual recommends the use of firm-specific nominal interest rates or, if firm-specific rates are not available, the bank prime rate (currently 3.25%). In response to EPA and FLM comments, the TDEC-APC recalculated the cost effectiveness using a nominal interest rate of 3.25% and included both costs in the draft SIP[6].

Remaining Useful Life: For fabric filters, EPA's *Air Pollution Control Cost Manual* states that the system lifetime varies from 5 to 40 years, with 20 years being typical. The TDEC-APC

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[6] As we noted in the four-factor analysis, "Eastman staff noted in follow-up discussions that use of the nominal interest rate is established per EPA's guidance but is not required by law or regulation. The Division takes no position on whether a real, as opposed to nominal, interest rate would be appropriate in this case, since our calculations indicate that controls would not be justified at the lower rate."

believes that the 20-year equipment life was reasonable. Nonetheless, in consideration of the comments on the robust nature of fabric filters, the TDEC-APC recalculated the cost effectiveness to determine how a 30-year life might affect the cost.

Contingencies: Regarding the contingencies included with Eastman's costs, Eastman's four factor analyses noted several factors, including complexities associated with retrofitting, that justify a higher contingency. These are primarily associated with the B-83 powerhouse, so it may be reasonable to consider a 10% contingency for Boiler 30. The TDEC-APC recalculated the cost effectiveness to determine how a 10% contingency might affect the cost.

Upgrade ESP to Fabric Filter for B-325 Boiler 30: Adjustment of Costs Based on NPS and NPCA Recommendations (3.25% Nominal Interest Rate)[7]	
Adjustment	**Cost Effectiveness ($/ton)**
Baseline	$6,083
Increase baghouse equipment life to 20 years (NPS recommendation)	$5,457
Increase baghouse equipment life to 30 years (NPCA recommendation)	$4,846
Increase baghouse equipment life to 20 years (NPS recommendation) and reduce contingency to 10% (NPCA recommendation)	$4,644
Increase baghouse equipment life to 30 years and reduce contingency to 10% (NPCA recommendation)	$4,123

When the cost effectiveness is recalculated using the commenter's recommendations, the costs are lower, but are not low enough to change our decision to defer additional controls to the next planning period.

Comment:

The TDEC-APC received comments regarding Eastman's Boilers 23 and 24. The commenters state that TDEC must correct the following flaws in the Boilers 23 and 24 four-factor analysis: TDEC must require that Eastman document its assertion that "due to a lack of available space, in order to install baghouses to the planned DSI systems, the baghouses would have to replace the ESPs, which would significantly increase the construction costs." TDEC must require that Eastman revise its apparent doubling of "some of the cost items for installing a baghouse on Boiler 30 in its cost analysis for installing baghouses on Boilers 23 and 24." TDEC must require that Eastman explain and document the "Construction Indirects" cost of $6,878,936, which is not

[7] Tennessee corrected several errors in the original calculation, so the values in this table are slightly different from those in the draft SIP.

defined, not part of the Control Cost Manual, and suspicious in that it is exactly the same number as the total labor cost, which itself is the total of 7 separate items. TDEC must not allow a contingency of 30%, rather a contingency of 10% can be used. TDEC must adjust Eastman's interest rate and equipment life from 8.5% to 3.25% and 15 years to 30 years.

Response:

Construction Indirects: See previous comment for Boiler 30.

Space Constraints: The TDEC-APC accepted Eastman's assertion based on a review of Google Earth imagery of the site and the Division's prior site visits. Specifically, we note that the space constraints require the *existing* control ESPs to be located on the roof of the B-83 powerhouse.

Engineering and Construction Costs: The comment states that engineering and construction costs should, at a minimum, not exceed the costs for Boiler 30 because the difference between Boiler 30 and Boilers 23/24 are minor. The commenter believes a more reasonable approach is to cut the engineering cost for this baghouse by half because "there should be little difference in engineering required in designing the second baghouse for Boiler 23 and Boiler 24." Although two related projects *may* have overlapping costs, EPA recommends that states separately assess units at a single source that can be controlled with separate equipment[8], and the TDEC-APC agrees with EPA's recommendation. The TDEC-APC believes that separate cost analyses must be evaluated for each unit.

Contrary to the commenter's assessment, there are good reasons to believe that Eastman is correct, and the engineering and construction costs will be higher for Boilers 23 and 24. The issue of space has been noted above, and Eastman's four-factor analysis states that the Building 83 complex and surrounding area are fully developed, and construction activities such as fabrication, laydown, and parking must be established remote to the project site, and all material and manpower transported to the construction footprint.

Finally, the TDEC-APC notes that the fabric filter on Boilers 23 and 24 would not be similar the Boiler 30 fabric filter, since the four-factor analysis is based on the conversion of the existing ESP shell to a fabric filter. Thus, it is unlikely that Eastman could simply overlap the engineering design costs of the two control devices.

Contingencies: Regarding the contingencies included with Eastman's costs, Eastman's four factor analysis notes that it is unknown if the existing induced draft fan on the ESP outlet is large enough to handle the increased pressure drop associated with baghouse controls. Eastman also states that a large fan could require stiffening of the existing boiler walls, and these changes would

[8] 2019 Regional Haze SIP guidance, page 40.

drive up the cost of this control option. With these issues in mind, the TDEC-APC declined to review the cost effectiveness with a lower contingency.

Remaining Useful Life: As noted above for Boiler 30, the TDEC-APC used the 20-year useful life specified in the *Air Pollution Control Cost Manual*, but in consideration of NPCA's comments on the robust nature of fabric filters, we recalculated the cost effectiveness to determine how a 30-year life might affect the cost.

Upgrade ESP to Fabric Filter for B-83 Boilers 23 and 24: Adjustment of Costs Based on NPS and NPCA Recommendations (3.25% Nominal Interest Rate) [9]	
Adjustment	**Cost Effectiveness ($/ton)**
Baseline	$7,336[10]
Change baghouse equipment life from 15 years to 20 years (NPS recommendation)	$6,728
Increase baghouse equipment life to 30 years (NPCA recommendation)	$5,789

<u>Comment:</u>

The TDEC-APC received comments regarding Eastman's Boilers 21 and 22. The commenters state that TDEC must correct the following flaws in the Boilers 21 and 22 four-factor analysis: TDEC must require documentation of Eastman's assertions regarding lack of room for wet scrubbing technologies; and require consideration of other technologies with smaller footprints that can also be configured to obviate the need for discharge. TDEC must require documentation for Eastman's assertions regarding capacity factors. TDEC must require documentation for Eastman's assertions regarding cost-effectiveness, and fixed capital costs. TDEC must require documentation for Eastman's use of a "complexity factor," which was used to scale costs from Boilers 23 and 24 to Boilers 21 and 22.

<u>Response:</u>

Space Constraints: The TDEC-APC accepted Eastman's assertion based on a review of Google Earth imagery of the site and the Division's prior site visits. Specifically, we note that the space constraints require the *existing* control ESPs to be located on the roof of the B-83 powerhouse.

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[9] The TDEC-APC corrected several errors in the original calculation, so the values in this table are slightly different from those in the draft SIP.

[10] The TDEC-APC noted in our review of the four-factor analysis, and it is worth restating here, that Eastman used a higher baseline emission rate to calculate the cost effectiveness of the ESP to fabric filter upgrade for Boilers 23 and 24. If the baseline is adjusted to match Eastman's 2028 projections, the cost per ton will increase accordingly.

Feasibility of Other Control Technologies: The TDEC-APC believes that the space constraints at B-83 are likely to preclude the use of wet scrubbers. The TDEC-APC previously reviewed the use of wet scrubbers as a control technology in the 2017 SO_2 Attainment Demonstration for the Sullivan County nonattainment area as follows:

> Under Tennessee Division of Water Resources (DWR) Rule 0400-40-03-.03(1)(d) (Criteria for Water Uses), total dissolved solids (TDS) may not exceed 500 mg/L in areas designated for use of Domestic Water Supply. Likewise, under Rule 0400-40-03-.03(3)(d), impacts to Fish and Aquatic Life are monitored for oversaturation of dissolved solids. This concentration limit is applied to contributions from all sources discharging to the waterway in question as well as waterways downstream. The addition of a wet scrubber discharging to the South Fork Holston River would require testing of TDS in order to ensure compliance with the general permissible limits set forth by DWR and the Clear Water Act. Eastman's permit (#TN0002640) does not stipulate a specific maximum discharge of TDS for the outfall as it is currently written.

Even if the space constraints are discounted, the dissolved solids loading could represent a substantial non-air related environmental impact. The TDEC-APC also notes that a caustic scrubber is likely to require additional equipment (slurry tanks, dual-alkali system, or forced oxidation system) to precipitate sulfite/sulfate and prevent the re-emission of absorbed SO_2. This equipment will add to the footprint of the system.

Capacity Factor: The following table shows estimates of the capacity factors from each boiler between 2013 and 2015. The capacity factor was estimated from Eastman's hourly emissions (reported for SO_2 SIP development) using an SO_2 emission rate of 1.9 lb/MMBtu. These values are similar to those reported by Eastman (since boiler utilization varies from year to year, and not all years were reviewed, the numbers do not match exactly).

	B-83 Capacity Factors			
Year	**Boiler 21**	**Boiler 22**	**Boiler 23**	**Boiler 24**
2013	0.27	0.26	0.44	0.46
2014	0.30	0.30	0.43	0.42
2015	0.26	0.35	0.46	0.44
Average	**0.28**	**0.30**	**0.44**	**0.44**

Scaling and Complexity Factor: The total capital investment (TCI) for Boilers 21 and 22 was calculated by scaling the TCI of Boilers 23 and 24, with no additional complexity factor[11], as follows:

$$TCI_{\text{Boilers 21 \& 22}} = (TCI_{\text{Boilers 23 \& 24}})\ (498\ \text{MMBtu/hr}/1{,}002\ \text{MMBtu/hr})^{0.6}$$
$$TCI_{\text{Boilers 21 \& 22}} = (\$60{,}799{,}686)\ (498\ \text{MMBtu/hr}/1{,}002\ \text{MMBtu/hr})^{0.6} = \$39{,}968{,}542$$

This value represents direct and indirect capital expenditures associated with the upgrade of Boilers 21 and 22. The difference between this figure and Eastman's is 0.36% and may be due to round-off error.

Comment:

The TDEC-APC received comments regarding enforceable measures. The commenters state that TDEC's draft SIP does not contain provisions to ensure emission limitations are permanent and enforceable and that its permits complement the Act's reasonable progress requirements. The TDEC-APC Draft SIP explains that its RPGs are based on modeling results, which does meet the RHR requirement that the RPGs are based on enforceable SIP measures. Additionally, the TDEC-APC received comments regarding emission reductions. The commenters state that TDEC must not rely on unquantified and unenforceable statements in its SIP. Tennessee's long-term strategy relies on emission reductions associated with a laundry list of items and explains that they "are included in the 2028 future year estimates upon which the RPGs are based. The TDEC-APC also received comments that retirements relied on to justify no control and no upgrades must be reflected as enforceable SIP measures. Another commenter stated that the proposed plan "attempts to rest on the laurels of reductions made largely by TVA in compliance with the 2011 Consent Decree".

Response:

The SIP permit for Eastman Chemical Company, which includes permanent dry sorbent injection on boilers 23 and 24 and the retirement of boilers 18, 19, and 20, will be finalized prior to submittal of the SIP to EPA. This permit is not a Title V permit and will not expire. The limits in the SIP permit cannot be changed unless a SIP revision is submitted.

While TDEC-APC has presented information regarding TVA's pending closure of several coal-fired utility plants, none of these were relied upon in either the source selection process or reasonable progress decisions.

The RHR at 40 CFR §51.308(f)(3) states that "(a) state in which a mandatory Class I Federal area is located must establish reasonable progress goals (expressed in deciviews) that reflect the

[11] The complexity factor was incorporated when the Boiler 30 cost estimate was scaled to Boilers 23 and 24.

visibility conditions that are projected to be achieved by the end of the applicable implementation period as a result of those enforceable emissions limitations, compliance schedules, and other measures required under paragraph (f)(2) of this section that can be fully implemented by the end of the applicable implementation period, as well as the implementation of other requirements of the CAA."

As detailed in a previous response on page 18 of this document, the LTS in Section 7 of the SIP contains numerous federal and state control programs. These programs are integrated into the 2028 emission projections that go into the model. Thus, the control programs that are part of the LTS go into the 2028 modeling, which yields the RPGs. The use of a projected 2028 emissions inventory as a starting point for identifying additional enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress is consistent with the RHR. Additionally, EPA's August 20, 2019, guidance states, "An initial assessment of projected visibility impairment in 2028, considering growth and on-the-books controls, can be a useful piece of information for states to consider as they decide how to select sources for control measure evaluation." Section 7.2 of the SIP explains several existing and planned emission controls, including some source retirements and the results of the TVA Consent Decree, that were included in the projected 2028 modeling inventory.

Table 8-1 provides the RPGs for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area on the 20% most impaired days. The RPGs are well below the Uniform Rate of Progress (URP) value. In fact, the RPGs are 20 years ahead of schedule since the 2028 RPGs are below the 2048 URP value. Table 8-2 shows that projected visibility on the 20% clearest days will not degrade but rather will improve significantly by 2028.

<u>Comment:</u>

The TDEC-APC received comments regarding reasonable progress goals (RPGs). The commenters state that TDEC must first conduct the required four-factor analysis and then develop the reasonable progress goals. The commenters state that TDEC's description of anticipated additional emissions reductions is misplaced. First, emission reductions that will occur as a result of the Four-Factor Analysis conducted for Eastman Chemical Company, must be included in setting the RPGs, not tacked on as an afterthought as TDEC suggests. Second, contrary to TDEC's explanation in its Draft SIP, communications from other states do not show anticipated reductions. TDEC-APC also received comments that information regarding in-state and out of state emission reductions that became available following completion of the VISTAS modeling is misplaced.

Response:

EPA's August 20, 2019, guidance provides states with the option of using a post-modeling approach for adjustment of reasonable progress goals [emphasis added]:

> Pages 47-48: *"Because the air quality modeling to calculate RPGs is resource intensive and time consuming, EPA does not always expect the modeling to be repeated after a subsequent change in the content of a state's own LTS, after a new determination by another state that an emission control measure is necessary to make reasonable progress, or after another state decides contrary to expectations that a measure is not necessary to make reasonable progress. … Therefore, if the modeling run did not include all such measures or included any other measures, a state* ***may*** *need to adjust its RPGs to reconcile the scenarios before the SIP revision with the RPGs is submitted."*

The reasonable progress analysis of Eastman Chemical Company will result in the permanent shutdown of B-83 Boilers 18, 19, and 20 and the installation of permanent dry sorbent injection (without upgrading the existing ESPs) on Boilers 23 and 24. These emission reduction measures are projected to result in a reduction of 2,608 tons of SO_2 per year. Section 8.2 of the SIP lists emission reductions, including those of Eastman Chemical, that were not included when calculating the RPGs for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. In addition, Ohio EPA's Regional Haze SIP for the Second Planning Period which includes an enforceable commitment for the permanent shutdown of the coal-fired boilers at the Zimmer Station by no later than January 1, 2028. These additional reductions provide additional evidence that the RPGs for these are appropriate. Both of these Class I areas are located in both Tennessee and North Carolina. In order to avoid establishing different RPGs for the same Class I area, TDEC-APC consulted with North Carolina DEQ to adopt the approach specified in section 8.2 of the SIP.

Since some of the other states have not finalized their SIPs yet, the TDEC-APC cannot say for sure what other state agencies will require of their facilities. Thus, the RPG's for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area were not adjusted to account for these.

Comment:

The TDEC-APC received comments regarding modeling. The commenters state that the public was not provided an opportunity to review and comment on the VISTAS emission inventories and modeling.

Response:
The TDEC-APC has met all the requirements of 40 CFR §51.102 for a public hearing for the Regional Haze SIP. The TDEC-APC posted the public notice on the TDEC website on October 21, 2021. The public hearing notice not only included a weblink to the draft SIP, but also a link to a TNCloud site that contained all of the appendices that were part of the SIP including Emission Inventory Reports pertaining to the VISTAS modeling. The public hearing was held on December 1, 2021. The end of the public comment period was initially set for December 1, 202, but was extended to December 10, 2021. Thus, the comment period was 50 days, which exceeds the 30-day requirement in the rule. There is no separate requirement for a public notice and comment period specifically for the emissions inventory and modeling.

As detailed in Section 10.2 of the SIP, the VISTAS states 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.

Comment:
The TDEC-APC received comments regarding visibility as a fifth factor. The commenters state that it is inconsistent with Clean Air Act's requirements to use visibility as a fifth factor to decide reasonable progress controls.

Response:
As documented in Appendix G-1 and G-2 of the SIP, the TDEC-APC used the four factors in its reasonable progress analysis for TVA Cumberland and Eastman Chemical Company. The reasonable progress analysis submitted by TVA Cumberland characterized the visibility benefits, but the TDEC-APC did not consider this information to determine whether additional controls would be required during this Regional Haze SIP review period. Thus, the TDEC-APC did not use visibility as a fifth factor as the commenter asserts.

Comment:
The TDEC-APC received comments regarding the glide path. The commenters state that TDEC attempts to justify deferring any further emission reductions for nearly every major source in the state by pointing out that Class I areas appear to be trending below these area's glide path or URP, which it states is sufficient to achieve reasonable progress. TDEC's suggestion that the RPGs being under the glide path is a safe harbor is inappropriate. Another commenter stated the Uniform

Rate of Progress "is in fact not uniform" that there will be an inflection point in the glide path at some point.

Response:

While the RHR does provide prescriptive requirements at 40 CFR 51.308(f)(ii)(A) and (B) regarding a state's obligations when a reasonable progress goal is established that is slower than the uniform rate of progress (glide path), it is not prescriptive regarding emissions reductions when reasonable progress goals are below the glide path. As explained earlier in this document, a state has flexibility to select a reasonable set of sources for four-factor analysis. TDEC-APC has taken an approach explained in the SIP and elsewhere within this document that considers a number of factors, including the significant progress that has been made in visibility improvement at Tennessee's two Class I areas. VISTAS determined the visibility impact of every point source in the domain by performing the AoI analysis. The AoI data was analyzed, and 87 point sources were chosen to undergo the CAMx PSAT modeling to further identify the top point sources that were impacting the Class I areas. The VISTAS states, including TDEC-APC, agreed that facilities above the 1% PSAT threshold would undergo a reasonable progress analysis, which included two Tennessee facilities (Eastman and TVA Cumberland). Additionally, seven out-of-state facilities were requested to perform a reasonable progress analysis based on their impact on the Great Smoky Mountains National Park and Joyce Kilmer-Slick Rock Wilderness Area. The TDEC-APC's determination of emissions reductions for reasonable progress was based on the four factors. At no point in the process did the TDEC-APC base its decisions for source selection or emissions reductions from sources solely on the fact that monitoring data and modeling data are below the glide path.

In response to the comment about Uniform Rate of Progress not being uniform and having an "inflection point", the reader should refer to section 3 of the SIP which discusses the requirement for establishing Uniform Rates of Progress (URPs), also known as "Glide Paths." As required by 40 CFR 51.308(f)(3), reasonable progress goals, and thus URPs, are to be expressed in deciviews. Deciview is defined in 40 CFR 51.301 as "the unit of measurement on the deciview index scale for quantifying in a standard manner human perceptions of visibility" and is calculated on a logarithmic scale based on light extinction. As can be seen in Figure 3-1 of the SIP, the URP is a straight line and there is no inflection point in a straight line.

Comment:

The TDEC-APC received comments regarding cost threshold. The commenters state that TDEC must establish and provide a basis for a cost effectiveness threshold. EPA's regional haze guidance and regulations require that the SIP "explain why the selected [cost] threshold is appropriate for that purpose and consistent with the requirements to make reasonable progress.

Response:

There are no requirements in either the RHR or EPA guidance for states to establish a cost effectiveness threshold. EPA's August 20, 2019, guidance states that "the Regional Haze Rule does not prevent states from implementing "bright line" rules, such as thresholds, when considering costs" (p. 38) the state must explain the basis for any threshold. Also, cost of compliance is just one of the four statutory factors to be evaluated when establishing reasonable progress goals[12]. Establishment of a cost effectiveness threshold for determining when a control measure should be required for reasonable progress would ignore the other three statutory factors and thus violate section 169A(g)(1) of Clean Air Act. While TDEC-APC has not established a bright line cost threshold, it has explained the basis for considering the cost of compliance in each four-factor analysis. As noted in one of the previous responses, the TDEC-APC compared the costs identified in each four-factor analysis to average and maximum costs (adjusted for inflation) compiled by VISTAS states for a range of control technologies. When the TDEC-APC compared the control options for Eastman Chemical and Cumberland Fossil Plant with the appropriate metric, the cost effectiveness did not justify the implementation of these control technologies during the current planning period. The TDEC-APC also noted that substantial reductions in SO_2 and NO_X emissions occurred in Tennessee and other VISTAS states between 2008 and 2020. Those reductions were not part of the four factors that were considered for each control option, but the TDEC-APC continues to believe that the decrease in emissions provides additional weight of evidence for the use of a lower cost threshold than recommended by commenters.

Comment:

The TDEC-APC received comments regarding adequate resources. The commenters state that TDEC's assertion that it lacks adequate resources is not a valid reason to avoid the Act's requirements. TDEC's apparent assertion that it lacks the time, personnel and funding resources to develop a complete regional haze SIP does not excuse it from the Act's requirements.

Response:

The TDEC-APC does not assert that it lacks the time, personnel and funding resources to develop a complete regional haze SIP. EPA's August 20, 2019, guidance states that "a State is not required to evaluate all sources of emissions in each implementation period" and "it is reasonable and permissible for a state to distribute its own analytical work, and the compliance expenditures of source owners, over time by addressing some sources in the second implementation period and other sources in later periods". The TDEC-APC approach to source selection for reasonable

[12] §169A(g)(1) of Clean Air Act: For the purpose of this section - (1) in determining reasonable progress there shall be taken into consideration the costs of compliance, the time necessary for compliance, and the energy and nonair quality environmental impacts of compliance, and the remaining useful life of any existing source subject to such requirements;

progress analysis resulted in a reasonable number of sources that can be evaluated and focused on the sources and pollutants with the largest impacts.

Comment:

The TDEC-APC received comments regarding PSAT modeling. The commenters state that PSAT modeling should not be used for sources located very close to Class I Areas. Based on the Federal Land Managers' Air Quality Values Workgroup (FLAG) guidance, regional grid models like CAMx are not the preferred model where the Class I separation distance is less than 50 km. Inside 50 km, the FLAG recommended visibility models address direct plume impacts and not contributions to light extinction from sulfate and nitrate. By relying only on CAMx/PSAT, the selection of contributing sources in the draft SIP did not consider direct visibility impacts to Class I areas closer than 50 km.

Response:

40 CFR Part 51, Appendix W is referred to as the Guideline on Air Quality Models. It provides EPA-recommended models and other techniques, as well as guidance for their use, for predicting ambient concentrations of air pollutants. Section 6.2.1 of Appendix W discusses the appropriate models for use in determining visibility impairment. Section 6.2.1.2 of Appendix W states that chemical transport models "are appropriate for assessment of near-field and regional scale reactive pollutant impacts from specific sources or all sources." CAMx is a chemical transport model and was used by VISTAS in the regional haze modeling. Thus, Appendix W asserts that CAMx PSAT is appropriate for assessment of source specific impacts. Section 5 of the SIP outlines the methods and inputs used by VISTAS for the regional haze modeling, which includes following the EPA's *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*. Section 6 of the SIP gives the model performance evaluation. As part of Section 6, the TDEC-APC asserted that 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.

Comment:

The TDEC-APC received comments regarding area sources. The commenters state that TDEC must fully consider area sources. Section 40 CFR 51.308(f)(2)(i) indicates that states should consider evaluating major and minor stationary sources or groups of sources, mobile sources, and area sources.

Response:

The TDEC-APC primarily focused on point sources, and not on area sources. The AoI results showed that point sources were the dominant visibility impairing source sector at both Great

Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area on the 20% most impaired days. This is shown in Tables 7-13 and 7-14 of the SIP. EPA's August 20, 2019, guidance states that "a State is not required to evaluate all sources of emissions in each implementation period". The TDEC-APC's source selection process is consistent with the RHR and EPA's August 20, 2019, guidance. Regarding the selection of sources for analysis (Step 3), EPA guidance states:

> Page 9: "*A key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period. Instead, a state may reasonably select a set of sources for an analysis of control measures. The guidance that an analysis of control measures is not required for every source in each implementation period is based on CAA section 169A(b)(2), which requires each SIP to contain emission limits, schedules of compliance, and other measures as may be necessary to make reasonable progress, but …does not provide direction regarding the particular sources or source categories to which such emission limits, etc., must apply. Selecting a set of sources for analysis of control measures in each implementation period is also consistent with the Regional Haze Rule, which sets up an iterative planning process and anticipates that a state may not need to analyze control measures for all its sources in a given SIP revision. Specifically, section 51.308(f)(2)(i) of the Regional Haze Rule requires a SIP to include a description of the criteria the state has used to determine the sources or groups of sources it evaluated for potential controls. Accordingly, it is reasonable and permissible for a state to distribute its own analytical work, and the compliance expenditures of source owners, over time by addressing some sources in the second implementation period and other sources in later periods. For the sources that are not selected for an analysis of control measures for purposes of the second implementation period, it may be appropriate for a state to consider whether measures for such sources are necessary to make reasonable progress in later implementation periods.*"

Comment:

The TDEC-APC received comments regarding TVA Cumberland. The commenters state that TDEC cannot grant the TVA a credit for funds expended on pollution controls.

Response:

TVA's letter to the TDEC-APC dated February 28, 2020, requested that the TDEC-APC not require a four-factor analysis for Cumberland Fossil Plant and cited Section II.B.3.f of EPA's 2019 Regional Haze SIP guidance, as follows:

> It may be reasonable for a state not to select an effectively controlled source. A source may already have effective controls in place as a result of a previous regional haze SIP or to meet another CAA requirement. In general, if post-combustion controls were selected and installed fairly recently (see illustrative examples below) to meet a CAA requirement, there will be only a low likelihood of a significant technological advancement that could provide further reasonable emission reductions having been made in the intervening period. *If a source owner has recently made a significant expenditure that has resulted in significant reductions of visibility impairing pollutants at an emissions unit, it may be reasonable for the state to assume that additional controls for that unit are unlikely to be reasonable for the upcoming implementation period* [emphasis added]. A state that does not select a source or sources for the following or any similar reasons should explain why the decision is consistent with the requirement to make reasonable progress, i.e., why it is reasonable to assume for the purposes of efficiency and prioritization that a full four-factor analysis would likely result in the conclusion that no further controls are necessary.

TVA cited Cumberland's use of add-on flue gas desulfurization and compliance with the 0.20 lb/MMBtu limit established by MATS in support of its request. The TDEC-APC's March 30, 2020, response, which *declined* TVA's request to utilize the MATS provision in the selecting sources for four-factor analyses, states that the TDEC-APC may consider MATS expenditures to determine what, if any, additional controls might be required at TVA Cumberland for the second planning period. The TDEC-APC believes that this approach is consistent with §§51.308(f)(2)(iv)(A), which states in part:

> The State <u>*must consider*</u> the following additional factors in developing its long-term strategy…(A) Emission reductions due to ongoing air pollution control programs, including measures to address reasonably attributable visibility impairment…

Ultimately, TVA declined to utilize this provision, and MATS expenditures were not considered in the review of TVA's four-factor analysis or development of the TDEC-APC's LTS.

<u>Comment:</u>

The TDEC-APC received comments regarding TVA Cumberland. The commenters state that the Cumberland cost analysis must be corrected. All information and assumptions must be documented. Cumberland assumed an 8% interest rate and a 10-year equipment life.

Response:
The TDEC-APC addressed the 8% interest rate issue during FLM consultation by recalculating the cost effectiveness of both options at an interest rate of 3.25%. In response to EPA's comment on page 22 of this document, the TDEC-APC clarified the explanation for the use of a 10-year equipment life in the cost calculation.

Comment:
The TDEC-APC received comments that TDEC relies heavily on market conditions for its view pollution will decline, particularly at Kingston and Gallatin.

Response:
As stated in section 4.2.1.1 of the SIP, electric generating unit (EGU) projections were derived from the most recently available EPA and Eastern Regional Technical Advisory Committee (ERTAC) emission projections. TDEC-APC did reduce its projected 2028 emissions for TVA Kingston based on a February 28, 2020, letter from TVA which provided information from TVA's Strategic Power Supply Plan (sPSP). In that letter, TVA sates that Kingston will transition from a "Base Dispatchable/Intermediate" assed to a "Peaking Economic/Reliability" asset beginning in 2026. TVA states that the sPSP includes capacity and generation projections for all of TVA's assets through 2040. Neither the EPA or ERTAC projections nor TVAs sPSP are based on market conditions.

Comment:
Eastman's Four-Factor Analysis merely listed what they consider representative emissions from some of their units, but none have provided any documentation for those figures. Nor has Eastman provided information in the SIP that completely lists the units in the SIP and their respective emissions for the last five years. This information is essential in order to identify which units should be reviewed and properly conduct a valid four-factor analysis." Because TDEC does not have source-specific emission data for Eastman in the Draft SIP, the SIP fails to meet the informational requirements of the Regional Haze Rule. Furthermore, TDEC cannot rationally approve the four-factor analyses because the agency does not have, and therefore could not verify, the cost-effectiveness analyses that necessarily rely on that emissions data.

Response:
The four-factor analysis states that Eastman projected the 2028 SO_2 emissions based on the highest production year for the past ten years, which was calendar year 2011. There is no requirement in the RHR or EPA regional haze guidance to provide five years of emissions data. The VISTAS 2011 and 2028 modeling runs, however, do include unit-level point source data.

Comment:
TDEC's proposal to rely on existing emission trading programs and upcoming EPA actions is misplaced. Regarding EGU's covered by CSAPR and the other emission trading programs, TDEC should not rely on that program to drive emission reductions for several reasons. First, several of Tennessee's EGUs have historically demonstrated they are capable of better emission control than they are currently displaying. Second, there does not appear to be any economic incentive from CSAPR that would cause EGUs to either run their existing controls at their full performance potential, or to install new controls. Furthermore, as the Draft SIP explains, "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." TDEC cannot rely on revised budgets that do not yet exist. Furthermore, contrary to the RHR requirements that emission limitations apply for the entire year, the CSAPR requirements only apply during the ozone season. Therefore, it is premature and impermissible for TDEC to suggest it will rely on these emission reductions.

Response:
Tennessee considered CSAPR and other existing emission trading programs as required by 40 CFR §51.308(d)(3)(v)(A), which requires states to consider emission reductions due to ongoing air pollution control programs in developing its LTS.

Comment:
The Regional Haze program requires states to adopt measures to prevent future visibility impairment as well as to address existing visibility impairment. TDEC's draft regional haze SIP revision lacks an accurate analysis of 2028 emission inventory projections and future source development; thus, the public has no information to assess whether emissions from specific source categories are projected to increase between 2011 and 2028 as seen in other states (e.g., anticipated new development in the State, ammonia emissions from nonroad sources, visibility-impairing pollutants from oil and gas and others). TDEC must analyze future emission inventory projections, explain what these emissions sources are within the state and discuss the programs it has in place to address any potential future increases in emissions. Importantly, TDEC must evaluate the measures that may be needed to prevent any currently projected future increases in visibility-impairing emissions from these source categories. Moreover, as TDEC develops permit modifications for existing sources and permits for new sources, it must take regional haze implications into consideration – these requirements should be discussed and committed to in the State's SIP. For example, TDEC's Draft SIP explains that TDEC-APC received a modeling protocol for TVA's proposed installation of ten new simple-cycle natural gas combustion turbines and shut down of sixteen of the existing simple-cycle units at its Johnsonville plant, and despite the fact that TVA's proposed emission increases will be 101.2 tpy for NOx, 57.6 tpy for PM, and 5.2 tpy for SO_2, TDEC neither explains not commits to take regional haze reasonable progress

requirements into consideration. The RH RP requirements apply and work in conjunction with permitting requirements, and TDEC must not defer until the next RH SIP update or planning period to address emission increases.

Response:

Tennessee's emission inventories were prepared consistent with 40 CFR §51.308(d)(4)(v) and §51.308(f)(6)(v), which require states to submit a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment, including 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 a baseline year, 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.

Regarding the specific comments for proposed simple cycle turbines at TVA Johnsonville, visibility impairment will be addressed in accordance with Tennessee Air Pollution Control Regulations 1200-03-09-.01(4) (Prevention of Significant Air Quality Deterioration).

Other Changes made to Tennessee's Regional Haze Plan

In addition to changes made in response to comments, TDEC-APC made the following additional changes to the Regional Haze Plan.

Section 7.2 - Expected Visibility in 2028 for Tennessee Class I Areas Under Existing and Planned Emissions Controls

- Updated status of retirement of coal-fired boilers

Section 7.6 – Screening of Sources for Reasonable Progress Analysis:

- Update information regarding projected emissions from McGhee Tyson airport and Memphis International Airport

Section 7.9.1 – Smoke Management

- Added information about MOU between TDEC, Tennessee Department of Agriculture, and Tennessee Division of Forestry regarding Basic Smoke Management Practices

Section 10.1 – Interstate Consultation

- Updated information from Georgia EPD
- Updated information regarding consultation with Indiana DEM
- Updated information from Ohio EPA

Other minor cross-references, wording changes, and grammatical and typographical corrections were also made.

TN Department of Environment & Conservation

Regional Haze State Implementation Plan

Mark A. Reynolds, Environmental Consultant

Timeline

Event	Date
Pre-Draft SIP sent to EPA	July 2021
Consultation draft sent to FLMs	July 2021
Comments received from EPA & FLMs	August 2021
Board Briefing	October 13, 2021
Public Notice	October 21, 2021
Public Hearing	December 1, 2021
End of Comment Period	December 10, 2021
Board Approval	February 9, 2022
Submit final SIP to EPA	February 2022

Comments Received

- U.S. EPA
- National Park Service (NPS)
- New Jersey Dept. of Environmental Protection
- MANE-VU (Northeastern States)
- National Parks Conservation Association (NPCA), Sierra Club and other environmental groups
- Sierra Club petition (201 individuals)
- Email Campaign (82 individuals)

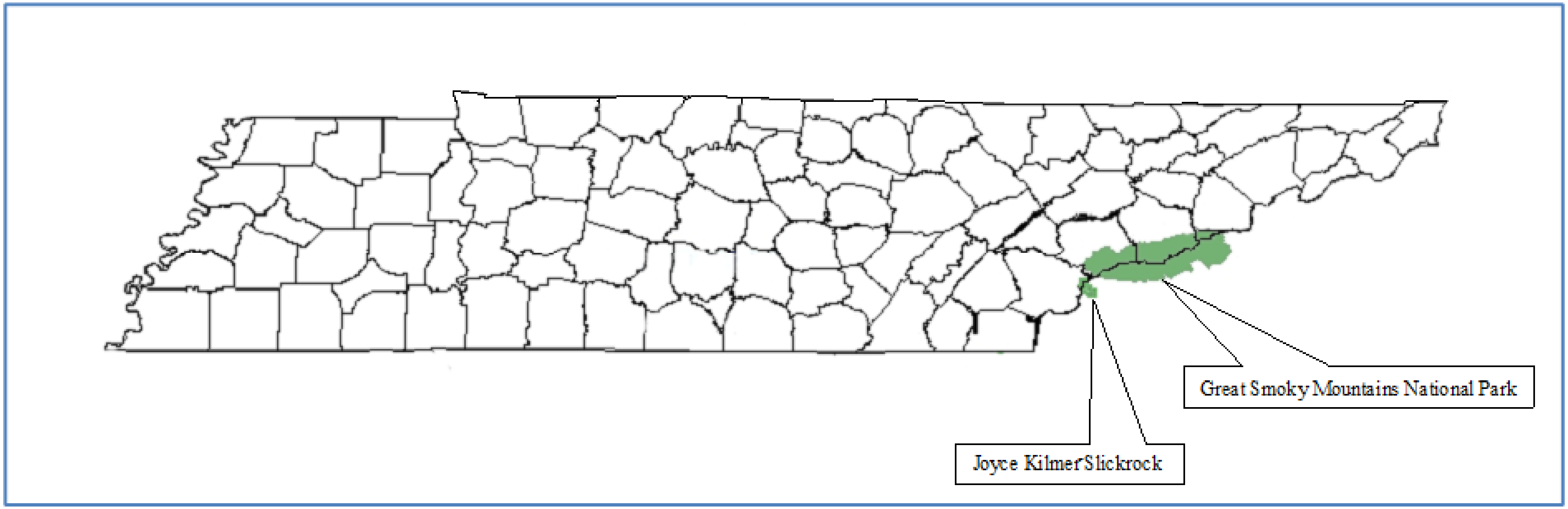
Regional Haze SIP

- Regional haze is pollution that impairs visibility over a large region, including national parks and wilderness areas (many termed "Class I" areas).

- In the southeast, the dominant sources of haze-forming emissions are from coal-fired power plants, industrial boilers, and other combustion sources. Sulfate is the predominant visibility impairing pollutant.

Tennessee Class I Areas

- Great Smoky Mountains National Park
- Joyce Kilmer-Slickrock Wilderness Area



VISTAS Class I Areas

- 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
- VISTAS--Visibility Improvement State and Tribal Association of the Southeast
- Contractors: ERG and Alpine


Dolly Sods
Otter Creek
Shenandoah
James River Face
Mammoth Cave
Great Smoky Mountains
Linville Gorge
Joyce Kilmer-Slickrock
Shining Rock
Swanquarter
Cohutta
Sipsey Wilderness
Cape Romain
Wolf Island
Okefenokee
St. Marks
Chassahowitzka
N
W
E
S
Everglades

Regional Haze SIP

- Regional Haze SIP due 12/17/07 for 1st Planning Period (2007-2018)
  - TDEC submitted on 4/8/08
- Progress Report submitted 4/10/13
- Revised SIP due 7/31/18 for 2nd Planning Period (2019-2028)
  - EPA revised rule to change due date to 7/31/21

Regional Haze SIP

- Regional haze rule requires states to develop programs to assure reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class 1 Federal areas, which impairment results from manmade air pollution

Long-term Strategy (LTS)

- Regional haze rule requires states to submit a long-term strategy (LTS) 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
- LTS includes enforceable emissions limitations, compliance schedules, and other measures as necessary to achieve the reasonable progress goals.

Long-term Strategy (LTS)

- Cross State Air Pollution Rule (CSAPR)
- Mercury and Air Toxics Standard (MATS)
- 2010 sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS)
- Other federal rules (NESHAP, etc.)
- North Carolina Clean Smokestacks Act
- Georgia Multi-Pollutant Rule
- Consent agreements with Tennessee Valley Authority (TVA) and other facilities
- BART & Reasonable Progress Analysis Controls

Reasonable Progress Analysis

- During the 1st and 2nd implementation periods, the rule required states to identify sources that are contributing to visibility impairment and require those sources to undergo a reasonable progress analysis (aka 4-factor analysis)
  - 1st – Resolute & INVISTA
  - 2nd – Eastman, TVA Cumberland, TVA Kingston

AoI and PSAT

- Area of Influence (AoI) analysis performed to identify specific point sources of SO_2 & NOx with greatest contribution to visibility impairment
  - Facilities ranked by their sulfate and nitrate visibility contribution at each Class I areas
- Based on AoI results, VISTAS states chose facilities to be tagged for CAMx PSAT photochemical modeling analysis
  - 87 facilities chosen

CAMx PSAT

- PSAT tags were included for 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

Reasonable Progress Analysis

- If the sulfate contribution was greater than or equal to 1.00%, then the facility was considered for an SO_2 reasonable progress analysis
  - Eastman, TVA Cumberland & TVA Kingston were above 1.00%
- If the nitrate contribution was greater than or equal to 1.00%, then the facility was considered for a NO_X reasonable progress analysis
  - No facilities above 1.00%

Reasonable Progress Analysis

- Eastman Chemical Company
  - Boilers 18, 19, & 20 converting from coal to natural gas by 2028
  - Boilers 23 & 24 installing permanent dry sorbent injection
- TVA Cumberland
  - No additional controls required
- TVA Kingston
  - Revised 2028 emission projections so below 1.00%
  - Retirement by 2035
  - Not required to perform reasonable progress analysis

Facilities selected by TDEC for Reasonable Progress Analysis (>1.00% sulfate at GSMNP or JOYC)

TN	Eastman Chemical Company
TN	TVA Cumberland
GA	Georgia Power Company-Plant Bowen
KY	TVA Shawnee
IN	Gibson
IN	Indiana Michigan Power-Rockport
OH	Duke Energy-Wm. H. Zimmer Station
OH	General James M. Gavin Power Plant
PA	Genon NE-Keystone Station

Comment

- Commenters stated that TDEC used a high threshold for the PSAT contribution and only chose two facilities for reasonable progress analysis.

Response

- EPA guidance states: "*A key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period. Instead, a state may reasonably select a set of sources for an analysis of control measures.*"

Response

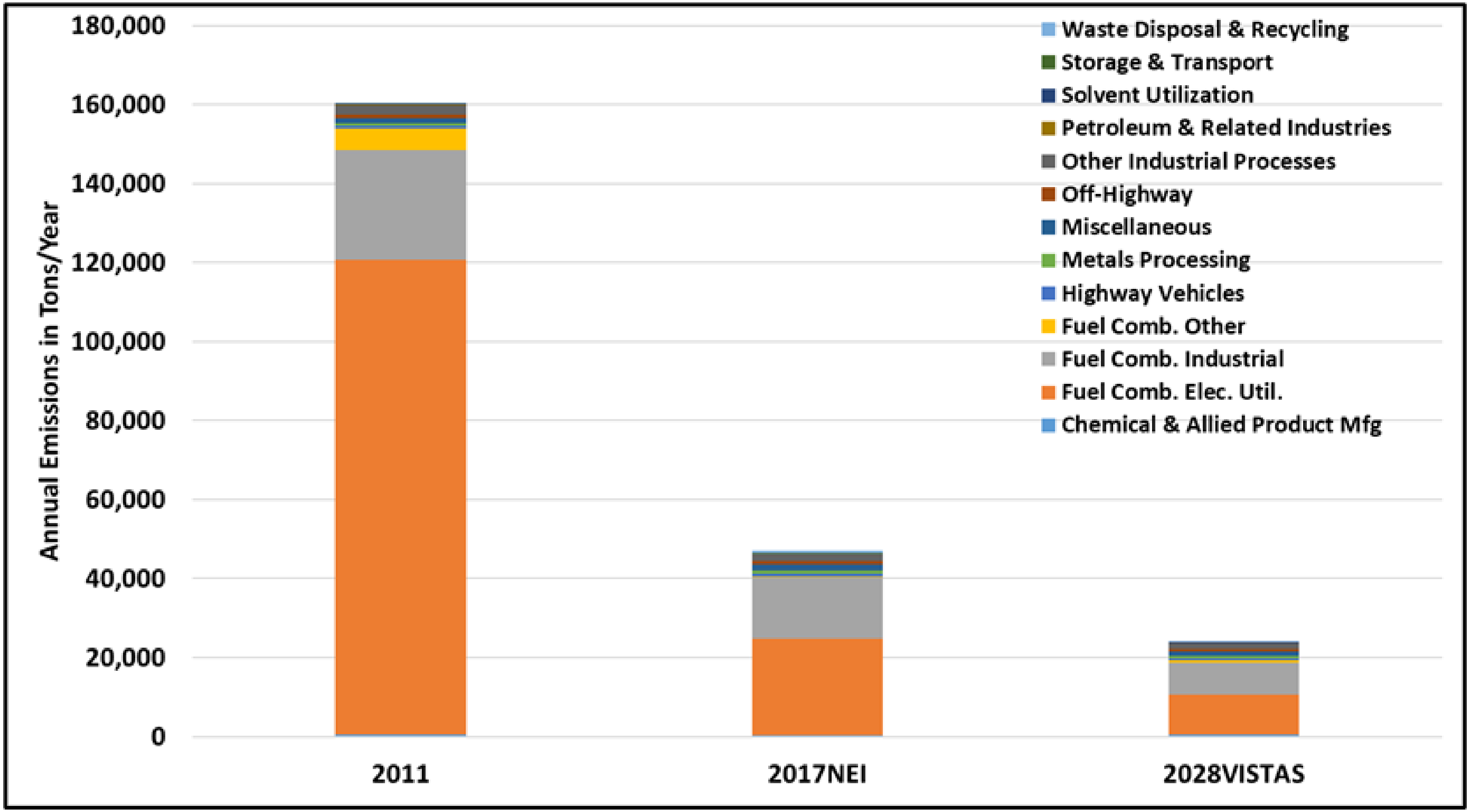
- From 2008 to 2019, there was a 94.6% reduction in SO_2 emissions and a 90.3% reduction in NO_x emissions from TVA's coal and natural gas plants in Tennessee.

- These actions have led to the situation that exists today where, as demonstrated from the PSAT modeling, stationary sources outside of Tennessee have a much higher impact on Class I areas in Tennessee than sources in the state.

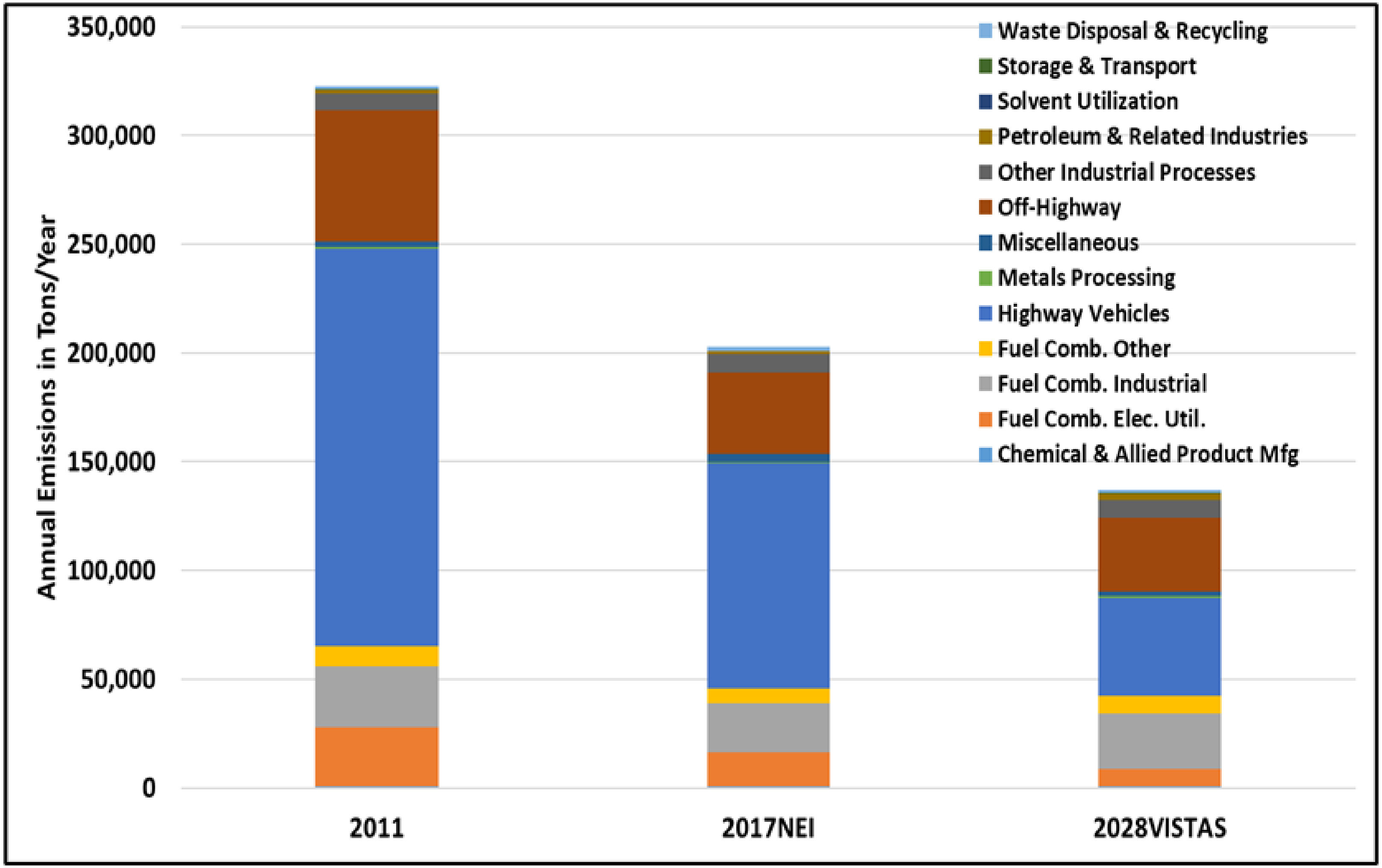
Response

- Eastman's and TVA Cumberland's projected 2028 SO_2 emissions are 6,420 tpy and 8,427 tpy, respectively.
- These combined emissions are over 62% of total state SO_2 emissions.
- TDEC's source selection process captures a meaningful portion of Tennessee's total contribution to visibility impairment to Class I areas

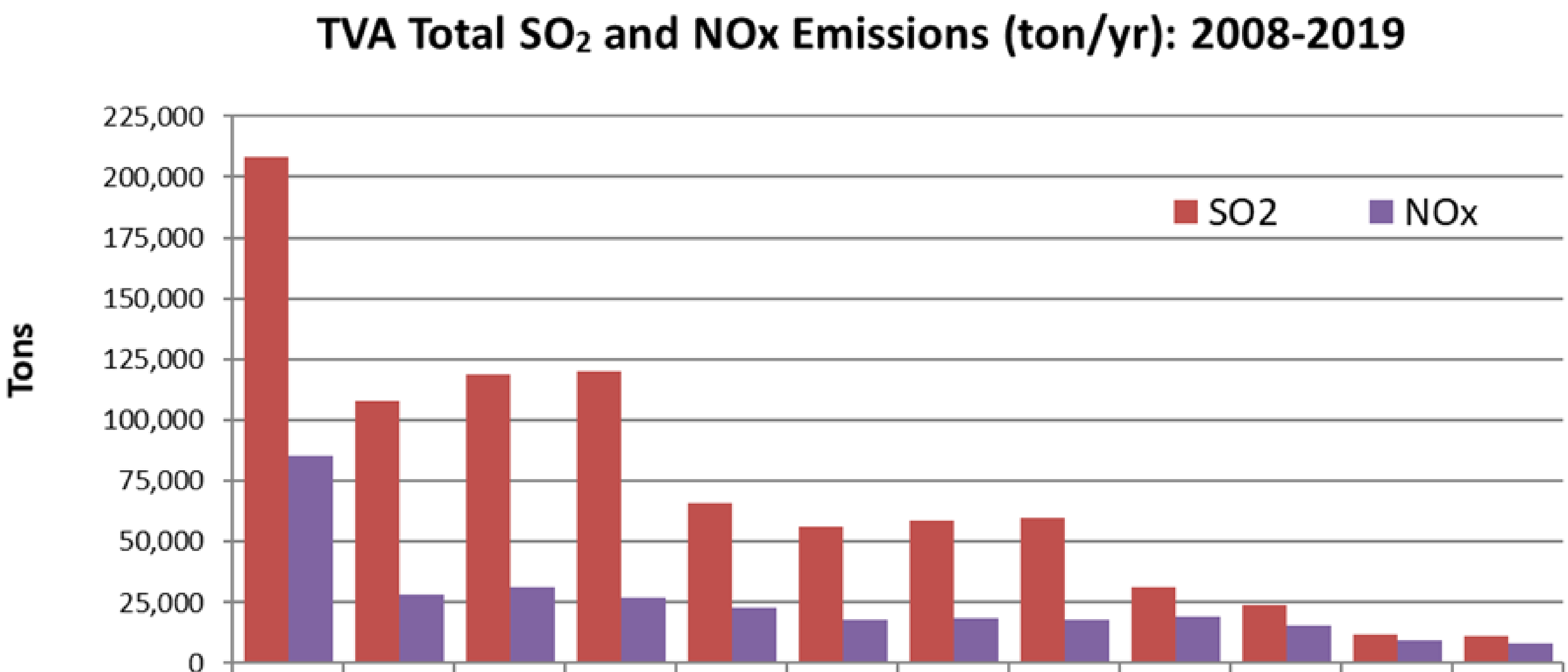
Tennessee SO_2 Emissions (2011-2028)



Tennessee NO_x Emissions (2011-2028)



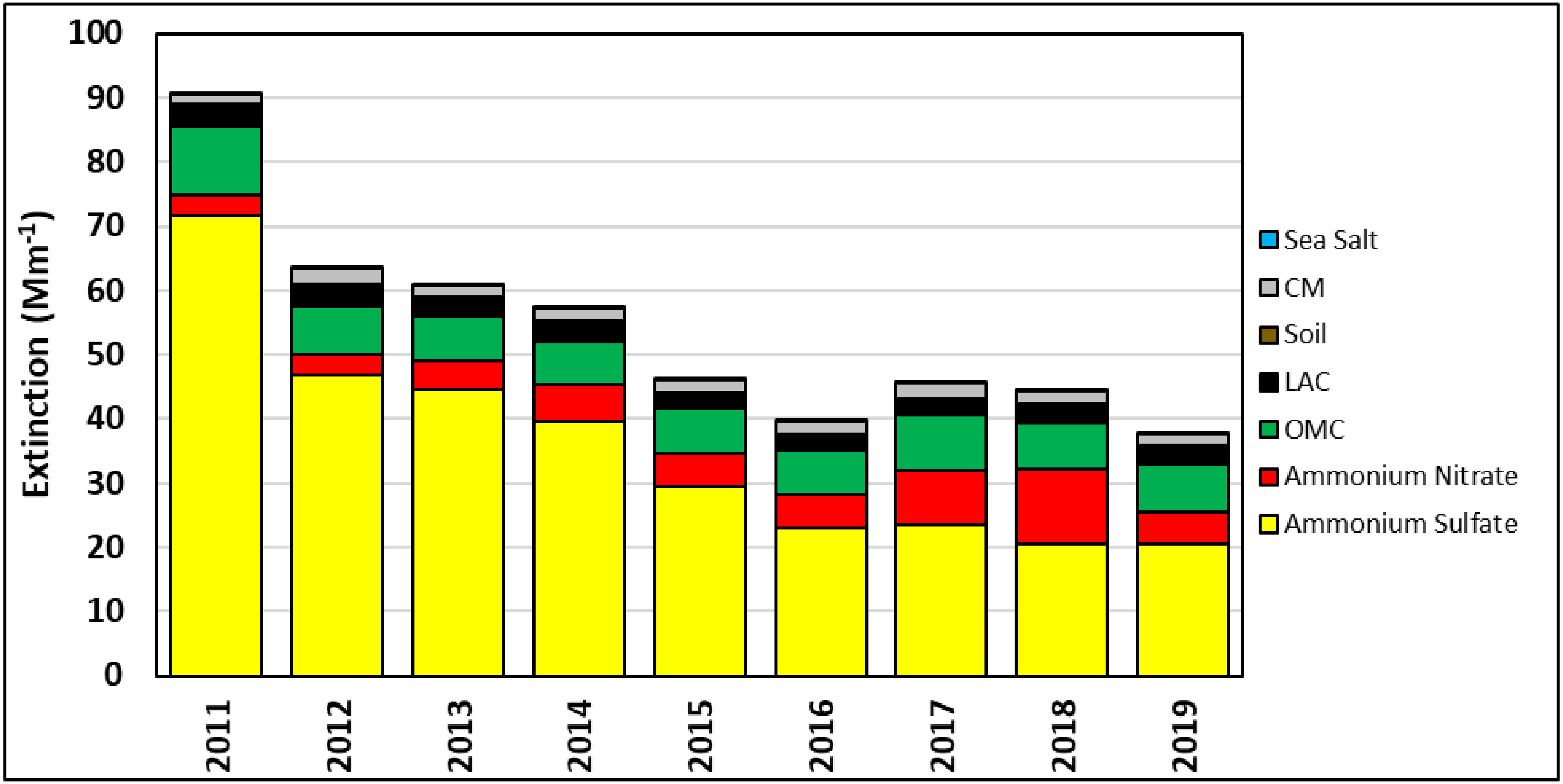
TVA Emissions from coal and natural gas plants in Tennessee (2008-2019)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SO2	208,069	108,081	119,087	120,353	66,258	56,405	58,434	59,697	31,270	24,312	11,735	11,224
NOx	85,641	28,029	31,343	27,012	22,613	18,109	18,746	18,180	19,231	15,771	9,250	8,301

Year

Particle Contributions to Light Extinction for 20% Most Impaired Days at Great Smoky Mountains National Park



Comment

- Commenters stated that TDEC omitted NOx in its analysis. SIP lacks control of NOx from point sources. VISTAS relied on outdated data. TDEC ignored changing composition of haze-inducing constituents.

TDEC Response

- Ammonium sulfate remains as the dominant visibility impairment species through 2019 based on monitoring data for Great Smoky Mountains NP
- As a percentage of visibility impairment, ammonium nitrate has increased over the years from 2011 to 2019. Ammonium nitrate levels increased in 2017 and 2018 but returned to 2015 levels in 2019. Further research is needed to understand the factors contributing to nitrate fraction.

TDEC Response

- No facilities were above 1.00% PSAT threshold for NOx. Thus, no facilities were asked to do a reasonable progress analysis for NOx.
- Majority of NOx emissions are from mobile sources; not point sources. Mobile sources are primary regulated at federal level; not state level.
- VISTAS used 2011 base year for modeling, which was the most current at the time modeling work started. Modeling work started 3 years before SIP due. EPA approved of use of 2011 platform.

EPA Comment

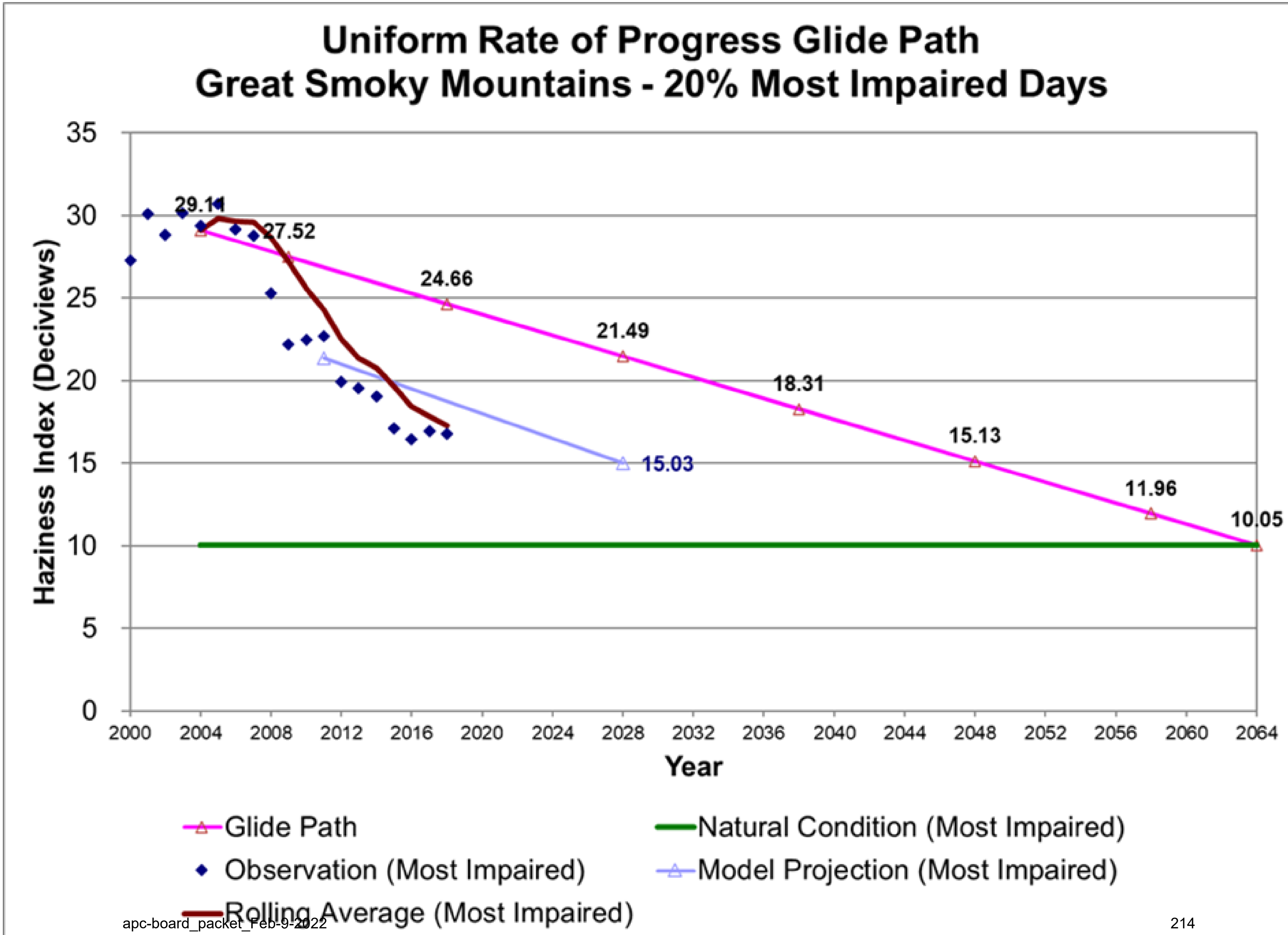
- Comment: EPA stated that once state consultations have concluded with Georgia and Indiana, document the final outcomes

- Background: TDEC requested that GA conduct reasonable progress analysis on Georgia Power Co.-Plant Bowen. VISTAS requested that IN conduct reasonable progress analysis on 3 EGUs; 2 that impacted TN Class I areas.

TDEC Response

- TDEC contacted GA in Dec. 2021 & GA provided reasonable progress analysis for Georgia Power Co.-Plant Bowen. GA has not submitted final SIP.

- TDEC commented on IN draft SIP in Nov. 2021. IN sent response letter to VISTAS on Dec. 22, 2021. IN not conducting reasonable progress analysis on EGU's; doing sources in other sectors. IN has submitted final SIP.


Uniform Rate of Progress Glide Path
Great Smoky Mountains - 20% Most Impaired Days
Haziness Index (Deciviews)
Year
29.11
27.52
24.66
21.49
18.31
15.13
11.96
10.05
15.03
Glide Path
Natural Condition (Most Impaired)
Observation (Most Impaired)
Model Projection (Most Impaired)
Rolling Average (Most Impaired)

Timeline

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Questions

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Tennessee Regional Haze
State Implementation Plan

Prepared by:

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Department of Environment & Conservation
Division of Air Pollution Control
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TN Department of Environment & Conservation

Final
February 9, 2022

Executive Summary

Introduction

Regional haze is pollution that impairs visibility over a large region, including national parks and wilderness areas (many termed "Class I" areas). Regional haze is caused by sources and activities emitting fine particles and their precursors, often transported over large regions. Particles affect visibility through the scattering and absorption of light. Reducing fine particles in the atmosphere is an effective method of improving visibility. In the southeast, the dominant sources of haze-forming emissions are coal-fired power plants, industrial boilers, and other combustion sources, but others include mobile source emissions, area sources, fires, and windblown dust.

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. 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 (dv), calculated directly from light extinction using a logarithmic scale.

The regional haze rule requires states to develop programs to assure reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from manmade air pollution.[1] The rule also requires states to calculate the baseline, current, and natural visibility conditions for each Class I Federal area located within the state.[2] Additionally, the rule requires states to 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.[3] The rule directs states to graphically show what would be a "uniform rate of progress" (URP), also known as the "glide path", toward natural conditions for each Class I area within the State and certain ones outside the State.[4] Natural visibility means visibility (contrast, coloration, and texture) on a day or days that would have existed under natural conditions.

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, including reasonable progress, for the first planning period from 2007 to 2018. The regional haze rule required states to submit periodic comprehensive revisions of their regional haze plans by July 31, 2018, and every ten years thereafter.[5] The United States Environmental Protection Agency (EPA) revised the regional haze rule to change the deadlines for submitting revisions and updates

[1] 40 CFR 51.300(a)
[2] 40 CFR 51.308(f)(1)
[3] 40 CFR 51.308(f)(1)(iv)
[4] 40 CFR 51.308(f)(1)(vi)
[5] 40 CFR 51.308(f)

to regional haze plans to July 31, 2021, July 31, 2028, and every 10 years thereafter.[6] This SIP was prepared for the second planning period, which includes years 2019 to 2028.

Tennessee's Class I areas

Tennessee has two Class I areas within its borders: Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. The Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area are each located in both North Carolina and Tennessee. The figure below illustrates the location of these Class I areas.

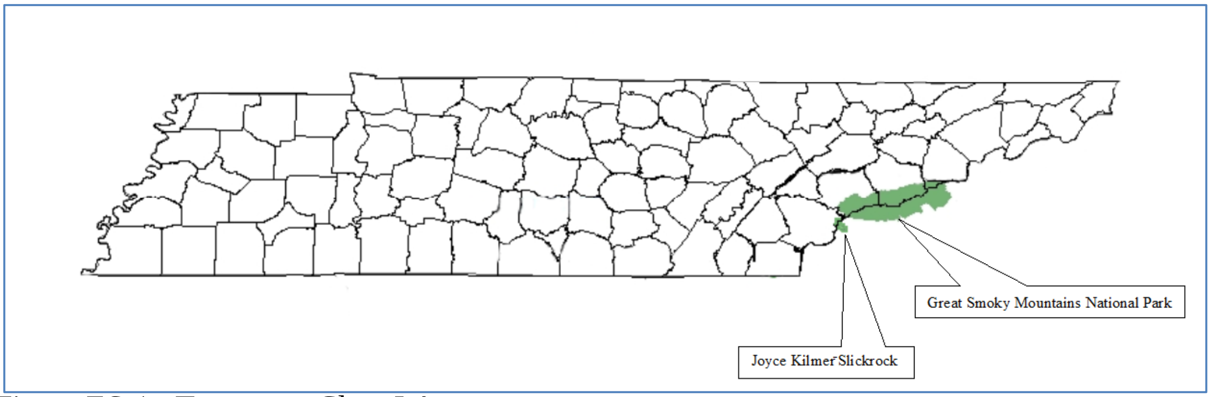

Figure ES-1: Tennessee Class I Areas

VISTAS Class I Areas

Successful implementation of a regional haze program involves long-term regional coordination among states. SESARM formed Visibility Improvement State and Tribal Association of the Southeast (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. Tennessee participated as a member state in VISTAS during the first and second planning periods. The figure below illustrates the location of the VISTAS Class I areas.

[6] Rule revision on January 10, 2017

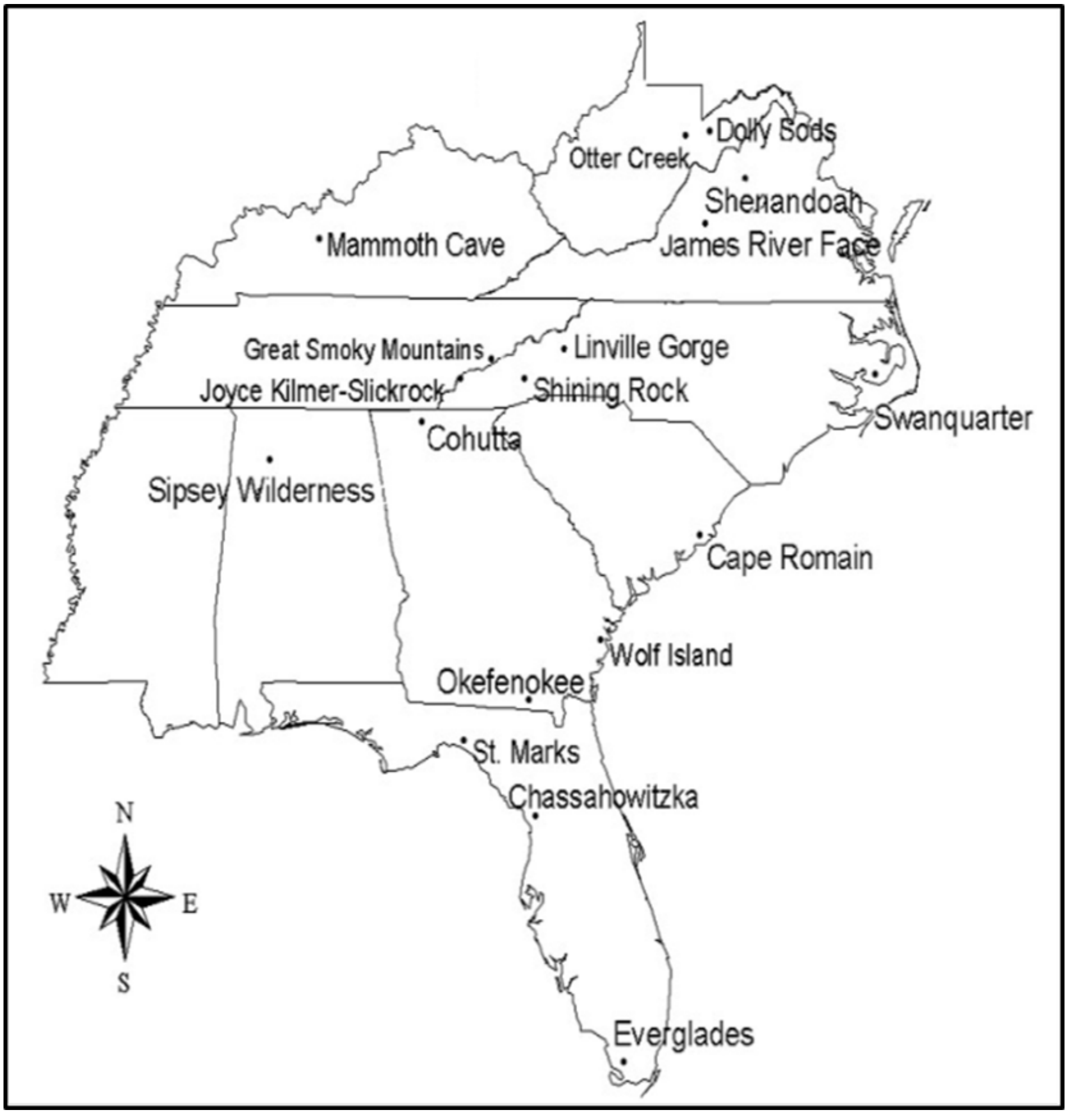

Figure ES-2: VISTAS Class I Areas

State Implementation Plan Requirements

States are required to submit state implementation plans (SIPs) to the EPA that set out each state's plan for assuring reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas. The regional haze regulation requires states to submit a long-term strategy (LTS) 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.[7] Thus, Tennessee's LTS addresses both Tennessee Class I areas and Class I areas in neighboring states like Cohutta Wilderness Area in Georgia, Linville Gorge

[7] 40 CFR 51.308(g)

Wilderness Area in North Carolina, Sipsey Wilderness Area in Alabama, and Mammoth Cave National Park in Kentucky. The regional haze rule requires each state to submit SIPs approximately every 10 years that include the state's reasonable progress goals, expressed in deciviews, for visibility improvement at each Class I area in the state for each planning period.

SIPs must include determinations of the baseline visibility conditions (expressed in deciviews) for the most impaired and clearest days. "Baseline" visibility is the starting point for the improvement of visibility conditions. Baseline visibility is calculated from the average of the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring data for 2000 through 2004. Most impaired days means the twenty percent of monitored days in a calendar year with the highest amounts of anthropogenic visibility impairment. Clearest days means the twenty percent of monitored days in a calendar year with the lowest values of the deciview index. In addition, states must include a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment. The LTS includes enforceable emissions limitations, compliance schedules, and other measures as necessary to achieve the reasonable progress goals. States must also consider ongoing control programs, measures to mitigate construction activities, source retirement and replacement schedules, smoke management programs for agriculture and forestry, and enforceability of specific measures.

The SIPs for the first implementation period were due December 17, 2007. These plans covered long-term strategies for visibility improvement between baseline conditions and 2018. States are required to evaluate progress toward reasonable progress goals every 5 years to assure that installed emissions controls are on track with emissions reduction forecasts in each SIP. The SIPs for the second implementation period are due July 31, 2021. These plans cover long-term strategies for visibility improvement between 2019 and 2028.

Federal and State Control Requirements

There are significant control programs being implemented between 2019 and 2028. These programs will all reduce the particulate emissions that affect visibility in the Class I areas, and include: the Cross State Air Pollution Rule (CSAPR), the Mercury and Air Toxics Standard (MATS), the 2010 sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS), the North Carolina Clean Smokestacks Act, Georgia Multi-Pollutant Rule, consent agreements with Tennessee Valley Authority (TVA), Lehigh Cement Company, Virginia Electric and Power Company (VEPCO), and Anchor Glass Container, heavy duty diesel (2007) engine standard (for on-road trucks and buses), Tier 3 tailpipe standards for on-road vehicles, nonroad diesel rule, commercial marine vessel rule, and various Federal Maximum Achievable Control Technology (MACT) regulations.

During the first implementation period, the regional haze rule required states to determine best available retrofit technology (BART) for certain facilities. Four BART sources in Tennessee were subjected to BART limitations. Two of the four BART sources (Alcoa and DuPont) have shut down and their permits have been surrendered since the first SIP was submitted. Permit limitations for the remaining two sources (Eastman Chemical Company and TVA Cumberland) are still in effect. During the first implementation period, the regional haze rule also required states to identify sources that are significantly contributing to visibility impairment and require those sources to undergo a reasonable progress analysis. Two emission units in Tennessee, Bowater, now named Resolute, and INVISTA, were required to submit a reasonable progress analysis. Based on review of these analyses consistent with the requirements of the regional haze rule, these emission units were not required to implement any additional controls or measures.

During this second implementation period, the regional haze rule required states to identify sources that are contributing to visibility impairment and require those sources to undergo a reasonable progress analysis. First, county-level area of influence (AoI) analyses were performed to determine that SO_2 and NO_X emissions from electricity generating unit (EGU) and non-EGU point sources are the greatest contributors to visibility impairment at VISTAS Class I areas. Analyses were then performed to identify the specific EGU and Non-EGU point sources of SO_2 and NO_X that had the greatest contribution to visibility impairment. This was performed by a two-step process. First, facility-level SO_2 and nitrogen oxides (NO_X) AoI analyses were performed for each Class I area to determine the relative visibility impact from each facility. These facilities were then ranked by their sulfate and nitrate visibility contribution at each Class I area. Second, Comprehensive Air Quality Model with Extensions (CAMx) Particulate Matter Source Apportionment Technology (PSAT) modeling was used to gain a better understanding of the source contributions to modeled visibility[8]. PSAT uses multiple tracer families to track the fate of both primary and secondary particulate matter (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. 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 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

[8] One facility, McGhee Tyson Airport, met Tennessee's threshold for the second step of the analysis, but could not be modeled using PSAT because of the release height of the facility's emissions. Further analysis by APC indicated that emissions from the airport would not have exceeded the 1.00% threshold for reasonable progress analyses. See section 7.6.1 for a full explanation.

equal to 1.00%, then the facility was considered for an SO_2 reasonable progress analysis. If the nitrate contribution was greater than or equal to 1.00%, then the facility was considered for a NO_X reasonable progress analysis. Three sources in Tennessee, Eastman Chemical Company, TVA Cumberland, and TVA Kingston, were required to submit a reasonable progress analysis due to sulfate contribution exceeding 1.00%. The Division of Air Pollution Control received information from TVA that contained revised projected emissions for TVA Kingston. When adjusted for these revised projections, the SO_2 contribution fell below 1.00%. No additional analysis was required for TVA Kingston. As a result of the analyses, Eastman Chemical Company will have permit limitations for several boilers. This is discussed in Section 7 of this document. TVA Cumberland will not have any additional limitations for the second planning period.

Uniform Rate of Progress Glide Slope

The figure below illustrates the predicted visibility improvement on the 20% most impaired days by 2028, compared to the URP glide paths for Great Smoky Mountains National Park. The pink lines represent the URP at the 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. 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.

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. The 2000-2004 average baseline visibility conditions for the 20% clearest days is 13.58 dv. The five year average (2014-2018) value for the IMPROVE monitoring data is 8.35 dv. The model predicts a value of 8.96 dv for the 20% clearest days in 2028 based on existing and planned emissions controls during the period of the LTS associated with this round of planning. The modeling value ensures no degradation of visibility conditions in 2028 on the 20% clearest visibility days at Great Smoky Mountains National Park.

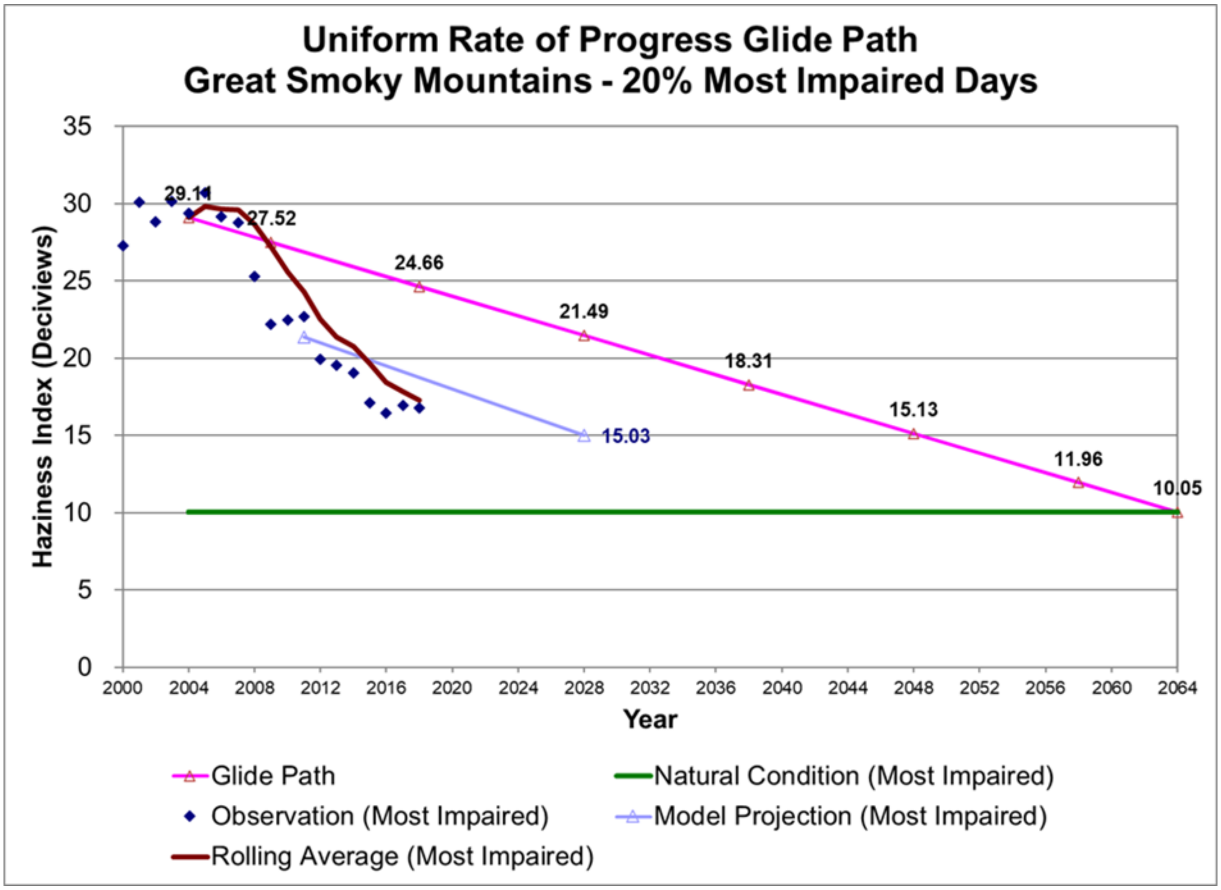

Figure ES-3: URP for Great Smoky Mountains National Park

Reasonable Progress Goals

At both Class I areas in Tennessee, visibility improvements on the 20% most impaired days are expected to be better than the uniform rate of progress glidepath by 2028 based on the control programs in Tennessee's LTS. Additionally, the visibility is expected to improve for the 20% clearest days for Tennessee Class I areas. The tables below display the 2028 reasonable progress goals (RPGs) for the Tennessee Class I areas. (Since there is not an IMPROVE monitor located at Joyce Kilmer-Slickrock Wilderness Area, the Great Smoky Mountains National Park uniform rate of progress and reasonable progress goals are being used as a surrogate for Joyce Kilmer-Slickrock.)

Table ES-1: Tennessee RPGs – 20% Most Impaired Days

Class I Area	**2000-2004 Baseline Visibility (dv)[1]**	**2028 Reasonable Progress Goals (dv)** [2004 – 2028 decrease, (dv)]	**2028 Uniform Rate of Progress (dv)** [2004 – 2028 decrease to meet uniform progress, (dv)]	**Natural Visibility (dv)** [2028 – 2064 decrease needed from 2028 goal]
Great Smoky Mountains National Park	29.11	15.03 [14.08]	21.49 [7.62]	10.05 [4.97]
Joyce Kilmer Slickrock Wilderness Area	29.11	15.03 [14.08]	21.49 [7.62]	10.05 [4.97]

(1) The 2000-2004 baseline visibility data derives from the 2018 data set on the VIEWS website (sia_impairment_daily_budgets_10_18.zip).

Table ES-2: Tennessee Class I Area 20% Clearest Day Comparisons

Class I Area	**2000-2004 Baseline Visibility (dv)[1]**	**2028 Reasonable Progress Goal (dv)** [2004 – 2028 improvement goal]	**Natural Visibility (dv) [2028 – 2064 decrease needed from 2028 goal]**
Great Smoky Mountains National Park	13.58	8.96 [4.62]	4.62 [4.34]
Joyce Kilmer Slickrock Wilderness Area	13.58	8.96 [4.62]	4.62 [4.34]

(1) The 2000-2004 baseline visibility data derives from the 2018 data set on the VIEWS website (sia_impairment_daily_budgets_10_18.zip).

Conclusion

Visibility at Tennessee's Class I areas has been steadily improving from 2000 to 2018 according to actual monitoring data. This is due, in part, to the LTS contained in Tennessee's SIP from the first implementation period. Modeling data predicts that visibility will continue to improve in 2028. The LTS contained in Tennessee's SIP for this second implementation period ensures that this predicted visibility improvement will occur in the future.

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Table of Appendices

Appendix ID	Description and File Names
Appendix A	Project Reports File Name: Appendix A1 A2 A3 for SIP Not Compressed.pdf
A-1	Revised Quality Assurance Project Plan Southeastern VISTAS II Regional Haze Analysis Project April 3, 2018
A-2	Work Plan Southeastern VISTAS II Regional Haze Analysis Project April 18, 2018
A-3	VISTAS II Regional Haze Air Quality Report (Final) – February 10, 2021
Appendix B	Emissions Preparation and Processing File Name: Appendix B1a B1b B2a B2b Combined for SIP.pdf
B-1a	Southeastern VISTAS II Regional Haze Analysis Project - Task 2A Emission Inventory Updates Report (AoI and PSAT) September 22, 2020
B-1b	Conversion of Task 2A 2028 Point Source Modeling Files for Emissions Processing with SMOKE (Task 3A) September 22, 2020
B-2a	VISTAS II Regional Haze Analysis Project - Task 2B Emission Inventory Updates Report (2028 Visibility Estimates) September 22, 2020
B-2b	Conversion of the Task 2B 2028 Point Source Remodeling Files for Emissions Processing with SMOKE (Task 3B) October 12, 2020
Appendix C	Monitoring, Meteorological, and Other Data Acquisition and Preparation File Name: Appendix C for SIP.pdf
C	Southeastern VISTAS II Regional Haze Analysis Project: Task 4 Report October 17, 2018
Appendix D	Area of Influence Analyses File Name: Appendix D1 for SIP.pdf Appendix D2 AoI and HYSPLIT graphics for VISTAS and Nearby ClassI Areas.pdf
D-1	Area of Influence Analysis Southeastern VISTAS II Regional Haze Analysis Project – Revised Final – December 2, 2020
D-2	AoI and HYSPLIT Graphics for VISTAS and Nearby Class I areas

Appendix ID	Description and File Names
Appendix E	Visibility and Source Apportionment Projections File Name: Appendix E1a Vistas Modeling Protocol For SIP.pdf Appendix E1b Modeling Protocol Update For SIP.pdf Appendix E2a BMR1 Runs 1 and 2 For SIP.pdf Appendix E2b BMR2 Run3 For SIP.pdf Appendix E2c BMR3 Run5 For SIP.pdf Appendix E2d BMR4 Run4.pdf Appendix E2e BMR5 Run6 For SIP.pdf Appendix E2f BMR6 Run7 For SIP.pdf Appendix E3 MPE PM and RH For SIP.pdf Appendix E4 MPE Deposition For SIP.pdf Appendix E5 MPE Ozone For SIP.pdf Appendix E6 Future Year Model Projections For SIP.pdf Appendix E7a PSAT Model Results For SIP.pdf Appendix E7b Roadmap for PSAT Scaled Adjustments for SIP.pdf Appendix E8 SMAT 2028 Bulk For SIP.pdf
E-1a	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project – Final Modeling Protocol June 27, 2018
E-1b	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project Final Modeling Protocol Update and Addendum to the Approved Modeling Protocol for Task 6.1 (June 2018) August 31, 2020
E-2a	Regional Haze Modeling for Southwestern VISTAS II Regional Haze Analysis Project 2011el and 2028el CAMx Benchmarking Report Task 6 Benchmark Report #1 Covering Benchmark Runs #1 and #2 August 17, 2020
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
E-2e	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project 2028elv3 CAMx Version 6.40 12km VISTAS and EPA 12km Continental Grid Comparison Report Task 6 Benchmark Report Number #5 Covering Benchmark Run #6 August 17, 2020
E-2f	Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project 2028 Emissions Version V3 and V5 Comparison Report Benchmark Report Task 6 Benchmark Report #6 Covering Benchmark Run #7 September 22, 2020
E-3	Model Performance Evaluation for Particulate Matter and Regional Haze of the CAMx 6.40 Modeling System and the VISTAS II 2011 Updated Modeling Platform for Task 8.0 October 29, 2020 APP_C_maps_pred_obs_mpe_results_station_all_dates_IMPROVE.xlsx APP_F_PM_EXINCTION_MPE.xlsx Spreadsheets only available in electronic format and upon request.
E-4	Deposition Model Performance Evaluation Southeastern VISTAS II Regional Haze Analysis Project (Task 8.1) August 17, 2020

Appendix ID	Description and File Names
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 AppendixA1-OzoneMPEbyStation.xlsx Spreadsheet only available in electronic format and upon request.
E-6	Future Year Model Projections Task 9a September 23, 2020 APP_A_ag_v6_40.2028elv5.vistas_12_SESARM (4 Sept 2020).xlsx APP_B_StackedBarCharts.xlsx APP_C_SESARM_2028elv5_URP_20200903.xlsx Spreadsheet only available in electronic format and upon request.
E-7a	Particulate Source Apportionment Technology Modeling Results Task 7 August 31, 2020 ATTACHMENT_A_PSAT_TAG_RESULTS.xlsm ATTACHMENT_B_DAY_BY_DAY_GROUP_10_90_20200824.xlsx Spreadsheet only available in electronic format and upon request.
E-7b	Roadmap for PSAT Scaled Adjustments ATTACHMENT_A_PSAT_TAG_RESULTS_adjusted_09-02-2020.xlsx Percent Contributions to Areas 9-2-2020.xlsx Spreadsheet only available in electronic format and upon request.
E-8	SMAT 2028 Bulk- EPA 2019 Modeling with graphics
Appendix F	Consultation File Name: Appendix F1 combined for SIP.pdf Appendix F2 combined for SIP.pdf Appendix F3a to F3n.pdf Appendix F4 combined for SIP.pdf
F-1	VISTAS state to VISTAS state Consultation
F-1a	TDEC-APC letter to GA dated October 23, 2020
F-1b	GA letter to TDEC-APC dated November 24, 2020
F-1c	TDEC-APC letter to GA dated January 14, 2021
F-1d	NC letter to TDEC-APC dated February 1, 2021
F-1e	TDEC-APC letter to NC dated February 18, 2021
F-1f	TDEC-APC letter to KY dated October 23, 2020
F-1g	TVA Shawnee (KY) submittal dated February 19, 2021
F-1h	Georgia Power Company-Plant Bowen (GA) submittal dated October 2021
F-2	VISTAS state to NonVISTAS State Consultation
F-2a	VISTAS Letter to IN Office of Air Quality dated June 22, 2020
F-2b	VISTAS Letter to OH Division of Air Pollution Control dated June 22, 2020
F-2c	VISTAS Letter to PA Bureau of Air Quality dated June 22, 2020
F-2d	PA letter to VISTAS dated July 8, 2020 (with attached letter dated May 26, 2020 to Keystone)
F-2e	MO letter to TDEC-APC dated September 11, 2020
F-2f	IN email to VISTAS dated October 22, 2020
F-2g	OH letter to VISTAS dated October 29, 2020

Appendix ID	Description and File Names
F-2h	TDEC-APC letter to MO dated January 14, 2021
F-2i	IN email to VISTAS dated February 12, 2021
F-2j	Keystone (PA) submittal dated January 11, 2021
F-2k	Keystone (PA) submittal dated February 11, 2021
F-2l	TDEC-APC letter to IN dated November 4, 2021
F-2m	IN letter to VISTAS dated December 22, 2021
F-2n	OH email to TDEC-APC dated December 27, 2021
F-3	EPA/FLM/Stakeholder Outreach and Presentations
F-3a	FLM/EPA Consultation Record
F-3b	National Regional Haze Meeting, Denver, CO December 5-7, 2017
F-3c	Presentation to FLMs, EPA Region 4, CC/TAWG on January 31, 2018
F-3d	VISTAS Call with FLMs August 1, 2018
F-3e	VISTAS Presentation to other RPOs September 5, 2018
F-3f	VISTAS Regional Haze Project Update June 3, 2019
F-3g	National Regional Haze Meeting, St Louis, MO October 28-30, 2019
F-3h	VISTAS Regional Haze Project Update April 2, 2020
F-3i	VISTAS Presentation to MJO April 21, 2020
F-3j	VISTAS Regional Haze Project Update to FLMs, EPA OAQPS, Region 3, Region 4, MJOs May 11, 2020
F-3k	VISTAS Regional Haze Project Update Stakeholder Briefing May 20, 2020
F-3l	VISTAS Regional Haze Project Update to EPA Region 3, Region 4, and OAQPS July 30, 2020
F-3m	VISTAS Regional Haze Project Update August 4, 2020
F-3n	EPA Region 4 Fall 2020 Air Director's Meeting-Regional Haze Update October 26, 2020
F-4	State and VISTAS Consultation Documentation with MANE-VU
F-4a	MANE-VU letter to TDEC-APC dated August 25, 2017
F-4b	TDEC-APC email to MANE-VU dated December 22, 2017
F-4c	January 27, 2018, letter to OTC/MANE-VU (Dave Foerter) from VISTAS (John Hornback) on behalf of AL, FL, KY, NC, TN, VA, WV offering comments on MANE-VU documents
F-4d	MANE-VU letter to TDEC-APC dated May 8, 2018
F-4e	TDEC-APC letter to MANE-VU dated January 13, 2021
F-4f	MANE-VU letter to TDEC-APC dated February 17, 2021
Appendix G	Reasonable Progress Evaluation/Long Term Strategy File Name: Appendix G1 combined for SIP.pdf Appendix G2 combined for SIP.pdf
G-1	Reasonable Progress Analysis for TVA Cumberland and TVA Kingston
G-1a	TDEC-APC letter to TVA dated February 13, 2020
G-1b	TVA letter to TDEC-APC dated February 28, 2020
G-1c	TDEC-APC letter to TVA dated March 30, 2020
G-1d	TVA letter to TDEC-APC dated June 17, 2020
G-1e	TDEC-APC letter to TVA dated June 17, 2020
G-1f	TVA report to TDEC-APC dated July 29, 2020
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G-2	Reasonable Progress Analysis for Eastman Chemical Company
G-2a	TDEC-APC letter to Eastman Chemical Company dated May 15, 2020
G-2b	Eastman Chemical Company letter to TDEC-APC dated May 28, 2020

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G-2c	Eastman Chemical Company letter to TDEC-APC dated August 13, 2020
G-2d	TDEC-APC letter to Eastman Chemical Company dated January 15, 2021
G-2e	Eastman Chemical Company letter to TDEC-APC dated February 8, 2021
G-2f	TDEC-APC evaluation of Eastman Chemical Company submittal
G-2g	Permit conditions
Appendix H	FLM Consultation Comments File Name: Appendix H1 combined for SIP.pdf
H-1a	TDEC-APC email to FLMs dated July 2, 2021
H-1b	Forest Service Comments dated August 27, 2021
H-1c	National Park Service Slides dated August 24, 2021
H-1d	National Park Service email dated August 31, 2021
H-1e	National Park Service Comments dated August 31, 2021 eastman 4FA boiler30 FF.xlsx eastman 4FA boilers21&22 FF DSI.xlsx eastman 4FA boilers23&24 FF.xlsx Haze Metric Conversions for TN Sources.xlsx NPS updated TN RP facilities.xlsx TVA units emiss record CAMD final.xlsx Spreadsheet only available in electronic format and upon request.
Appendix I	Comments Received, Public Notice, Hearing Summary, and Response to Comments File Name: Appendix I1 to I6 combined for SIP Appendix I7 Appendix I8 Appendix I9
I-1	Comments from National Parks Conservation Association, Sierra Club, Tennessee Citizens for Wilderness Planning, Southern Environmental Law Center, Appalachian Voices, Center for Biological Diversity, Sowing Justice, Tennessee Interfaith Power and Light, Citizens Climate Coalition
I-2	Comments from Sierra Club
I-3	Comments from National Park Service
I-4	Comments from U.S. Environmental Protection Agency
I-5	Comments from New Jersey Department of Environmental Protection
I-6	Comments from MANE-VU
I-7	Comments from Public Email Campaign
I-8	Comments from National Parks Conservation Association, Sierra Club, Tennessee Citizens for Wilderness Planning, and Coalition to Protect America's National Parks Ex 2 Attachment TN EGU emissions.xlsx Spreadsheet only available in electronic format and upon request.
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List of Acronyms and Abbreviations

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
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
FGD	flue gas desulfurization
FIA	Forest Inventory and Analysis
FLM	federal land manager

Acronym/Abbreviation	Meaning
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
lbs/mmbtu	pounds per million British thermal units
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
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
NEI	National Emissions Inventory
NEEDS	National Electric Energy Database Systems
NH_3	ammonia
NH_4^+	ammonium ion

Acronym/Abbreviation	Meaning
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
PSAT	Particulate Matter Source Apportionment Technology
PTE	potential to emit
Q	emissions, tons per year
RACT	reasonably available control technology
RFG	reformulated gasoline
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
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

Acronym/Abbreviation	**Meaning**
TDEC-APC	Tennessee Department of Environment and Conservation-Air Pollution Control Division
TECO	Tampa Electric Company
tpOS	tons per ozone season
tpy	tons per year
TVA	Tennessee Valley Authority
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 less than or equal to 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 the EPA to issue regional haze rules. The regional haze rule that the 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.[9] 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, the 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.[10] The Southeastern States Air Resource Managers, Inc. (SESARM) has been designated 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.

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[9] 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).
[10] URL: https://www.epa.gov/visibility/visibility-regional-planning-organizations

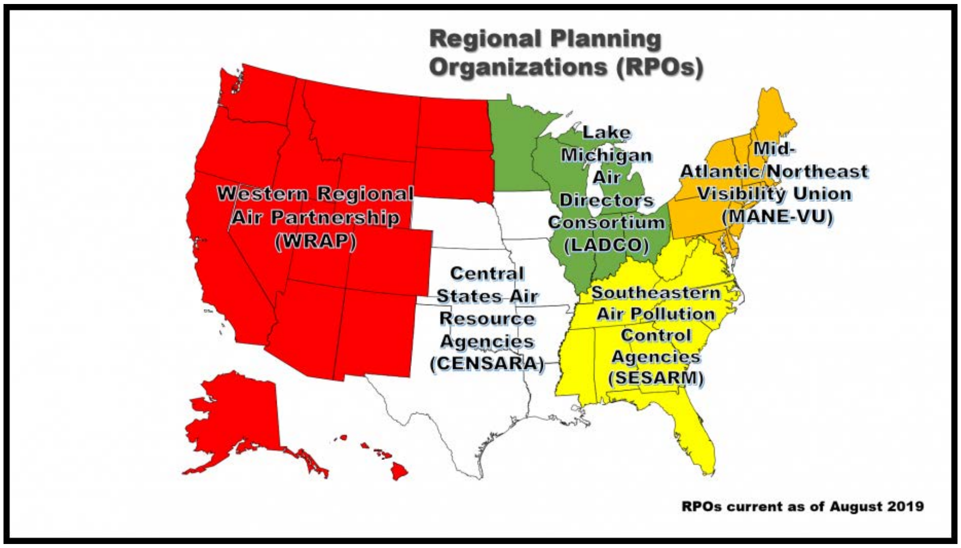

Figure 1-1: Geographical Areas of Regional Planning Organizations

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. All regional haze SIPs must include the following:

- Reasonable progress goals (RPGs) for each mandatory federal Class I area located within the state;
- Natural, baseline, and current visibility conditions for each mandatory federal Class I area within the state;
- 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
- Other requirements and analyses.

The regional haze rule requires states 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 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.[11] 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 must include the current visibility conditions for the most anthropogenically 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. For this SIP, the current visibility conditions include data from years 2014 to 2018. 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)(i)-(iv)).

The 2028 RPGs for each Class I area must be met through measures contained in the state's long-term strategy. 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 169A 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 useful life) when developing the long-term strategy upon which it bases the RPGs for each Class I area. 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;

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

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)(iv)).

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. 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 SIPs for this second planning period cover long-term strategies for visibility improvement 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. All VISTAS states followed these guidance documents in developing the technical analyses reported in this plan.

- 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)

- Memorandum Titled Clarification Regarding Regional Haze State Implementation Plans for the Second Implementation Period (EPA, July 8, 2021)

1.4. Mandatory Federal Class I Areas in Tennessee

Tennessee has two mandatory Class I areas within its borders: Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. The Tennessee Department of Environment and Conservation – Air Pollution Control Division (TDEC-APC) is responsible for developing the regional haze SIP for Tennessee and submitting it to the Tennessee Air Pollution Control Board for approval. This SIP establishes reasonable progress goals for visibility improvement at each of these mandatory federal Class I areas and a long-term strategy that will achieve those reasonable progress goals within the second regional haze planning period. The Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area are located in both Tennessee and North Carolina. Tennessee and North Carolina coordinated to establish 2028 RPGs for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. Joyce-Kilmer Slickrock Wilderness Area does not contain an IMPROVE site; thus, the rate of progress for Great Smoky Mountains National Park is considered representative of Joyce Kilmer-Slickrock Wilderness Area. These two Class I Areas for Tennessee are described at 40 CFR 81.428 and are shown in Figure 1-2. The Great Smoky Mountains National Park is 514,758 acres with 241,207 acres located in Tennessee and 273,551 acres located in North Carolina. With respect to the Joyce Kilmer Slickrock Wilderness Area, the total area is 14,033 acres with 3,832 acres in Tennessee and 10,201 acres in North Carolina.

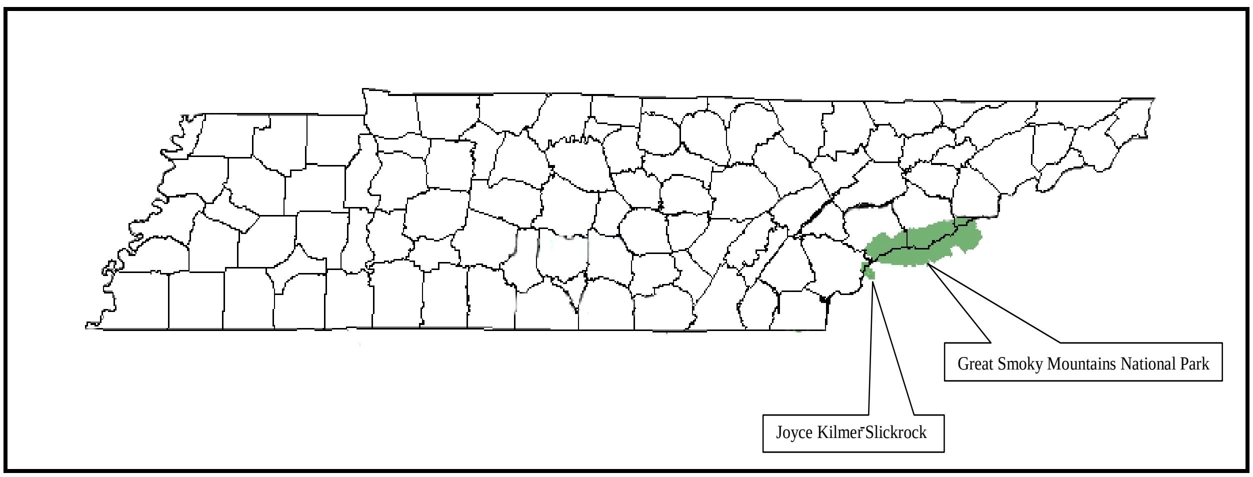

Figure 1-2: Tennessee's Mandatory Federal Class I Areas

As required by the regional haze rule, TDEC-APC has also considered the impacts of emission sources outside of Tennessee that may affect visibility at these Tennessee Class I areas and emission sources within Tennessee 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 in Tennessee and those affected by emissions from Tennessee. This technical work is discussed further in Sections

5, 6, and 7 below. Consultations to date between Tennessee and other states are summarized in Section 10; these consultations are ongoing.

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 1-3 and Table 1-1). Tennessee 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.

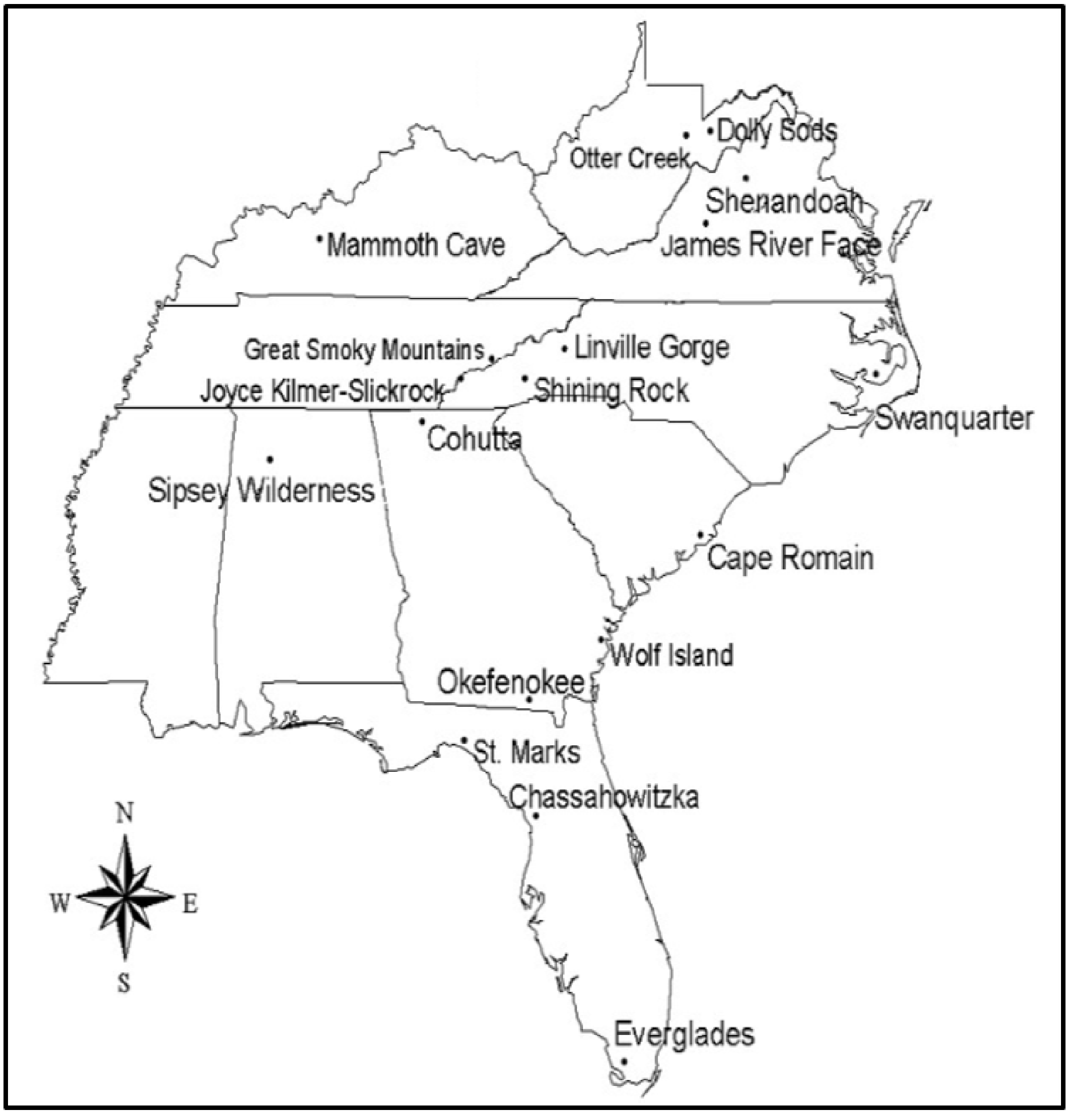

Figure 1-3: Mandatory Federal Class I Areas in the VISTAS Region

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

State	Area Name	Acreage	Federal Land Manager
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 40 CFR 51.308(f)(2)(ii) and 40 CFR 51.308(i)(4) the regional haze SIP must include procedures for continuing state-to-state consultation and FLM consultation 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. The three FLMs are the United States Department of Interior's (USDI) Fish and Wildlife Service (FWS) and National Park Service (NPS), and the United States Department of Agriculture's (USDA) Forest Service (FS).

Coordination with the FLMs of Tennessee's continuing obligations to periodically revise its regional haze SIP is also discussed in Section 10. TDEC-APC 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. As required by CAA section 169A(d), Tennessee consulted with the FLMs prior to the public hearing and included a summary of the conclusions and recommendations of the FLMs in the notice to the public.

The FLMs were involved in the preparation of this regional haze SIP. Documentation of the formal comments made by the FLMs appears in Appendix H and TDEC-APC's response appears in Section 10.4.

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), (g), and (i)

Rule Section	Chapter/Section in SIP	Description
(f)	11	Requirements for periodic comprehensive revisions of implementation plans for regional haze
(f)(1)	2.1, 2.2, 2.3, 2.4, 2.6, 3	Calculations of baseline, current, and natural visibility conditions; progress to date; and the uniform rate of progress
(f)(1)(i)	2.4	Baseline visibility conditions for the most impaired and clearest days
(f)(1)(ii)	2.3	Natural visibility conditions for the most impaired and clearest days

Rule Section	Chapter/Section in SIP	Description
(f)(1)(iii)	2.6	Current visibility conditions for the most impaired and clearest days
(f)(1)(iv)	2.7	Progress to date for the most impaired and clearest days
(f)(1)(v)	2.7	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
(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)	7.9.2	Measures to mitigate the impacts of construction activities
(f)(2)(vi)(C)	7.2.2	Source retirement and replacement schedules
(f)(2)(vi)(D)	7.9.1	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

Rule Section	Chapter/Section in SIP	Description
(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.
(f)(5)	13	So that the plan revision will serve also as a progress report, the State must address in the plan revision the requirements of paragraphs (g)(1) through (5) of this section. However, the period to be addressed for these elements shall be the period since the most recent progress report.
(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)	not applicable	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.
(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.

Rule Section	Chapter/Section in SIP	Description
(g)(3)	13.4	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.
(g)(3)(i)(A)	13.4	Progress reports due before January 31, 2025. The current visibility conditions for the most impaired and least impaired days.
(g)(3)(i)(B)	not applicable	Progress reports due on and after January 31, 2025. The current visibility conditions for the most impaired and clearest days
(g)(3)(ii)(A)	13.4	Progress reports due before January 31, 2025. The difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions.
(g)(3)(ii)(B)	not applicable	Progress reports due on and after January 31, 2025. The difference between current visibility conditions for the most impaired and clearest days and baseline visibility conditions.
(g)(3)(iii)(A)	13.4	Progress reports due before January 31, 2025. The change in visibility impairment for the most impaired and least impaired days over the period since the period addressed in the most recent plan required under paragraph (f) of this section.
(g)(3)(iii)(B)	not applicable	Progress reports due on and after January 31, 2025. 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 (f) of this section.
(g)(4)	13.5	An analysis tracking the change over the period since the period addressed in the most recent plan required under paragraph (f) of this section in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity. With respect to all sources and activities, the analysis must extend at least through the most recent year for which the state has submitted emission inventory information to the Administrator in compliance with the triennial reporting requirements of subpart A of this part as of a date 6 months preceding the required date of the progress report. With respect to sources that report directly to a centralized emissions data system operated by the Administrator, the analysis must extend through the most recent year for which the Administrator has provided a State-level summary of such reported data or an internet-based tool by which the State may obtain such a summary as of a date 6 months preceding the required date of the progress report. The State is not required to backcast previously reported emissions to be consistent with more recent emissions estimation procedures, and may draw attention to actual or possible inconsistencies created by changes in estimation procedures.
(g)(5)	13.5	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 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.
(i)	10.4	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}).[12] 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.[13]

"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.

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

[13] 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 this SIP is 2014-2018, inclusive.

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.[14]

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 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.

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

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

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

2.2. IMPROVE Monitoring Sites

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

Class I Area	IMPROVE Site Identification Number
St. Marks Wilderness Area	SAMA1
Swanquarter Wilderness Area	SWAN1
Wolf Island Wilderness Area	OKEF1

2.3. 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,[15] 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,[16] and EPA guidance that updates recommended methodologies for tracking visibility impairment, issued in December 2018.[17] 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 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.

2.3.1. Natural Background Conditions on 20% Clearest Days

EPA's 2018 guidance 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 is 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.

[15] URL: https://www3.epa.gov/ttnamti1/files/ambient/visible/tracking.pdf
[16] Final Rule: Protection of Visibility: Amendments to Requirements for State Plans, 82 FR 3078, January 10, 2017.
[17] 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

2.3.2. 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.

2.3.3. 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

Class I Areas	Average for 20% Most Impaired Days*	Average for 20% Clearest Days*
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."[18]

2.4. Baseline Conditions

Baseline visibility conditions at each Tennessee Class I area are estimated using sampling data collected at IMPROVE monitoring sites at one of the two Class I areas in Tennessee. 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. IMPROVE data records for Great Smoky Mountains National Park for the period 2000 to 2004 meet the EPA requirements for data completeness (75% for the year and 50% for each quarter). The Forest Service does not operate a monitor at Joyce Kilmer Wilderness Area and considers the IMPROVE monitor at Great Smoky Mountains National Park to be representative of visibility in the Joyce Kilmer-Slickrock Wilderness Area.

2.4.1. 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 (dated June 3, 2020) 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."[19]

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

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

Class I Areas	Average for 20% Most Impaired Days	Average for 20% Clearest Days
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

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

The 20% most impaired visibility days at the Southern Appalachian sites (in Tennessee: Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area) during the baseline period generally occurred in the period April to September. As discussed later in this section, sulfate is the largest component of visibility impairment during the 20% most impaired days. To illustrate this, Figure 2-1 displays the 2000 – 2004 reconstructed extinction for the 20% most impaired days for the Great Smoky Mountains National Park. 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% clearest days at the Southern Appalachian sites can occur at any time of year. At the coastal sites, the 20% most impaired and clearest visibility days are distributed throughout the year.

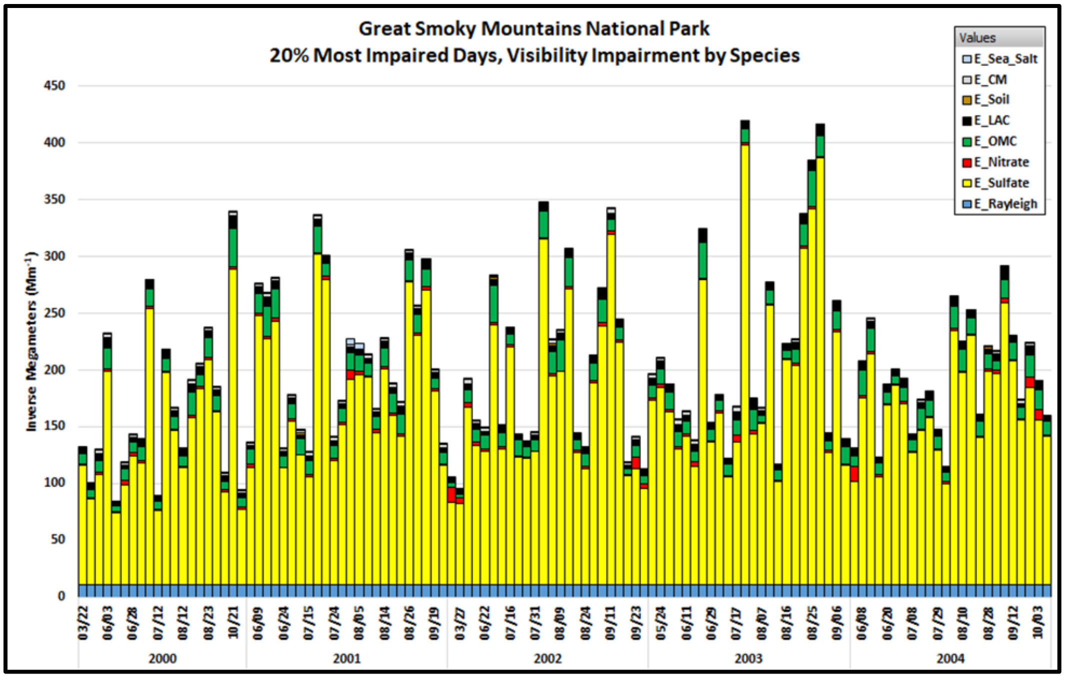


Figure 2-1: 2000-2004 Reconstructed Extinction for the 20% Most Impaired Days at the Great Smoky Mountains National Park

Figure 2-2 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 2-3 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.

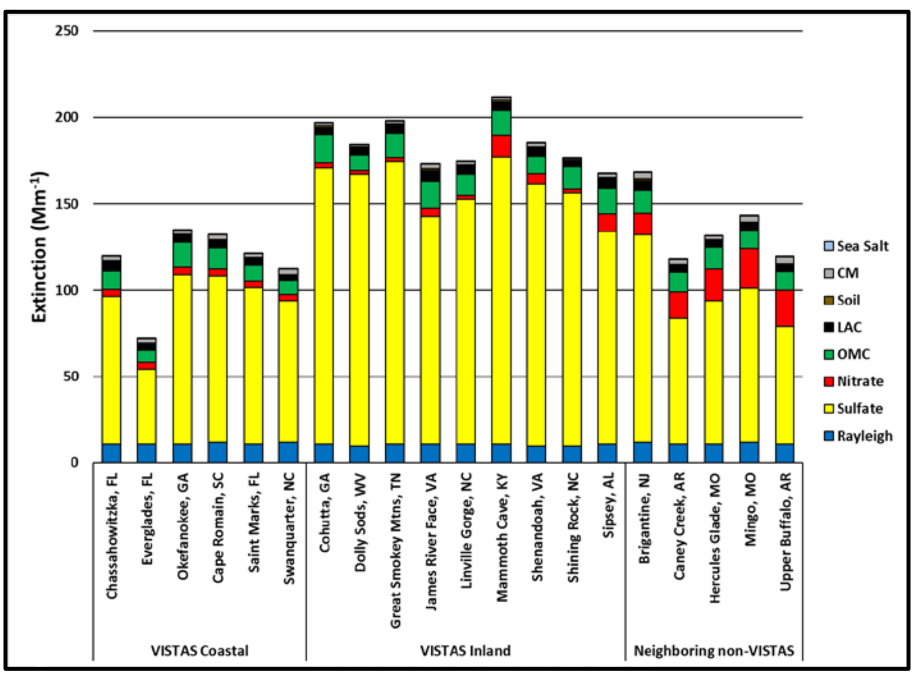


Figure 2-2: Average Light Extinction, 20% Most Impaired Days, 2000-2004, VISTAS and Neighboring Class I Areas

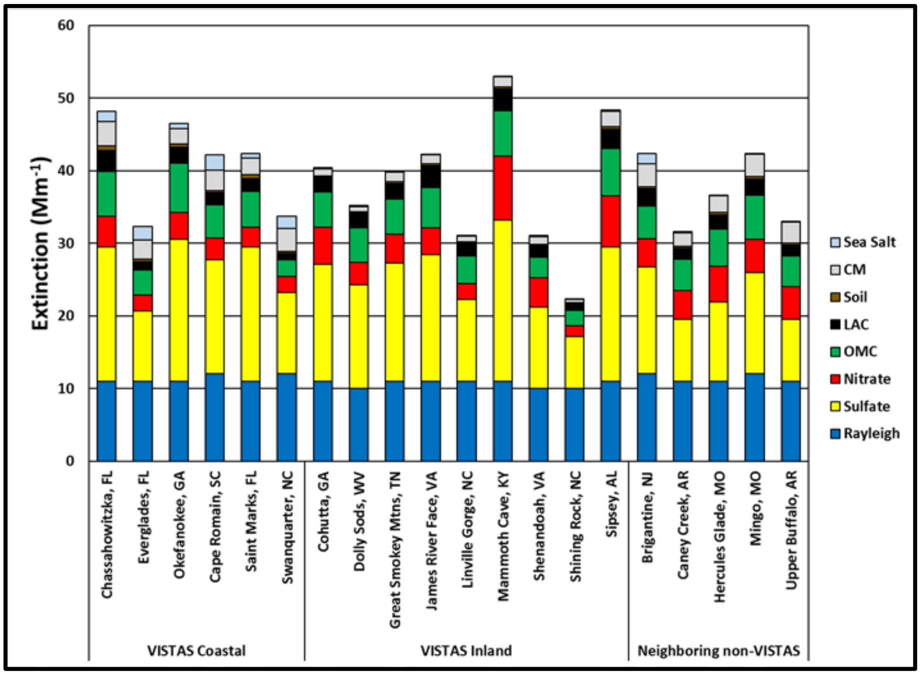


Figure 2-3: Average Light Extinction, 20% Clearest Days, 2000-2004, VISTAS and Neighboring Class I Areas

These bar charts (Figure 2-1, Figure 2-2, and Figure 2-3) 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 oi Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program."[20] 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.

Sulfates are the most important contributor to visibility impairment and fine particle mass on the 20% most impaired and 20% clearest visibility days at all the Tennessee 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 2-2). On the 20% clearest days, sulfate levels are more uniform across the region (Figure 2-3). [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

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

Area, 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, and 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 Tennessee Class I areas during the baseline period. Days with visibility impairment from elevated levels of POM and elemental carbon are associated with natural events such as wildland fires. The events are (for the most part) removed from the 20% most impaired days because they are regarded as natural sources. Significant fire impacts are infrequent at Class I areas in Tennessee. 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.

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 were a minor contributor to visibility impairment during the baseline period of 2000-2004 as the 20% most impaired days in the Tennessee Class I areas generally occurred during the summer months. 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. ECs 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. This suggests that 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}.

2.5. 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.

2.5.1. 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.

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

Figure 2-4 shows the 2009 – 2013 reconstructed extinction for the 20% most impaired days for the Great Smoky Mountains National Park. Similar plots for the other 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. The figure also shows the improvement in visibility impairment when compared to Figure 2-1. While maximum values in Figure 2-1 are in the range of 400 Mm^{-1}, maximum values in Figure 2-4 are in the 180 Mm^{-1} range, highlighting the impact of the many facility shutdowns and control programs implemented at facilities in Tennessee and other states during the intervening period.

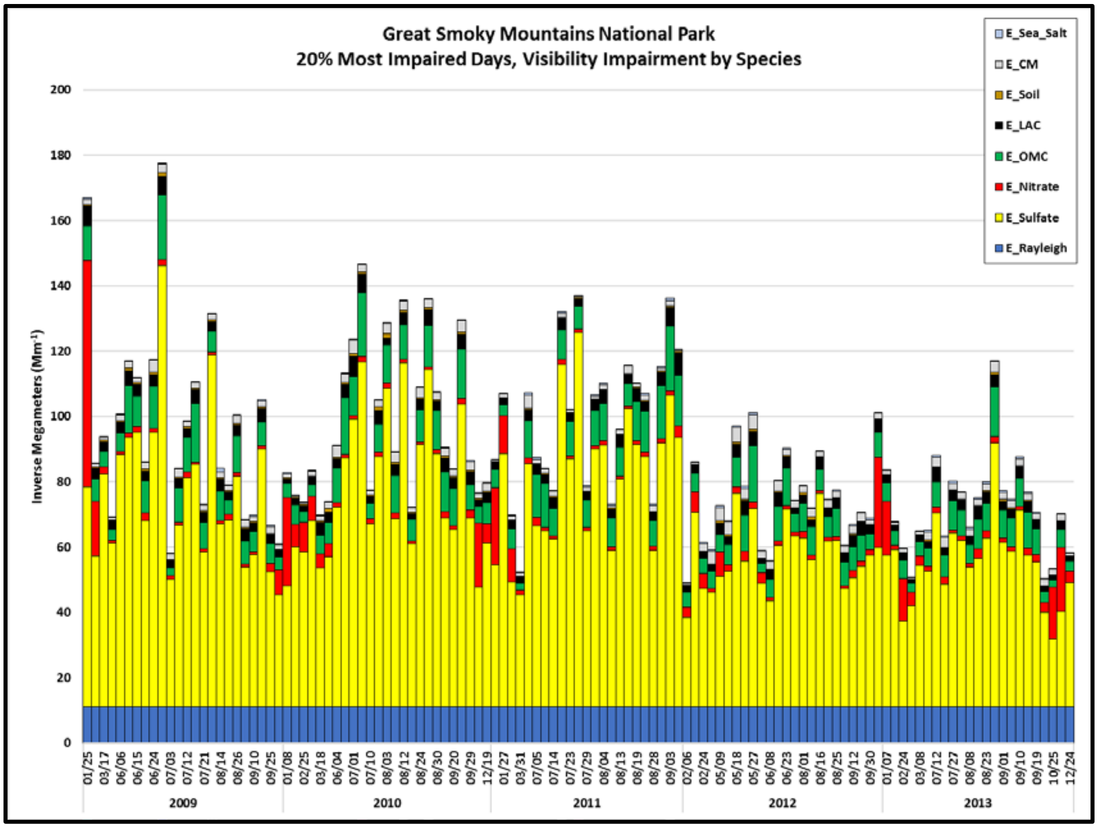


Figure 2-4: 2009-2013 Reconstructed Extinction for the 20% Most Impaired Days at the Great Smoky Mountains National Park

Figure 2-5 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. Figure 2-5 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.

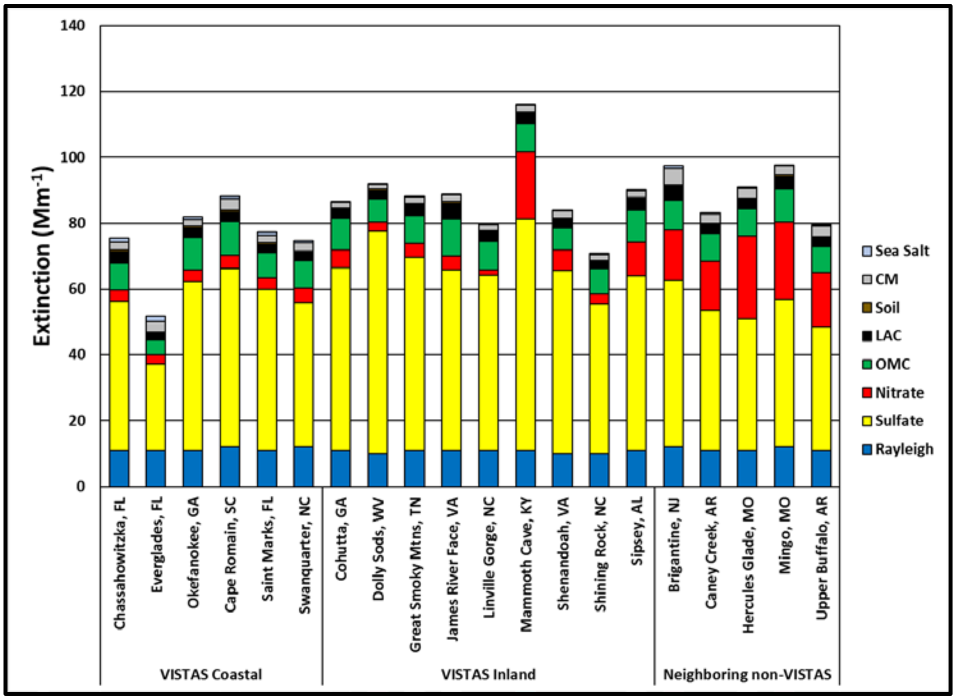


Figure 2-5: Average Light Extinction, 20% Most Impaired Days, 2009-2013, VISTAS and Neighboring Class I Areas

Figure 2-6 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 there is visibility improvement on 20% clearest days.

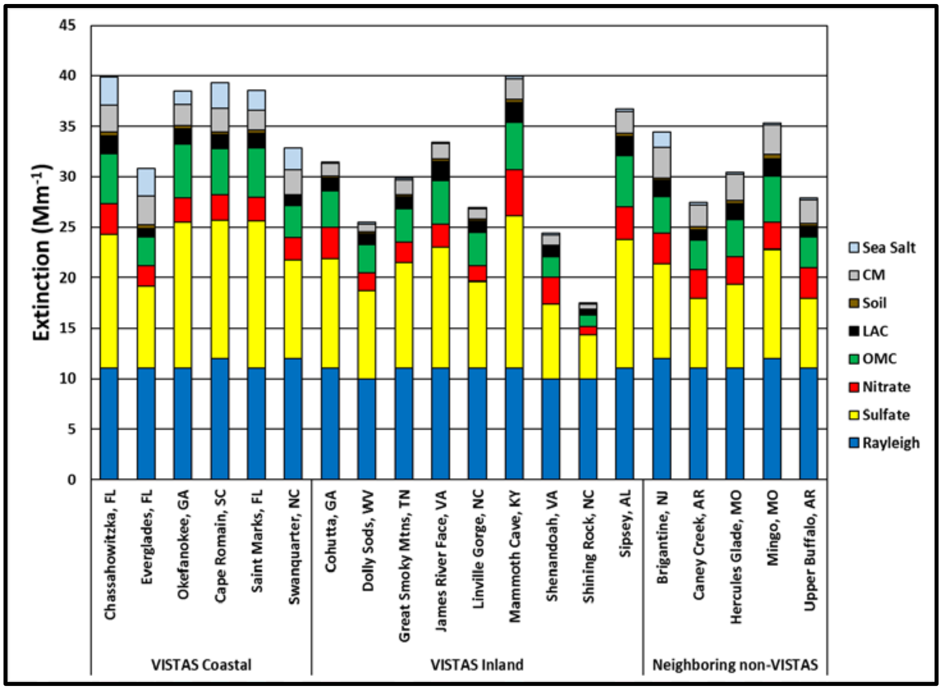


Figure 2-6: Average Light Extinction, 20% Clearest Days, 2009-2013, VISTAS and Neighboring Class I Areas

These bar charts (Figure 2-4, Figure 2-5, Figure 2-6) 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.

2.6. Current Conditions

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

2.6.1. 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."[21]

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

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

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

Figure 2-7 displays the 2014 – 2018 reconstructed extinction for the 20% most impaired days for the Great Smoky Mountains National Park. Similar plots for the other VISTAS Class I areas can be found in Appendix C-2. For the VISTAS region and neighboring Class I areas, Figure 2-8 and Figure 2-9 show light extinction averaged from 2014-2018 IMPROVE data for the 20% most impaired and clearest days, respectively. These bar charts (Figure 2-7, Figure 2-8, and Figure 2-9) 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.

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.

Figure 2-8 presents average data for 20% most impaired days and shows that on average sulfate continues to be the predominant visibility impairing pollutant. However, the data in Figure 2-7, which is daily monitoring values, shows that occasionally nitrate is the predominant visibility impairing pollutant on certain days, generally in winter months.

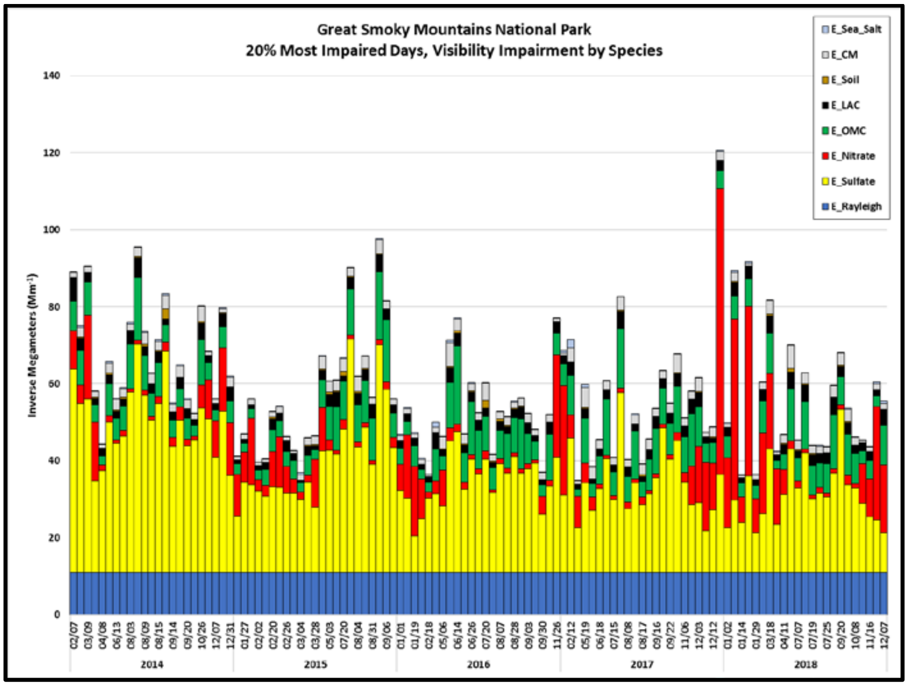


Figure 2-7: 2014-2018 Reconstructed Extinction for the 20% Most Impaired Days at the Great Smoky Mountains National Park

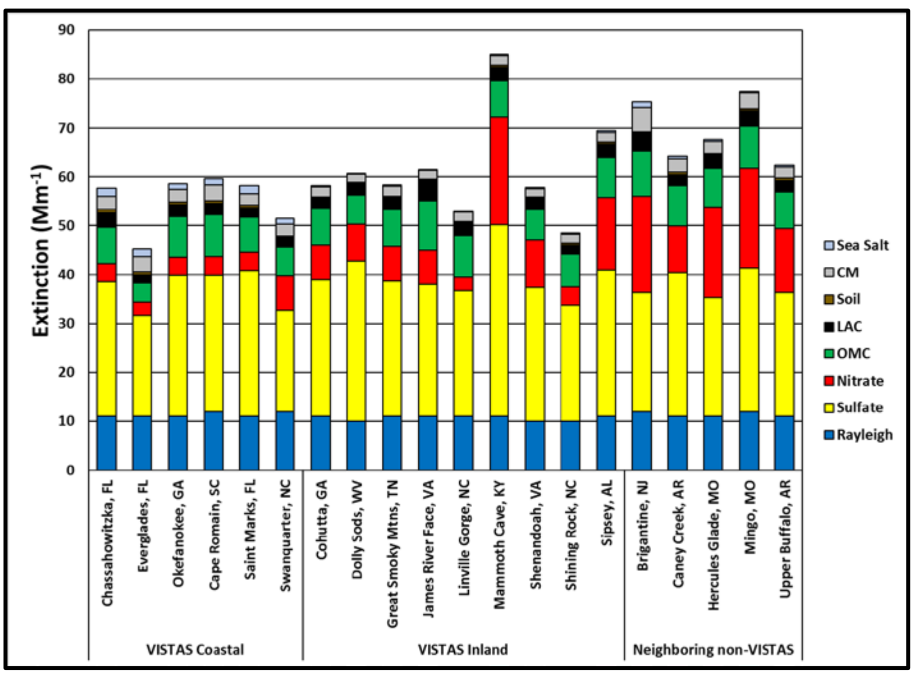


Figure 2-8: Average Light Extinction, 20% Most Impaired Days, 2014-2018, VISTAS and Neighboring Class I Areas

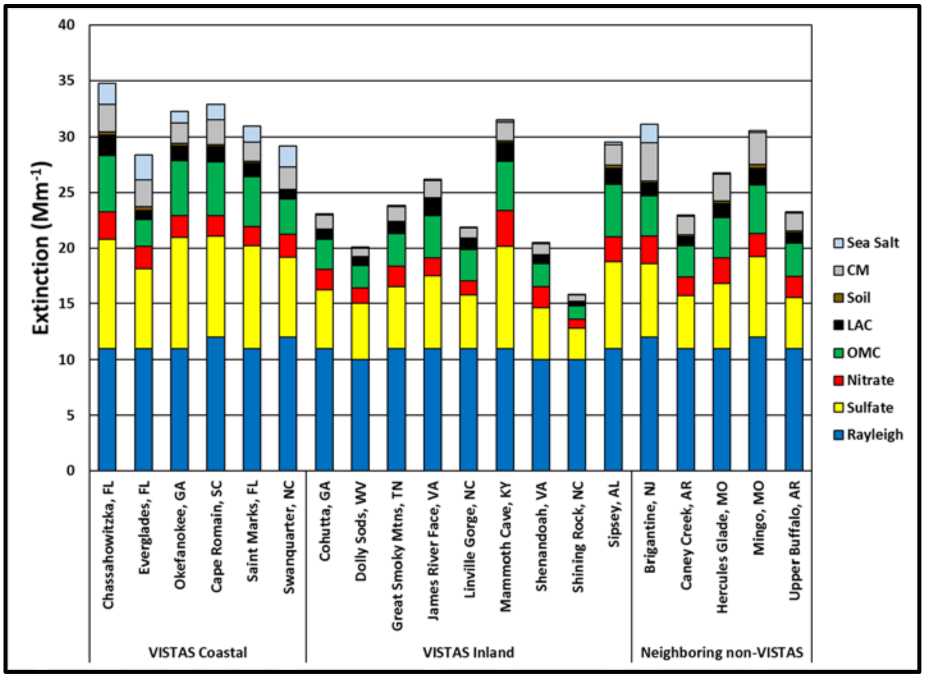


Figure 2-9: Average Light Extinction, 20% Clearest Days, 2014-2018, VISTAS and Neighboring Class I Areas

2.7. 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

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
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

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
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 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. 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.

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[22] and used data collected from the IMPROVE monitoring sites as described in Section 2 of this document.

Figure 3-1 shows the glide path for the 20% most impaired days for Great Smoky Mountains National Park assuming a uniform rate of progress toward natural conditions. Natural background visibility for the most impaired days at Great Smoky Mountains National Park is calculated to be 10.05 dv. As stated in Section 2.2, the Joyce Kilmer-Slickrock Wilderness Area does not have an IMPROVE monitoring site located within its boundaries and relies upon data from the Great Smoky Mountains National Park IMPROVE monitoring site.

The data in Figure 3-1 is derived 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."[23]

[22] URL: https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf
[23] URL: https://www.epa.gov/sites/production/files/2020-06/documents/memo_data_for_regional_haze_technical_addendum.pdf

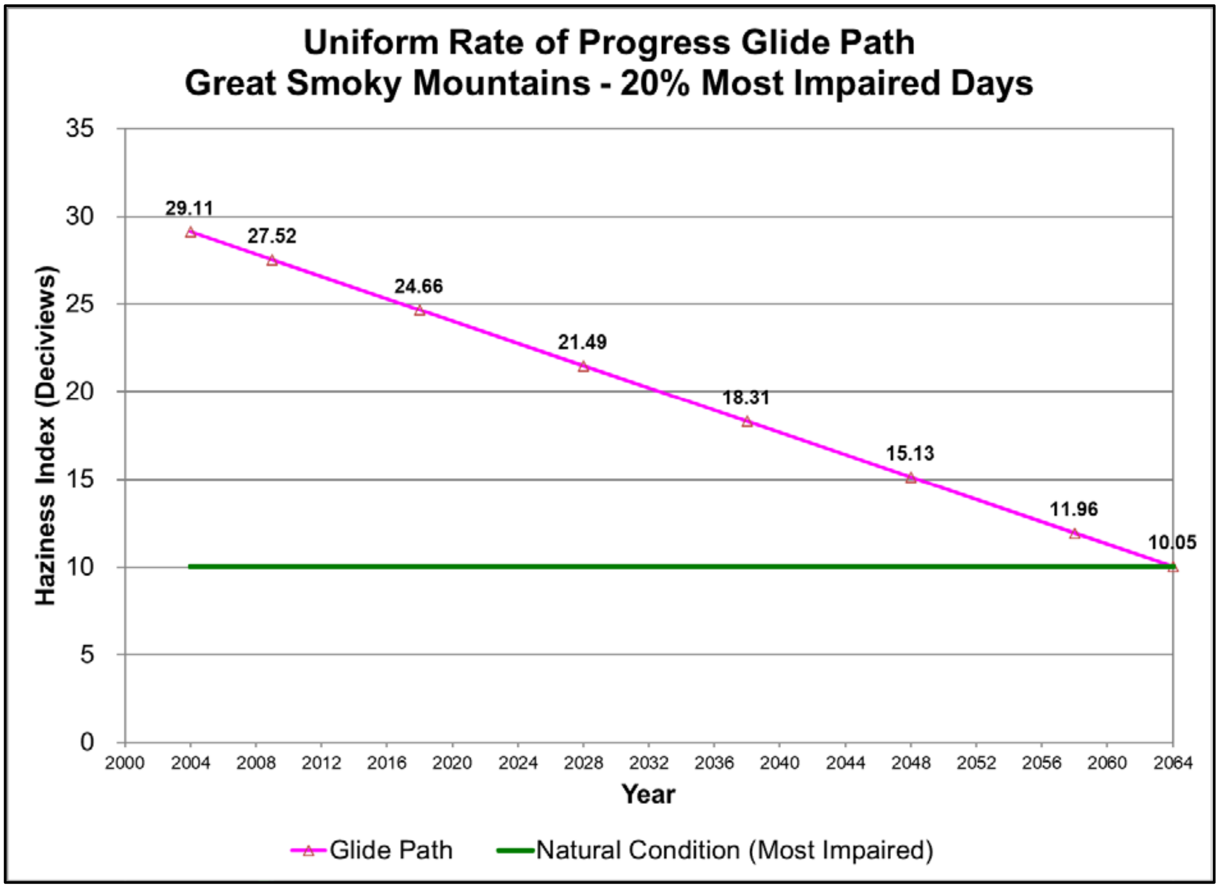


Figure 3-1: Uniform Rate of Progress Glide Path for 20% Most Impaired Days at Great Smoky Mountains National Park

4. Emission Inventories Used For Visibility Analyses

4.1. Overview

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. Tennessee complies with the Air Emission Reporting Requirements (AERR) by submitting the required triennial (and annual data for mega-sources based on pollutant quantity thresholds) inventories to EPA. 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 Tennessee commits to do.

In January 2018, VISTAS began work to identify a modeling platform to support regional haze modeling for 2028. After consultation with EPA, VISTAS selected EPA's 2011el-based air quality modeling platform with projections to 2028 because this was the latest available modeling platform at the time. VISTAS completed its initial modeling using the 2011el/2028 modeling platform in October 2019 and is labeled "elv3." The elv3 inventory was used to support the Area of Influence Analysis (AoI) analysis (see Section 7.5) and initial PSAT modeling (see Section 7.6).

Subsequently, after consulting with EPA, VISTAS revised the 2028 point source emissions inventory and modeling to reflect updated emissions projections that became available in late 2019 after VISTAS completed its elv3 modeling. This final inventory, labeled "elv5", was used to update the initial PSAT modeling and re-modeling of the RPGs for each Class I area. Table 4-1 identifies the uses for VISTAS' 2028 elv3 and elv5 modeling inventories and cites the documentation of the inventories and emissions processing of the emissions data.

Table 4-1: Uses and Documentation of VISTAS' Initial and Revised / Final 2028 Emissions Inventory for Regional Haze Modeling

<table>
<tr><th>Purpose</th><th>Initial 2028 Inventory (version = elv3)</th><th>Revised / Final Inventory (version = elv5)*</th></tr>
<tr><td>Area of Influence Analysis (AoI)</td><td rowspan="2">Documentation provided in Appendices B-1a and B-1b of this SIP</td><td></td></tr>
<tr><td>Initial PSAT Source Apportionment Modeling</td><td></td></tr>
<tr><td>Adjusted PSAT Source Apportionment Modeling</td><td></td><td rowspan="2">Documentation provided in Appendices B-2a and B-2b of this SIP</td></tr>
<tr><td>Modeling of Reasonable Progress Goals (RPGs) for 2028</td><td></td></tr>
</table>

The following pollutants were included in the inventories and modeling: SO_2, NOx, VOC, PM-2.5 Primary (filterable and condensible), PM-10-Primary (filterable and condensible), and NH_3. For combustion sources, the PM2.5 and PM10 emissions included in the modeling inventories include both the filterable and condensable fractions. The modeling inventories also included carbon monoxide (CO) and are included in emissions tables in this SIP. However, CO is not a visibility impairing pollutant and thus, CO data were not evaluated for this regional haze plan.

Section 4.2 provides a summary of the emission source sectors included in the 2011 base year inventory and methods used to develop the 2028 elv3 inventory for VISTAS modeling. VISTAS relied on the 2028 emissions projections included in EPA's 2011el-based modeling platform for all sectors except the point EGU and point non-EGU sectors for which VISTAS updated 2028 emissions. Section 4.3 provides an overview of revisions completed to the 2028 elv3 inventory to develop the final 2028 elv5 inventory for the point source sectors. Section 7.2.4 of this SIP provides further documentation of the VISTAS projected 2028 emissions inventory including comparisons of 2011 and 2028 emissions by state. Section 7.2.5 provides summaries comparing recent EPA inventories for 2014, 2016, and 2017.

4.2. 2011 and 2028 elv3 Emissions Inventory

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 with projections to 2028 because this was the latest available modeling platform at the time. This modeling platform includes emissions, meteorology, and other inputs for 2011, as the base year for the modeling described in EPA's Technical Suppport Document (TSD) entitled "Documentation for the EPA's Preliminary 2028 Regional Haze Modeling."[24] The VISTAS states did not revise the 2011 base year emissions inventory.

EPA has projected the 2011 base year emissions[25] to a 2028 future year base case scenario. 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[26] and the subsequent notice of data availability (NODA)[27] to support ozone transport for the 2015 ozone NAAQS. With the assistance of ERG, the VISTAS states revised the 2028 point source inventory. Appendix B-1a and Appendix B-2a contain complete reports from ERG detailing the emission inventory work.

[24] EPA OAQPS, *Documentation for the EPA's Preliminary 2028 Regional Haze Modeling,* October 2017.
[25] URL: https://www.epa.gov/air-emissions-modeling/2011-version-63-technical-support-document
[26] URL: https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update
[27] URL: https://www.epa.gov/airmarkets/notice-data-availability-preliminary-interstate-ozone-transport-modeling-data-2015-ozone

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.[28] The following sections define each emission inventory source sector and the emission estimation methods applied to estimate emissions for each sector.

4.2.1. 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. 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.

4.2.1.1. 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

[28] Note that prescribed fires and wildfires are designated events in the National Emissions Inventory.

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 may not be 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. TDEC-APC used a combination of ERTAC, 2011el, 2023en, and 2028el data for projected 2028 EGU emissions.

4.2.1.2. 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 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 itinerate operations are defined as aircraft take-offs or aircraft landings. The EPA used projected itinerate information available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System.

4.2.2. 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 future year inventory for 2028.

4.2.3. 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. The emissions from these sources, like nonpoint sources, are estimated at the county level. 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.

4.2.4. 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. The emissions from these sources are estimated at the county level. 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.

4.2.5. Biogenic Sources

Biogenic sources are natural sources of emissions like trees, crops, grasses, and natural decay of plants. The emissions from these sources are estimated at the county level. 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.

4.2.6. 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

4.2.7. Summary of 2011 Baseline Emissions Inventory for Tennessee

Table 4-2 is a summary of the 2011 baseline emission inventory for Tennessee. 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.

Table 4-2: 2011 Emissions Inventory Summary for Tennessee (tpy)

Sector	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
EGU	5,366	242	27,000	5,194	4,162	120,139	725
Non-EGU Point	46,109	1,073	38,354	11,613	8,330	35,849	33,662
Nonpoint	78,166	35,917	40,792	160,910	43,771	2,321	102,554
Onroad	739,041	3,017	182,796	9,927	5,778	769	80,463
Non-Road	294,062	40	31,193	3,189	3,035	86	44,035
Point-Fires	124,436	2,057	2,430	13,312	11,282	1,159	29,563
Total	**1,287,180**	**42,346**	**322,565**	**204,145**	**76,358**	**160,323**	**291,002**

4.2.8. Summary of the 2011 Emissions Inventory and Assessment of Relative Contributions from Specific Pollutants and Source Categories

As noted in Section 2.4 for the years 2000-2004 and Section 2.6 for years 2014-2018, ammonium sulfate is the largest contributor to visibility impairment at the Tennessee 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 Tennessee the stationary point sources, consisting mostly of electric generating facilities and industrial point sources, contribute 97.3% of SO_2 emissions in the state (see Table 4-3).

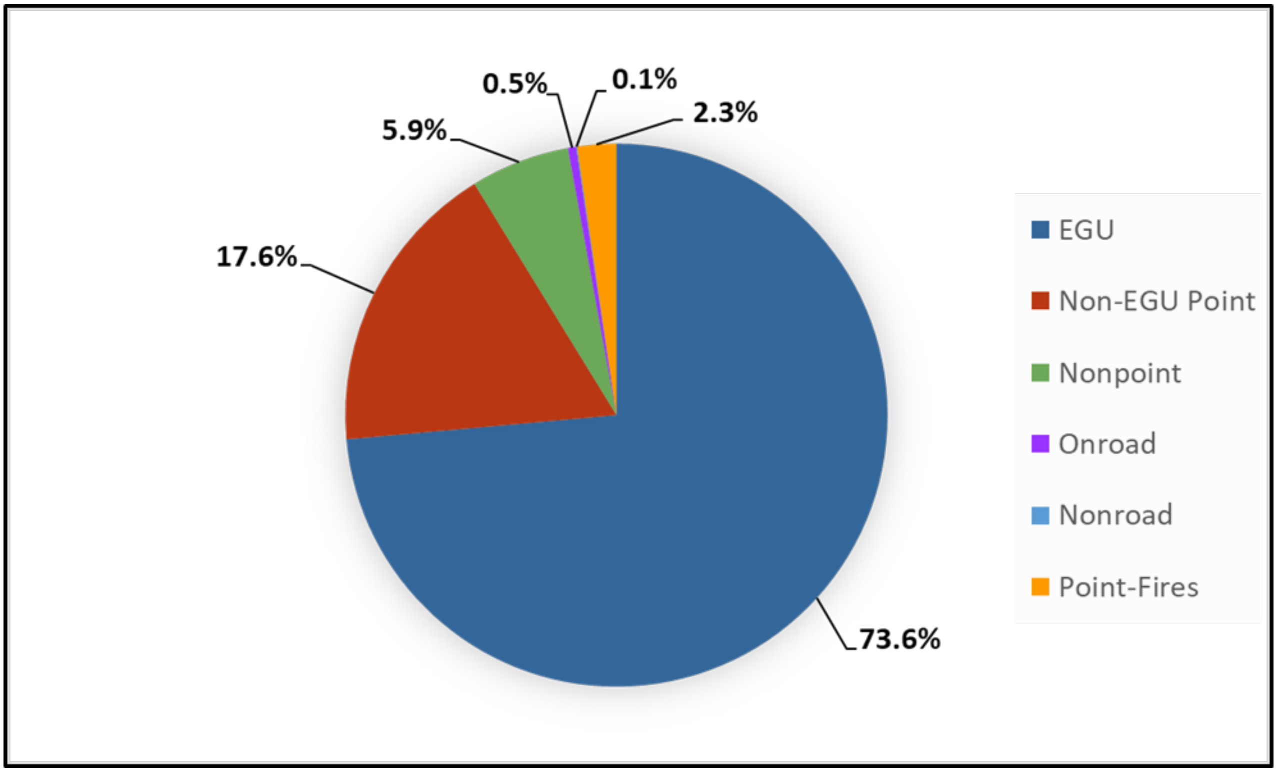


Figure 4-1: 2011 SO2 Emissions in the VISTAS States

Table 4-3: 2011 SO_2 Emissions for Tennessee, tpy

Sector	SO_2, tpy	Percentage
Point	155,988	97.3%
Nonpoint	2,321	1.4%
Onroad	769	0.5%
Non-Road	86	0.1%
Point-Fires	1,159	0.7%
Total	160,323	100.0%

Since the largest source of SO_2 emissions comes from the stationary point sources, the focus of potential controls and the impacts for those controls was on this source sector. In Tennessee, the types of sources emitting SO_2, and thus contributing to the visibility impairment of the Class I areas, were predominately coal fired utilities and industrial boilers.

4.3. 2028 elv5 (Revision to 2028 elv3) Emissions Inventory

After completing modeling in October 2019, EPA completed work on a new 2016 base year modeling platform (2016v1) and prepared a 2028 projection year inventory for which it used to conduct regional haze modeling for 2028.[29] In addition, ERTAC revised the base year of the ERTAC EGU projections tool from 2011 to 2016 and developed new estimates of 2028 emissions from the 2016 base year.

The Regional Haze Rule (RHR) and guidance indicate that future year projections should be as accurate as possible. Therefore, for point sources, VISTAS compared the VISTAS 2028 elv3 projections to the EPA and ERTAC 2028 projections from a 2016 base year. Table 4-4 compares the 2028 point source emissions from VISTAS' elv3 inventory to the EPA's 2028 emissions (projected from EPA's 2016v1 platform).[30] The emissions in Table 4-4 were extracted from the VISTAS12 modeling domain, which covers the eastern U.S. As shown in Table 4-4, EPA's SO_2 emissions are 45.61% lower than VISTAS' elv3 estimates, and EPA's NOx emissions are 20.19% lower than VISTAS' elv3 estimates.

Table 4-5 and Table 4-6 compare 2028 SO_2 and NO_X emissions, respectively, for ERTACv2.7 (2011 base year) and ERTACv16.0 (2016 base year) for the VISTAS and adjacent Regional Planning Organizations (RPOs). The ERTACv2.7 was used in the VISTAS' elv3 modeling for the non-VISTAS states in the VISTAS modeling domain. As explained in Section 4.2.1.1, each VISTAS state determined 2028 emissions for the EGUs in its state. These comparisons indicated that for EGUs, the 2028 emissions developed using ERTACv16.0 are significantly lower than the 2028 emissions developed using ERTACv2.7. For VISTAS, the 2028 ERTACv16.0 projections for SO_2 are about 41% lower than the 2028 ERTACv2.7 projections, and 2028 ERTACv16.0 projections for NOx are 25.8% lower than the 2028 ERTACv2.7 projections.

The reasons for the large differences in the 2028 emissions between the VISTAS' elv3 inventory and EPA's 2016v1 platform (and between ERTACv2.7 and ERTACv16.0) are believed to be

[29] The EPA's Technical Support Document for EPA'S Updated 2028 Regional Haze Modeling is available at: https://www.epa.gov/visibility/technical-support-document-epas-updated-2028-regional-haze-modeling.

[30] The EPA's 2016v1 modeling platform and 2016 Version 1 Technical Support Document are available at: https://www.epa.gov/air-emissions-modeling/2016-version-1-technical-support-document. The starting point for the 2016 inventory was the 2014 National Emissions Inventory (NEI), version 2 (2014NEIv2), although many inventory sectors were updated to represent the year 2016 through the incorporation of 2016-specific state and local data along with nationally-applied adjustment methods. For non-EGU point sources, North Carolina provided to EPA point source 2028 projections from 2016 base year emissions. The EPA used the Integrated Planning Model to develop 2028 projections for EGUs.

associated the retirement of coal-fired EGUs and industrial boilers as well as economic factors (e.g., conversion of coal to natural gas when natural gas prices became competitive with coal prices) not captured in the VISTAS' elv3 2028 projections from the 2011 base year.

Table 4-4: 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%

Table 4-5: Comparison of ERTAC v16.0 to ERTAC v2.7 SO2 Emission Projections for 2028

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 4-6: Comparison of ERTAC v16.0 to ERTAC v2. 7 NOx Emission Projections for 2028

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%

Thus, after consulting with EPA, VISTAS decided to revise the 2028 elv3 point source inventory to use 2016 as the base year to incorporate SO_2 and NOx emission reductions not previously captured in the 2028 elv3 inventory. These improvements to 2028 emissions are detailed in the VISTAS emissions inventory report in Appendix B-2a and Appendix B-2b.[31] Each VISTAS state was given the opportunity to adjust any point source emissions in the 2028 inventory. For EGUs in the non-VISTAS states, ERTACv2.7 2028 emissions were replaced with the ERTACv16.0 2028 emissions, except for the LADCO states where ERTACv2.7 2028 emissions were replaced with ERTACv16.1 2028 emissions.

A summary of 2028 emissions inventory for Tennessee and the other VISTAS states is shown in Table 7-9.

[31] When comparing emissions processing results from the elv3 modeling and the subsequent elv5 modeling, several issues were identified within the elv3 modeling framework, including differences in modeled emissions being significantly different than expected emissions (i.e., the mass emissions used as inputs to the SMOKE emissions processor vs. after processing). These issues, which are documented in a memorandum included Appendix B-1b, affected the 2028 elv3 RPGs but did not affect the AOI or PSAT modeling results. Consequently, the RPGs modeled with the 2028 elv3 and elv5 inventories cannot be compared.

5. Regional Haze Modeling Methods and Inputs

Modeling for regional haze was performed by VISTAS for the ten southeastern states, including Tennessee. 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[32] and the subsequent NODA[33] 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[34] 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

[32] URL: https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update
[33] URL: https://www.epa.gov/airmarkets/notice-data-availability-preliminary-interstate-ozone-transport-modeling-data-2015-ozone
[34] 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[35] 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

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

haze SIPs throughout the U.S. and has used this model to evaluate regional mitigation strategies including those for most recent regional-scale rules such as CSAPR.

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[36] 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),

[36] 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[37] 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[38] 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

[37] URL: http://www.smoke-model.org/index.cfm
[38] 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.

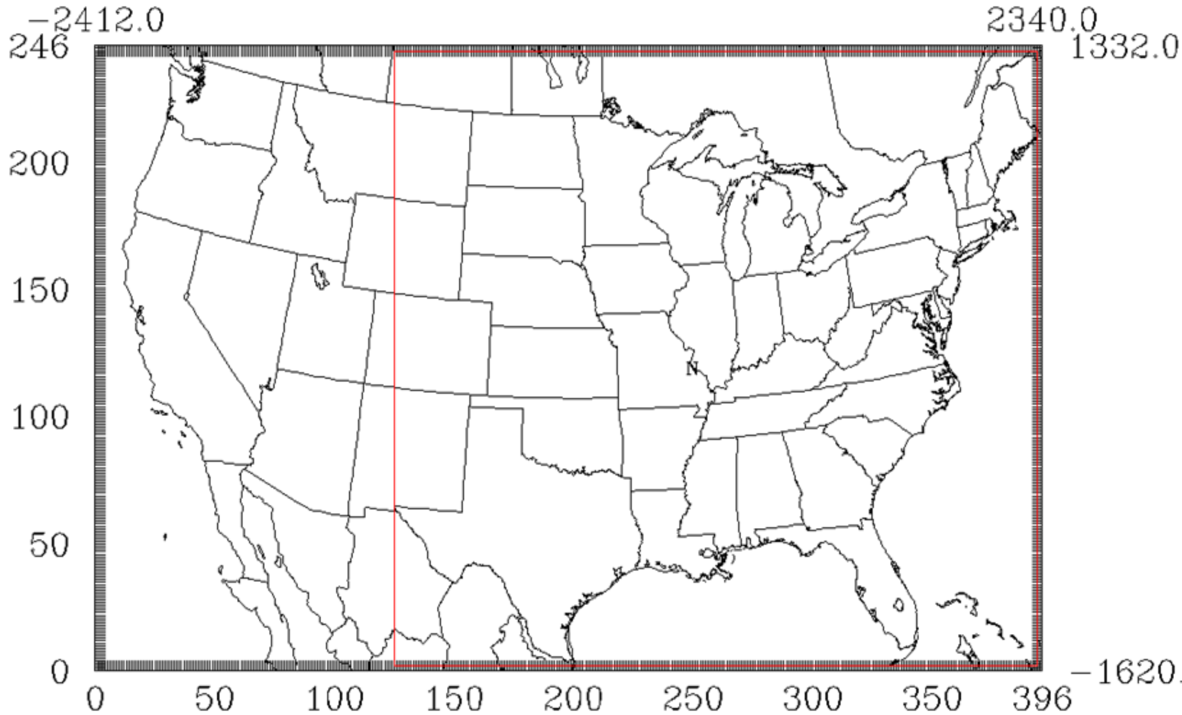


Figure 5-1: Map of 12-km CAMx Modeling Domains; VISTAS_12 Domain Represented as Inner Red Domain

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.[39]

[39] 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."[40] 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

[40] 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.

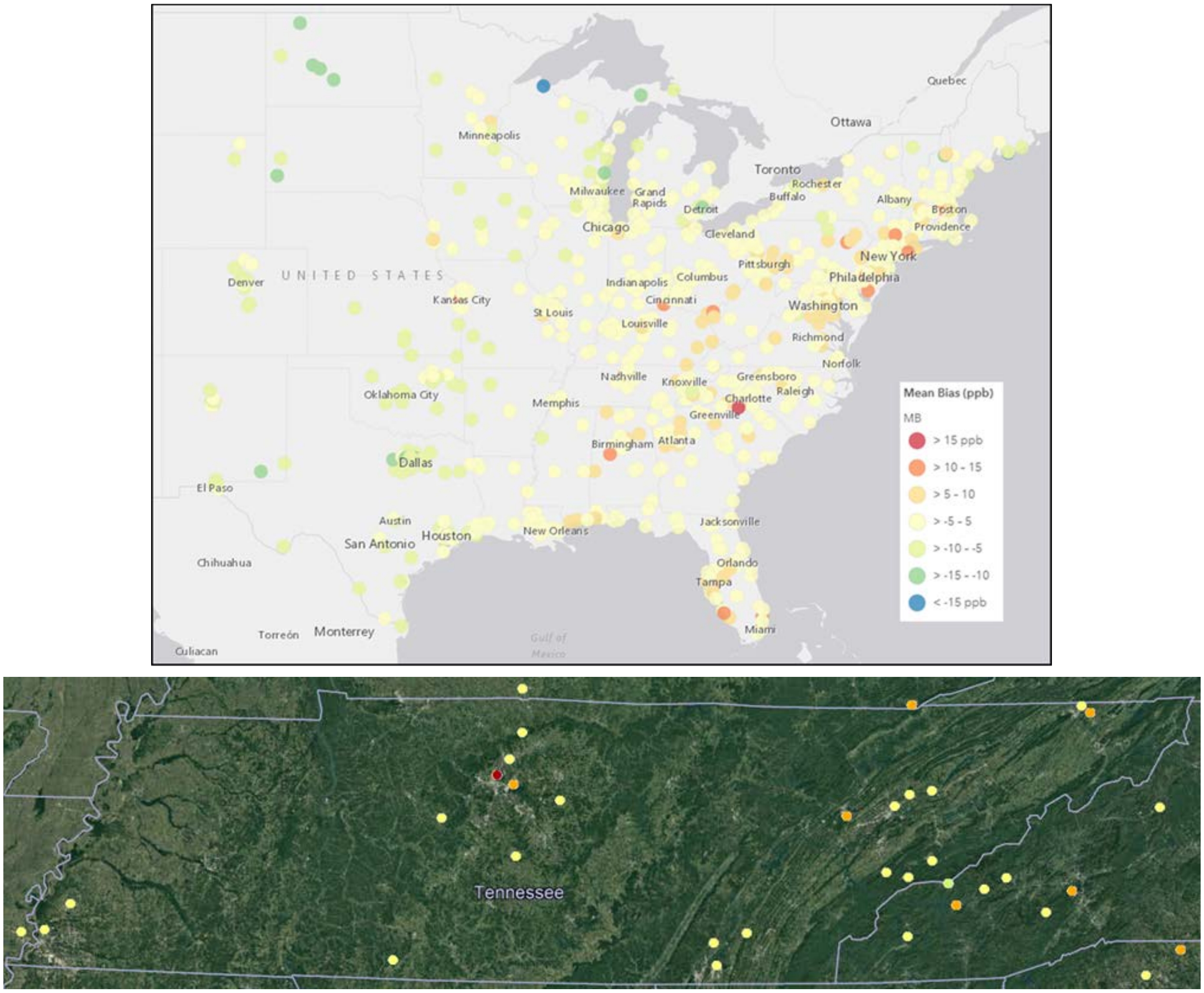


Figure 6-1: Mean Bias (ppb) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

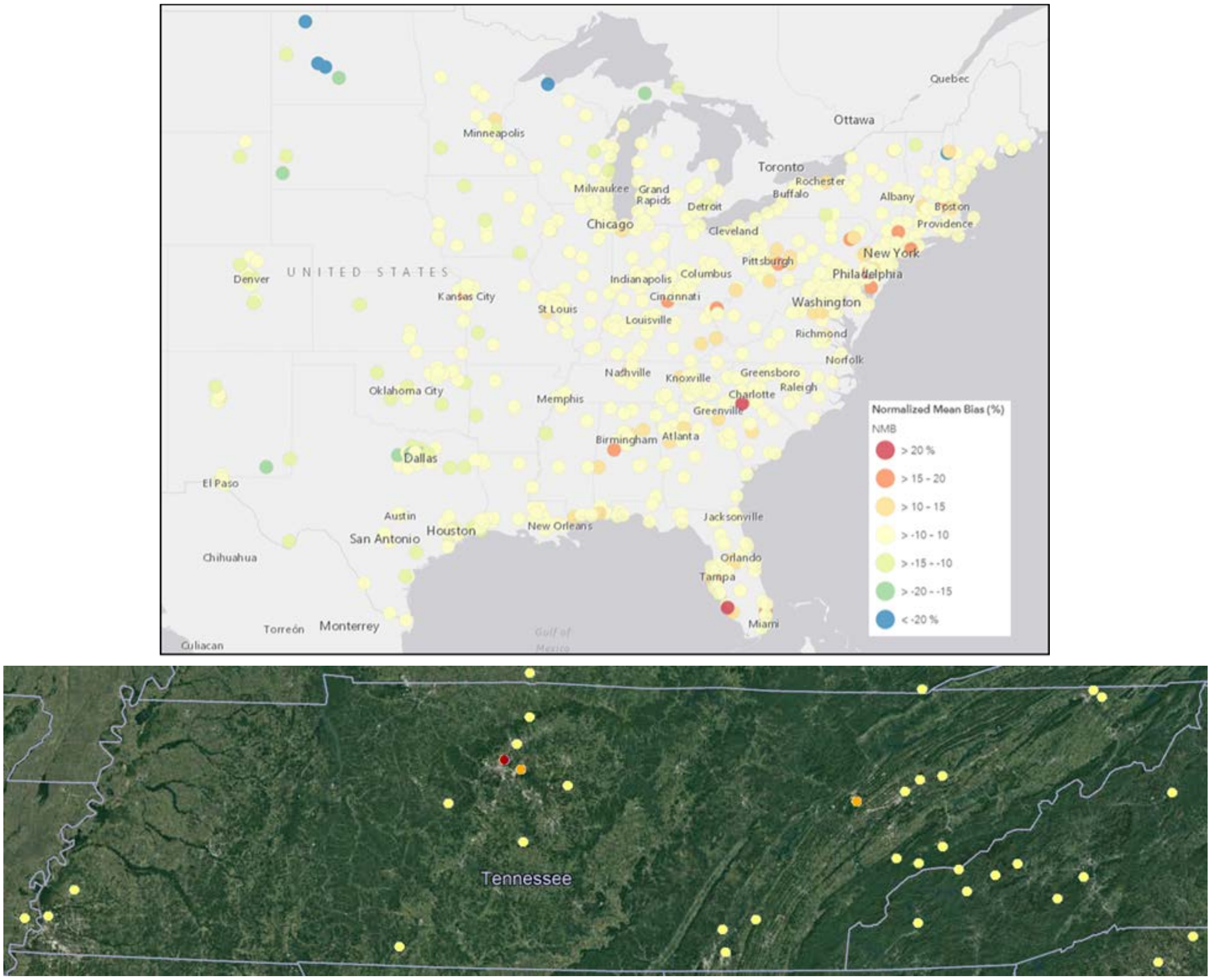


Figure 6-2: Normalized Mean Bias (%) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

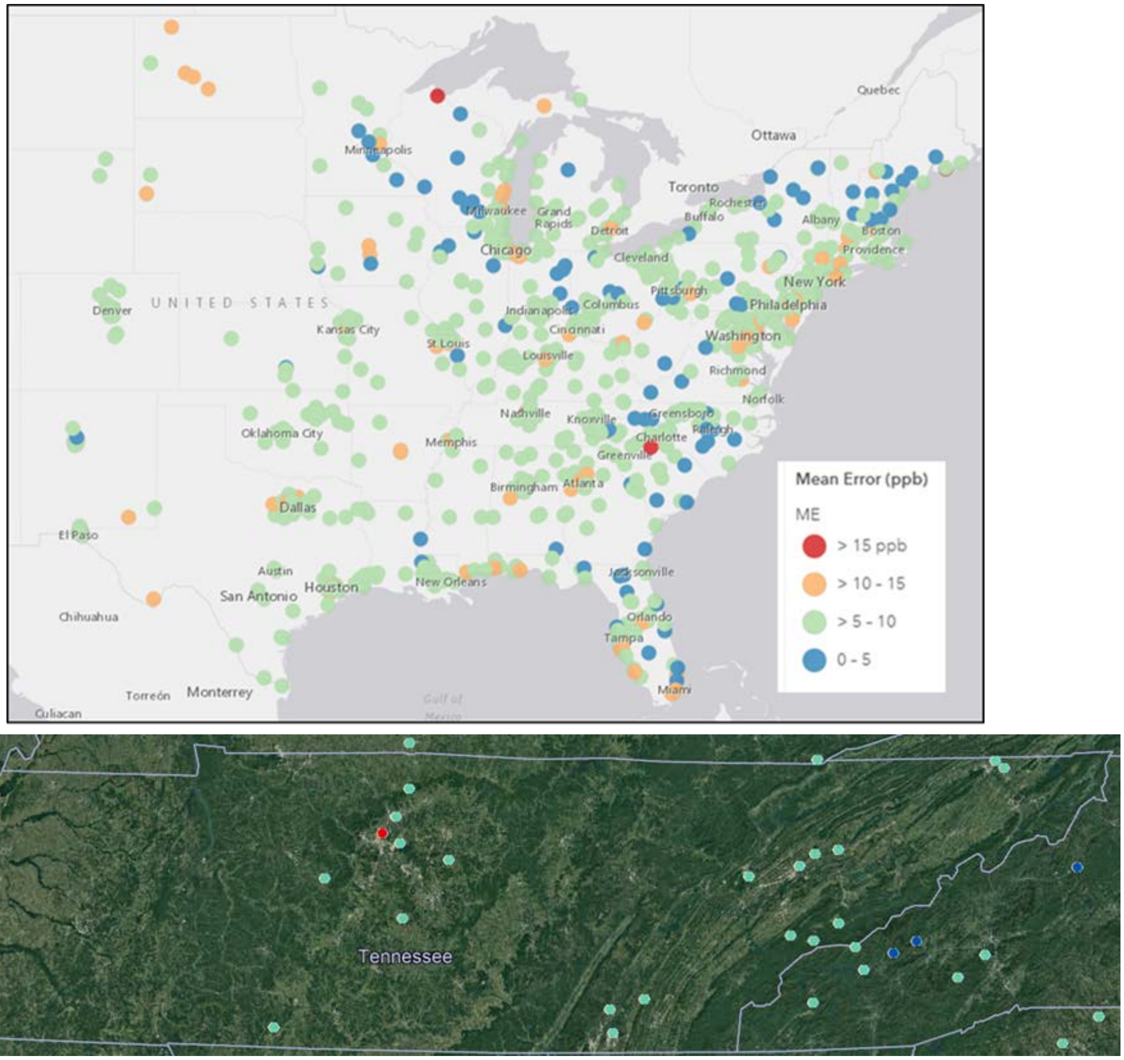


Figure 6-3: ME (ppb) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

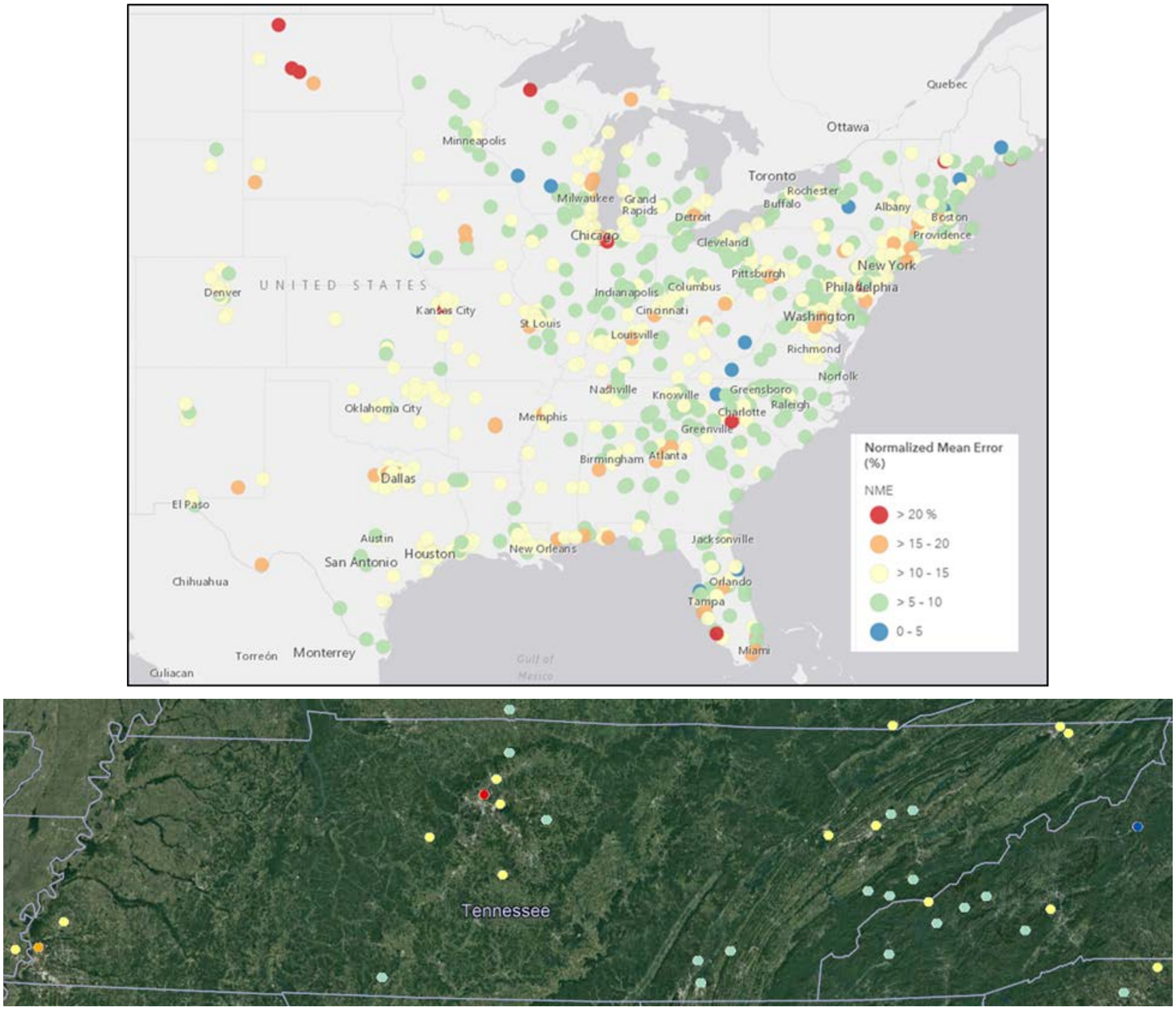


Figure 6-4: NME (%) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

6.2. Acid Deposition Model Performance Evaluation

The primary source for deposition data is the National Atmospheric Deposition Program (NADP).[41] The NADP monitoring networks used in this evaluation include:

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

[41] 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/

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).

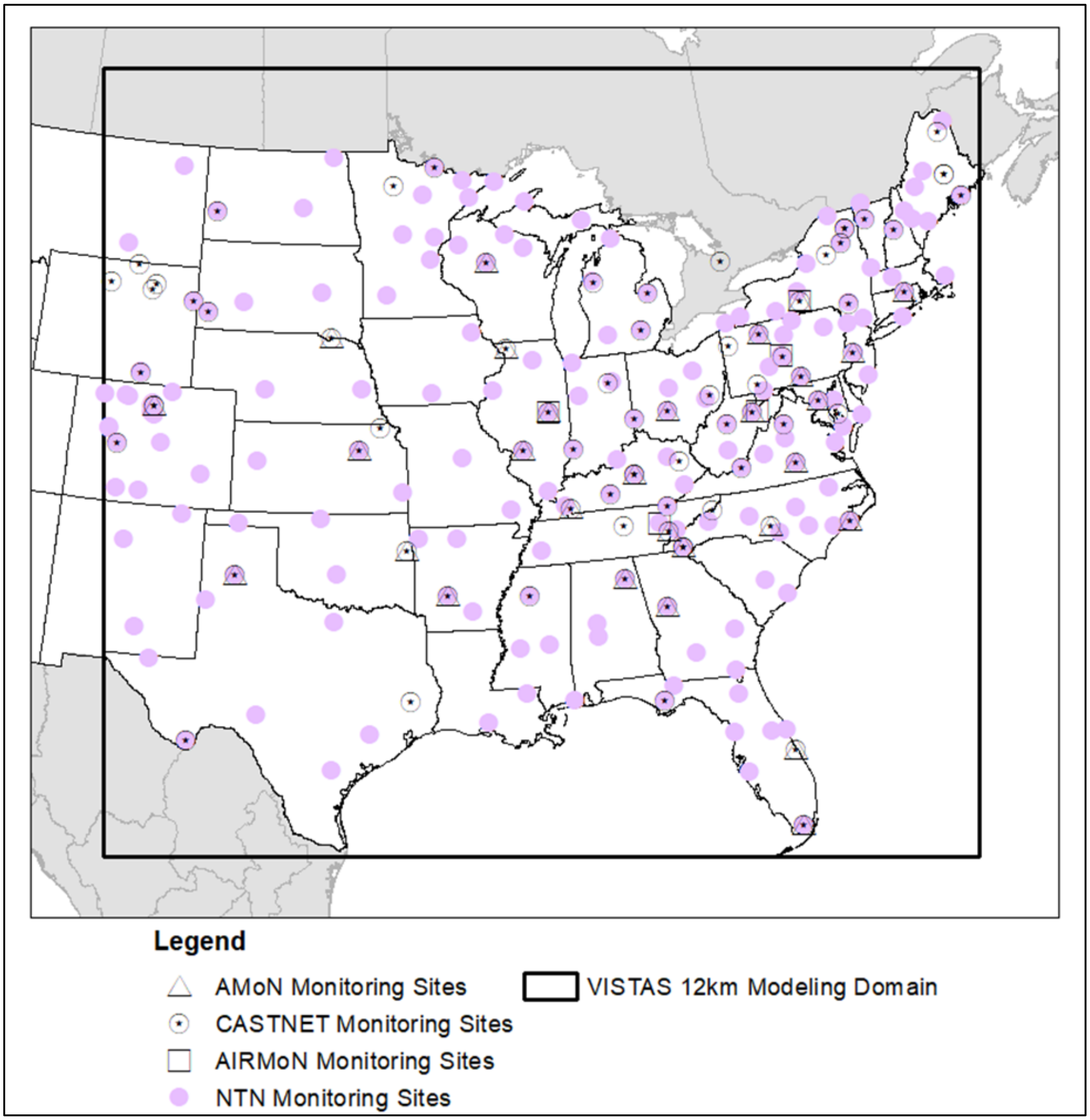


Figure 6-5: Deposition Monitors Included in the VISTAS 12 Domain

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[42] 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 and **Table 6-7** below were used for this modeling. The original publication notes that the temporal scales for the 24-hour total and speciated PM should not exceed 3 months (or 1 season) and the spatial scales should range from urban to less than or equal to 1000 kilometers. This indicates that model performance should be evaluated based on the entire domain, as modeling discussed in Section

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

6.4, and not based on individual monitor performance as presented for Great Smoky Mountains National Park, as presented in Section 6.5.

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

Species	NMB, Goal	NMB, Criteria	NME, Goal	NME, Criteria	r, Goal	r, Criteria
24-hr $PM_{2.5}$ and sulfate	<± 10%	<± 30%	< 35%	< 50%	> 0.75	> 0.50
24-hr nitrate	<± 10%	<± 65%	< 65%	< 115%	> 0.70	> 0.40
24-hr OC	<± 15%	<± 50%	< 45%	< 65%	None	None
24-hr EC	<± 20%	<± 40%	< 50%	< 75%	None	None

Table 6-7: Fine Particulate Matter Performance Goals and Criteria

Species	FB, Goal	FB, Criteria	FE, Goal	FE, Criteria
24-hr $PM_{2.5}$ and sulfate	<± 30%	<± 60%	< 50%	< 75%
24-hr nitrate	<± 30%	<± 60%	< 50%	< 75%
24-hr OC	<± 30%	<± 60%	< 50%	< 75%
24-hr EC	<± 30%	<± 60%	< 50%	< 75%

The mapping of the CAMx species into the observed species are presented in Table 6-8.

Table 6-8: 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 6-9) in the VISTAS12 modeling domain and model output data from the VISTAS2011 annual air quality modeling.

Table 6-9: 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.

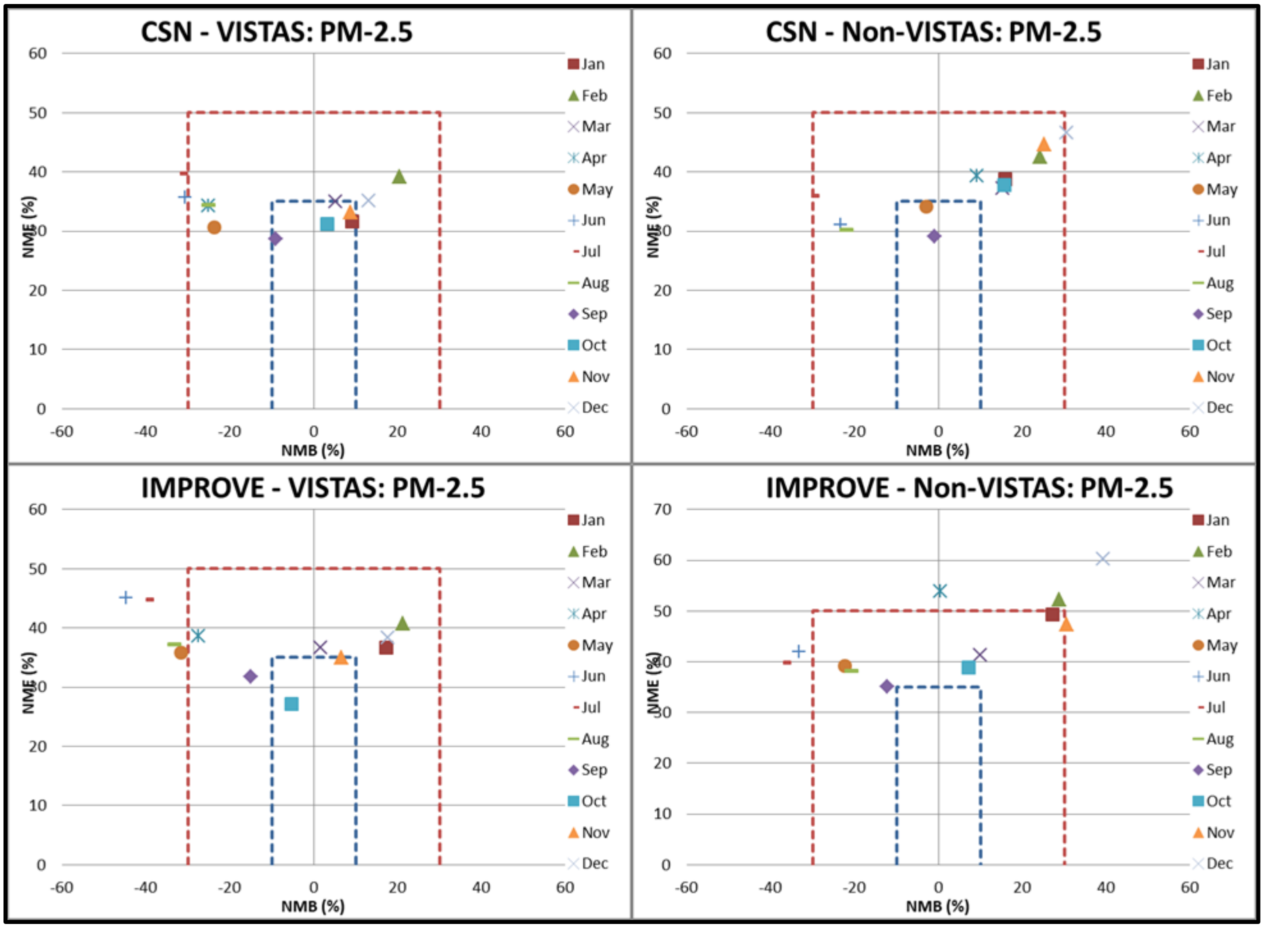


Figure 6-6: Soccer Plots of Total $PM_{2.5}$ by Network and Month for VISTAS and Non-VISTAS Sites

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.

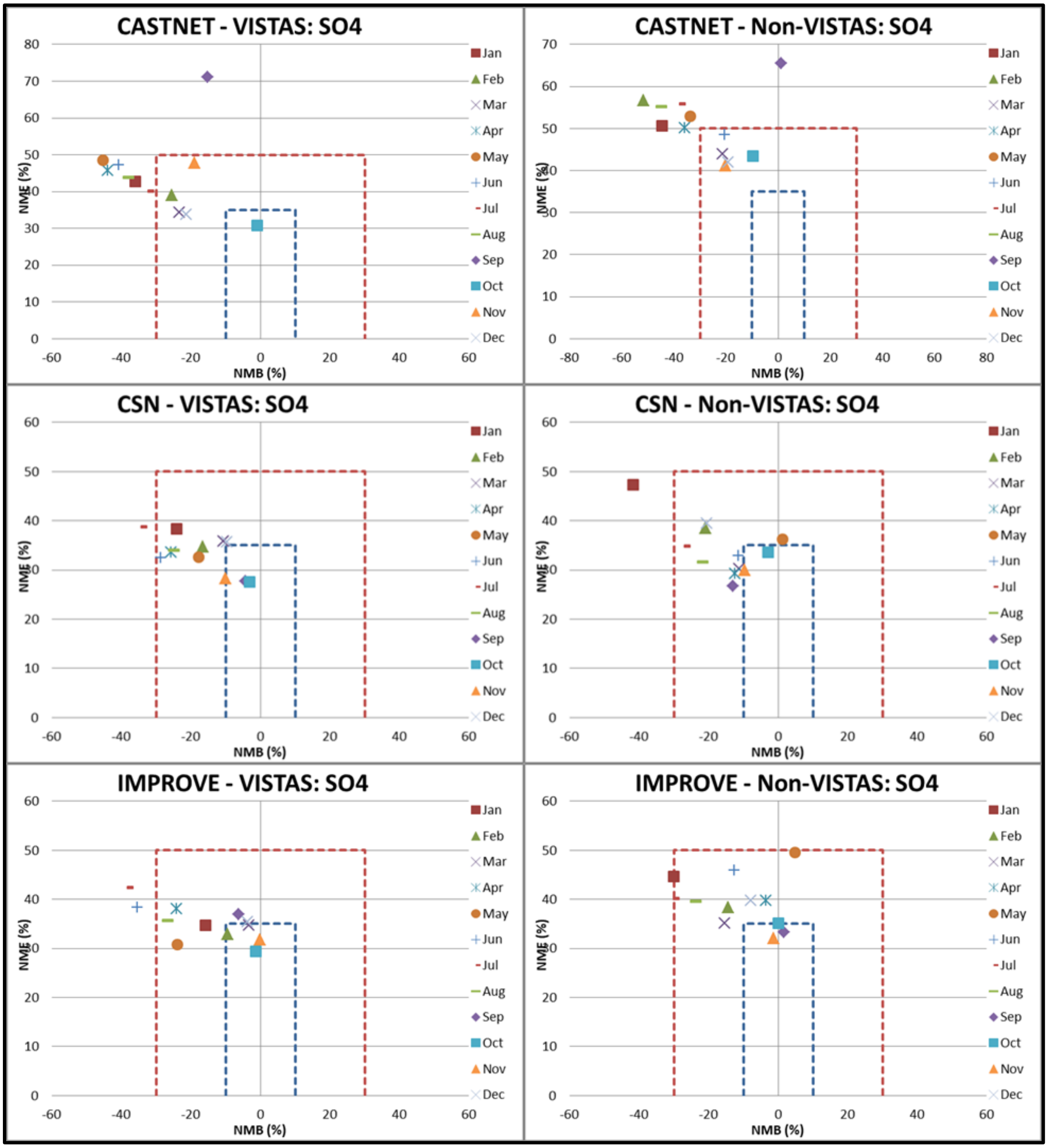


Figure 6-7: Soccer Plots by Network and Month for VISTAS and Non-VISTAS Sites

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.

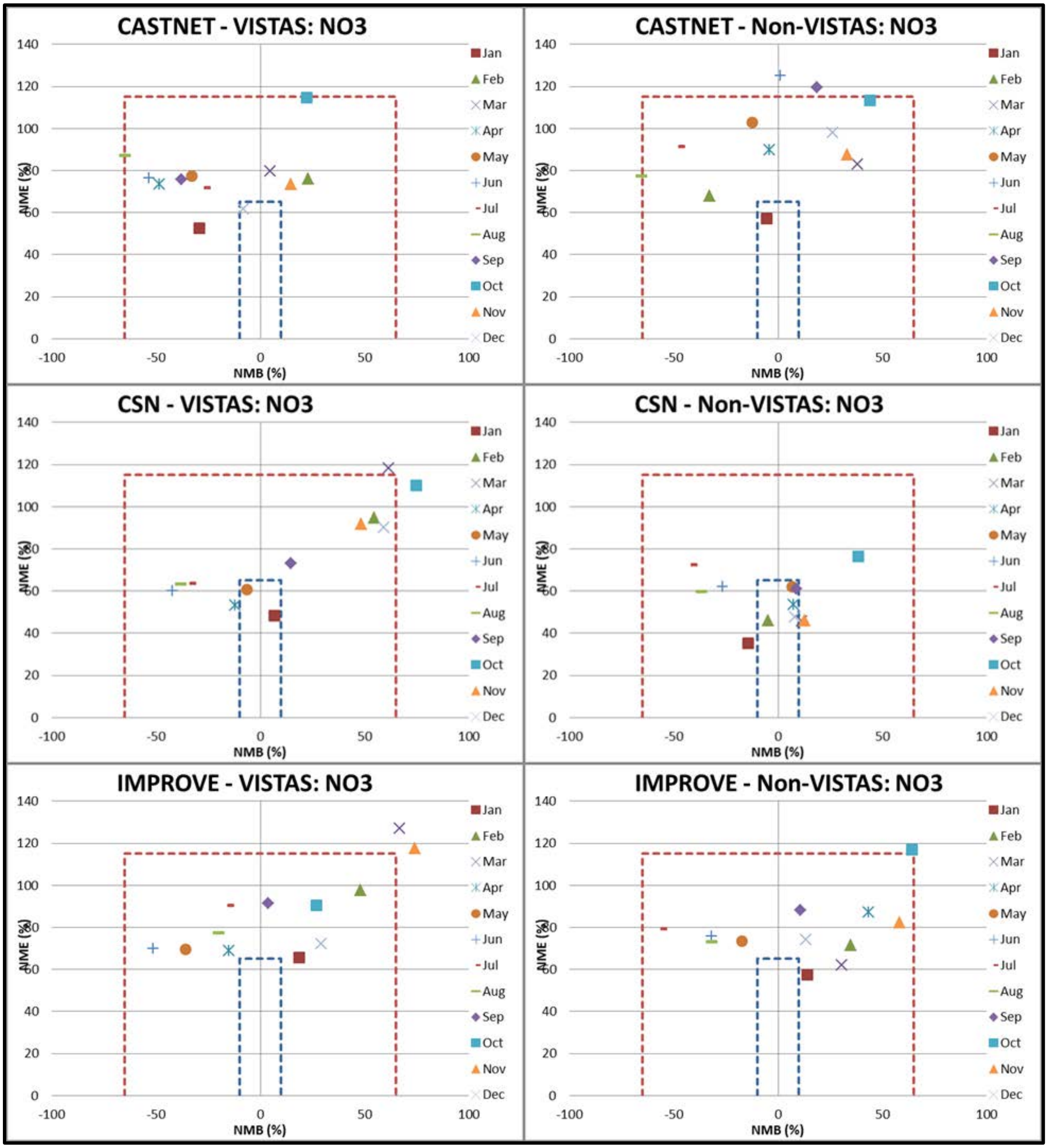


Figure 6-8: Soccer Plots of Nitrate by Network and Month for VISTAS and Non-VISTAS Sites

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.

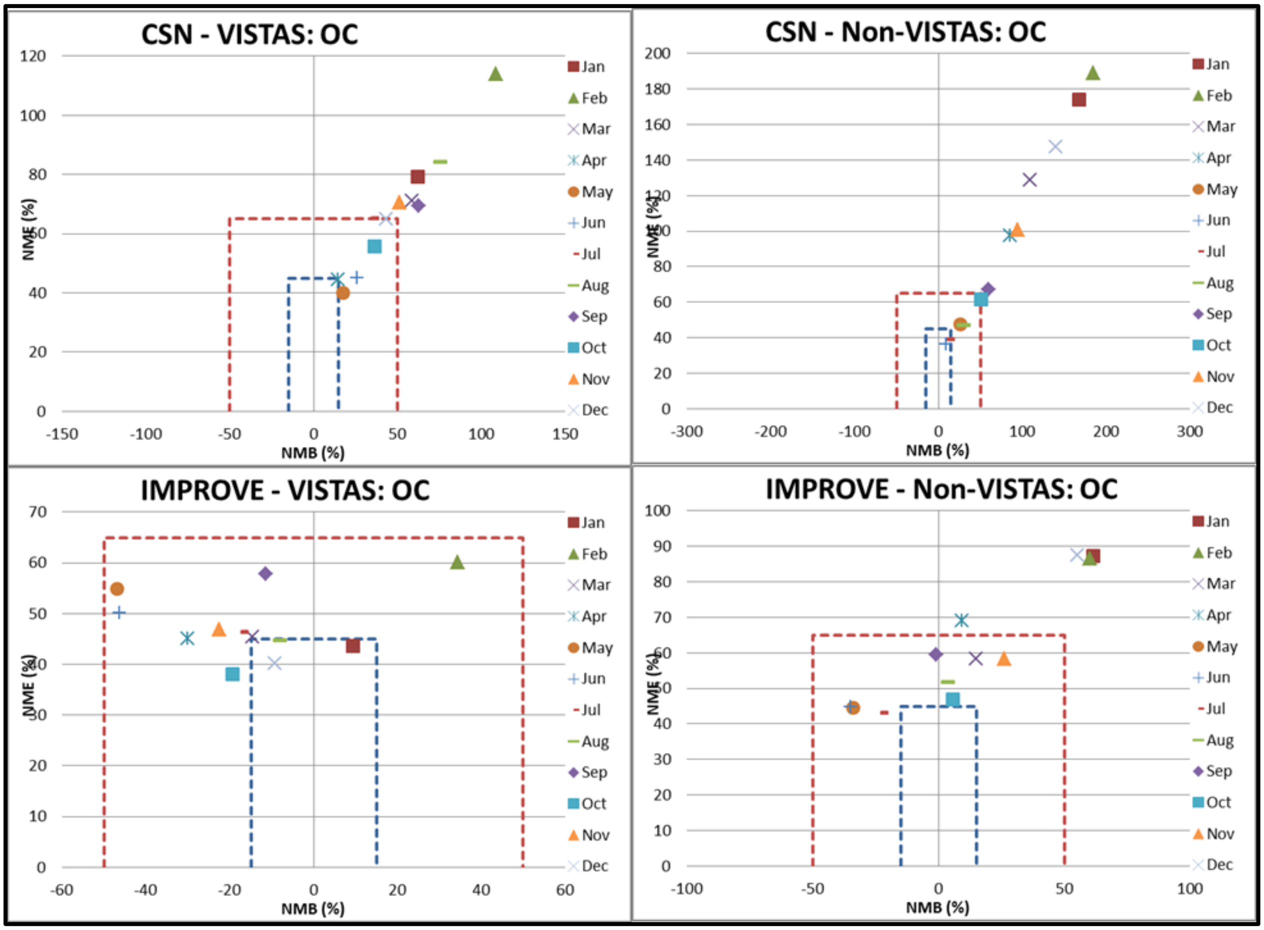


Figure 6-9: Soccer Plots of OC by Network and Month for VISTAS and Non-VISTAS Sites

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.

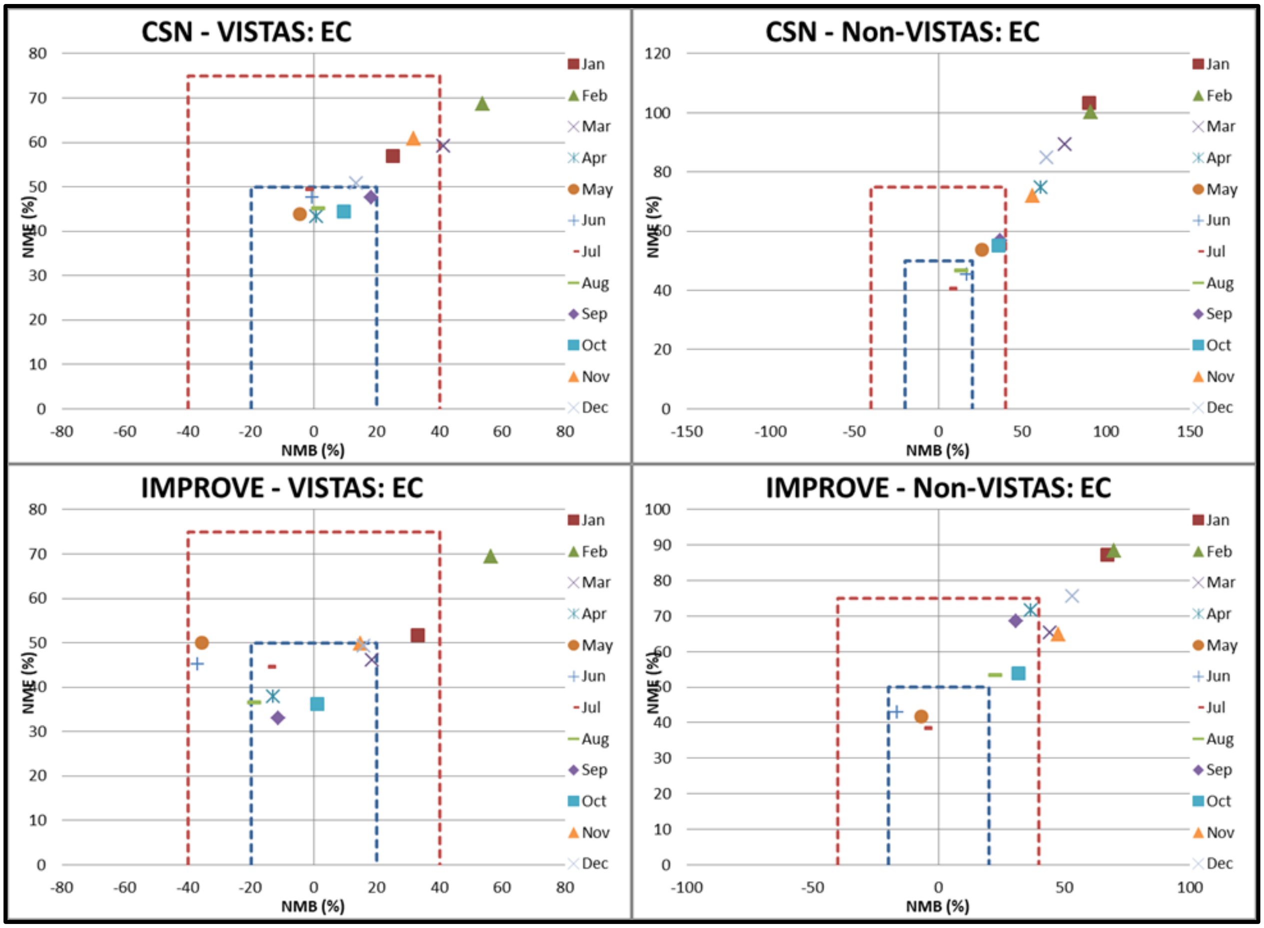


Figure 6-10: Soccer Plots of EC by Network and Month for VISTAS and Non-VISTAS Sites

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 6-10 shows model performance statistics for the Class I Areas in VISTAS and closely surrounding VISTAS. The criteria for each statistic is listed in the first row. These criteria are listed in Table 6-6 and Table 6-7. The values in red text in Table 6-10 indicate that the criteria was not met. As stated previously, the model performance statistics should be looked 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 6-10 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 (NMB) average did not meet the criteria and it was only slightly above the criteria. The other four statistics meet 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.[43] 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.[44] The EPA recommends that air agencies conduct a variety of performance tests and weigh them qualitatively to assess model performance.[45]

For the most part, modeled and observed $PM_{2.5}$ concentrations and light extinctions at each Class I area match reasonably well on both 20% most-impaired days and 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

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

modeled value. The future year sulfate concentrations are 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 underprediction of sulfates, and will not lead to an under-estimation of source contributions.

Overall, based on the weight of evidence approach recommended by EPA's guidance document, TDEC-APC found 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. TDEC-APC 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.

Table 6-10: Sulfate Model Performance Criteria for 20% Most Impaired Days in 2011

Class I Area	**# Obs.**	**NMB (<±30%)**	**MFB (<±60%)**	**NME (<50%)**	**MFE (<75%)**	**r (>0.4)**
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[46]	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**

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

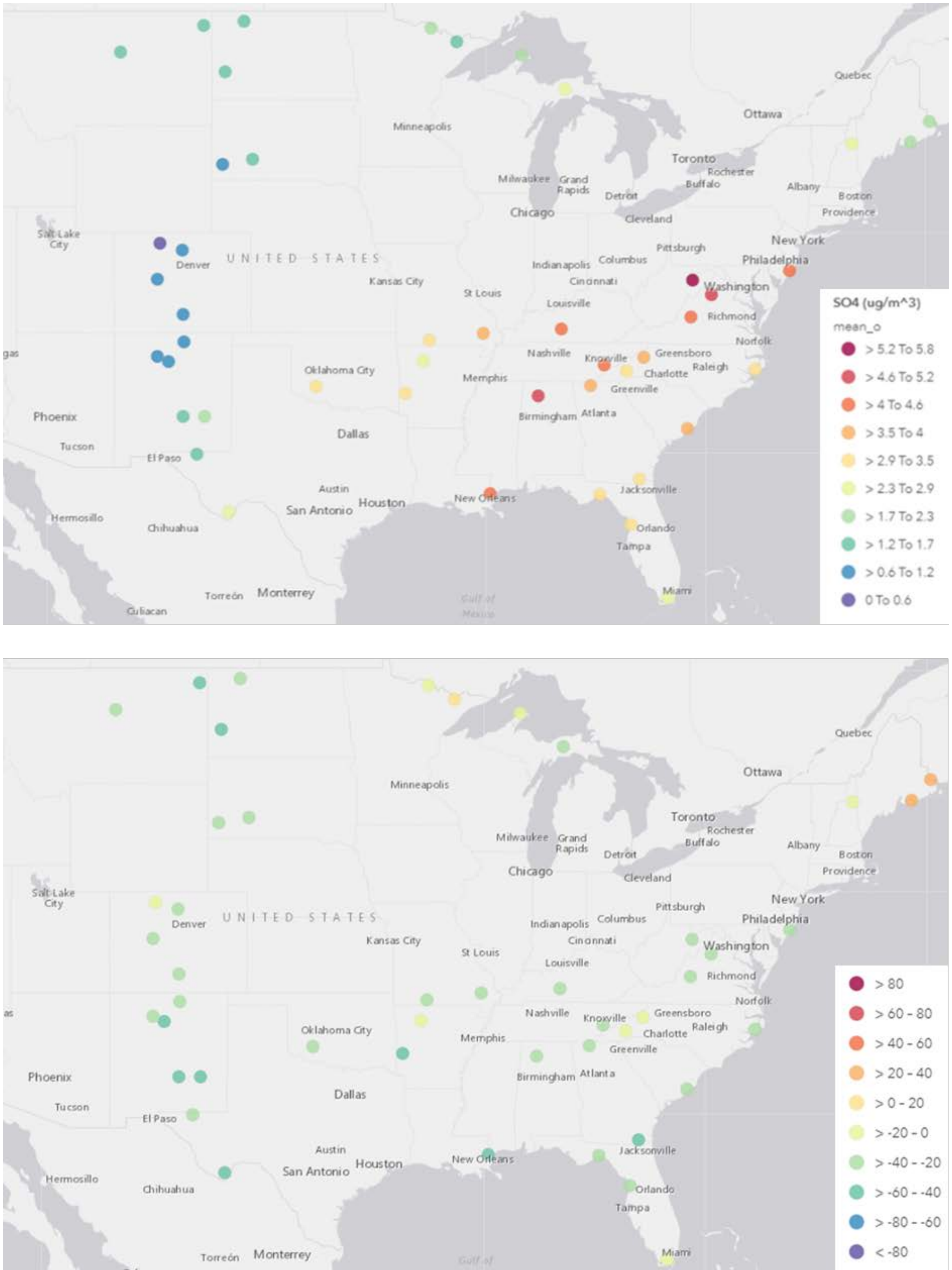


Figure 6-11: Observed Sulfate (Top) and Modeled NMB (Bottom) for Sulfate on the 20% Most-Impaired Days at IMPROVE Monitor Locations

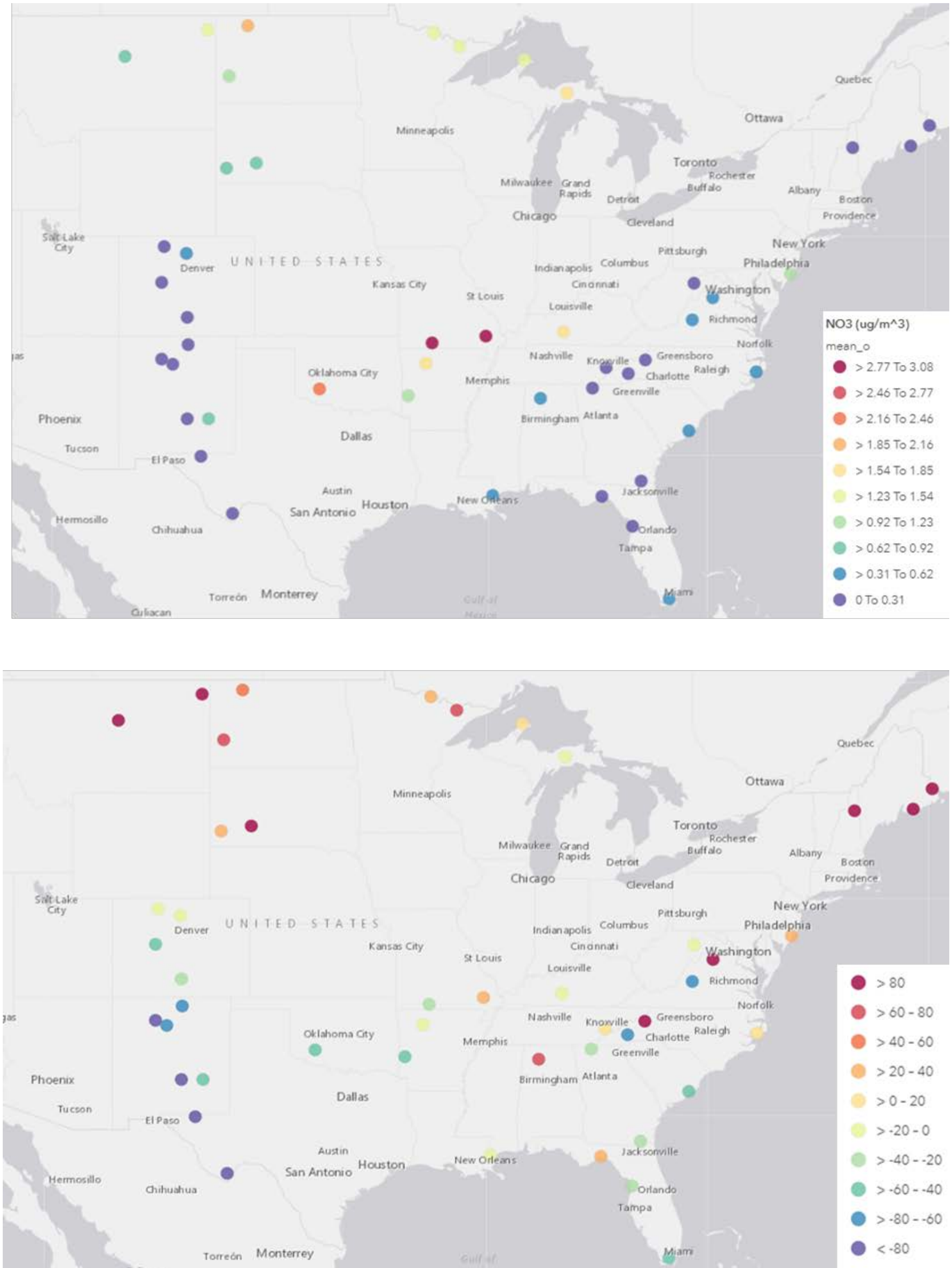


Figure 6-12: Observed Nitrate (Top) and Modeled NMB (Bottom) for Nitrate on the 20% Most Impaired Days at Improve Monitor Locations

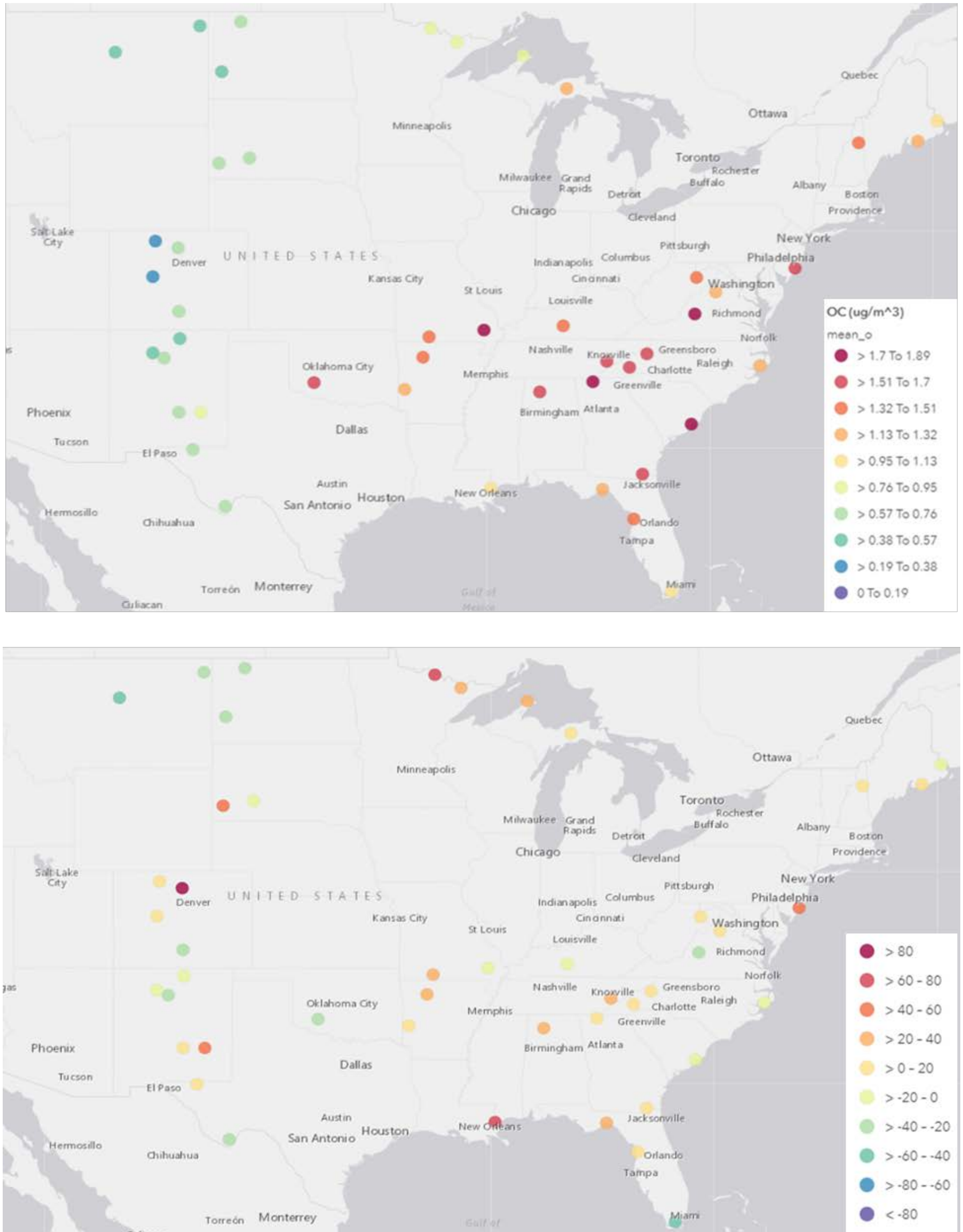
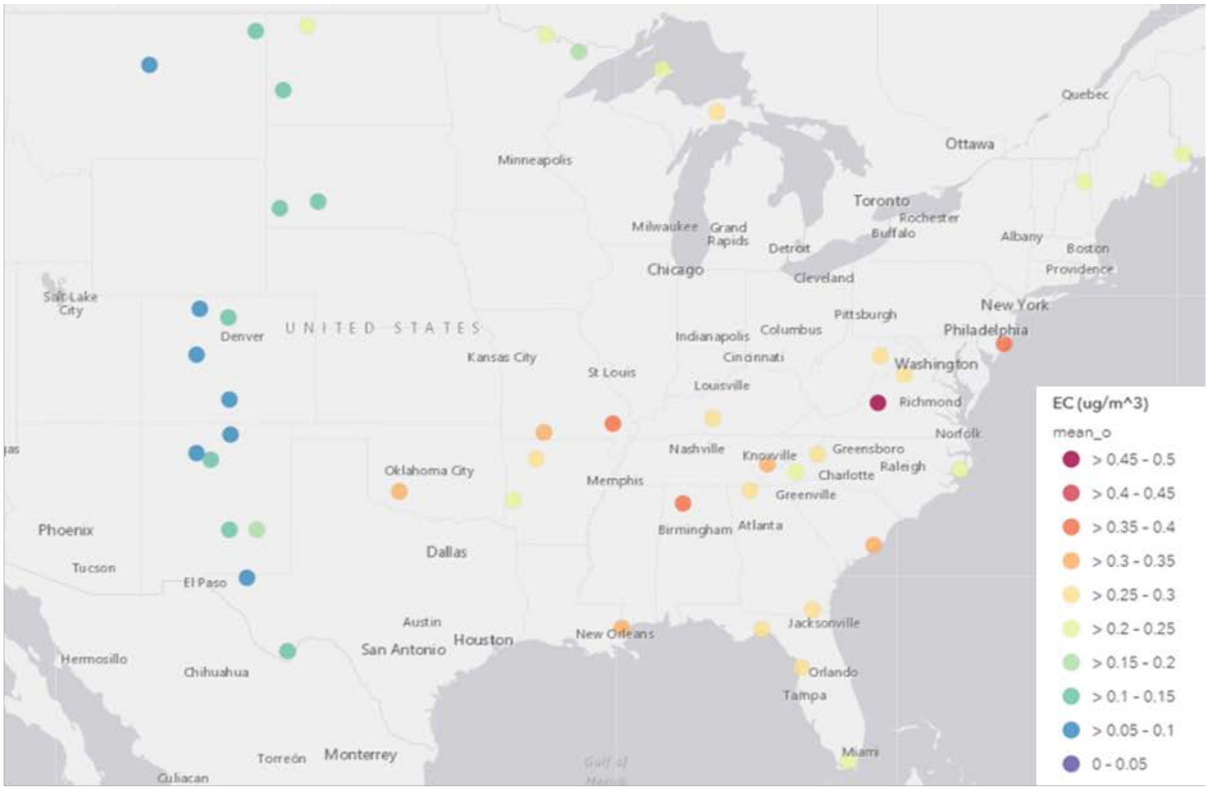


Figure 6-13: Observed OC (Top) and Modeled NMB (Bottom) for OC on the 20% Most-Impaired Days at IMPROVE Monitor Locations



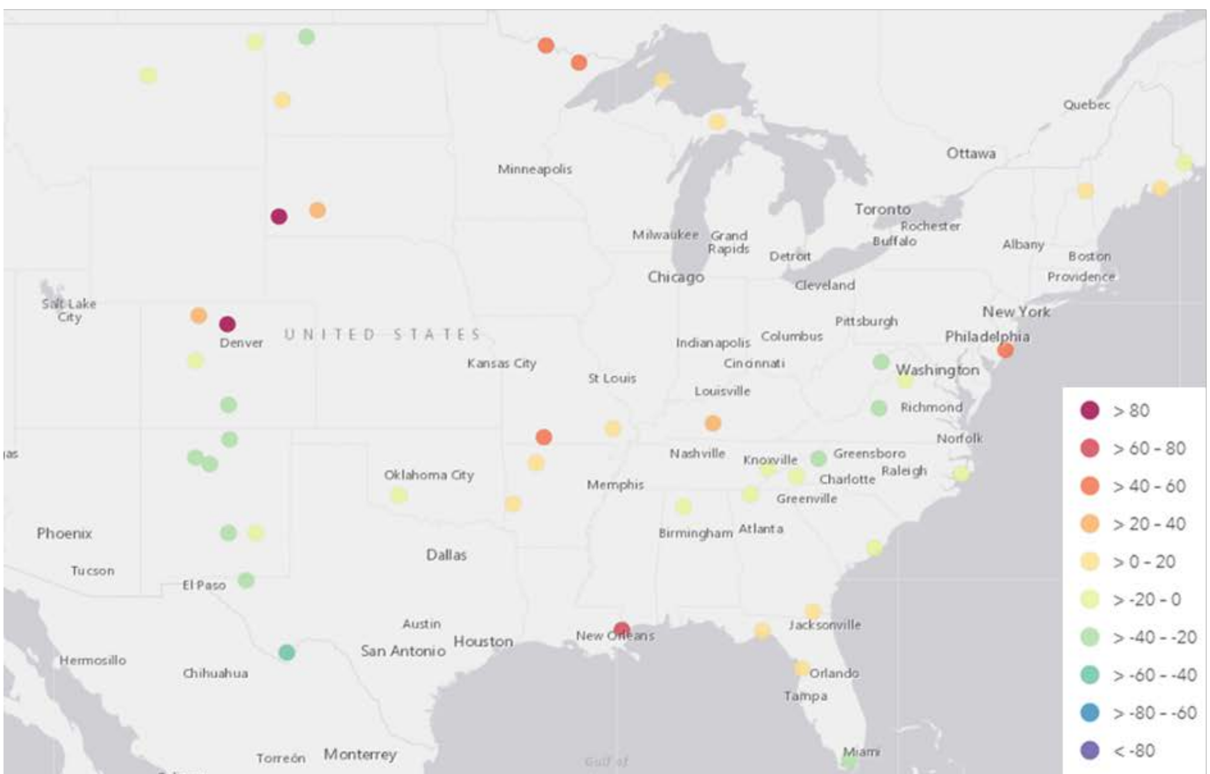
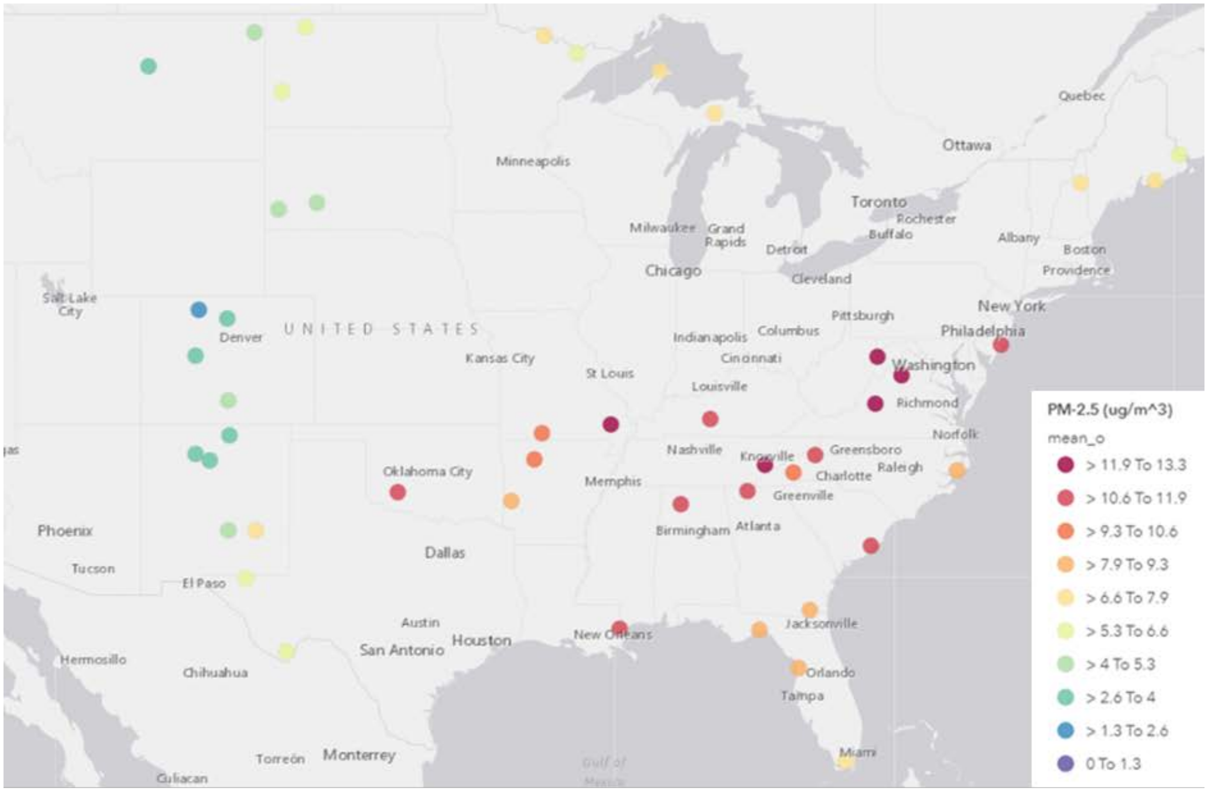


Figure 6-14: Observed EC (Top) and Modeled NMB (Bottom) for EC on the 20% Most-Impaired Days at IMPROVE Monitor Locations



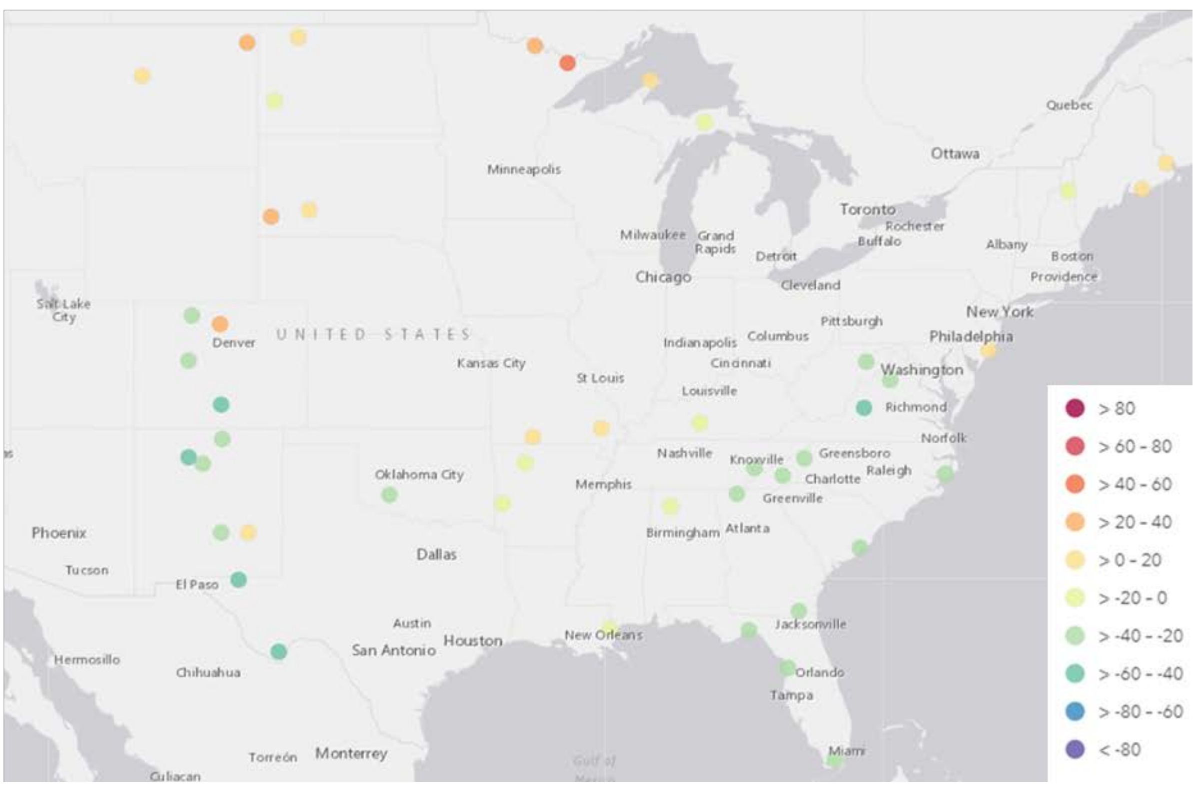
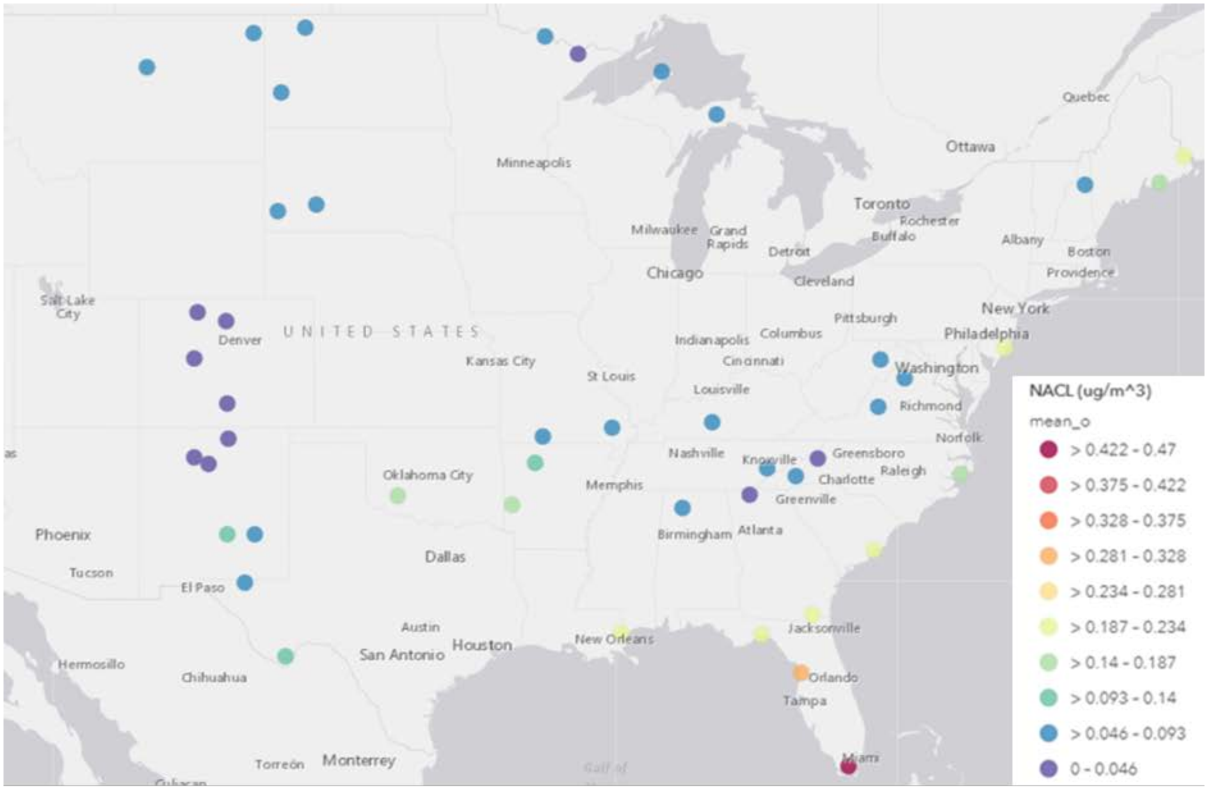


Figure 6-15: Observed Total $PM_{2.5}$ (Top) and Modeled NMB (Bottom) for Total $PM_{2.5}$ on the 20% Most-Impaired Days at IMPROVE Monitor Locations



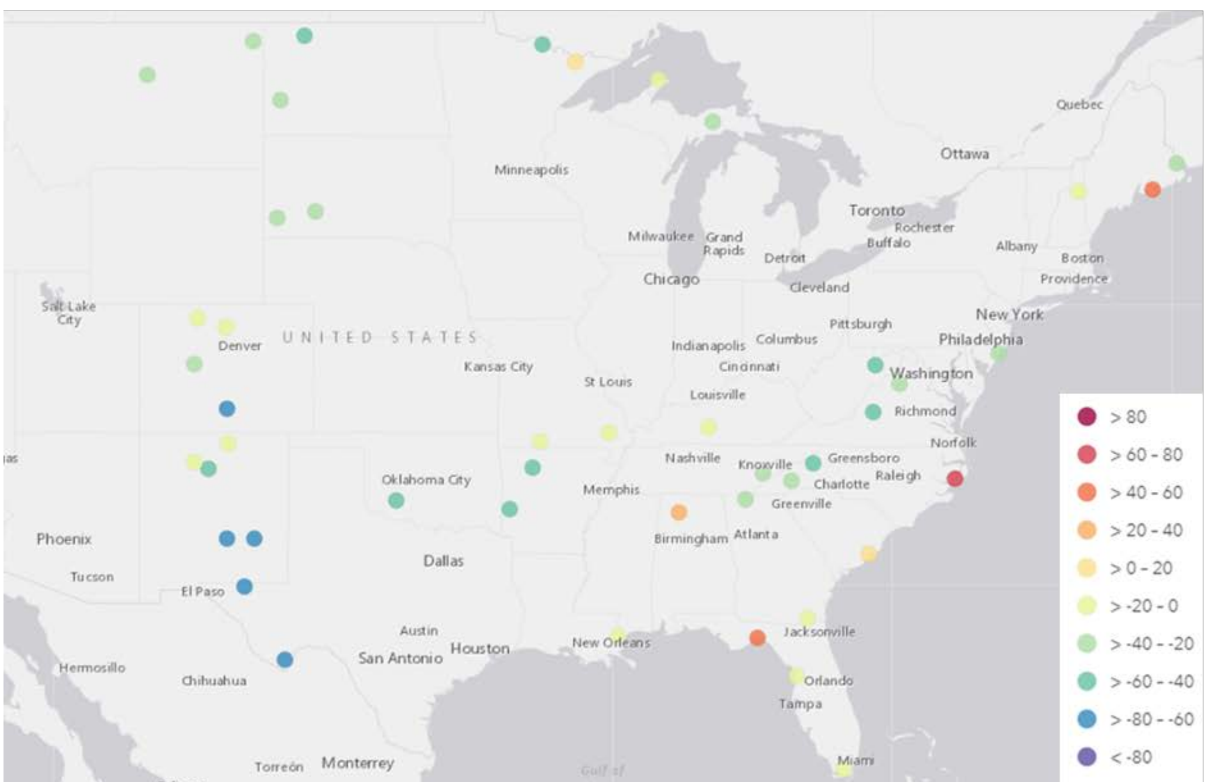


Figure 6-16: Observed Sea Salt (Top) and Modeled NMB (Bottom) for Sea Salt on the 20% Most-Impaired Days at IMPROVE Monitor Locations

6.5. PM Model Performance Evaluation for Class I Areas in Tennessee

The following section provides a detailed model performance evaluation for Great Smoky Mountains National Park. This evaluation includes average stacked bar charts, day-by-day stacked bar charts, scatter plots, soccer plots, and bugle plots for the 20% most-impaired days and 20% clearest days.

Figure 6-17 through Figure 6-18 contain the average stacked bar charts for Great Smoky Mountains National Park. These figures include (1) observed and modeled mass concentrations of particulate matter constituents and (2) observed and modeled light extinctions constituents on the 20% most-impaired days and the 20% clearest days. The color codes for the stacked bars are:

- Yellow = mass concentrations of or light extinction due to sulfates
- Red = mass concentrations of or light extinction due to nitrates
- Green = mass concentrations of or light extinction due to organic carbon
- Black = mass concentrations of or light extinction due to elemental carbon
- Brown = mass concentrations of or light extinction due to soil
- Blue = mass concentrations of or light extinction due to sea salt
- Gray = mass concentrations of or light extinction due to coarse mass

Overall, modeled and observed $PM_{2.5}$ concentrations and light extinctions at Great Smoky Mountains National Park match reasonably well on both 20% most-impaired days and clearest days. Model performance for sulfate at Great Smoky Mountains National Park is biased low on 20% most-impaired days.

Figure 6-19 through Figure 6-22 contain the day-by-day stacked bar charts for Great Smoky Mountains National Park. These charts allow a side-by-side comparison of observed and modeled speciated PM concentrations and speciated light extinctions on each 20% most-impaired and 20% clearest days. The speciated components are presented in the same order for both the observations (left bar) and modeled data (right bar) to help identify specific days when the predicted mass concentrations or light extinction for the components differ from the observed values. The total height of the bar provides the total particulate matter mass concentrations or the total reconstructed light extinction values. It should be noted that values used for these stacked bar charts are from the grid cell where each IMPROVE monitor is located.

According to Figure 6-17 through Figure 6-22, sulfates and organic carbon are the largest contributors to light extinction in the Tennessee Class I areas on both the 20% most-impaired days and the 20% clearest days. The stacked bar charts also suggest that nitrates can be important on the 20% clearest days. Model performance discussion for individual species were further examined with scatter plots.

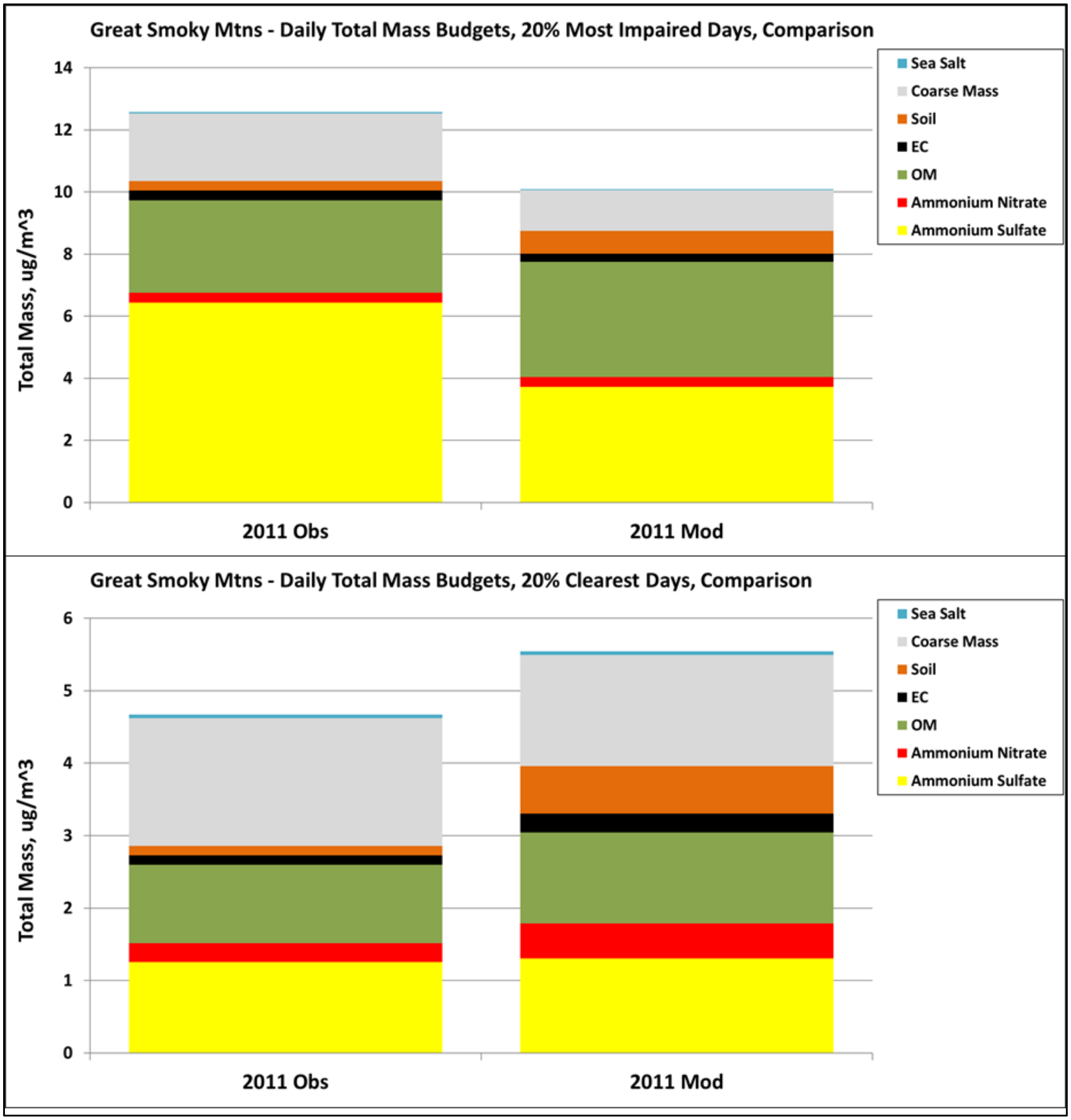


Figure 6-17: Stacked Bar Charts for Average $PM_{2.5}$ Concentrations on the 20% Most Impaired Days (top) and 20% Clearest Days (bottom) at Great Smoky Mountains National Park

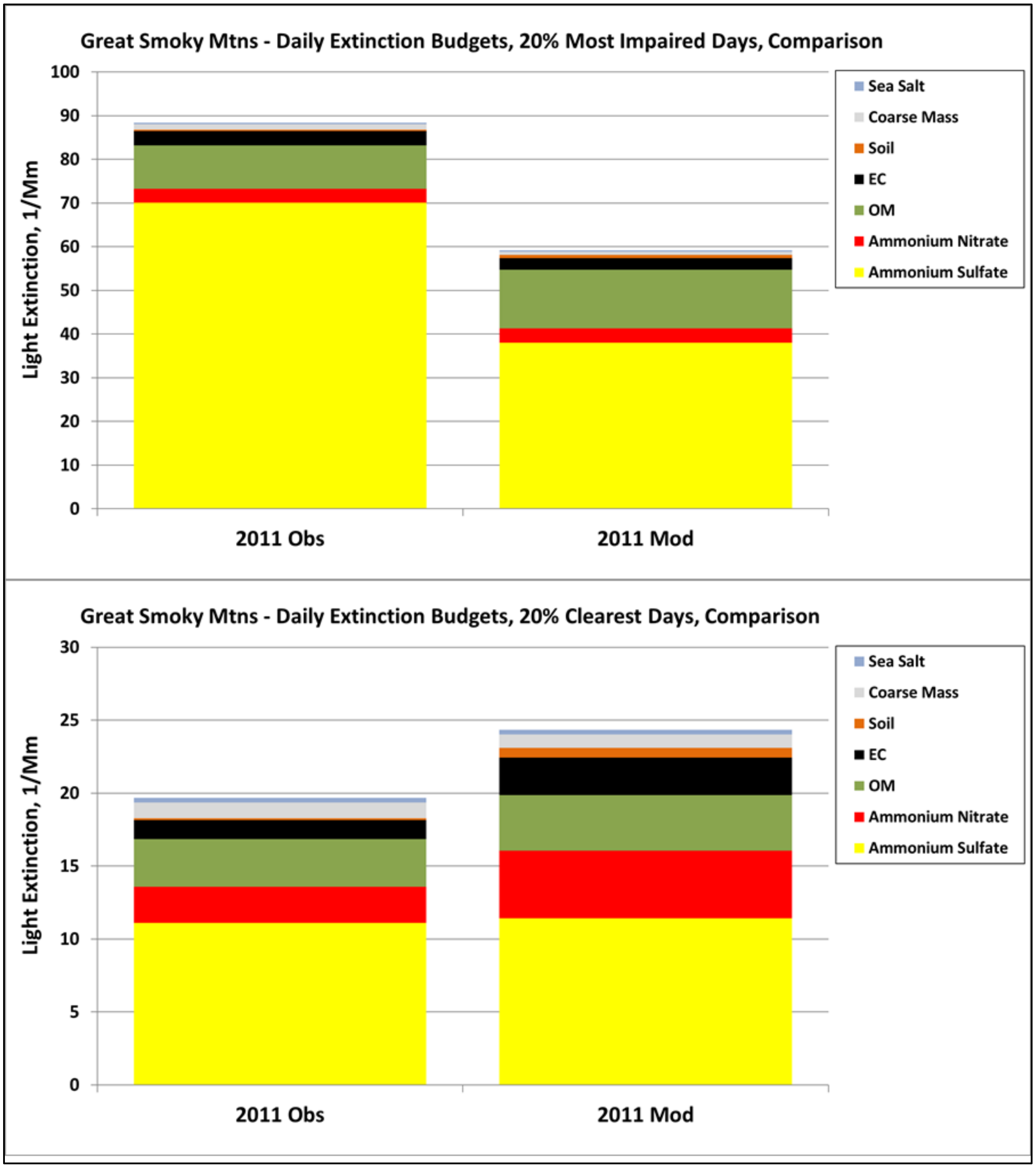


Figure 6-18: Stacked Bar Charts for Average Light Extinction on the 20% Most Impaired Days (top) and 20% Clearest Days (bottom) at Great Smoky Mountains National Park

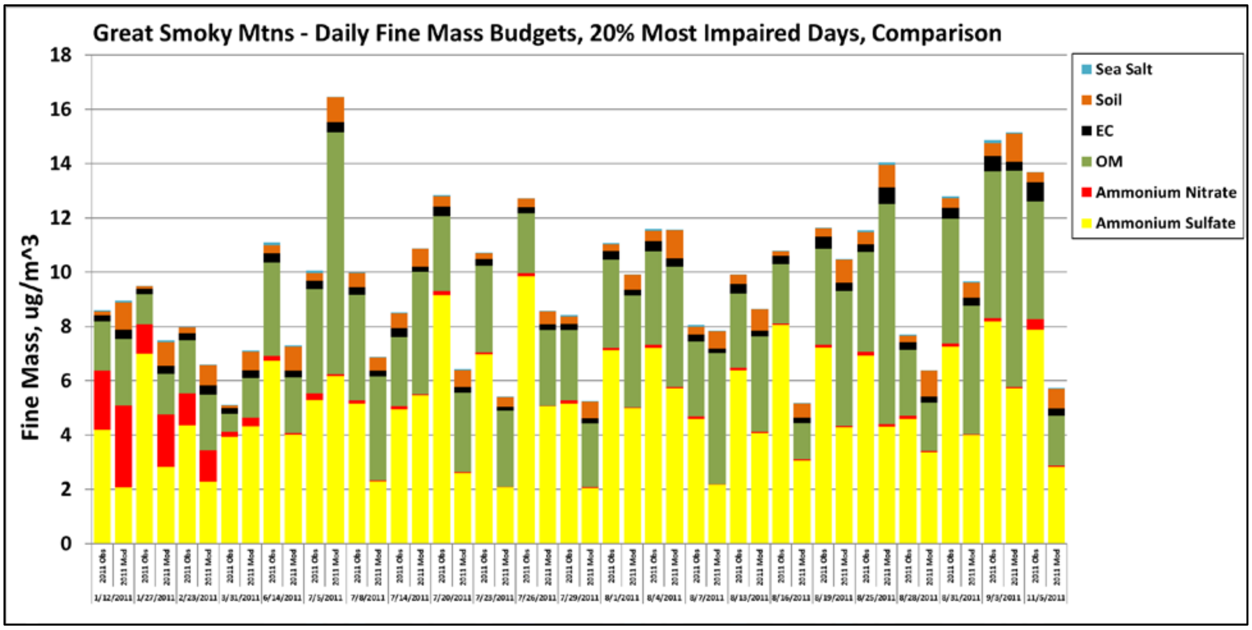


Figure 6-19: Stacked Bar Charts for Daily $PM_{2.5}$ Concentrations at Great Smoky Mountains National Park on the 20% Most Impaired Days: Observation (left) and Modeled (Right)

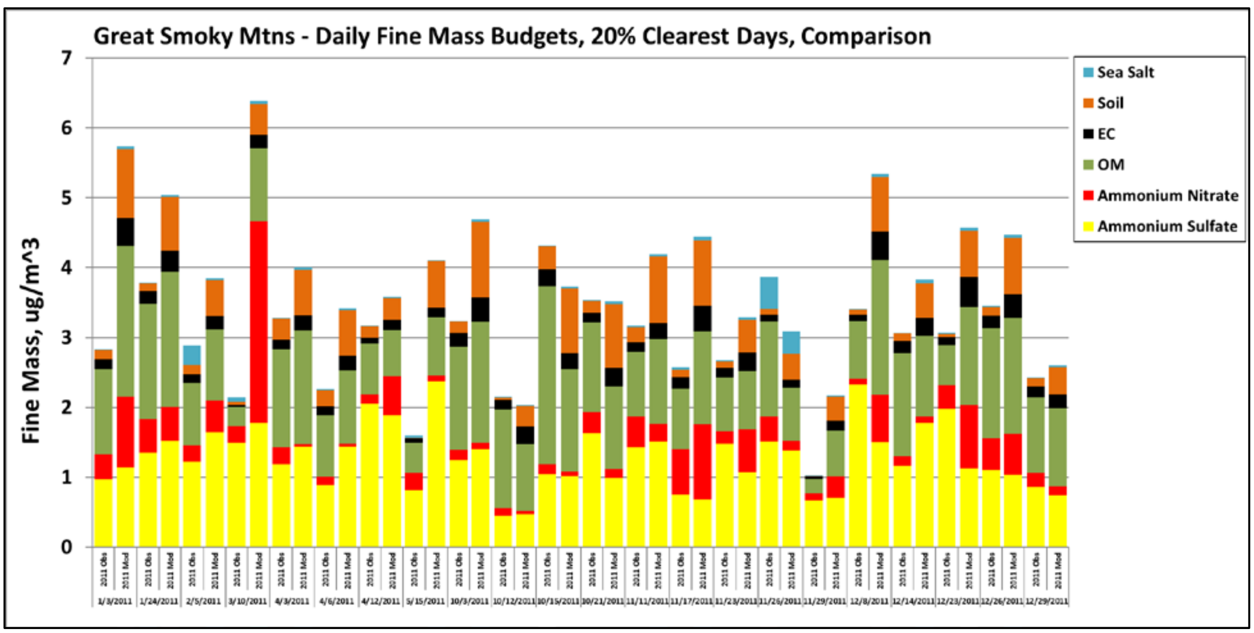


Figure 6-20: Stacked Bar Charts for Daily $PM_{2.5}$ Concentrations at Great Smoky Mountains National Park on the 20% Clearest Days: Observation (left) and Modeled (Right)

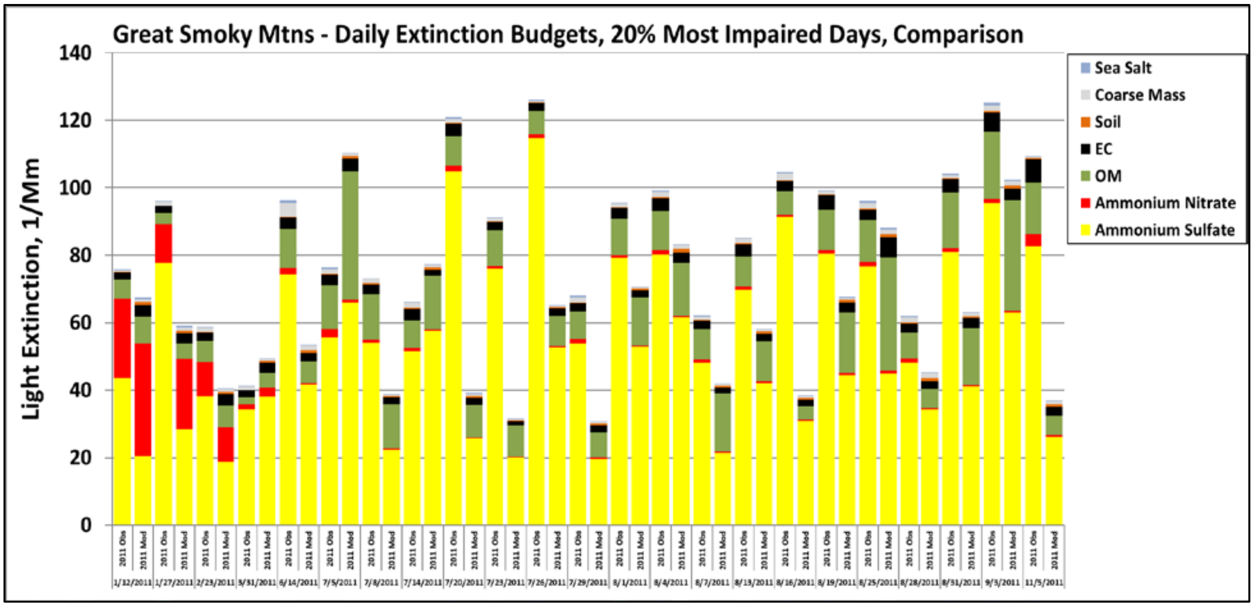


Figure 6-21: Stacked Bar Charts for Light Extinction at Great Smoky Mountains National Park on the 20% Most-Impaired Days: Observation (left) and Modeled (Right)

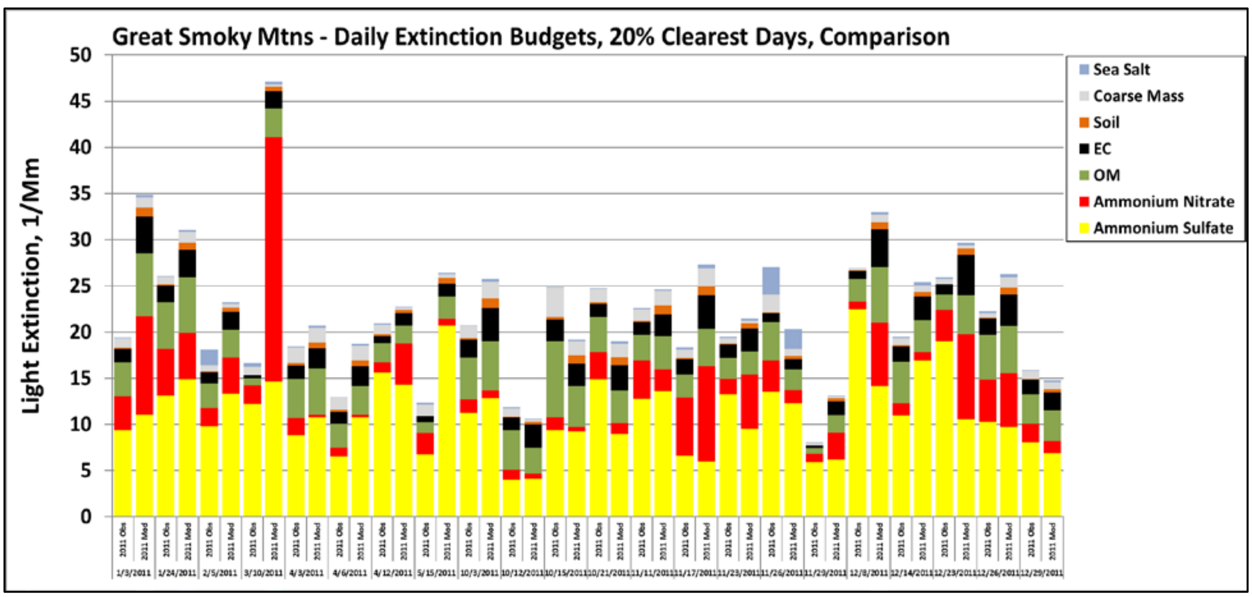


Figure 6-22: Stacked Bar Charts for Light Extinction at Great Smoky Mountains National Park on the 20% Clearest Days: Observation (left) and Modeled (Right)

Figure 6-23 and Figure 6-24 contain scatter plots of daily observations vs. modeled concentration for $PM_{2.5}$, sulfate, nitrate, organic carbon, elemental carbon, crustal (labeled as soil), sea salt, and coarse mass for Great Smoky Mountains National Park on the 20% most-impaired days. $PM_{2.5}$, sulfate, and coarse mass (labeled as PMC) were generally under predicted while crustal was generally over predicted. Organic carbon, nitrate elemental carbon, and sea salt show both over predictions and under predictions.

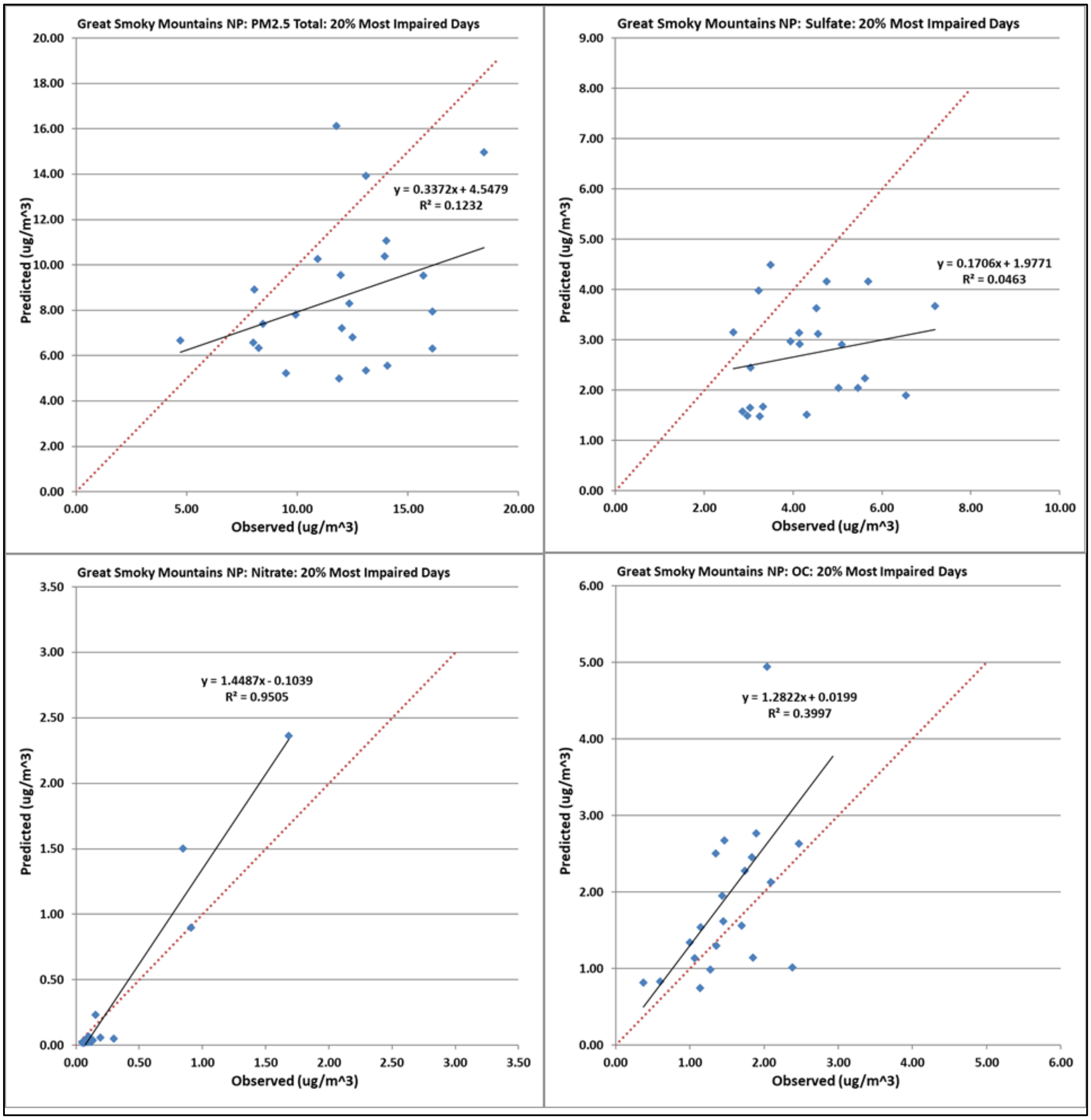


Figure 6-23: Scatter Plot for Daily $PM_{2.5}$ (top left), Sulfate (top right), Nitrate (bottom left), and Organic Carbon (bottom right) Concentrations at Great Smoky Mountains National Park on the 20% Most Impaired Days

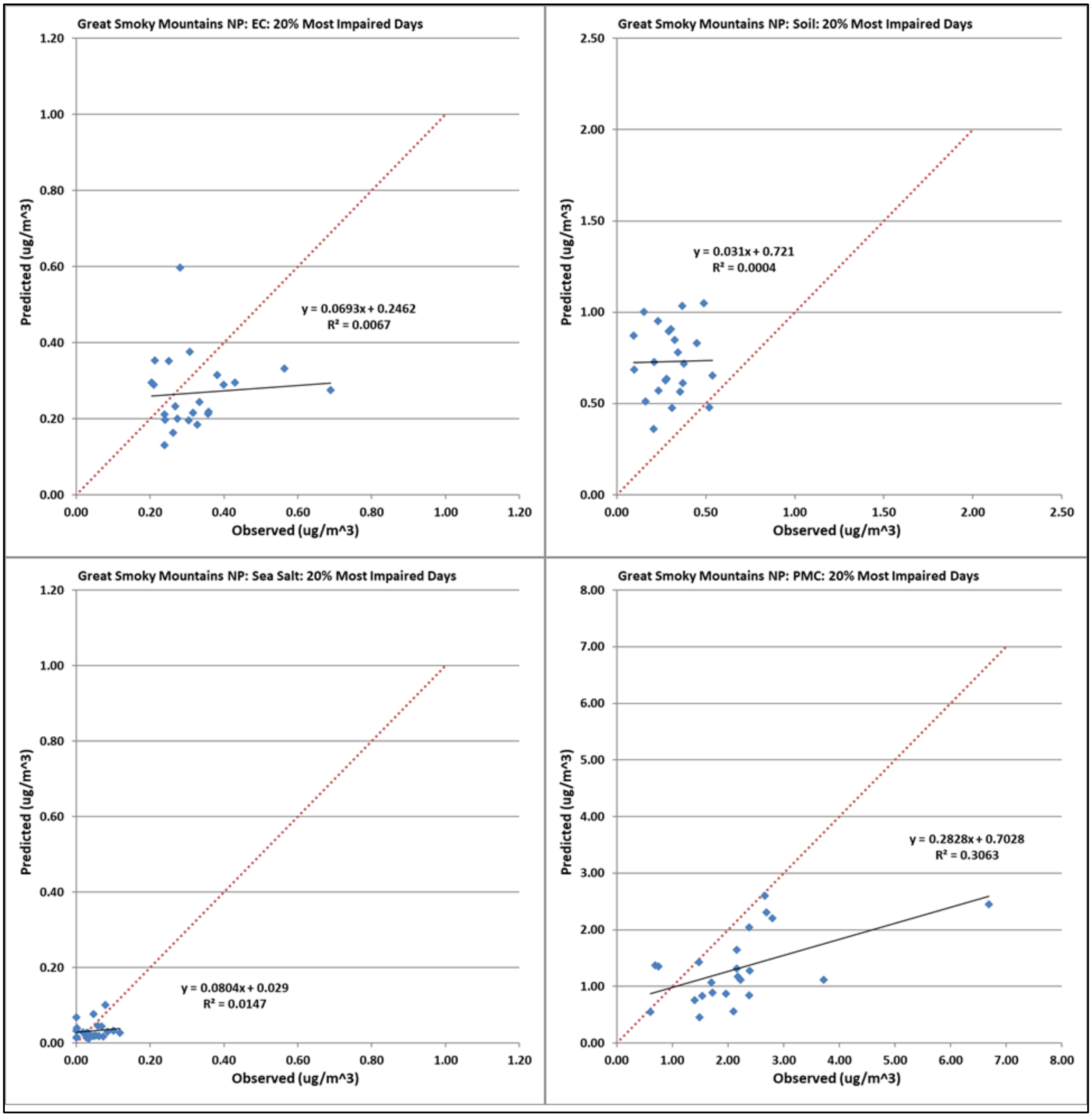


Figure 6-24: Scatter Plot for Daily Elemental Carbon (top left), Crustal (top right), Sea Salt (bottom left), and Coarse Mass (bottom right, labeled as PMC) Concentrations at Great Smoky Mountains National Park on the 20% Most Impaired Days

Figure 6-25 and Figure 6-26 contain scatter plots of daily observations vs. modeled concentration for $PM_{2.5}$, sulfate, nitrate, organic carbon, elemental carbon, crustal (labeled as soil), sea salt, and coarse mass (labeled as PMC) for Great Smoky Mountains National Park on the 20% clearest days. $PM_{2.5}$, elemental carbon, and crustal were generally over predicted. Nitrate, sulfate, organic carbon, sea salt, and coarse mass show both over predictions and under predictions.

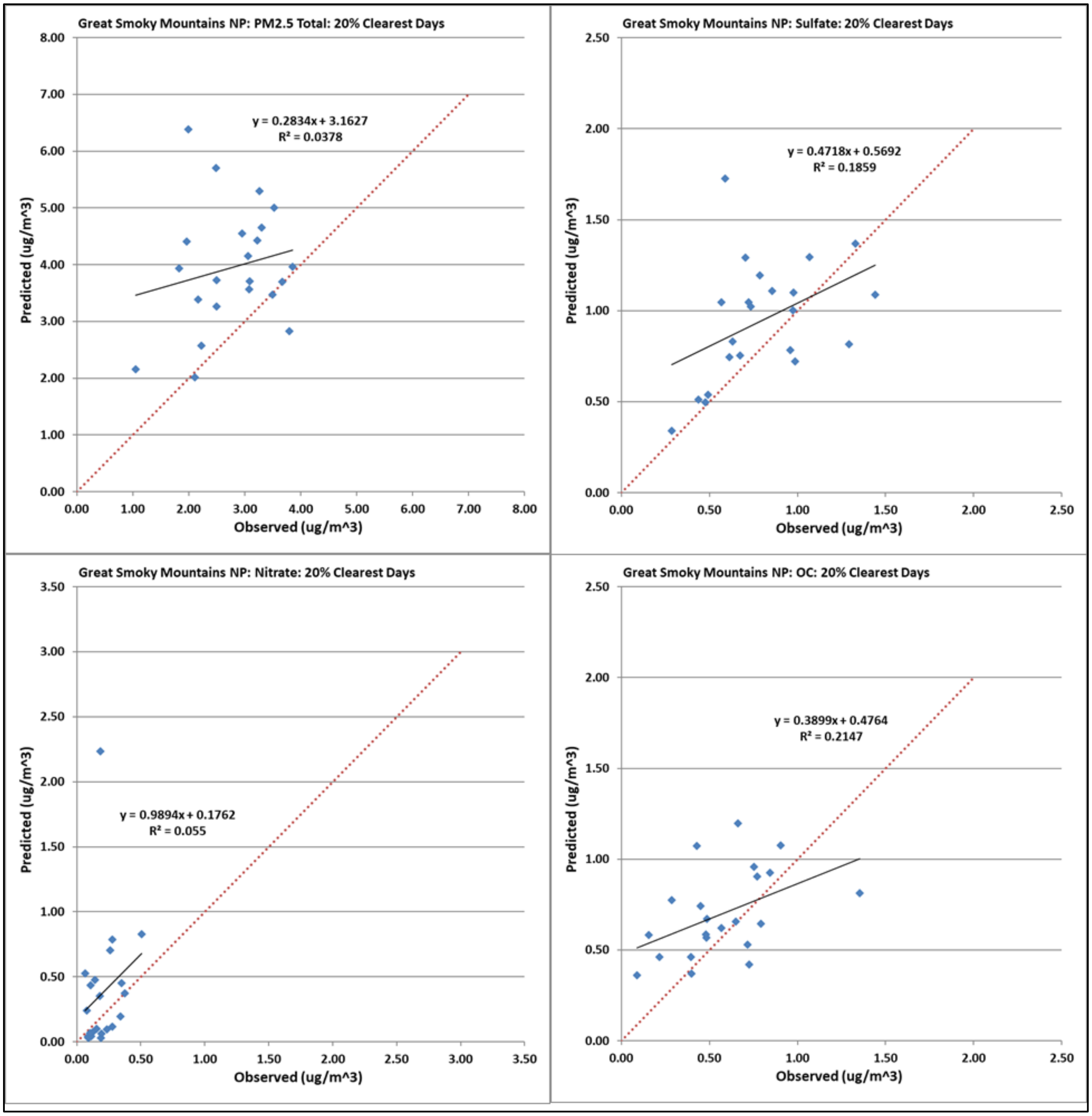


Figure 6-25: Scatter Plot for Daily $PM_{2.5}$ (top left), Sulfate (top right), Nitrate (bottom left), and Organic Carbon (bottom right) Concentrations at Great Smoky Mountains National Park on the 20% Clearest Days.

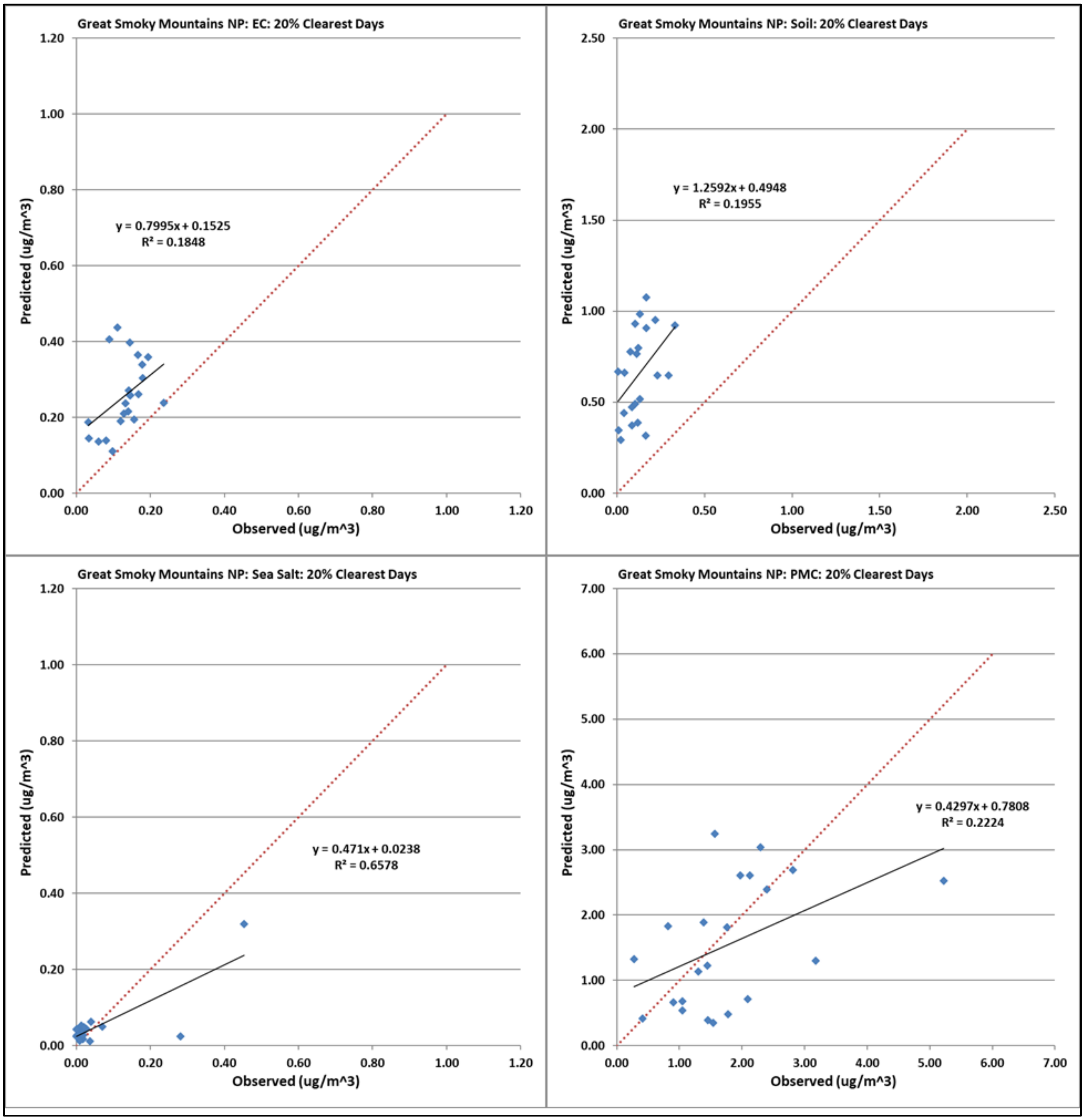


Figure 6-26: Scatter Plot for Daily Elemental Carbon (top left), Crustal (top right), Sea Salt (bottom left), and Coarse Mass (bottom right, labeled as PMC) Concentrations at Great Smoky Mountains National Park on the 20% Clearest Days

Figure 6-27 through Figure 6-28 are soccer plots showing NMB and NME for modeled sulfate, nitrate, organic carbon, elemental carbon, crustal, and coarse mass for Great Smoky Mountains National Park on the 20% most impaired days and the 20% clearest days. For Great Smoky Mountains National Park on the 20% most impaired days, sulfate, nitrate, organic carbon, elemental carbon, and coarse mass meet the NMB and NME criteria while crustal does not. For Great Smoky Mountains National Park on the 20% clearest days, sulfate, organic carbon, and coarse mass meet the NMB and NME criteria while nitrate, elemental carbon, and crustal do not.

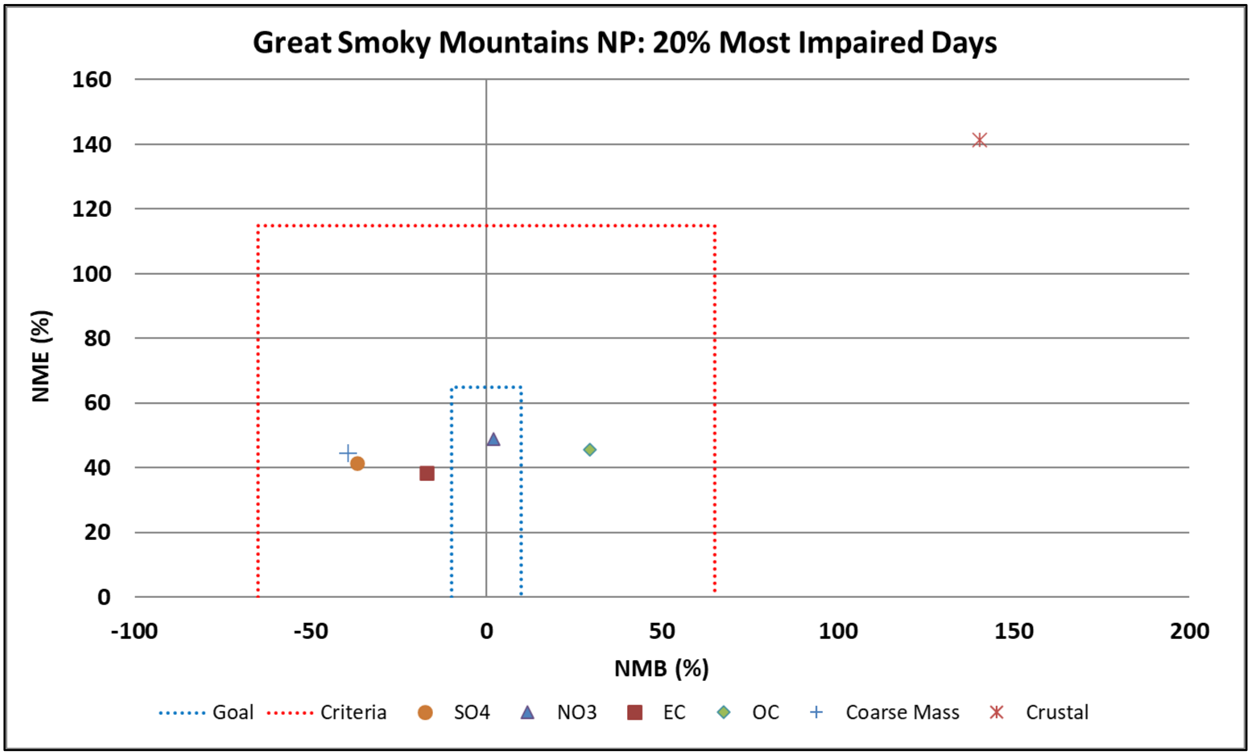


Figure 6-27: Soccer Plot for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Most Impaired Days at Great Smoky Mountains National Park

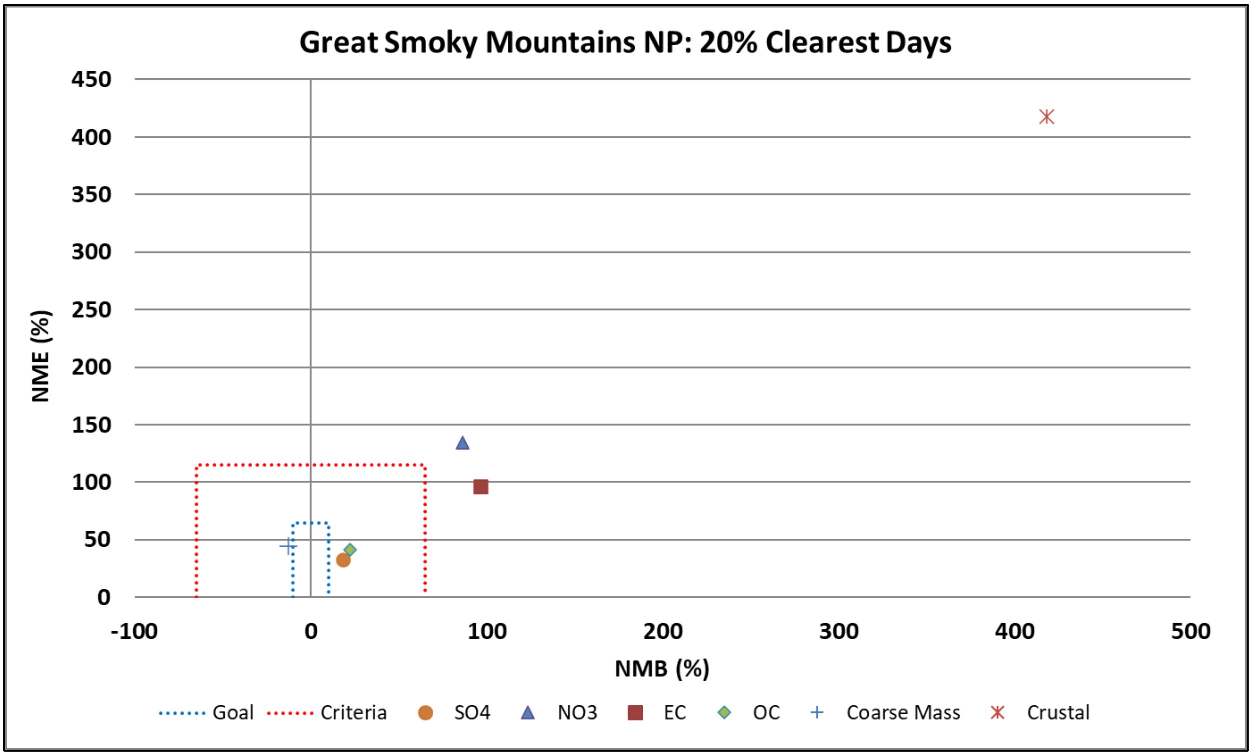


Figure 6-28: Soccer Plot for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Clearest Days at Great Smoky Mountains National Park

Figure 6-29 and Figure 6-30 are bugle plots showing MFB and MFE for modeled sulfate, nitrate, organic carbon, elemental carbon, crustal, and coarse mass for Great Smoky Mountains National Park on the 20% most impaired days and the 20% clearest days. On the 20% most impaired days and the 20% clearest days, all species meet the MFB and MFE criteria (red line). On the 20% most impaired days and the 20% clearest days, all species (except sulfate MFB on 20% most impaired days) meet the MFB and MFE goal (green line).

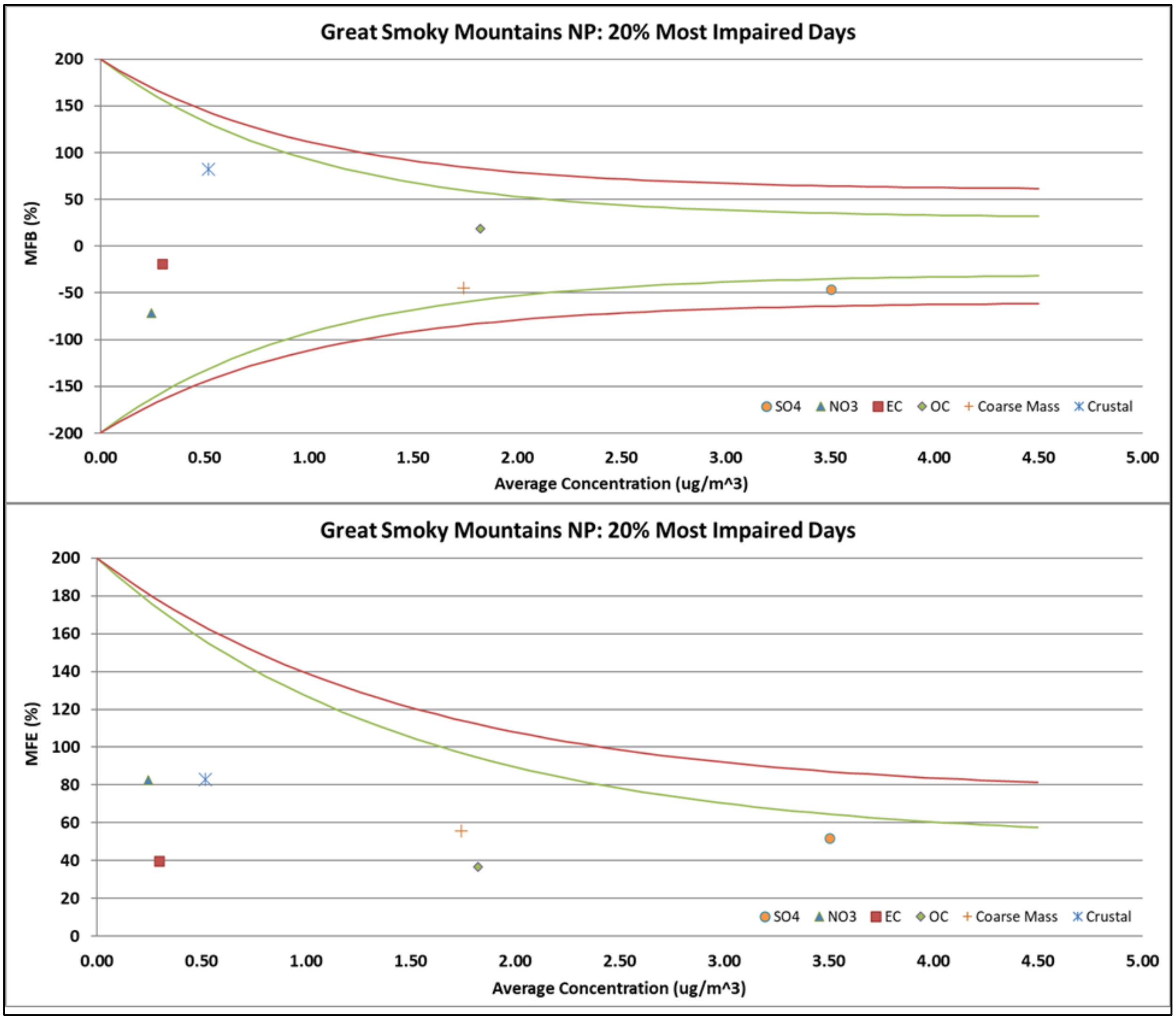
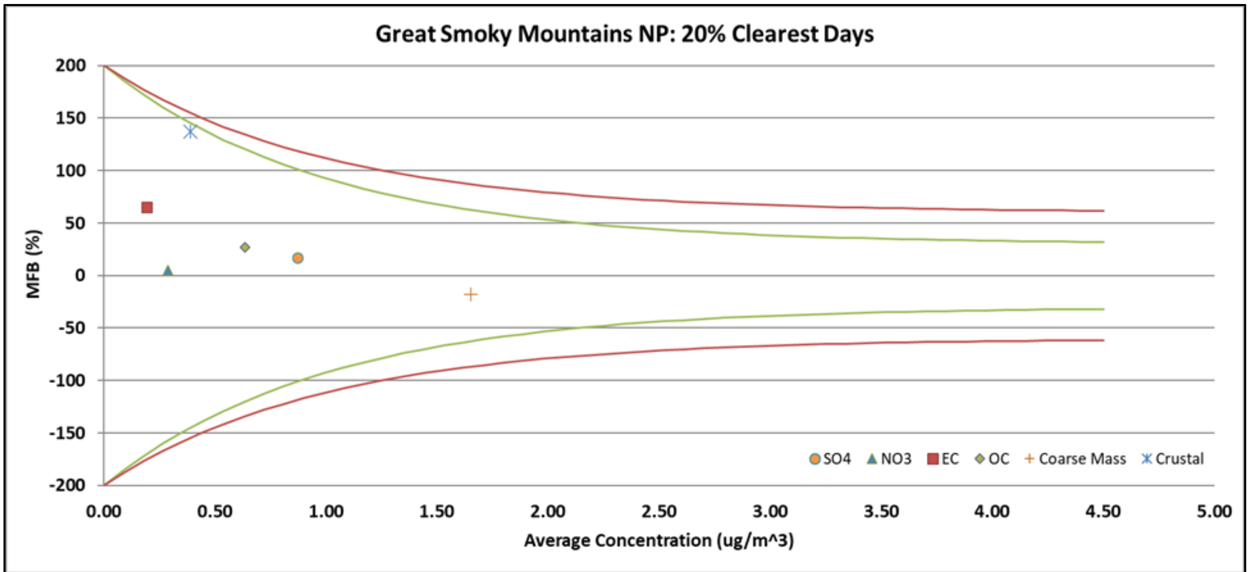


Figure 6-29: Bugle Plots of MFB (top) and MFE (bottom) for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Most Impaired Days at Great Smoky Mountains National Park



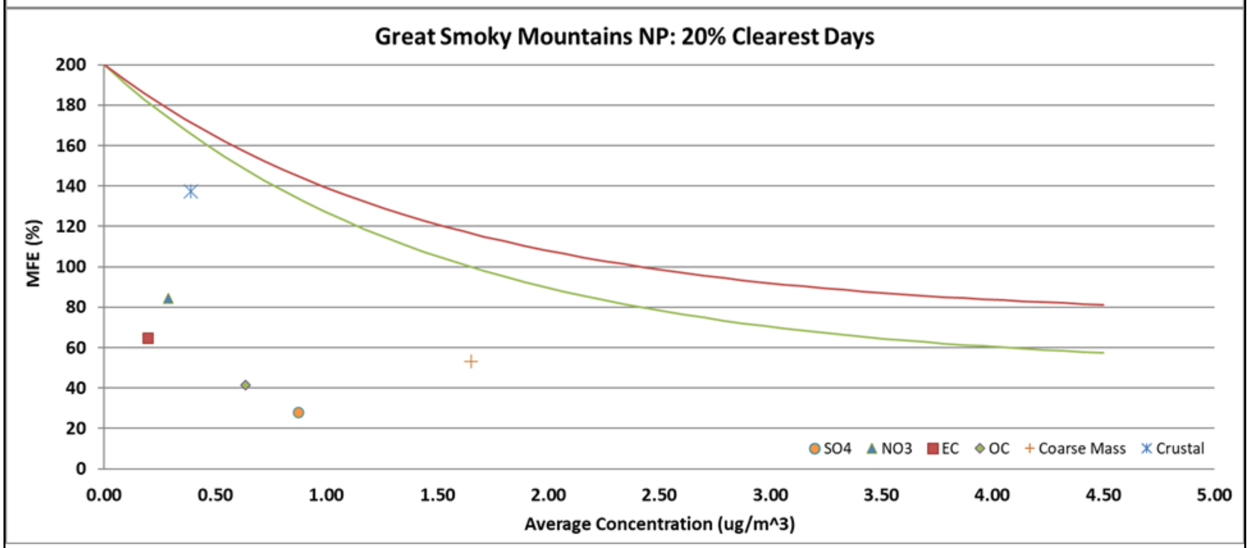


Figure 6-30: Bugle Plots of MFB (top) and MFE (bottom) for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Clearest Days at Great Smoky Mountains National Park

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 deciviews. 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. This section discusses development of Tennessee's long-term strategy. Section 7.8 specifies measures in the LTS that the TDEC-APC deems are necessary for reasonable progress and proposes that these measures be incorporated into the regulatory portion of the SIP. The TDEC-APC proposes that all other measures in the LTS not be incorporated into the regulatory portion of the SIP.

7.1. Overview of the Long-Term Strategy Development Process

The monitor data and the modeling analyses included with the first 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 shows the daily visibility data for 20% most impaired days during the baseline period for Great Smoky Mountains National Park. Sulfate accounted for the vast majority of the pollutant impairing species on these days. Visibility data for the baseline period for most VISTAS Class I areas showed this same trend.

More current speciation data for years 2014 through 2018 show significant visibility improvement on the 20% most impaired days. As shown in Figure 2-7 for Great Smoky Mountains National Park, 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 Tennessee 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 Tennessee Class I areas during the period 2014 to 2018 continue to be impacted most heavily by sulfate. The 2014 to 2018 IMPROVE data for other VISTAS Class I areas, provided in Appendix C-2, show similar trends. 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 Tennessee and the VISTAS region, how much visibility improvement, compared to the glide path, is expected at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area by 2028?
- Which mandatory federal Class I areas located outside of Tennessee are significantly impacted by visibility impairing pollutants originating from within Tennessee?
- 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. Expected Visibility in 2028 for Tennessee Class I Areas Under Existing and Planned Emissions Controls

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 the RPGs 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, which 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 NO_x Ozone Season Group 2 emissions budgets for EGUs with revised budgets under a new CSAPR NO_x 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 NO_x combustion controls beginning in the 2022 ozone season. EPA estimates the Revised CSAPR Update will reduce summertime NO_x 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.

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 one-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, reductions in SO_2 emissions have occurred and further reductions may be necessary at certain point sources.

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,[47] 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

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

within 200 nautical miles of the coast of North America, also known as the North American Emission Control Area.

7.2.1.5. Consent Agreements

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 applies 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.

7.2.2. 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.

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%.

7.2.2.1. Tennessee Valley Authority Consent Decree

The largest source of SO_2 and NO_x emissions in Tennessee is Electric Generating Units (EGU's), which are all owned by the Tennessee Valley Authority (TVA). The TVA entered into a court settlement in 2011 for previous violations of the Clean Air Act. This settlement required shut downs, new controls, and a switch from coal to natural gas at certain facilities. Specifically, the following changes have been implemented:

- Shut down of the TVA Allen coal plant in Shelby County, which was replaced by a natural gas combined cycle plant (equipped with SCR controls) on the same site. The coal-fired units were retired on March 31, 2018
- Shut down of the TVA John Sevier coal plant in Hawkins County, which was replaced by a natural gas combined cycle plant. Units 1 and 2 were retired on December 31, 2012 and Units 3 and 4 were retired on June 25, 2014
- Shut down of the TVA Johnsonville coal plant in Humphreys County. Units 5-10 were retired on December 31, 2015, and Units 1-4 were retired on December 31, 2017. This plant currently consists of twenty natural gas or oil-fired combustion turbines, four natural gas preheaters, a combined heat and power (CHP) unit that provides steam to an off-site customer, and two natural gas auxiliary boilers that are backup steam generators for the CHP unit. In June 2021, the TDEC-APC received a modeling protocol for TVA's proposed installation of ten new simple-cycle natural gas combustion turbines and shut down of sixteen of the existing simple-cycle units. TVA predicts that the proposed emission increases will be 101.2 tpy for NOx, 57.6 tpy for PM, and 5.2 tpy for SO_2. Since this is a recent submittal, these emission increases are not included in the 2028 modeling.
- Addition of selective catalytic reduction (SCR) controls at the TVA Gallatin coal plant in Sumner County. All SCRs were installed and operational by December 2017. Addition of FGD controls on Unit 1, 3 and 4 in 2015 and Unit 2 in 2016
- The terms of the Consent Decree required continuous operation of all SO_2 and NO_x control devices at all of the coal plants

In addition to the settlement agreement, the TVA has started producing electricity from Watts Bar 2 nuclear plant in Rhea County in October 2016, which could decrease power production from the TVA fossil fuel-fired facilities. Also, on February 14, 2019, the TVA Board of Directors approved the retirement of the TVA Bull Run coal plant in Anderson County, which would take place as early as 2023. In two Federal Register notices, the TVA has announced plans to retire all of the coal-fired units at TVA Cumberland and TVA Kingston. On May 11, 2021 (86 Federal Register 25933), the TVA proposed the retirement of one unit at TVA Cumberland as early as 2026 but no later than 2030, and the remaining unit as early as 2028 but no later than 2033. On June 15, 2021 (86 Federal Register 31780), the TVA proposed the retirement of three units at TVA Kingston as early as 2026, but no later than 2031, and the remaining six units as early as 2027, but no later than 2033.

Figure 7-1 is a map of the TVA region showing the coal, natural gas, nuclear, and hydroelectric plants. Table 7-1 provides a summary of the coal plant retirements and SO_2 and NO_x controls. Figures 7-2 through 7-16 show the annual SO_2 and NO_x emissions from 2008 to 2019 for the TVA power plants. All of the emission data comes from the EPA's Clean Air Markets Division. These figures illustrate the tremendous decrease in SO_2 and NO_x emissions over this time period.

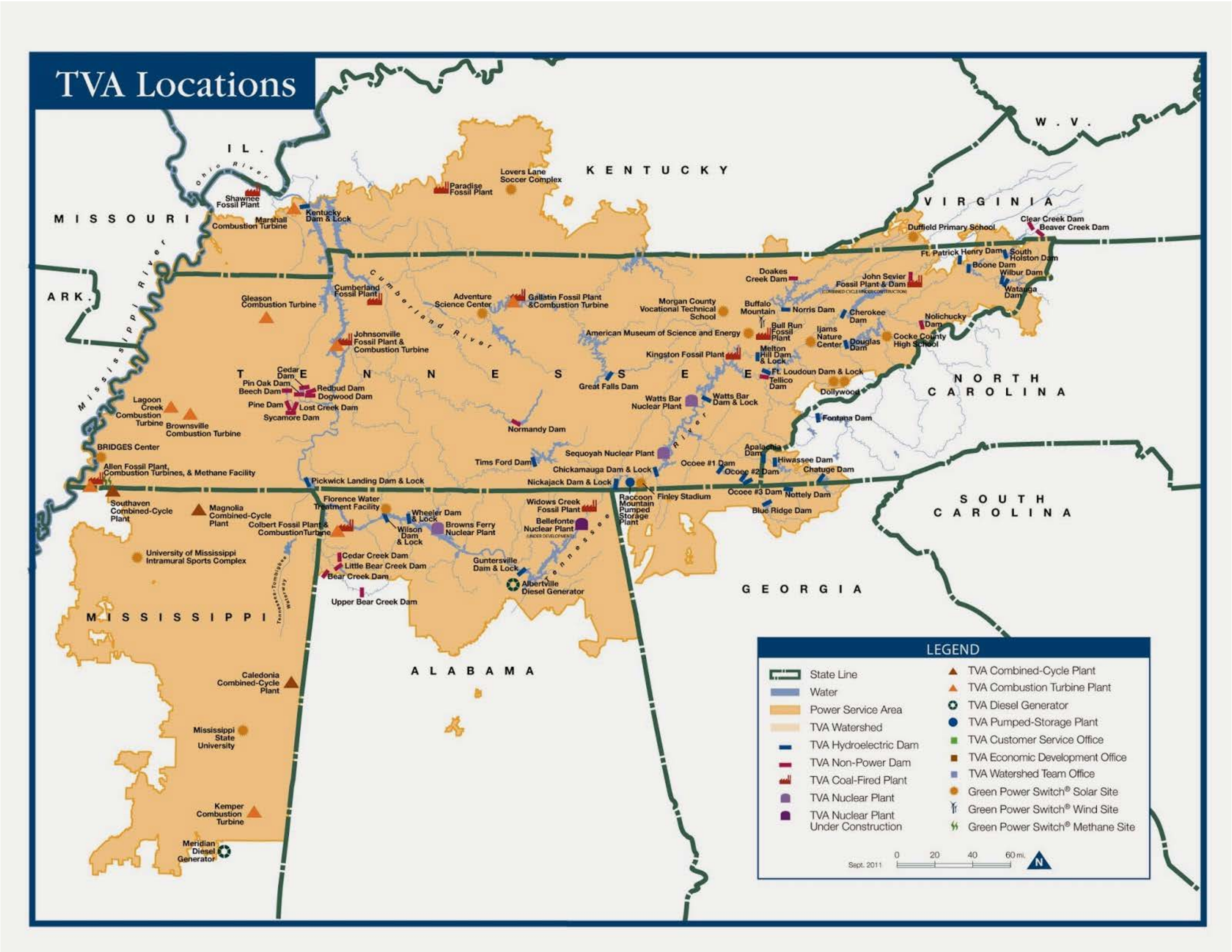


Figure 7-1: TVA Region

Table 7-1: Summary of TVA Coal-fired Power Plants

Facility	Emission Unit	Current SO_2 Emission Control	Current NO_x Emission Control	Status
TVA Allen	1	N/A	N/A	Retired March 31, 2018
	2	N/A	N/A	Retired March 31, 2018
	3	N/A	N/A	Retired March 31, 2018
TVA Bull Run	1	Wet Scrubber	SCR	Unit will retire before end of 2023
TVA Cumberland	1	Wet Scrubber	SCR	Wet scrubber in place since 1995
	2	Wet Scrubber	SCR	Wet scrubber in place since 1995
TVA Gallatin	1	FGD	SCR	FGD started in 2015; SCR started in 2017
	2	FGD	SCR	FGD started in 2016; SCR started in 2017
	3	FGD	SCR	FGD started in 2015; SCR started in 2017
	4	FGD	SCR	FGD started in 2015; SCR started in 2017
TVA John Sevier	1	N/A	N/A	Retired December 31, 2012
	2	N/A	N/A	Retired December 31, 2012
	3	N/A	N/A	Retired June 25, 2014
	4	N/A	N/A	Retired June 25, 2014
TVA Johnsonville	1	N/A	N/A	Retired December 31, 2017
	2	N/A	N/A	Retired December 31, 2017
	3	N/A	N/A	Retired December 31, 2017
	4	N/A	N/A	Retired December 31, 2017
	5	N/A	N/A	Retired December 31, 2015
	6	N/A	N/A	Retired December 31, 2015
	7	N/A	N/A	Retired December 31, 2015
	8	N/A	N/A	Retired December 31, 2015
	9	N/A	N/A	Retired December 31, 2015
	10	N/A	N/A	Retired December 31, 2015
TVA Kingston	1	FGD	SCR	FGD started in 2009; SCR started in 2004
	2	FGD	SCR	FGD started in 2009; SCR started in 2004
	3	FGD	SCR	FGD started in 2009; SCR started in 2004
	4	FGD	SCR	FGD started in 2009; SCR started in 2004
	5	FGD	SCR	FGD started in 2009; SCR started in 2005
	6	FGD	SCR	FGD started in 2009; SCR started in 2005
	7	FGD	SCR	FGD started in 2009; SCR started in 2004
	8	FGD	SCR	FGD started in 2009; SCR started in 2004
	9	FGD	SCR	FGD started in 2009; SCR started in 2006

For TVA Allen, Figure 7-2 shows a decrease in SO_2 emissions from 12,495 ton/yr in 2008 to 14 ton/yr in 2019. Figure 7-3 shows a decrease in NO_x emission from 8,061 ton/yr in 2008 to 227 ton/yr in 2019.

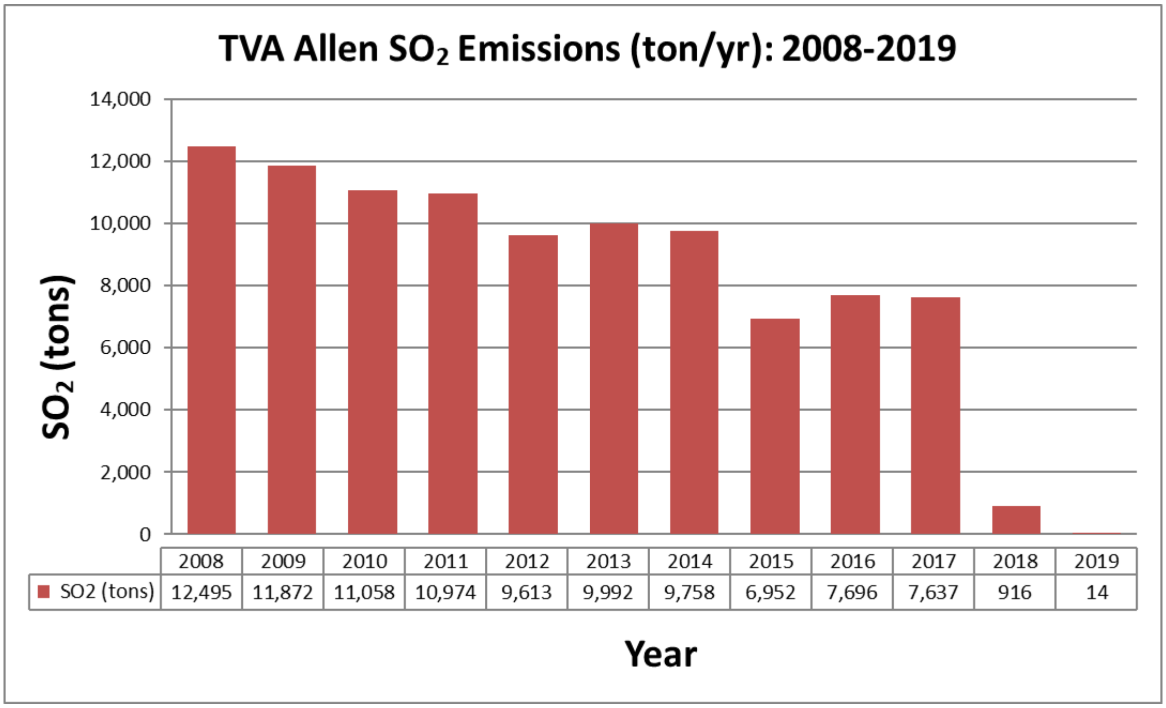


Figure 7-2: TVA Allen SO_2 Emissions (ton/yr): 2008-2019

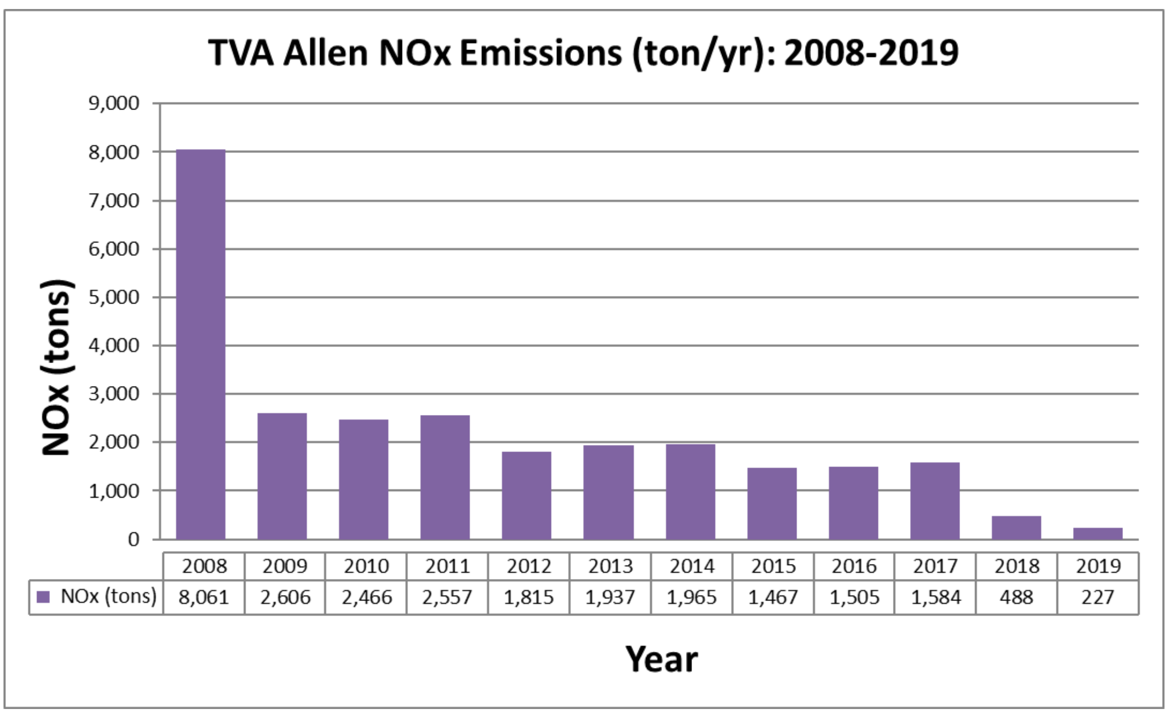


Figure 7-3: TVA Allen NO_x Emissions (ton/yr): 2008-2019

For TVA Bull Run, Figure 7-4 shows a decrease in SO_2 emissions from 28,287 ton/yr in 2008 to 308 ton/yr in 2019. Figure 7-5 shows a decrease in NO_x emission from 8,622 ton/yr in 2008 to 733 ton/yr in 2019.

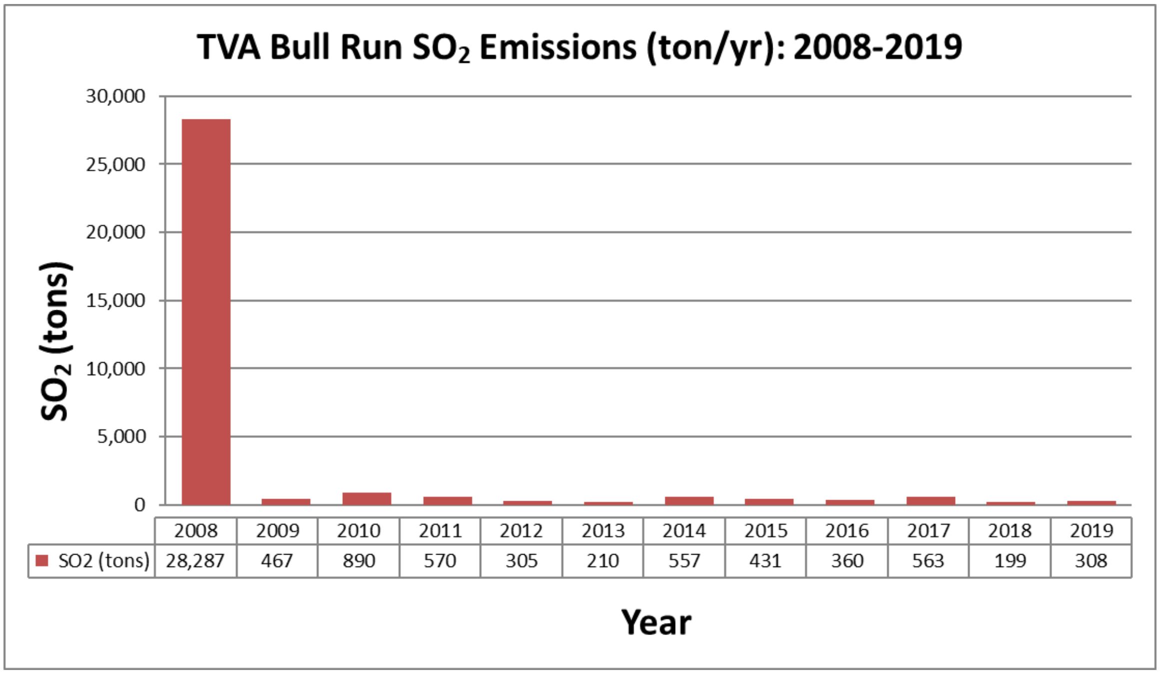


Figure 7-4: TVA Bull Run SO_2 Emissions (ton/yr): 2008-2019

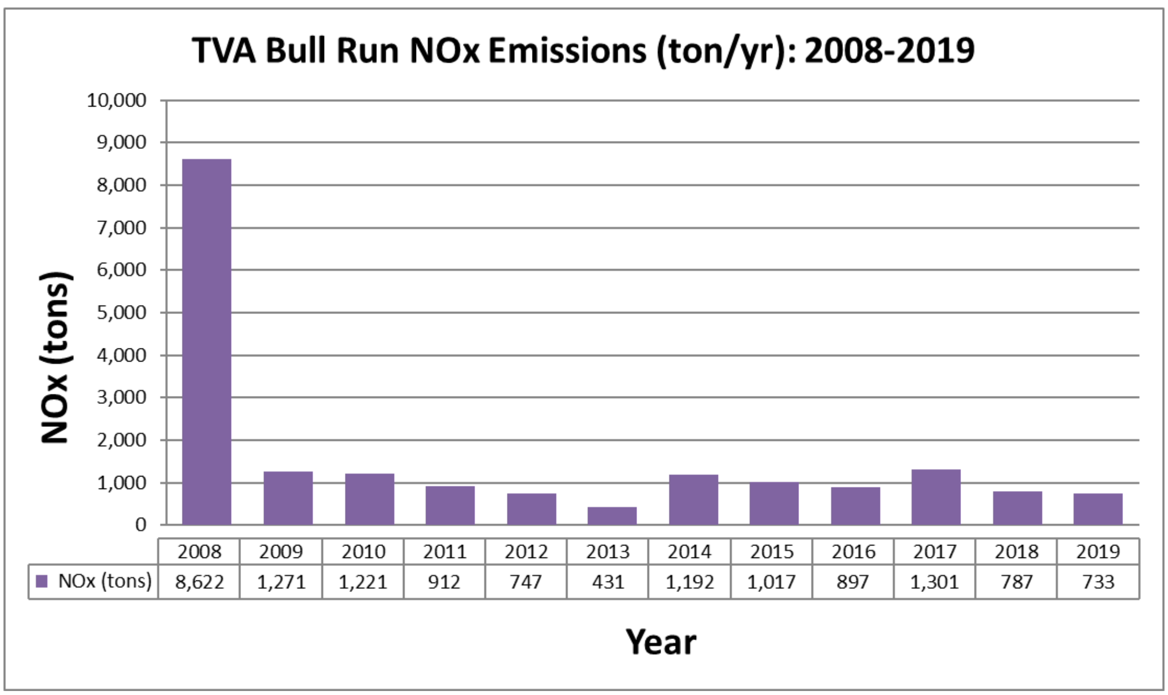


Figure 7-5: TVA Bull Run NO_x Emissions (ton/yr): 2008-2019

For TVA Cumberland, Figure 7-6 shows a decrease in SO_2 emissions from 14,701 ton/yr in 2008 to 7,209 ton/yr in 2019. Figure 7-7 shows a decrease in NO_x emission from 30,680 ton/yr in 2008 to 3,932 ton/yr in 2019.

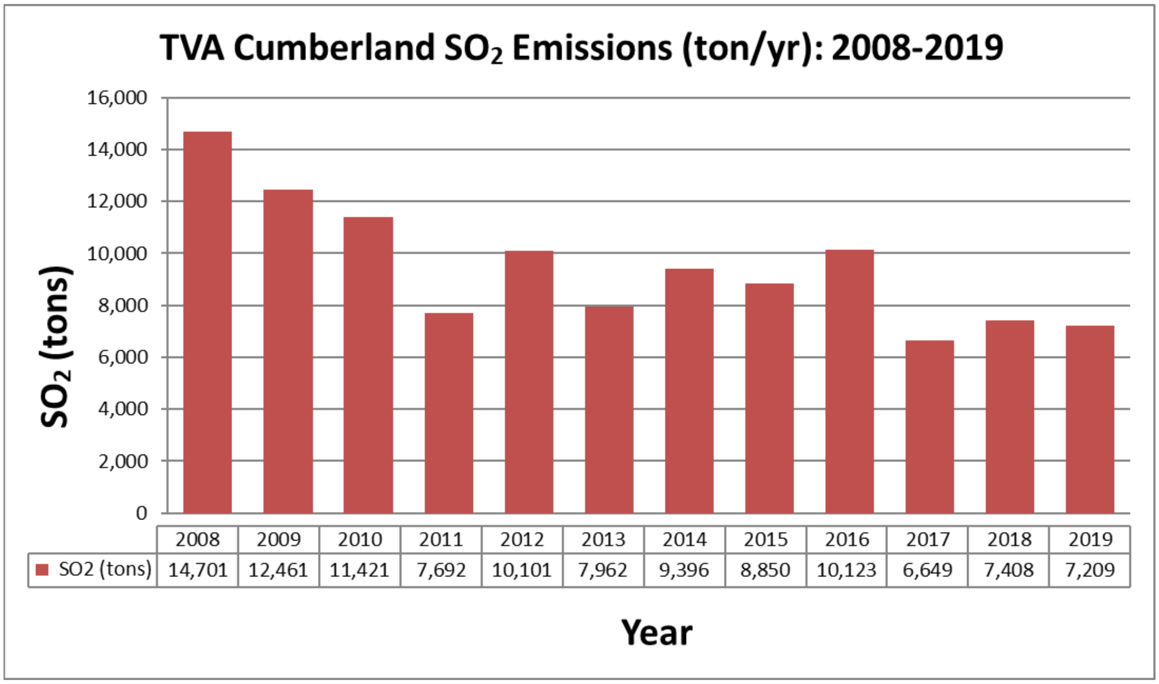


Figure 7-6: TVA Cumberland SO_2 Emissions (ton/yr): 2008-2019

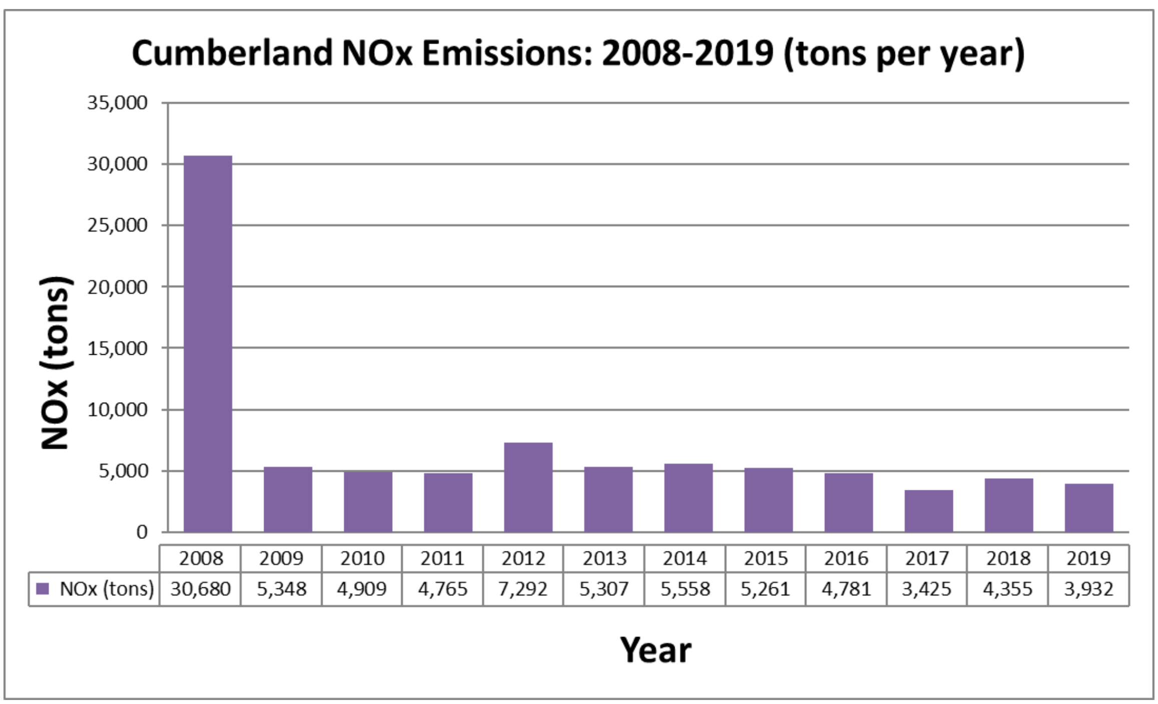


Figure 7-7: TVA Cumberland NO_x Emissions (ton/yr): 2008-2019

For TVA Gallatin, Figure 7-8 shows a decrease in SO_2 emissions from 23,426 ton/yr in 2008 to 1,741 ton/yr in 2019. Figure 7-9 shows a decrease in NO_x emission from 6,141 ton/yr in 2008 to 1,342 ton/yr in 2019.

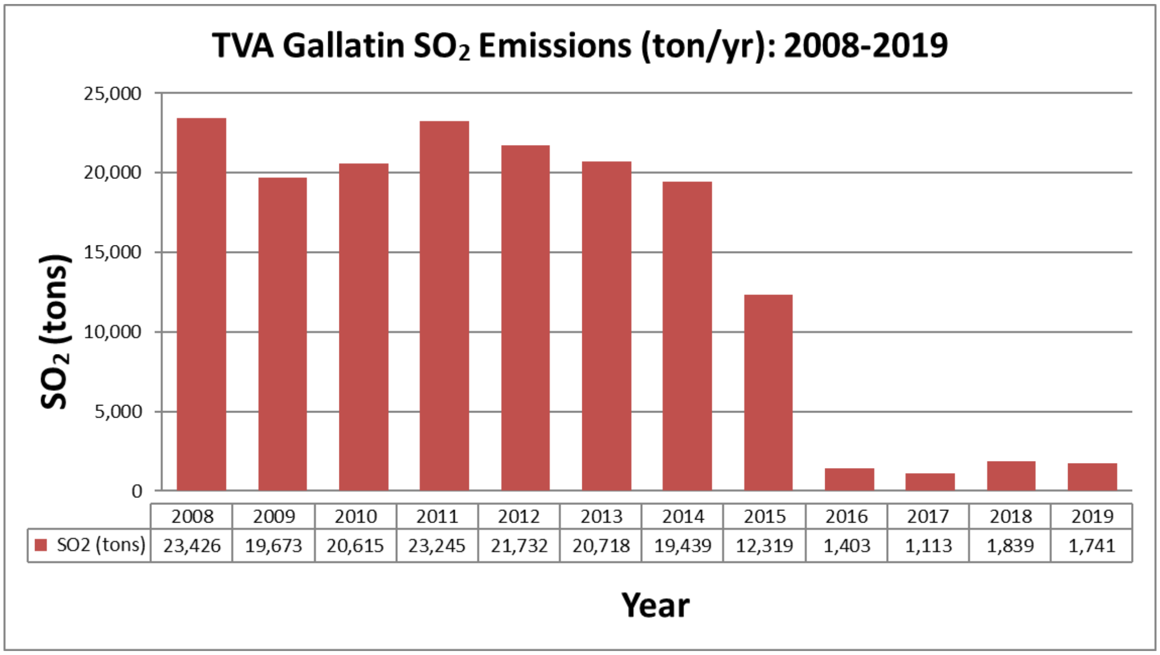


Figure 7-8: TVA Gallatin SO_2 Emissions (ton/yr): 2008-2019

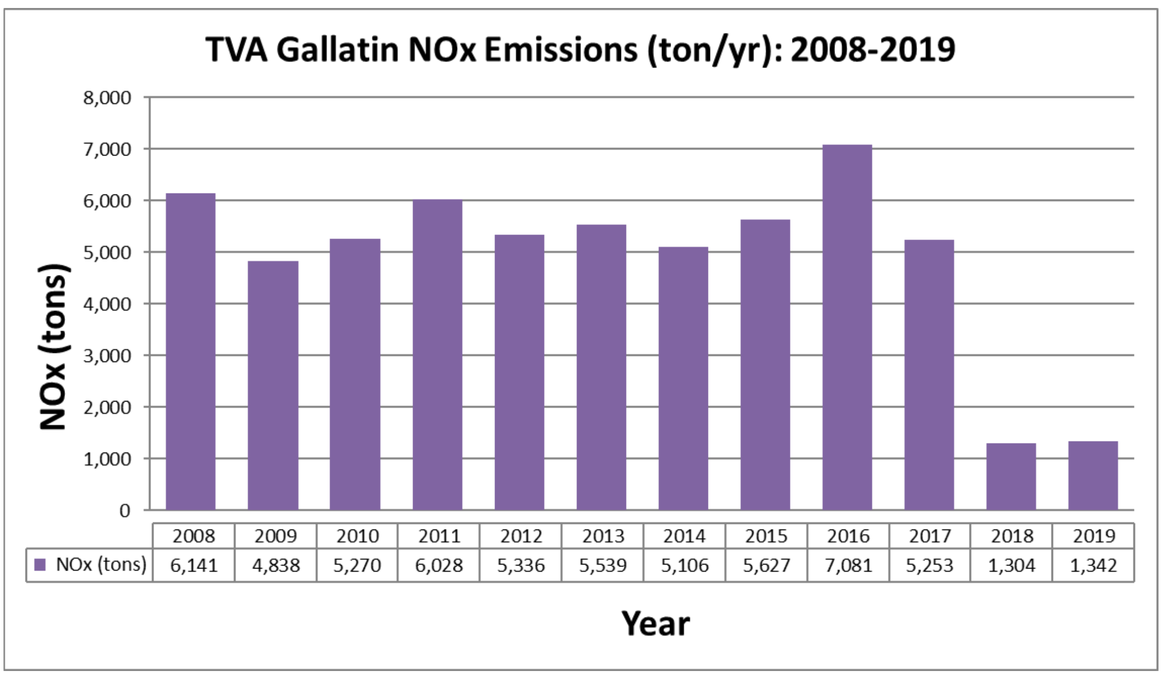


Figure 7-9: TVA Gallatin NO_x Emissions (ton/yr): 2008-2019

For TVA John Sevier, Figure 7-10 shows a decrease in SO_2 emissions from 27,745 ton/yr in 2008 to 11 ton/yr in 2019. Figure 7-11 shows a decrease in NO_x emission from 8,648 ton/yr in 2008 to 172 ton/yr in 2019.

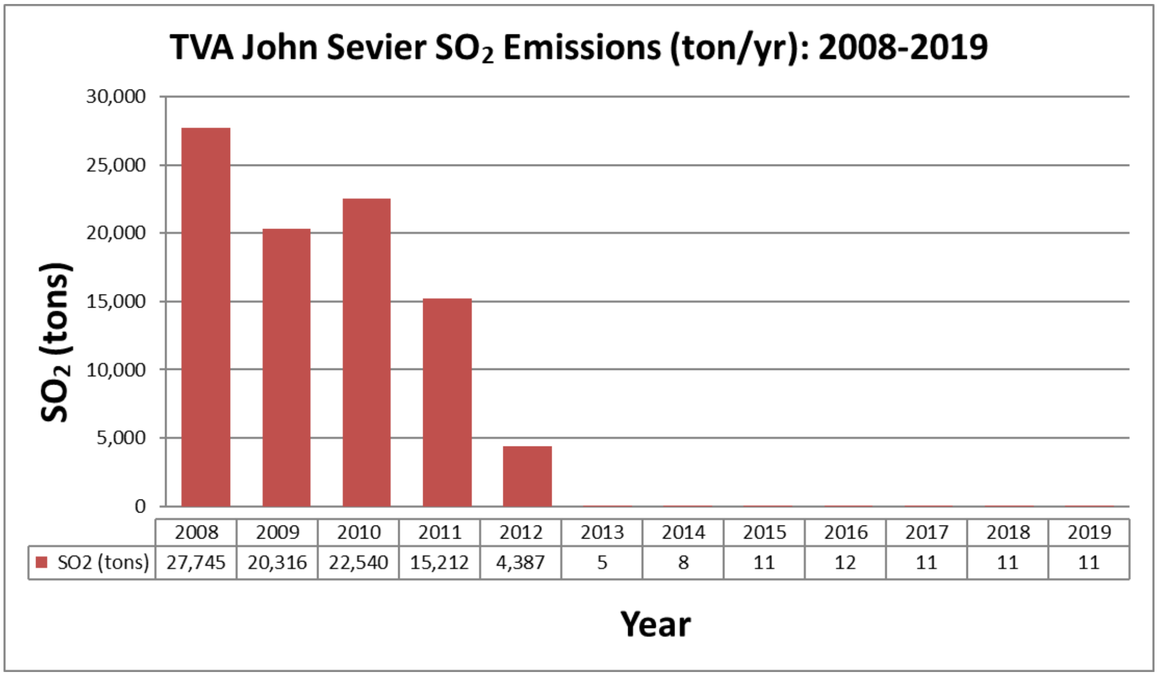


Figure 7-10: TVA John Sevier SO_2 Emissions (ton/yr): 2008-2019

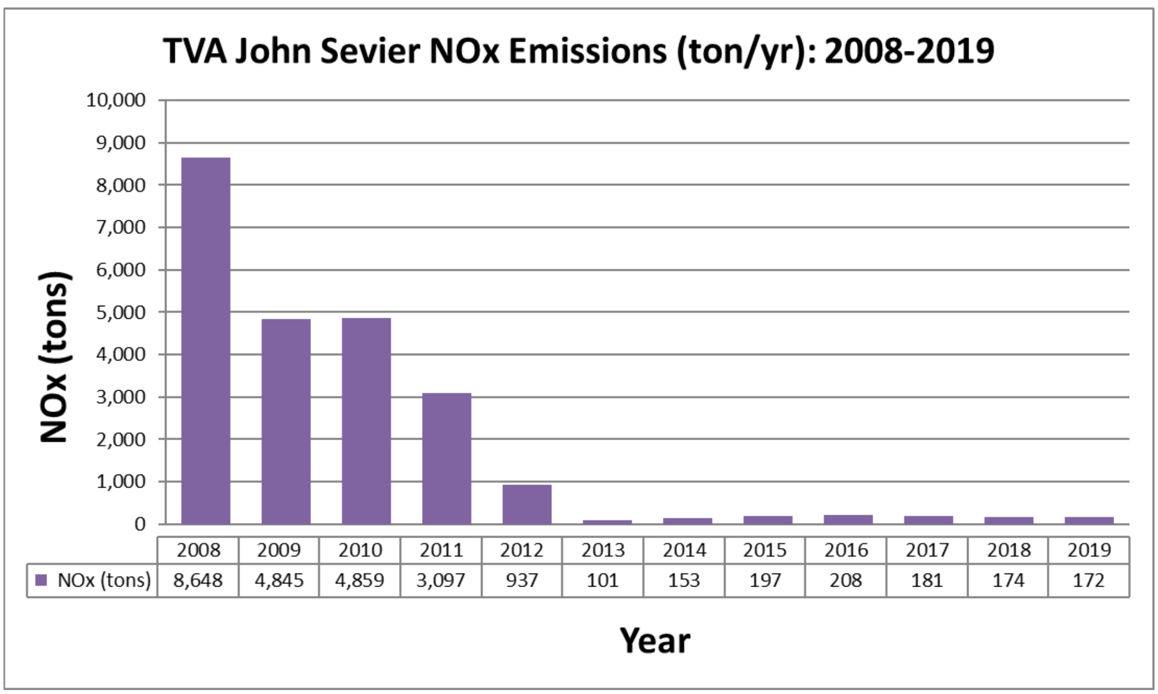
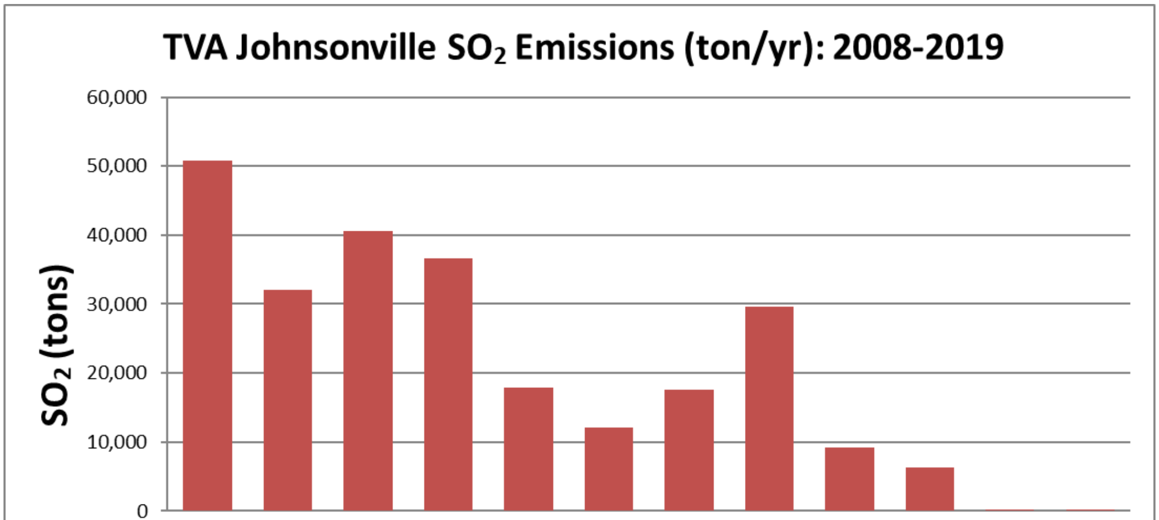


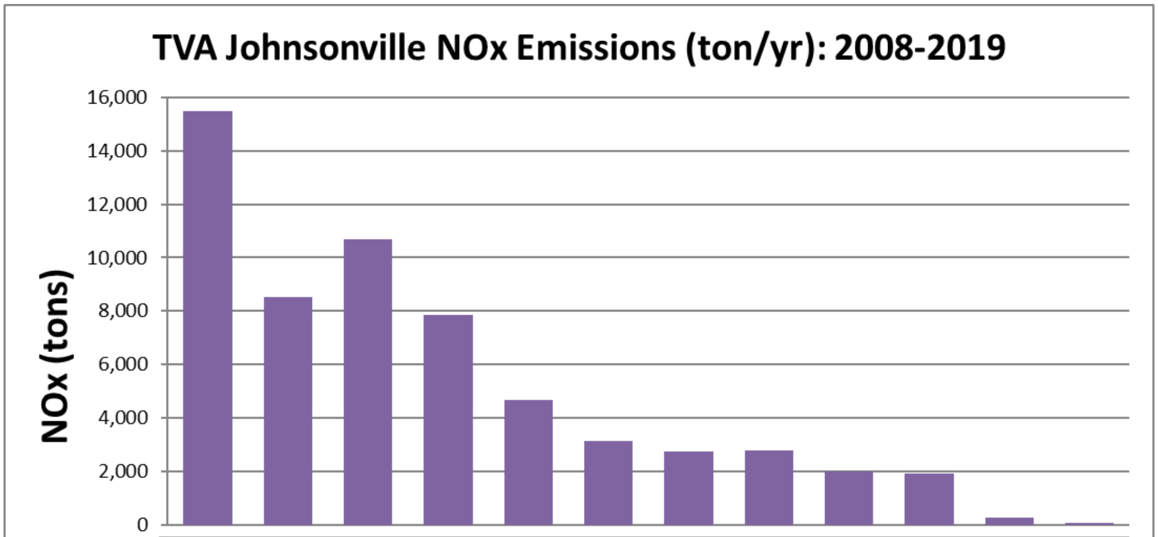
Figure 7-11: TVA John Sevier NO_x Emissions (ton/yr): 2008-2019

For TVA Johnsonville, Figure 7-12 shows a decrease in SO_2 emissions from 50,797 ton/yr in 2008 to 13 ton/yr in 2019. Figure 7-13 shows a decrease in NO_x emission from 15,492 ton/yr in 2008 to 64 ton/yr in 2019.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SO2 (tons)	50,797	32,030	40,632	36,595	17,842	12,087	17,535	29,654	9,210	6,330	22	13

Figure 7-12: TVA Johnsonville SO_2 Emissions (ton/yr): 2008-2019



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NOx (tons)	15,492	8,521	10,705	7,854	4,654	3,132	2,731	2,778	1,984	1,906	243	64

Figure 7-13: TVA Johnsonville NO_x Emissions (ton/yr): 2008-2019

For TVA Kingston, Figure 7-14 shows a decrease in SO_2 emissions from 50,617 ton/yr in 2008 to 1,917 ton/yr in 2019. Figure 7-15 shows a decrease in NO_x emission from 7,928 ton/yr in 2008 to 1,259 ton/yr in 2019.

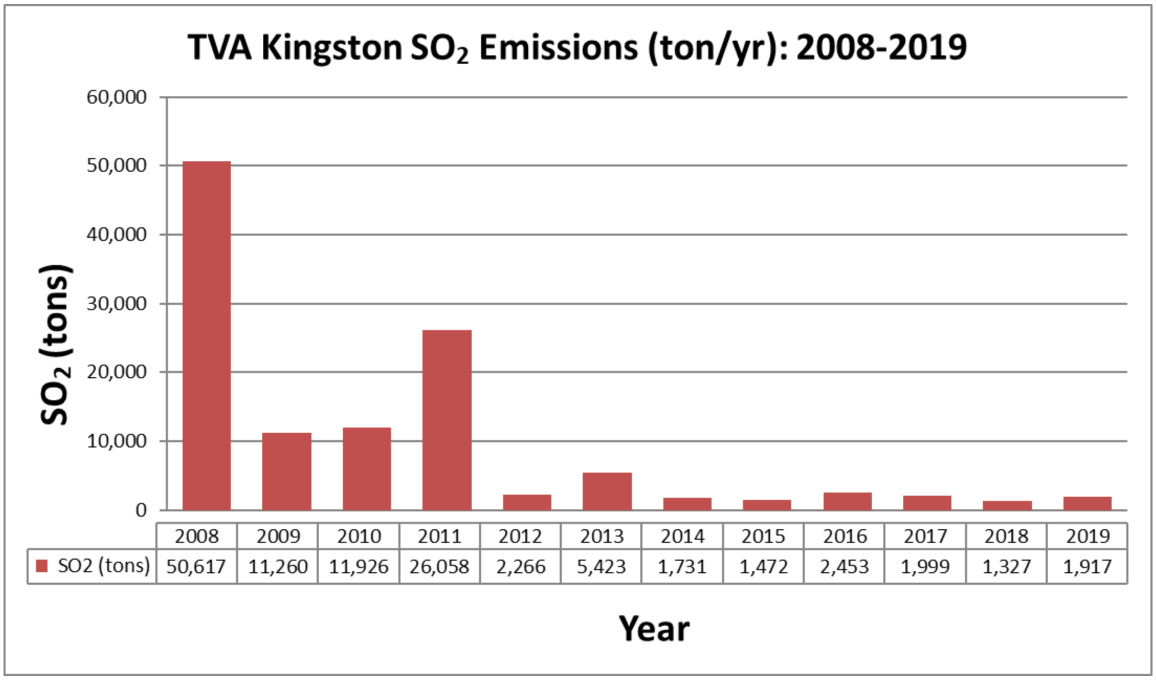


Figure 7-14: TVA Kingston SO_2 Emissions (ton/yr): 2008-2019

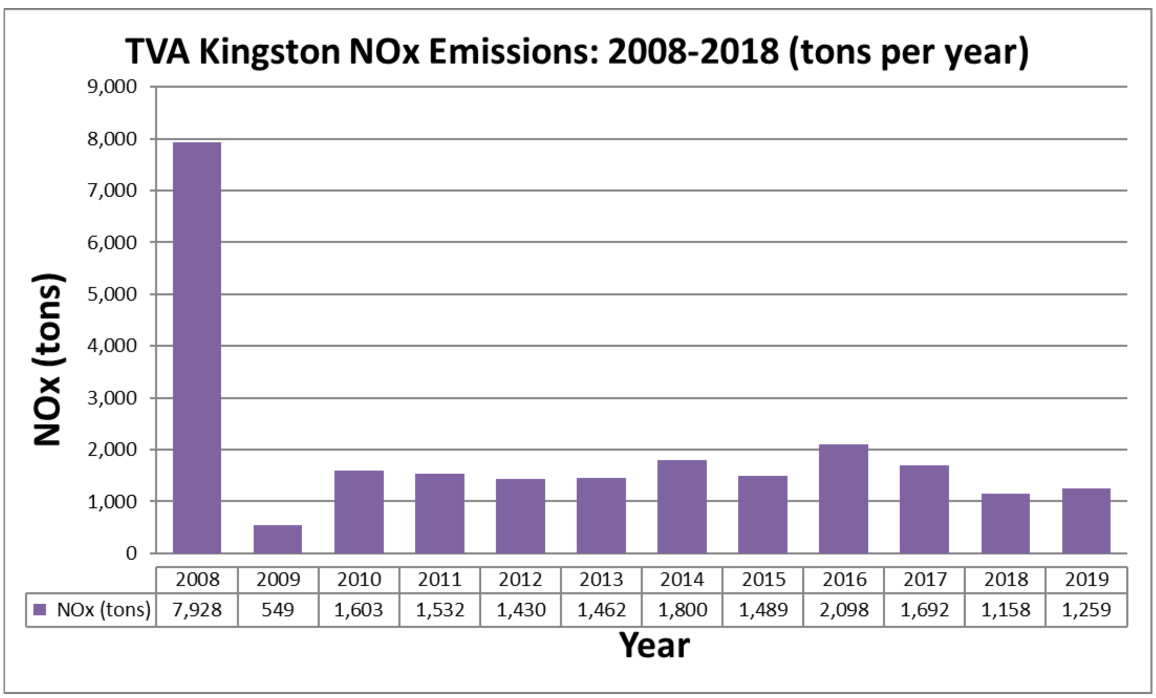


Figure 7-15: TVA Kingston NO_x Emissions (ton/yr): 2008-2019

Figure 7-16 shows the total SO_2 and NO_x emissions for all of TVA's coal and natural gas plants in Tennessee from 2008 to 2019. The figure shows a decrease in SO_2 emissions from 208,069 ton/yr in 2008 to 11,224 ton/yr in 2019 (a 94.6% reduction) and a decrease in NO_x emissions from 85,641 ton/yr in 2008 to 8,301 ton/yr in 2019 (a 90.3% reduction).

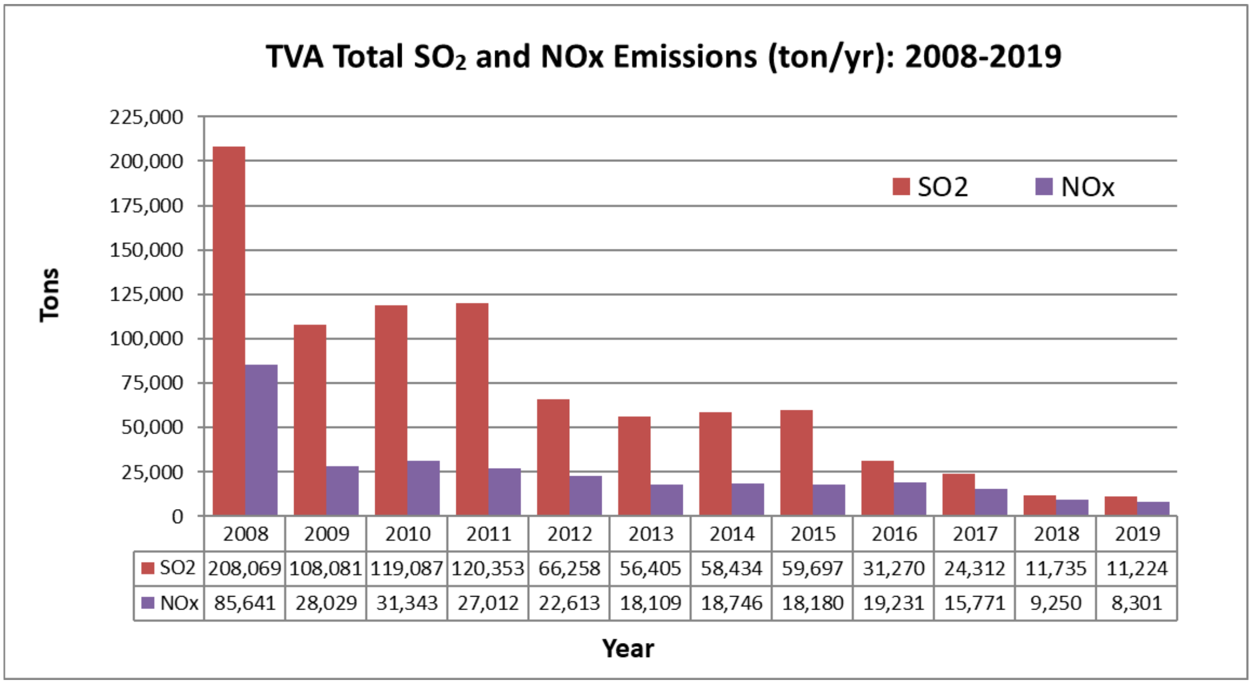


Figure 7-16: TVA SO_2 and NO_x Emissions from coal and natural gas plants in Tennessee

7.2.2.2. Nissan North America, Inc.

Nissan North America, Inc. (Facility ID# 75-0155) is an automobile manufacturing operation located in Rutherford County, Tennessee. The facility operated three coal and natural gas-fired boilers to produce steam for their operations. The boilers had a capacity of 119.85 MMBTU/hr heat input. The facility was issued a construction permit on October 31, 2012, allowing the construction of three natural gas-fired boilers that replaced the three coal and natural gas-fired boilers. This permit limits the total emissions from the new natural gas boilers to no more than 22.2 tpy of NO_X and 4.38 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal and natural gas-fired boilers in 2013. Table 7-2 provides the boiler emissions of NO_X and SO_2 from this facility.

Table 7-2: Nissan North America, Inc. Boiler Emissions of SO_2 and NO_X

Year	Tons NO_X/Year	Tons SO_2/Year
2011	89.1	240.7
2014	5.7	0.28
2017	4.8	0.23
2018	5.2	0.25
2019	4.8	0.23

Data Source: NEI

7.2.2.3. Resolute FP US Inc.

Resolute FP US Inc. (Facility ID# 54-0012) is a kraft pulp and paper mill located in McMinn County, Tennessee. The facility operates three boilers, which are allowed to burn coal, natural gas, and fuel oil. The boilers have a total capacity of 1,134 MMBTU/hr heat input. The current Title V permit limits the total emissions from the three boilers to no more than 2,214 tpy of NO_X and 4,562 tpy of SO_2. These are the same limits contained in the consent decree that the facility agreed to in 2010. Prior to the consent decree, the permit limits for the three boilers were 3,189 tpy for NO_X and 18,803 tpy of SO_2. The facility has not burned coal since 2010, and their actual emissions are well below their allowable permit limits. Table 7-3 provides the emissions of NO_X and SO_2 from the entire facility.

Table 7-3: Resolute FP US Emissions of SO_2 and NO_X

Year	Tons NO_X/Year	Tons SO_2/Year
2014	961.0	321.6
2017	919.6	217.6
2018	1,211.7	328.1
2019	1,133.3	308.3

Data Source: NEI

7.2.2.4. Holston Army Ammunition Plant

Holston Army Ammunition Plant (Facility ID# 37-0028) is military explosives manufacturer located in Hawkins County, Tennessee. The facility operated four coal-fired boilers with two natural gas-fired burners. The boilers and burners had a total capacity of 839.2 MMBTU/hr heat input. The facility was issued a construction permit on October 18, 2018, allowing the construction of four natural gas-fired boilers that replaced the four coal-fired boilers and two natural gas-fired burners. The four coal-fired boilers with two natural gas-fired burners permanently retired on October 4, 2021. Each new boiler has a capacity of 327 MMBTU/hr when burning natural gas and a capacity of 310 MMBTU/hr when burning fuel oil. This permit limits the total emissions from the new natural gas boilers to no more than 0.2 lb NO_X/MMBtu, 0.8 lb SO_2/MMBtu, and 6.4 tpy of SO_2. Low-NOx burners and selective catalytic reduction are used to control NOx emissions from each boiler. The capacity factor for fuel oil is limited to 3.8%. Table 7-4 provides the boiler emissions of NO_X and SO_2 from this facility.

Table 7-4: Holston Army Ammunition Plant Boiler Emissions of SO_2 and NO_X

Year	Tons NO_X/Year	Tons SO_2/Year
2011	291.7	1,511.4
2014	329.9	1,710.3
2017	341.1	1,767.3
2018	312.3	1,620.6
2019	276.1	1,388.5

Data Source: NEI

7.2.2.5. Tate and Lyle

Tate and Lyle (Facility ID# 53-0081) is corn wet milling and alcohol production facility located in Loudon County, Tennessee. The facility operated two coal-fired boilers and one natural gas-fired boiler. Each coal-fired boiler had a capacity of 290 MMBTU/hr heat input, and the natural gas-fired boiler has a capacity of 180 MMBTU/hr. The facility was issued a construction permit on September 9, 2015, which limited the two coal-fired boilers to burning natural gas only and also derated the boilers to 94 MMBTU/hr. This permit also includes the natural gas-fired boiler, which remained at a capacity of 180 MMBTU/hr and is allowed to burn fuel oil and fermentation byproducts. This permit limits the total emissions from the three boilers to no more than 78.7 tpy of NO_X and 71.6 tpy of SO_2. Additionally, the facility was issued two construction permits for two new natural gas cogeneration units. These two permits limit total SO_2 to 3.0 tpy and total NO_x to 382.6 tpy. Table 7-5 provides the boiler and cogeneration unit emissions of NO_X and SO_2 from this facility.

Table 7-5: Tate & Lyle Boiler & Cogen Emissions of SO_2 and NO_X

Year	Tons NO_X/Year	Tons SO_2/Year
2011	417.2	265.2
2014	432.3	267.9
2017	33.5	74.6
2018	199.3	76.8
2019	207.7	67.2

Data Source: NEI

7.2.2.6. Cargill Corn Milling

Cargill Corn Milling is a corn milling operation located in Shelby County, Tennessee. This facility has undergone operational changes that have significantly reduced their emissions. The facility operated two coal-fired boilers. Each boiler had a capacity of 247 MMBTU/hr heat input. In 2015, the coal-fired boiler were replaced with natural gas-fired boilers, which have a capacity of 75 and 95 MMBTU/hr heat input. The current permit limits the fuel to natural gas only. In addition to the change from coal to natural gas boilers, the facility permanently shut down several processes, which reduced emissions. Table 7-6 provides the emissions of NO_X and SO_2 from the entire facility.

Table 7-6: Cargill Corn Milling Emissions of SO_2 and NO_X

Year	Tons NO_X/Year	Tons SO_2/Year
2011	566.9	3,007.0
2014	525.1	3,375.1
2017	17.1	0.1
2018	17.1	0.1

Data Source: NEI

7.2.2.7. East Tennessee State University (ETSU)

ETSU (Facility ID# 90-0029) is a state university located in Washington County, Tennessee. The facility operated three coal-fired boilers. Each boiler had a capacity of 37.5 MMBTU/hr heat input. The facility was issued two construction permits on September 16, 2016, allowing the construction of two natural gas-fired boilers that replaced the three coal-fired boilers. These permits limit the total emissions from the new natural gas boilers to no more than 17.7 tpy of NO_X and 0.22 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal-fired boilers in 2017. Complete emission data is not available for ETSU.

7.2.2.8. University of Tennessee

The University of Tennessee (Facility ID# 47-0018) is a state university located in Knox County, Tennessee. The facility operated three coal-fired boilers. Each boiler had a capacity of 99 MMBTU/hr heat input. The facility was issued a construction permit on July 9, 2014, allowing the construction of two natural gas-fired boilers that replaced the two coal-fired boilers. The third coal-fired boiler was converted to natural gas. All three natural gas boilers are allowed to burn a limited amount of No. 2 Fuel oil. This permit limits the total emissions from the three natural gas boilers to no more than 97.2 tpy of NO_X and 53.3 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal-fired boilers in 2015. Table 7-7 provides the emissions of NO_X and SO_2 from the entire facility.

Table 7-7: UTK Boiler Emissions of SO_2 and NO_X

Year	Tons NO_X/Year	Tons SO_2/Year
2011	110.0	321.7
2014	75.8	242.6
2017	32.2	0.77
2018	46.3	7.3
2019	40.4	0.46

Data Source: NEI

7.2.2.9. Vanderbilt University

Vanderbilt University (Facility ID# 70-0039) is a private university located in Davidson County, Tennessee. The facility operated four coal, natural gas, and fuel oil-fired boilers. The boilers had a combined capacity of 442 MMBTU/hr heat input. The facility was issued a construction permit on March 31, 2014, allowing the construction of two natural gas and fuel oil-fired boilers that replaced the four coal, natural gas, and fuel oil-fired boilers. This permit limits the total emissions from the new natural gas and fuel oil-fired boilers to no more than 42.6 tpy of NO_x and 44.7 tpy of SO_2. After the natural gas boilers began operations, the facility permanently retired the coal, natural gas, and fuel oil-fired boilers in 2014. Table 7-8 provides the boiler emissions of NO_x and SO_2 from this facility.

Table 7-8: Vanderbilt University Boiler Emissions of SO_2 and NO_x

Year	Tons NO_x/Year	Tons SO_2/Year
2011	466	1,012
2014	376	842
2017	4.73	0.03
2018	4.44	0.03
2019	9.15	0.13

Data Source: Emission Inventory Reports

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(f)(2)(iv)(A), states are also required to consider the air quality benefits of measures to mitigate the impacts of construction activities (40 CFR 51.308(f)(2)(iv)(B)) and agricultural and forestry smoke management (40 CFR 51.308(f)(2)(iv)(D)). 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 accounts 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.[48] 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 may not be reflective of probable emissions for 2028. The ERTAC EGU tool outputs do not consider the impacts of the CPP. Tennessee used a combination of ERTAC, 2011el, 2023en, and 2028el data for projected 2028 EGU emissions. 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, NC 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 7-17 and Figure 7-18 show the expected decrease in emissions of SO_2 and NO_X, respectively, across the VISTAS states from 2011 to 2028.

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

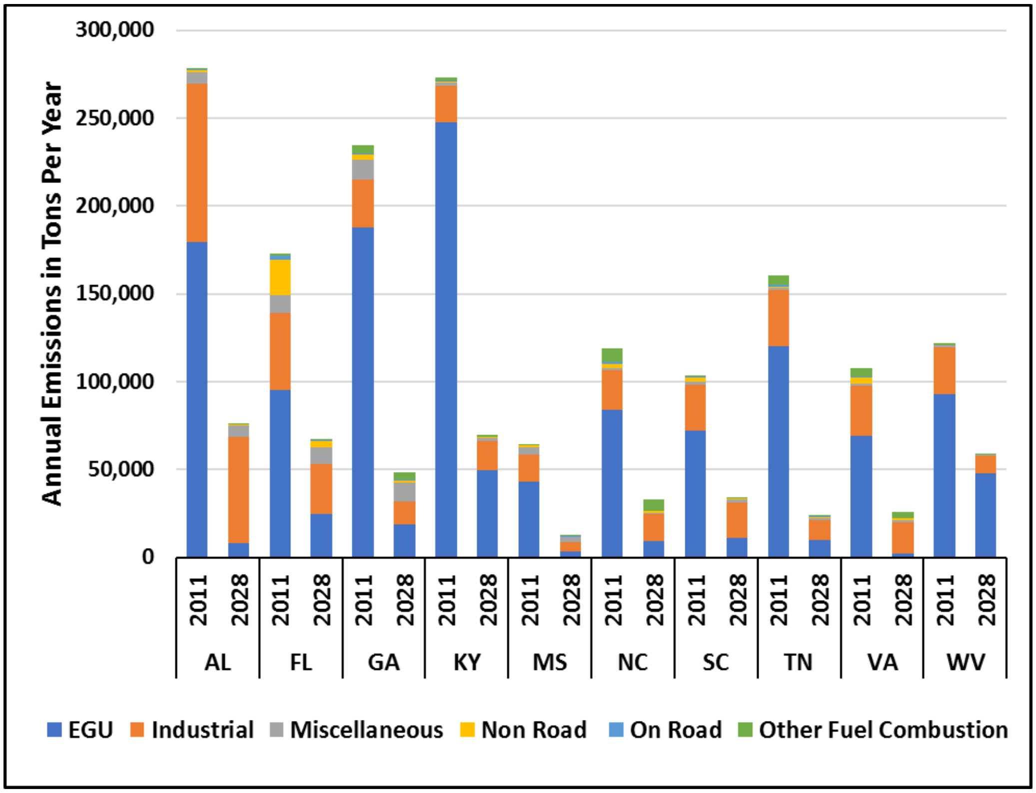


Figure 7-17: SO_2 Emissions for 2011 and 2028 for VISTAS States

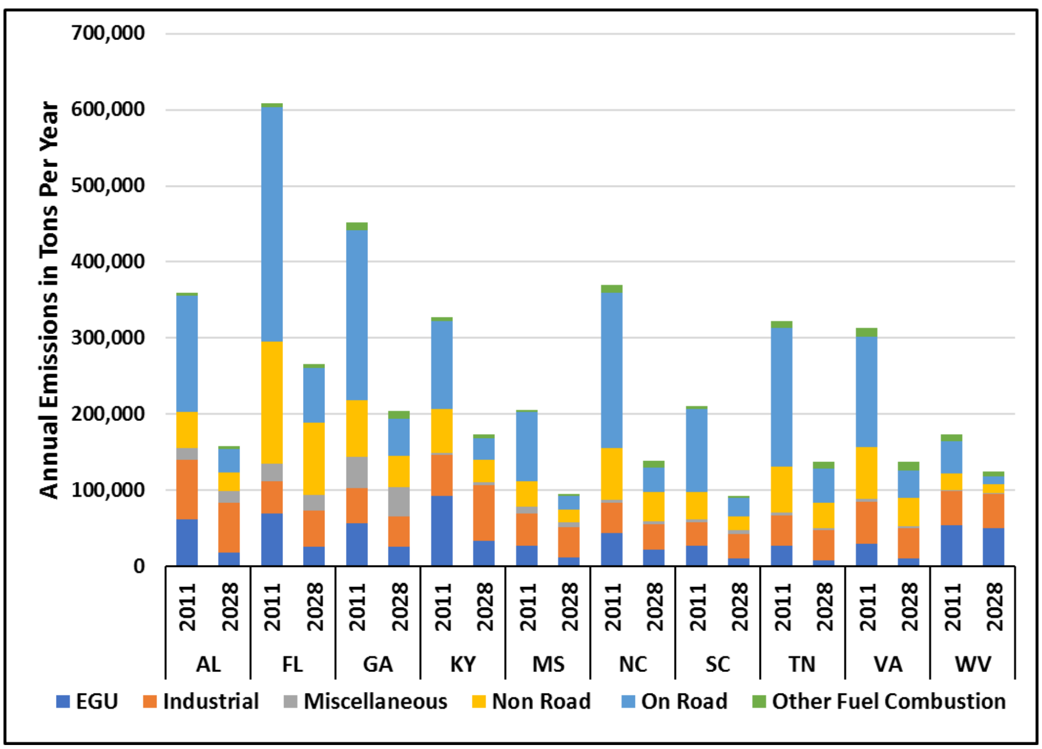


Figure 7-18: NO_X Emissions for 2011 and 2028 for VISTAS States

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, very efficient combined cycle generating units, the use of cleaner burning fuels, and other factors.

Figure 7-19 and Figure 7-20 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.

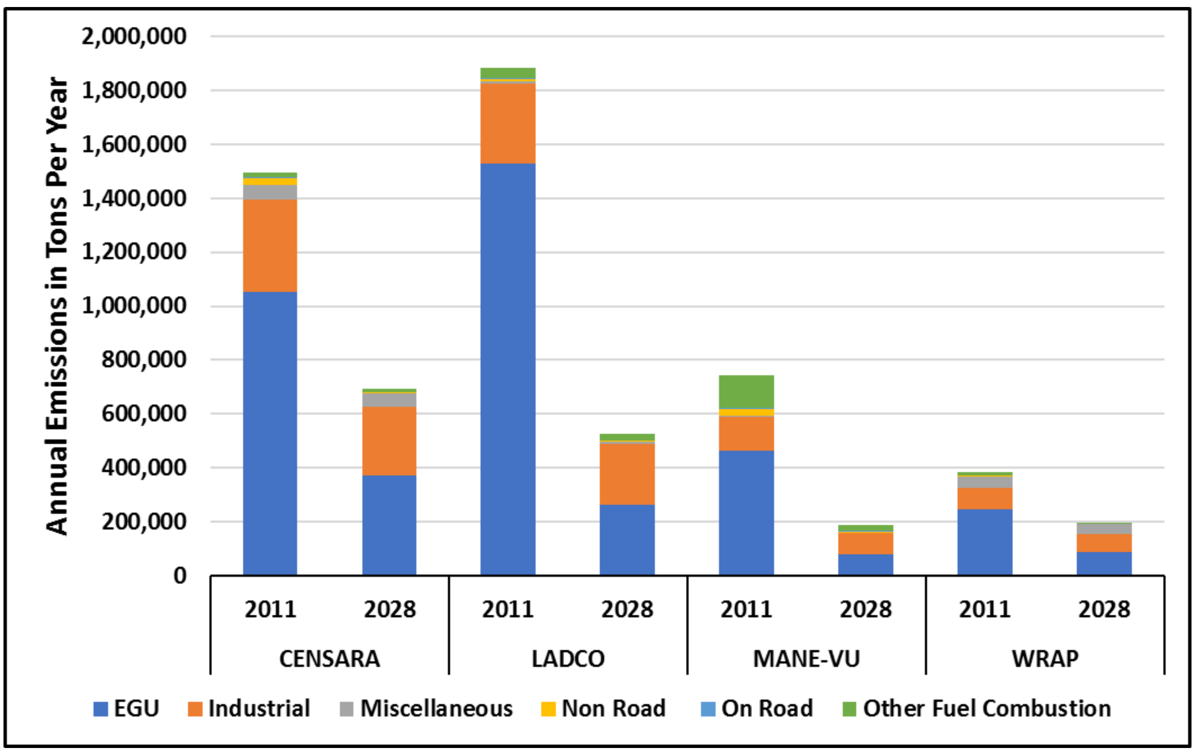


Figure 7-19: SO_2 Emissions for 2011 and 2028 for Other RPOs

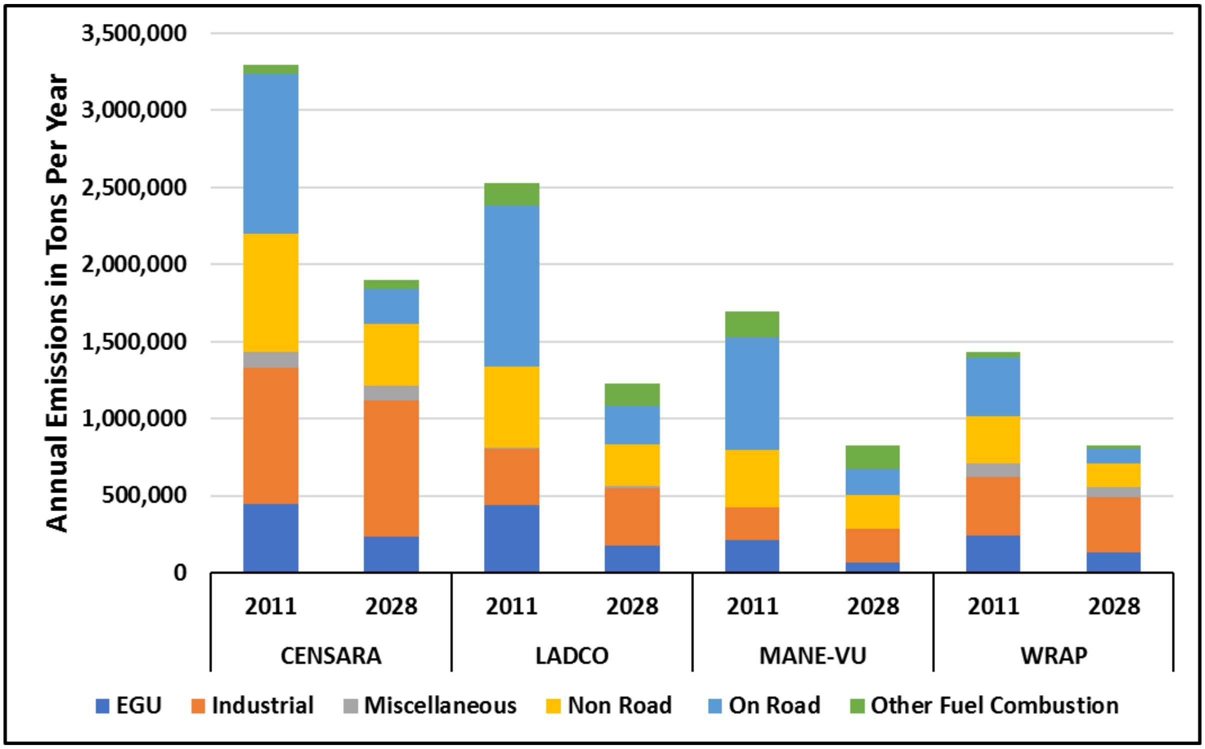


Figure 7-20: NOx Emissions for 2011 and 2028 for Other RPOs

Table 7-9 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 7-9: 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.[49] 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[50] 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 7-21 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 7-22 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

[49] URL: https://www.epa.gov/air-emissions-modeling/2016v1-platform
[50] 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 does 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.

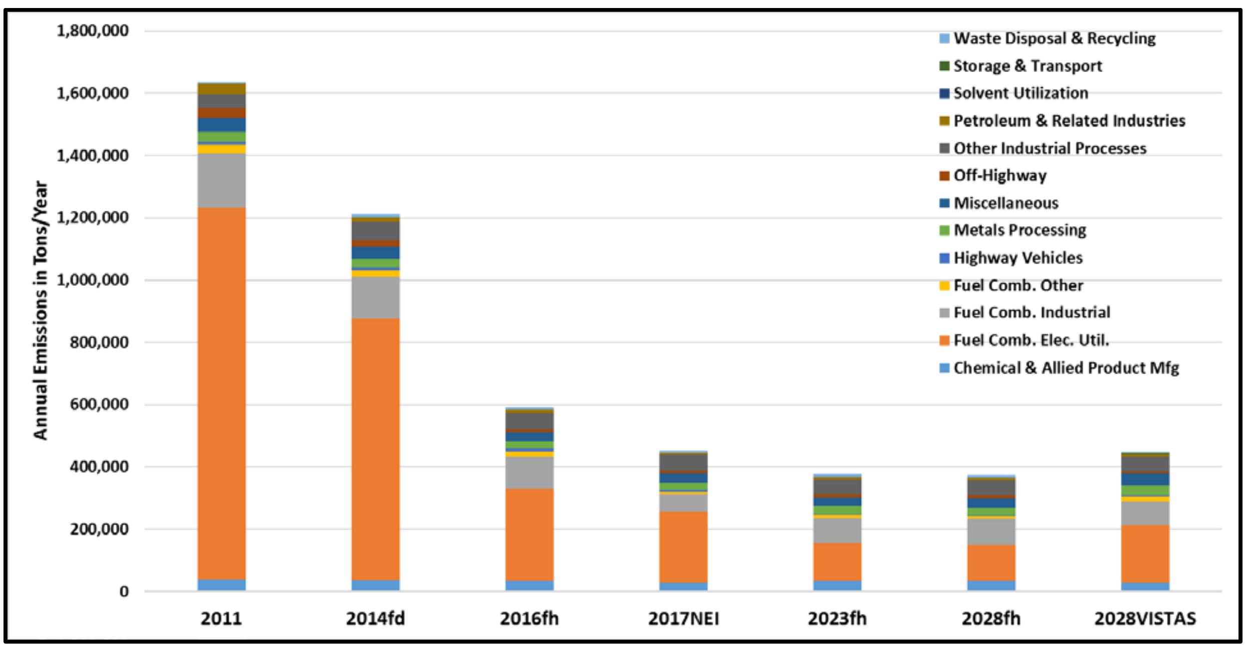


Figure 7-21: SO_2 Emissions from VISTAS States

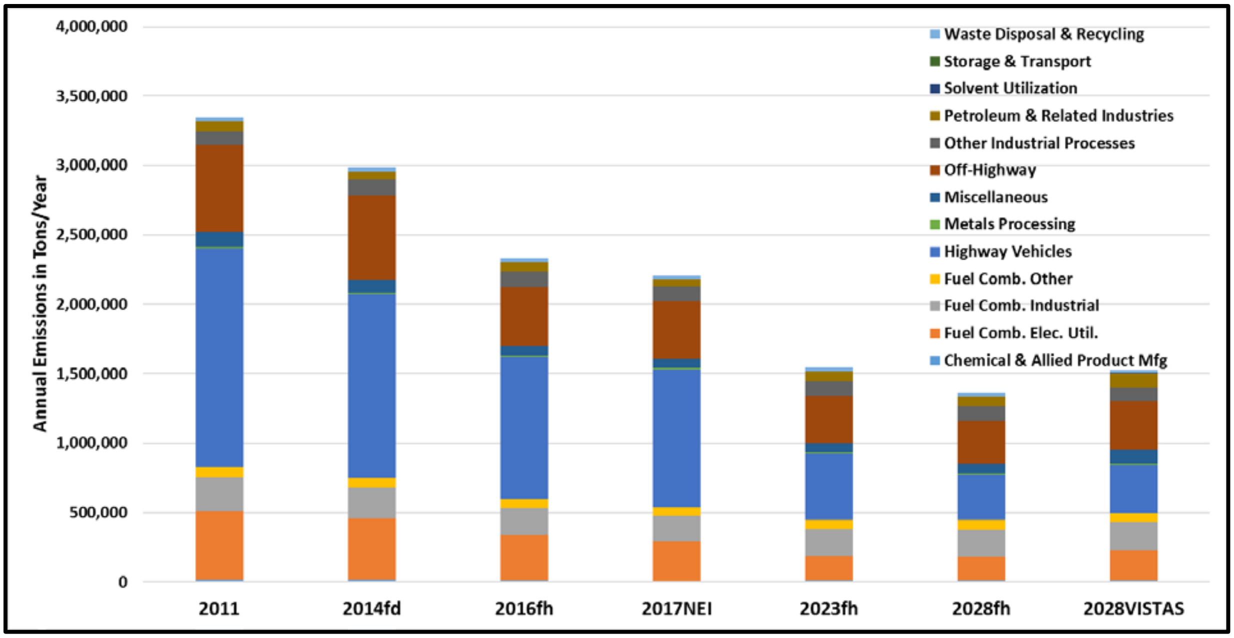


Figure 7-22: NO_X Emissions from VISTAS States

The data for Tennessee in the EPA inventories also forecast significant declines in both SO_2 and NO_X emissions. Figure 7-23 provides EPA's estimates of Tennessee'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 above 160,000 tons of SO_2 emissions from Tennessee in 2011. EPA expects SO_2 emissions in Tennessee will drop to just above 20,000 tons by 2028, an 87% reduction. The VISTAS projection for Tennessee shows emissions of SO_2 should drop to just under 24,000 tons by 2028, an 85% reduction.

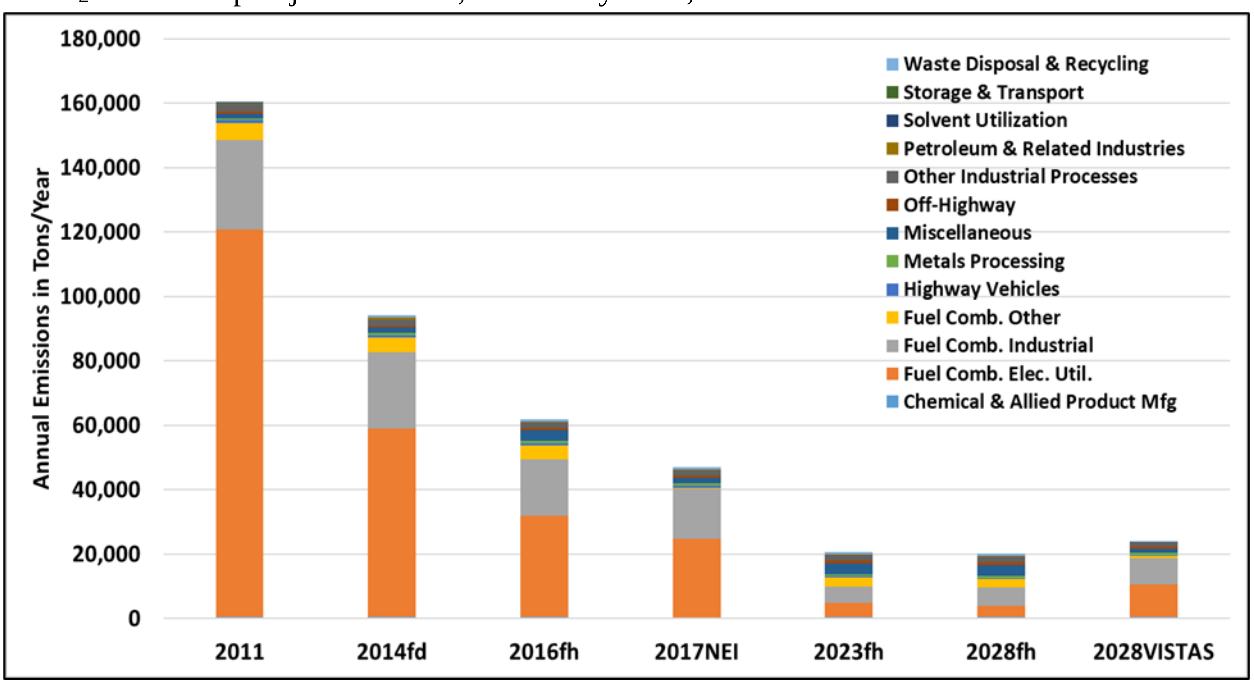


Figure 7-23: Tennessee SO_2 Emissions

Figure 7-24 provides EPA's estimates of actual NO_X emissions in Tennessee 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 about 322,500 tons of NO_X emissions from Tennessee in 2011. EPA expects NO_X emissions in Tennessee will drop to under 126,500 tons by 2028, a 61% reduction. The VISTAS projections estimate Tennessee NO_X emissions will drop to about 137,000 tons by 2028, a 57% reduction.

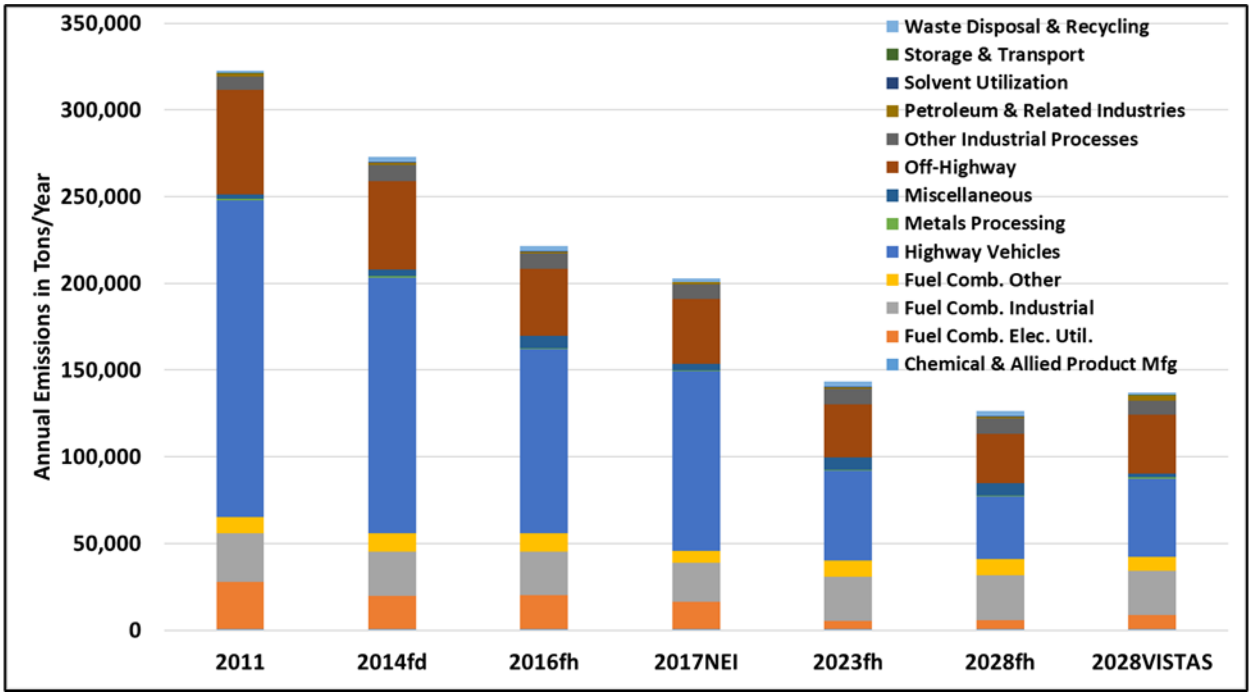


Figure 7-24: Tennessee NO_X Emissions

The VISTAS 2028 projections do not include reductions from programs noted in Section 8.2 so the estimates are likely conservative. 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[51] is an EPA software tool that implements the procedures in the "Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$,

[51] URL: https://www.epa.gov/scram/photochemical-modeling-tools

and Regional Haze," (SIP modeling guidance)[52] 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.

7.2.6.1. Calculation of 2028 Visibility Estimates

The visibility projections follow the procedures in Section 5 of the EPA 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 2.5 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.[53] 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

[52] URL: https://www.epa.gov/sites/production/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf
[53] 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

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 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 2.2 for a description and listing of these sites. When using 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 7-10 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 7-10: 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 Tennessee Class I Areas

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 base line 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 7-25 illustrates the predicted visibility improvement on the 20% most impaired days by 2028, compared to the URP glide paths for Great Smoky Mountains National Park. The pink lines represent the URP at the 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 Great Smoky Mountains National Park, visibility improvements on the 20% most impaired days are expected to be significantly better than the uniform rate of progress glide path by 2028.

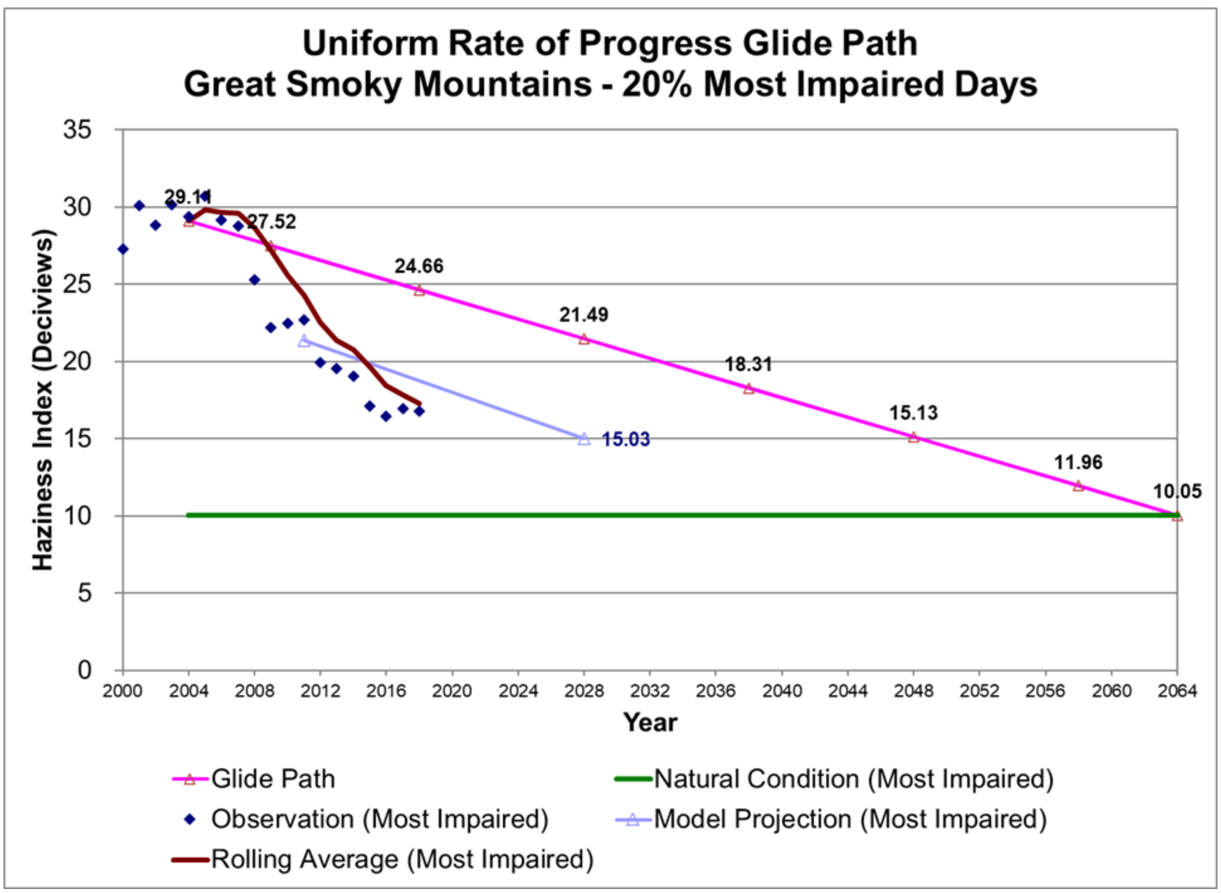


Figure 7-25: Great Smoky Mountains National Park URP on the 20% Most Impaired Days

As illustrated in Figure 7-26, visibility improvements at all the VISTAS Class I areas except the Everglades are projected to be better than the uniform rate of progress through 2028. In Figure

7-26, 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 example, haze in the Great Smoky Mountains National Park is projected to be 30% lower than the expected visibility for 2028 on the URP. For most areas, visibility improvements are well ahead of the timeline noted on the URP.

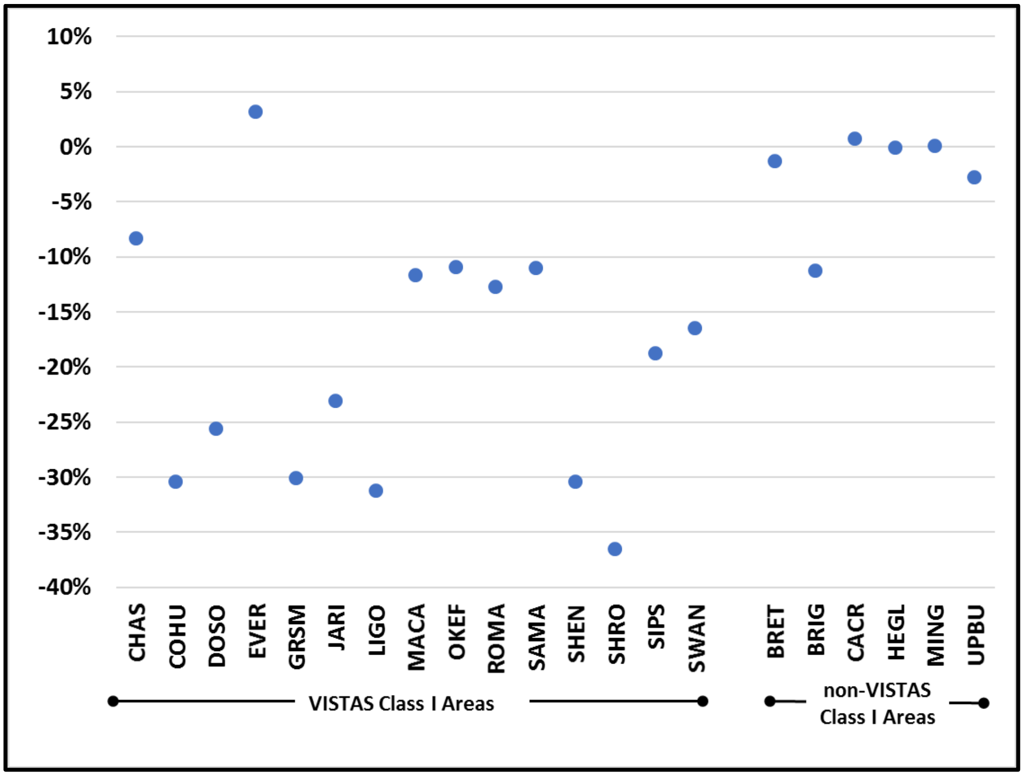


Figure 7-26: Percent of URP in 2028

Figure 7-27 illustrates the visibility improvement in 20% most impaired days. This figure shows scenery at the Great Smoky Mountains National Park 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 7-27: Great Smoky Mountains National Park 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 7-28 shows 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 brown lines denote IMPROVE monitoring data five year averages. As noted in this figure, visibility conditions in 2028 on the 20% clearest visibility days are expected to continue to improve at Great Smoky Mountains National Park.

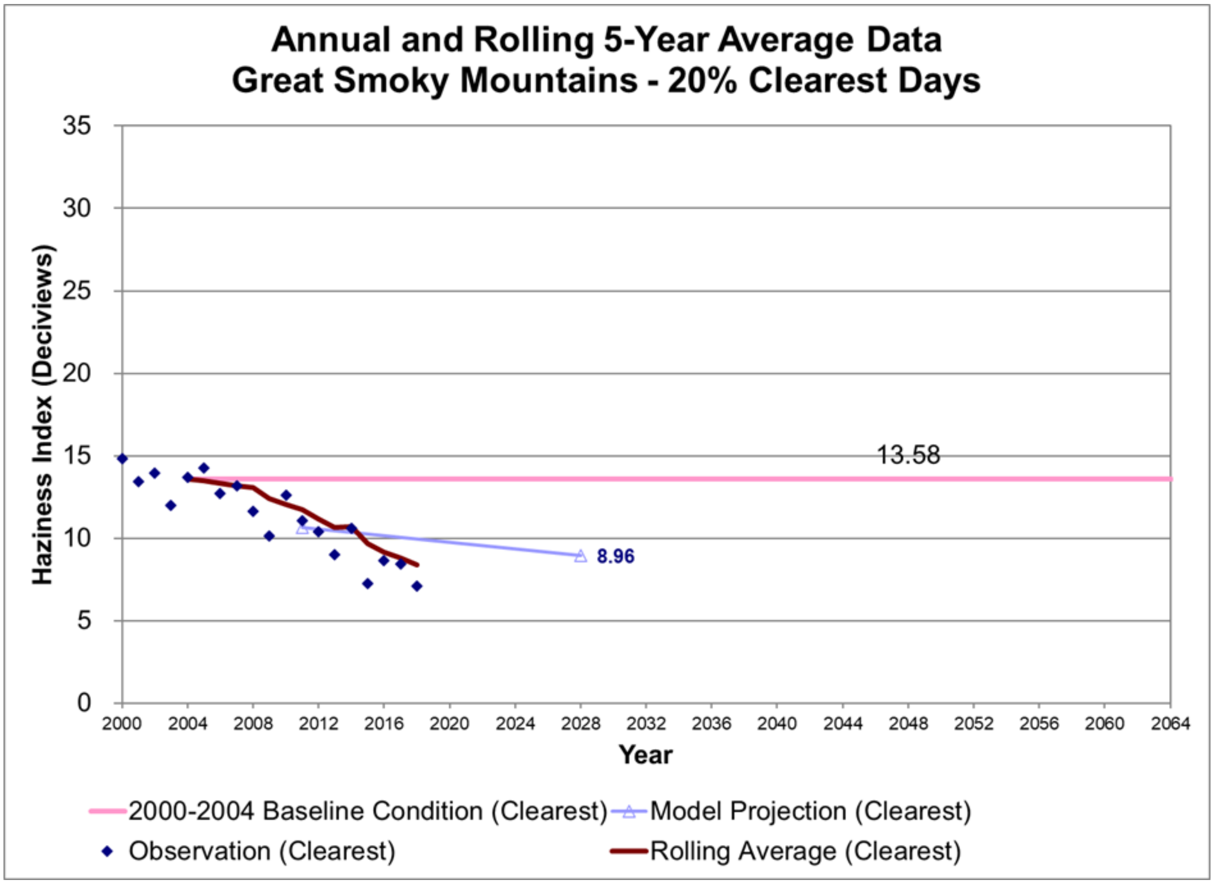


Figure 7-28: 20% Clearest Days Rate of Progress for Great Smoky Mountains National Park

As illustrated in Figure 7-29, 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. The percent improvement on 20% clearest days is projected to be -34% for the Great Smoky Mountains National Park.

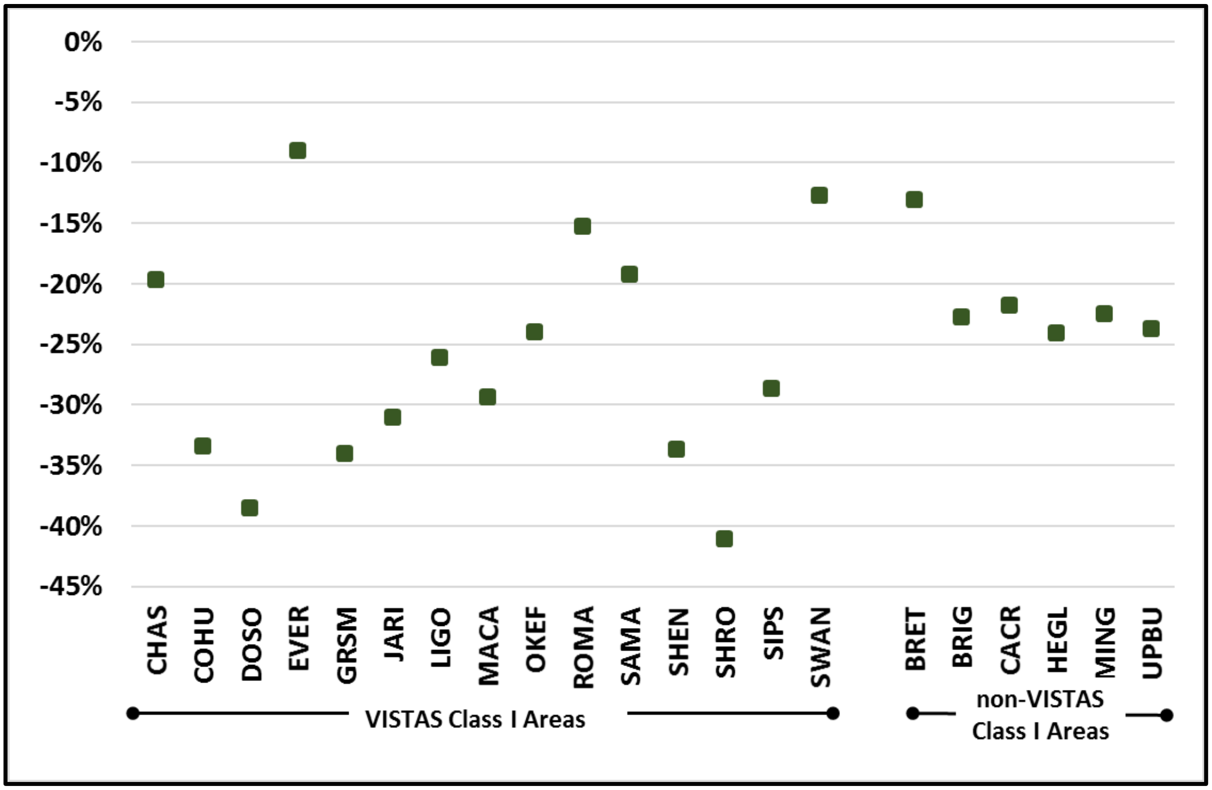


Figure 7-29: Percent Visibility Improvement on 20% Clearest Days

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.[54] 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

[54] 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 7-11 provides the estimated international anthropogenic visibility impacts to VISTAS Class I area from EPA's study.

Table 7-11: 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

Tennessee's Class I areas are expected to be well beneath the 2028 uniform rate of progress goal based on VISTAS modeling, which includes current and forthcoming control programs. The estimated international emissions impact for Great Smoky Mountains National Park is 4.48 Mm^{-1}. Adjustments to the 2028 uniform rate of progress goal based on these estimated visibility impairment contributions of international anthropogenic emissions would not change the conclusion that these areas will experience visibility improvements that are significantly better than those on the uniform rate of progress. Therefore, in this round of regional haze planning, Tennessee is not updating the 2028 uniform rate of progress goals based on EPA's contribution study of international anthropogenic emissions.

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 CENSARA, 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 CENSARA, 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 CENSARA, 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 7-30 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 CENSARA, 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 7-31 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 CENSARA, 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.

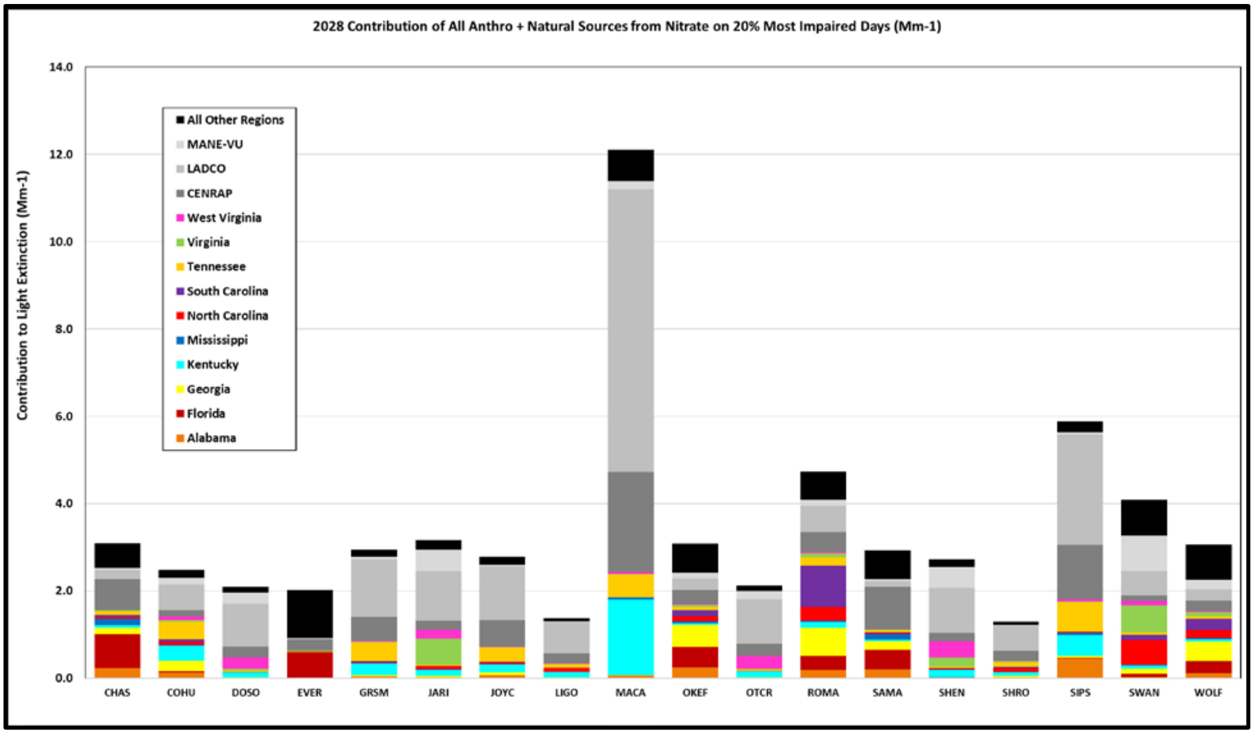


Figure 7-30: 2028 Nitrate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas

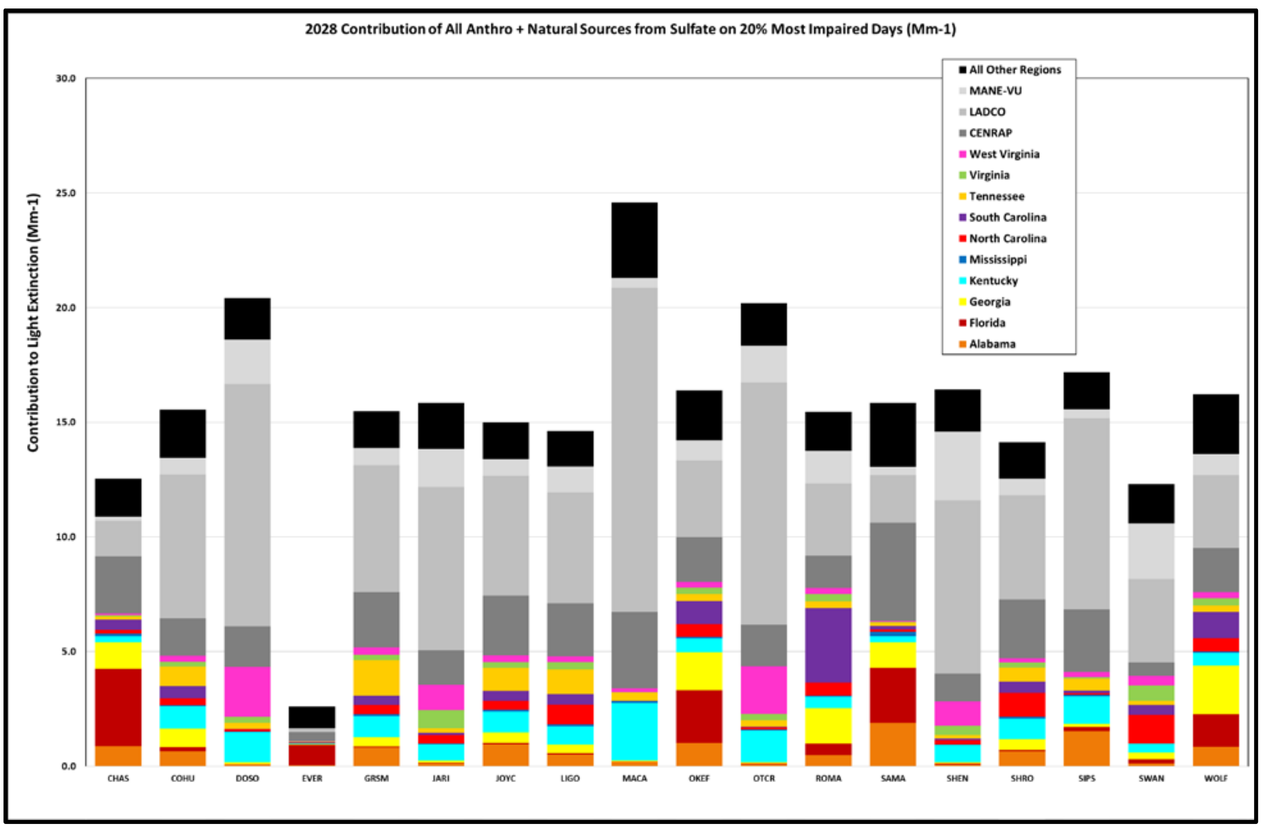


Figure 7-31: 2028 Sulfate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas

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 the home state and outside of VISTAS have a significant impact on visibility in mandatory federal VISTAS Class I areas.

Figure 7-32 and Figure 7-33 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 7-32 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 7-32 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 7-33 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.

Figure 7-32 and Figure 7-33 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 7-33 also show that the majority of nitrate light extinction is not caused by NO_X emissions from EGU and non-EGU point sources.

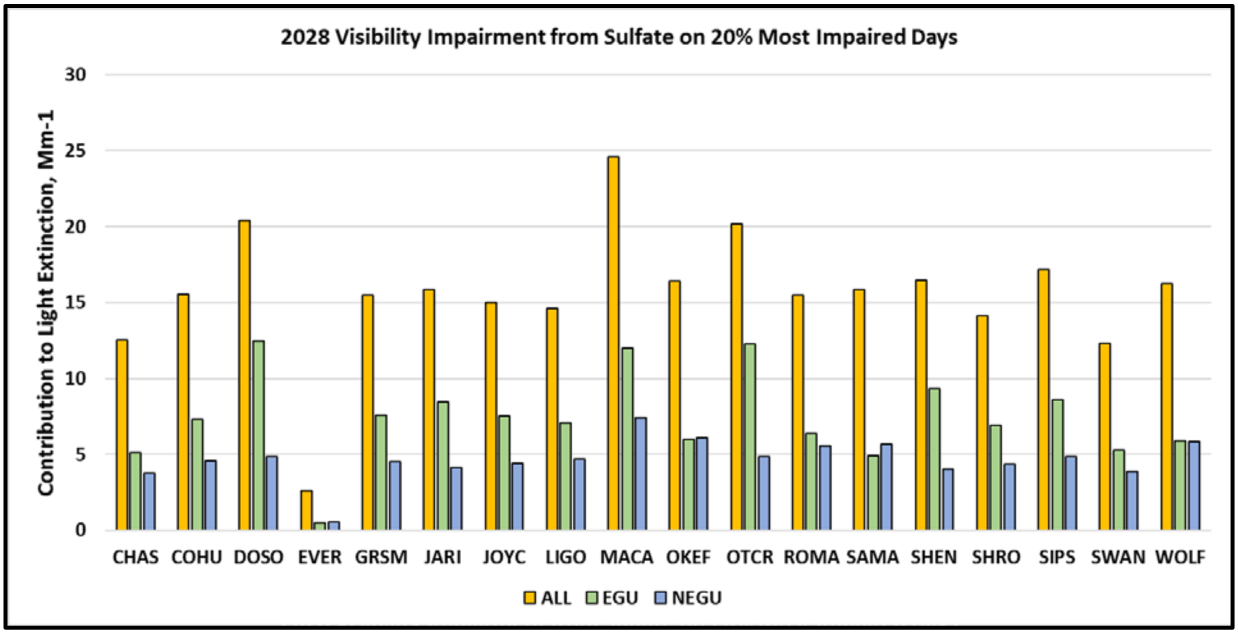


Figure 7-32: 2028 Visibility Impairment from Sulfate on 20% Most Impaired Days, VISTAS Class I Areas

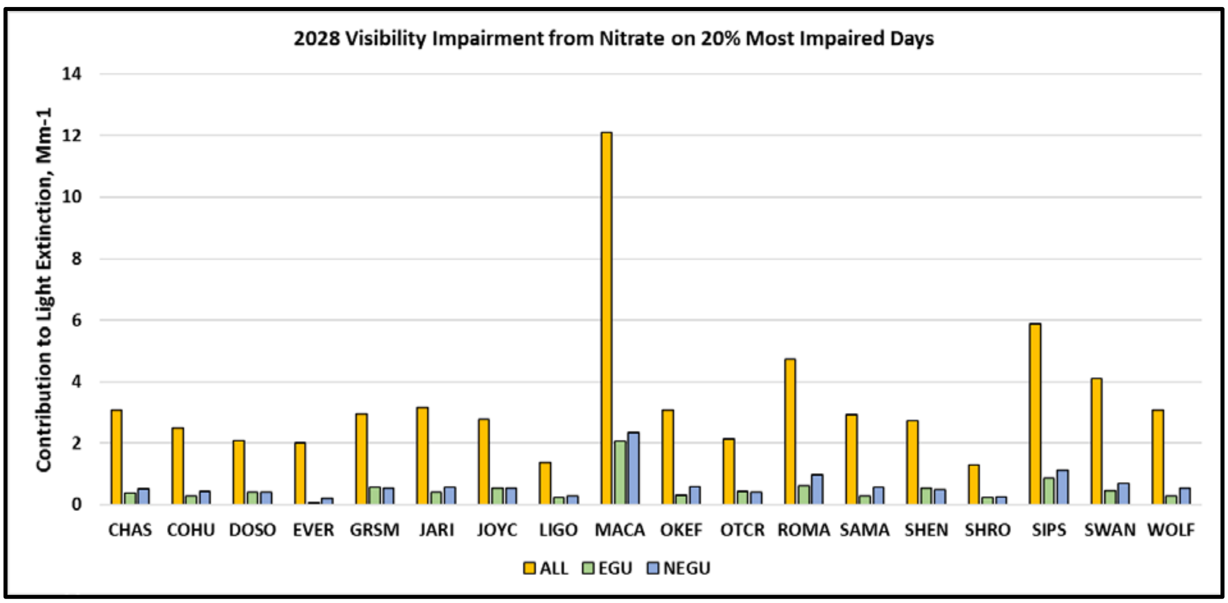


Figure 7-33: 2028 Visibility Impairment from Nitrate on 20% Most Impaired Days, VISTAS Class I Areas

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 CENSARA) 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 7-34 provides more detailed comparisons for the Great Smoky Mountains National Park. This figure shows that projected light extinction in 2028 from total sulfate is significantly larger than light extinction from total nitrate. At Great Smoky Mountains National Park, projected total sulfate extinction is slightly less than 19 Mm^{-1} while total projected nitrate extinction is less than 3.4 Mm^{-1}. This figure also shows that sulfate from EGUs and non-EGUs account for the majority of the total sulfate impact at the mandatory federal Class I areas in Tennessee. At Great Smoky Mountains National Park, the 2028 sulfate extinction from EGUs and non-EGU point sources is 12.1 Mm^{-1} while the total sulfate extinction is 18.99 Mm^{-1}. Therefore, EGU and non-EGU point sources account for 64% of the total sulfate impact at Great Smoky Mountains National Park. Lastly, this figure shows that sulfates originating in the LADCO region contribute substantially to the estimated 2028 sulfate impairment at these mandatory federal Class I areas in Tennessee. At Great Smoky Mountains National Park, sulfates originating within LADCO contribute 5.5 Mm^{-1} to visibility impairment in 2028, or 29% of the total sulfate impact.

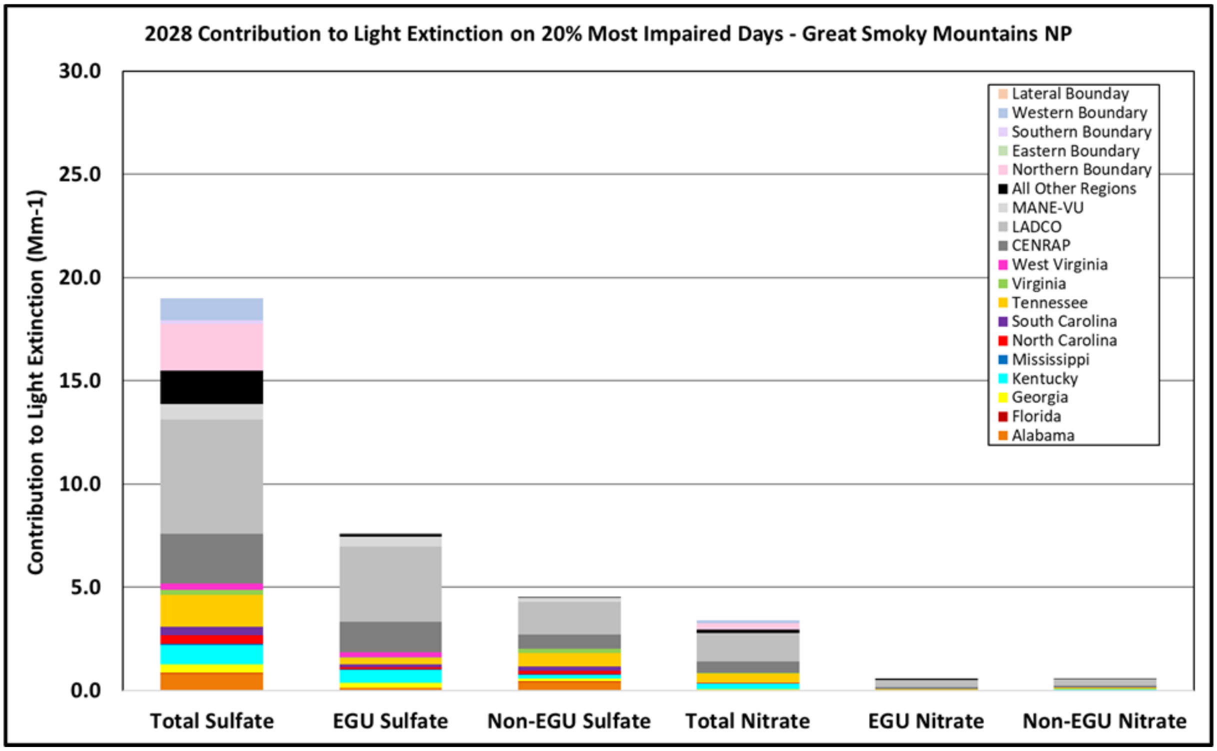


Figure 7-34: 2028 Contribution to Light Extinction on the 20% Most Impaired Days at Great Smoky Mountains National Park

EPA released an updated 2028 visibility air quality modeling study in September 2019.[55] 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 7-35 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 2-2 and of current conditions shown in Figure 2-8. Figure 7-35 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.

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

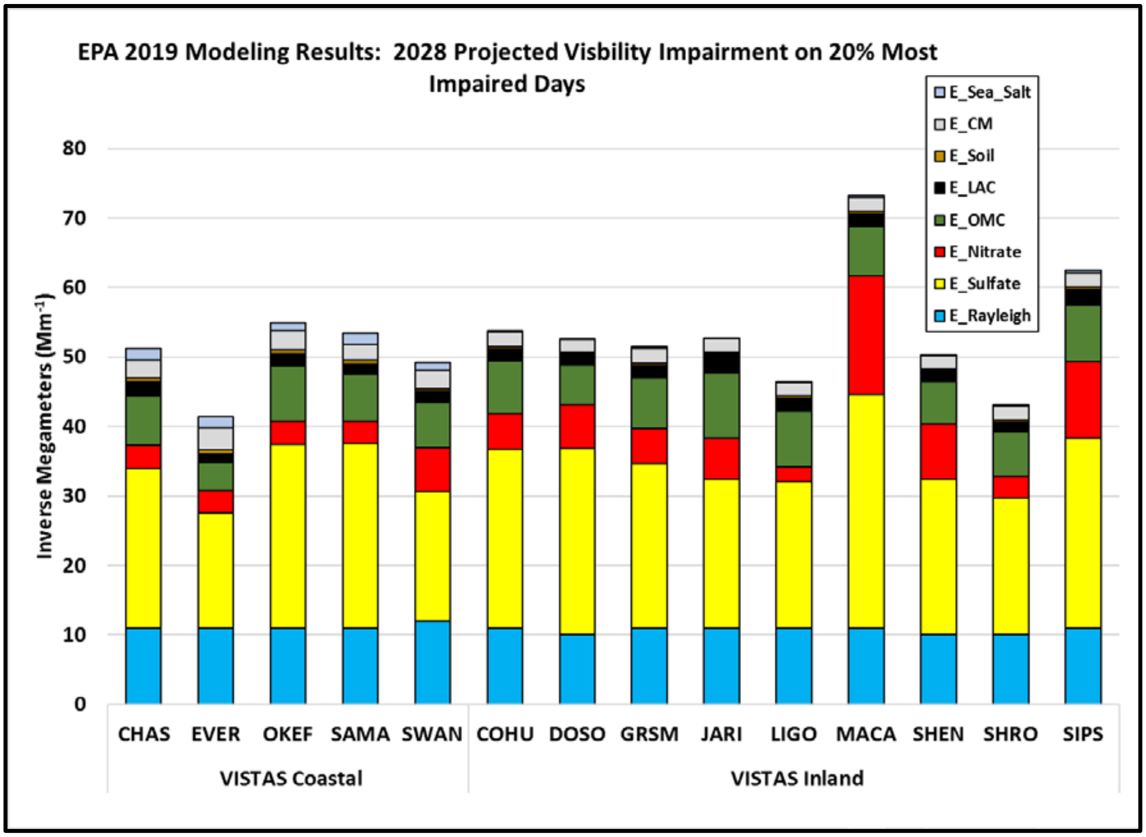


Figure 7-35: 2028 Projected Visibility Impairment by Pollutant Species, EPA 2019 Modeling Results

In accordance with 40 CFR 51.308(f)(2), the TDEC-APC used the results of the PSAT analysis to determine how Tennessee's state-wide emissions may affect Class I areas outside of Tennessee. 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 7-12 presents the results of PSAT modeling VISTAS conducted to estimate the impact of statewide SO_2 and NOx emissions in 2028 on total light extinction for the 20% most impaired days in all Class I areas in the VISTAS modeling domain (see Section 5.4 of this SIP). The results show total impairment for each Class I area and the state and RPO in which the Class I area is located. The statewide contribution to total impairment is provided in the fifth column in the table followed by the combined contribution from the nine remaining VISTAS states and the states located in CENRAP, LADCO, and MANE-VU. The last column in the table represents the contribution from the portion of the WRAP region that falls within the VISTAS modeling domain (see Figure 5-1). Contributions to visibility impairment that come from outside of the VISTAS modeling domain, including the remainder of the WRAP region, are accounted for via the boundary contributions which are provided in Appendix E-7a. Tennessee's total sulfate plus nitrate contribution to total visibility impairment in Class I areas in the VISTAS, MANE-VU, LADCO, CENRAP, and WRAP states (within the VISTAS modeling domain) is 10.90 Mm^{-1}, 0.41 Mm^{-1}, 0.20 Mm^{-1}, 1.21 Mm^{-1}, and 0.01 Mm^{-1}, respectively. The total sulfate plus nitrate contribution to Class I areas in the VISTAS states is 7.60 Mm^{-1} if the two Class I areas in Tennessee are excluded. The TDEC-APC believes it has statewide emissions that are reasonably anticipated to contribute to visibility impairment in the following Class I Federal areas: Cohutta Wilderness Area (GA), Sipsey Wilderness Area (AL), Linville Gorge Wilderness Area (NC), Shining Rock Wilderness Area (NC), Great Smoky Mountains National Park (NC/TN), and Joyce Kilmer-Slick Rock Wilderness Area (NC/TN). The TDEC-APC consulted with all the VISTAS states throughout the SIP development process. As discussed in Section 10.1, the TDEC-APC has consulted with Georgia, Alabama, and North Carolina about specific facilities in Tennessee. The TDEC-APC did not use a threshold to determine if statewide emissions were reasonably anticipated to contribute to visibility impairment in Class I areas.

It should be noted that the values in columns five through ten do not add up to the total impairment value in column four due to the fact that columns five through ten do not include non-anthropogenic emissions and boundary contributions. As detailed in Section 10.2, the VISTAS states participated in national conferences and consultation meetings with other states, RPOs, FLMs, and EPA throughout the SIP development process to share this information.

Table 7-12: Tennessee Statewide Contributions of 2028 SO_2 and NO_x Emissions for all Source Sectors to Visibility Impairment for the 20% Most Impaired Days for Class I Areas in the VISTAS Modeling Domain (Mm^{-1})

RPO	State	Class I Area	Projected 2028 20% Most Impaired Days	TN	All other VISTAS states	CENRAP Region	LADCO Region	MANE-VU Region	WRAP Region within VISTAS Modeling Domain
CENRAP	AR	CACR	63.2	0.10	0.79	16.80	3.10	0.06	2.20
CENRAP	AR	UPBU	60.59	0.15	1.02	15.29	3.22	0.09	2.94
CENRAP	LA	BRET2	63.36	0.23	4.03	11.34	4.40	0.08	3.40
CENRAP	MO	HEGL	65.88	0.20	0.99	18.92	6.89	0.09	3.46
CENRAP	MO	MING	70.75	0.51	2.85	11.67	14.70	0.18	3.31
CENRAP	OK	WIMO	62.62	0.02	0.25	15.27	1.24	0.01	4.38
CENRAP	TX	BIBE	41.72	0.00	0.05	1.96	0.07	0.00	5.77
CENRAP	TX	CAVE	34.39	0.01	0.10	2.71	0.09	0.00	5.38
CENRAP	TX	GUMO	34.39	0.01	0.10	2.71	0.09	0.00	5.38
LADCO	MI	ISLE	47.51	0.06	0.31	6.19	7.88	0.20	2.89
LADCO	MI	SENE	56.63	0.12	0.81	4.63	14.63	0.70	3.29
LADCO	MN	BOWA	42.54	0.02	0.18	8.72	3.65	0.11	2.66
MANEVU	ME	ACAD	45.5	0.04	0.65	0.51	1.45	2.96	2.44
MANEVU	ME	MOOS	43.29	0.02	0.35	0.45	1.24	1.96	1.75
MANEVU	ME	ROCA	43.29	0.02	0.35	0.45	1.24	1.96	1.75
MANEVU	NH	GRGU	35.56	0.07	0.64	1.13	3.18	1.91	3.20
MANEVU	NH	PRRA	35.56	0.07	0.64	1.13	3.18	1.91	3.20
MANEVU	NJ	BRIG	63.05	0.10	1.91	1.63	8.48	9.96	4.08

RPO	State	Class I Area	Projected 2028 20% Most Impaired Days	TN	All other VISTAS states	CENRAP Region	LADCO Region	MANE-VU Region	WRAP Region within VISTAS Modeling Domain
MANEVU	VT	LYBR2	42.3	0.11	1.30	1.39	4.67	5.10	3.77
VISTAS	AL	SIPS	52.88	1.19	4.73	3.98	10.86	0.46	1.86
VISTAS	FL	CHAS	53.92	0.22	7.99	3.21	1.76	0.22	2.22
VISTAS	FL	EVER	47.7	0.01	1.70	0.68	0.17	0.03	2.05
VISTAS	FL	SAMA	52.91	0.20	7.26	5.26	2.21	0.39	3.44
VISTAS	GA	COHU	45.28	1.25	4.98	1.76	6.88	0.87	2.30
VISTAS	GA	OKEF	54.66	0.36	9.38	2.27	3.60	1.01	2.84
VISTAS	GA	WOLF	53.59	0.35	8.78	2.15	3.44	1.15	3.41
VISTAS	KY	MACA	68.18	0.89	4.95	5.61	20.62	0.63	4.01
VISTAS	NC	LIGO	42.52	1.15	3.99	2.55	5.54	1.15	1.62
VISTAS	NC	SHRO	42.09	0.72	4.38	2.80	5.11	0.75	1.67
VISTAS	NC	SWAN	46.39	0.23	5.47	0.72	4.19	3.23	2.56
VISTAS	NC/TN	GRSM	45.75	1.98	4.07	2.96	6.84	0.82	1.76
VISTAS	NC/TN	JOYC	45.12	1.32	4.24	3.21	6.46	0.76	1.78
VISTAS	SC	ROMO	52.82	0.00	0.00	0.48	0.00	0.00	2.19
VISTAS	VA	JARI	49.09	0.23	4.43	1.70	8.26	2.15	2.24
VISTAS	VA	SHEN	43.05	0.19	3.47	1.43	8.57	3.48	2.02
VISTAS	WV	DOSO	46.13	0.29	4.50	2.03	11.56	2.20	1.92
VISTAS	WV	OTCR	46	0.32	4.56	2.08	11.58	1.81	1.98
WRAP	CO	EANE	17.23	0.00	0.00	0.04	0.00	0.00	0.47
WRAP	CO	FLTO	17.23	0.00	0.00	0.04	0.00	0.00	0.47
WRAP	CO	GRSA	23.22	0.00	0.01	0.41	0.01	0.00	1.22
WRAP	CO	MABE	17.23	0.00	0.00	0.04	0.00	0.00	0.47
WRAP	CO	MOZI	17.64	0.00	0.00	0.07	0.00	0.00	0.79
WRAP	CO	RAWA	17.64	0.00	0.00	0.07	0.00	0.00	0.79
WRAP	CO	ROMO	23.72	0.00	0.00	0.48	0.00	0.00	2.19
WRAP	CO	WEEL	17.23	0.00	0.00	0.04	0.00	0.00	0.47
WRAP	MT	MELA	51.88	0.00	0.00	1.12	0.52	0.02	10.05
WRAP	MT	ULBE	32.66	0.00	0.00	0.37	0.39	0.00	2.47
WRAP	ND	THRO	46.07	0.00	0.00	1.49	0.50	0.02	8.12
WRAP	NM	BAND	25.33	0.00	0.00	0.68	0.02	0.00	1.28
WRAP	NM	BOAP	30.33	0.00	0.02	0.93	0.01	0.00	1.60
WRAP	NM	PECO	19.67	0.00	0.00	0.54	0.01	0.00	0.78
WRAP	NM	SACR	46.02	0.00	0.04	4.48	0.06	0.00	8.06
WRAP	NM	SAPE	19.58	0.00	0.00	0.29	0.01	0.00	0.57
WRAP	NM	WHIT	28.18	0.00	0.06	1.50	0.06	0.00	2.79
WRAP	NM	WHPE	19.67	0.00	0.00	0.54	0.01	0.00	0.78
WRAP	SD	BADL	37.55	0.00	0.02	4.32	1.03	0.01	3.73
WRAP	SD	WICA	31.66	0.00	0.00	2.37	0.31	0.00	4.39

7.5. Area of Influence Analyses for Tennessee Class I Areas

Once 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. These facilities were then 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)[56] back trajectories for IMPROVE monitoring sites in Tennessee and 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 7-36 and Figure 7-37 contain the 100-meter back trajectories for the 20% most impaired visibility days (2011-2016) at the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. Figure 7-38 and Figure 7-39 contain the 100-meter back trajectories by season for the 20% most impaired visibility days (2011-2016) at the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. Figure 7-40 and Figure 7-41 contain the 100-meter, 500-meter, 1000-meter, and 1500-meter back trajectories for the 20% most impaired visibility days (2011-2016) at the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. These back trajectories for the 20% most impaired days were then used to develop residence time (RT) plots.

[56] 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

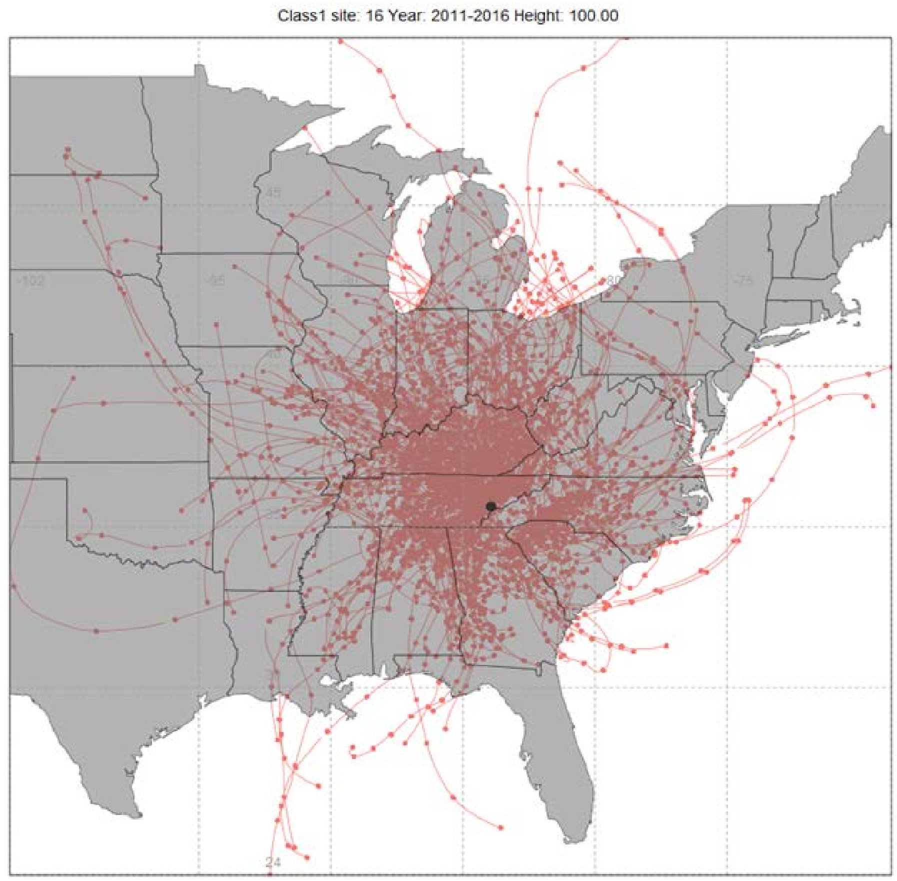


Figure 7-36: 100-Meter Back Trajectories for the 20% Most Impaired Visibility Days (2011-2016), from Great Smoky Mountains National Park

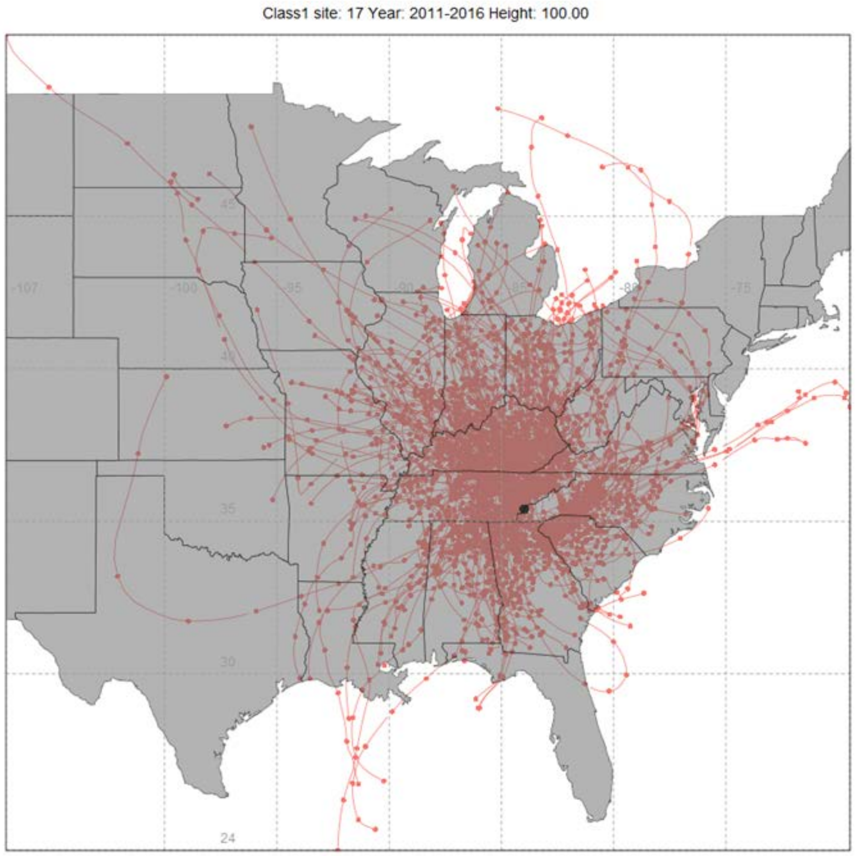


Figure 7-37: 100-Meter Back Trajectories for the 20% Most Impaired Visibility Days (2011-2016), from Joyce Kilmer-Slickrock Wilderness Area

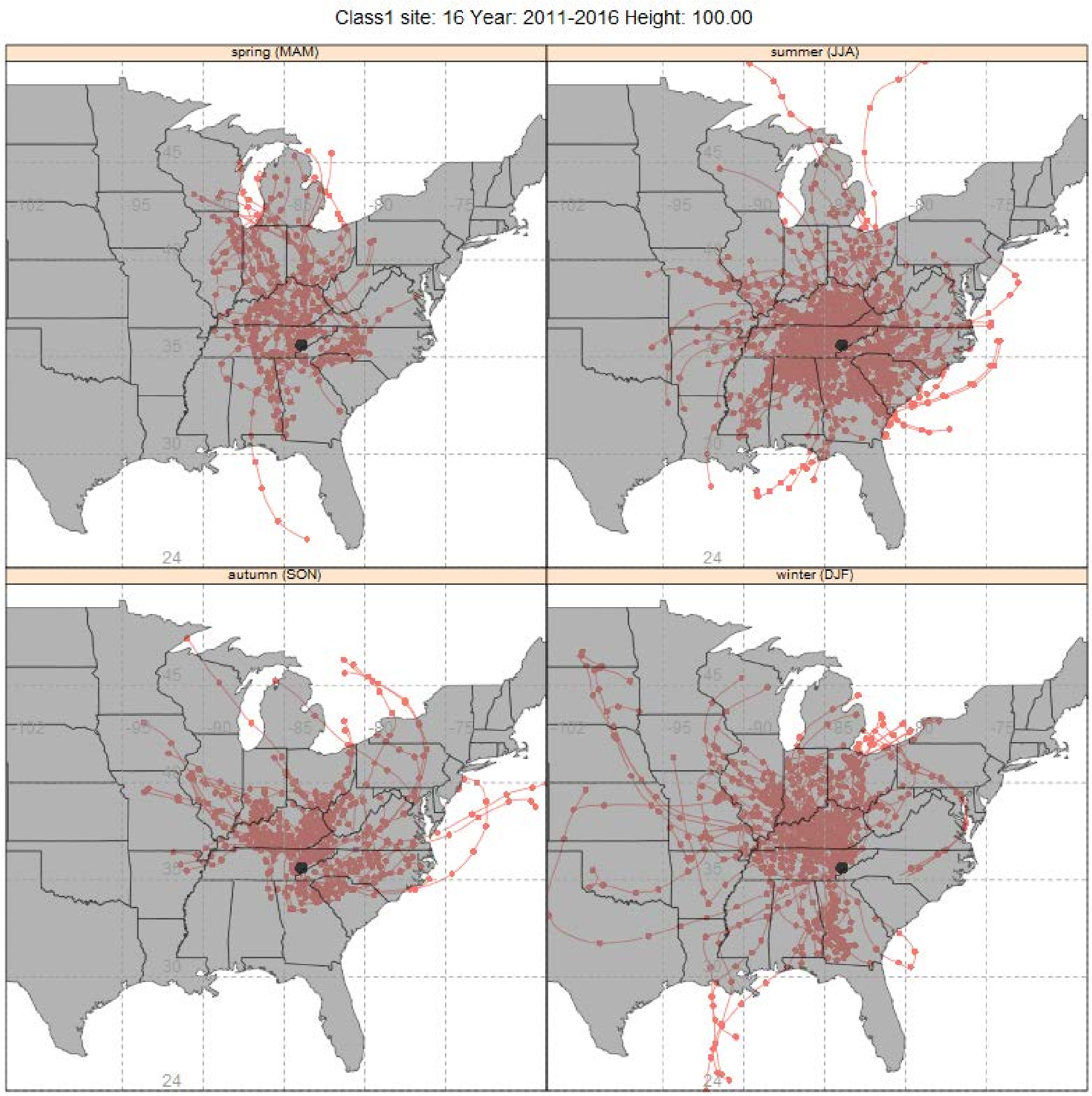


Figure 7-38: 100-Meter Back Trajectories by Season for the 20% Most Impaired Visibility Days (2011-2016) from Great Smoky Mountains National Park

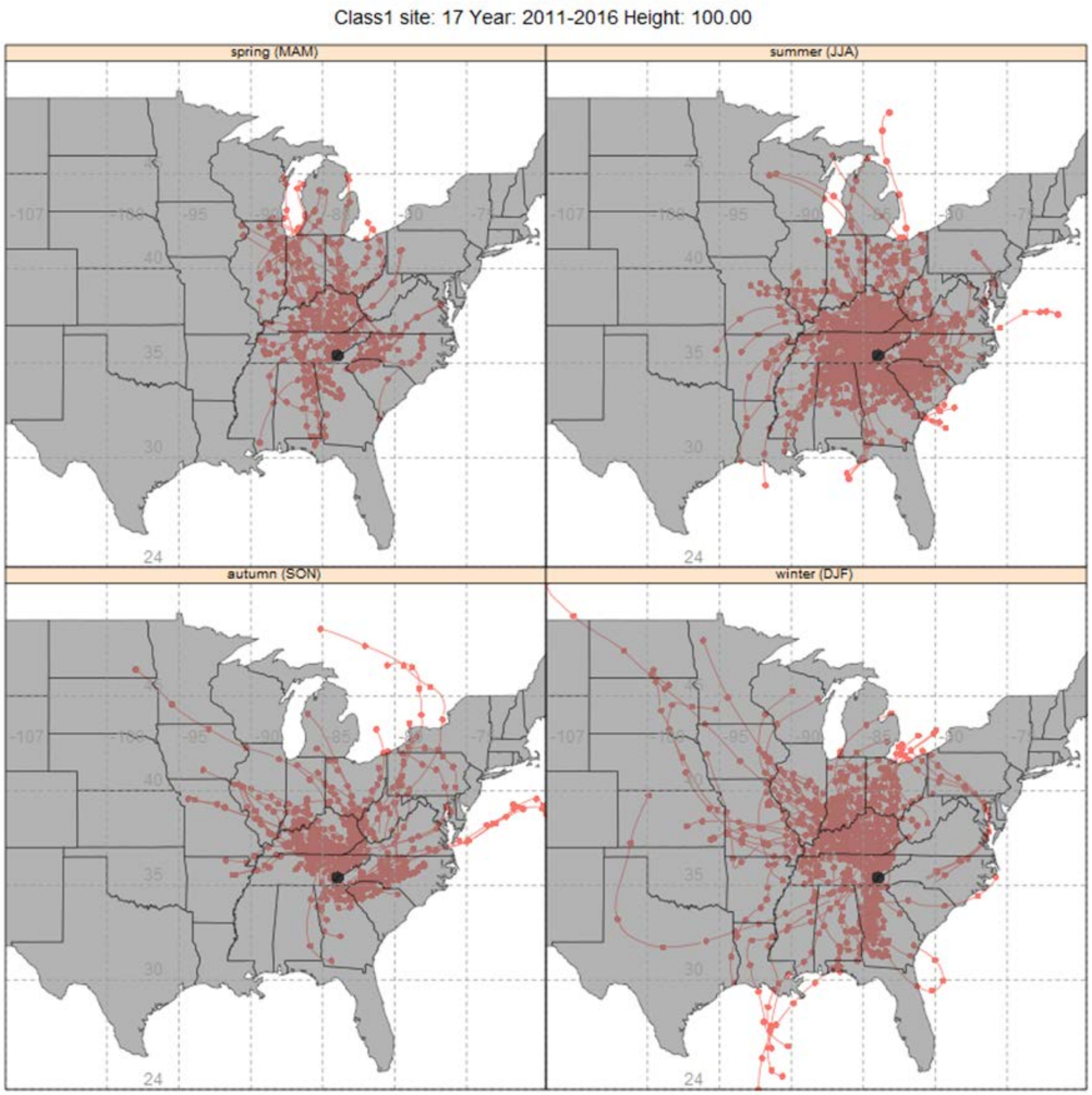


Figure 7-39: 100-Meter Back Trajectories by Season for the 20% Most Impaired Visibility Days (2011-2016) from Joyce Kilmer-Slickrock Wilderness Area

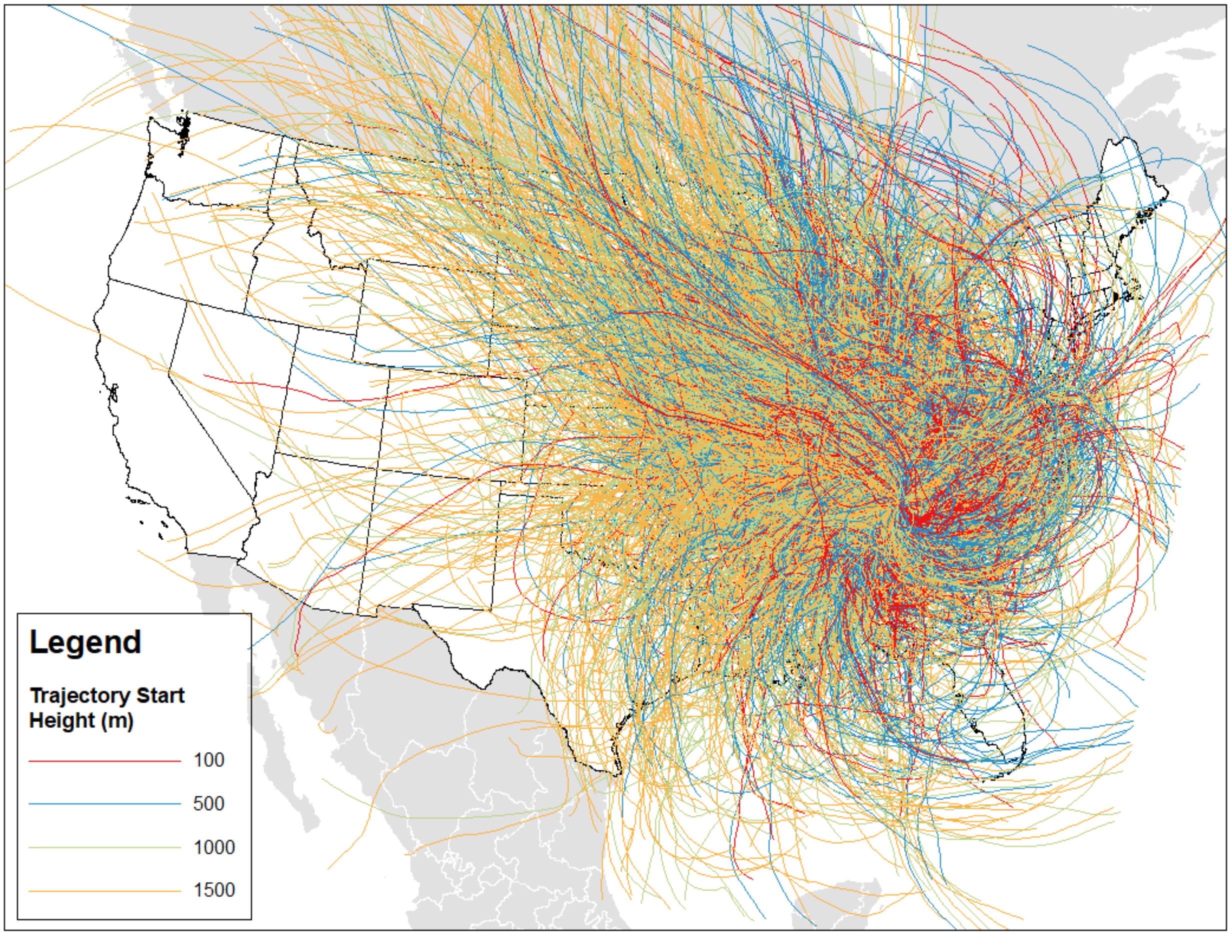


Figure 7-40: 100-Meter, 500-Meter, 1000-Meter, and 1500-Meter Back Trajectories for the 20% Most Impaired Days (2011-2016) from Great Smoky Mountains National Park

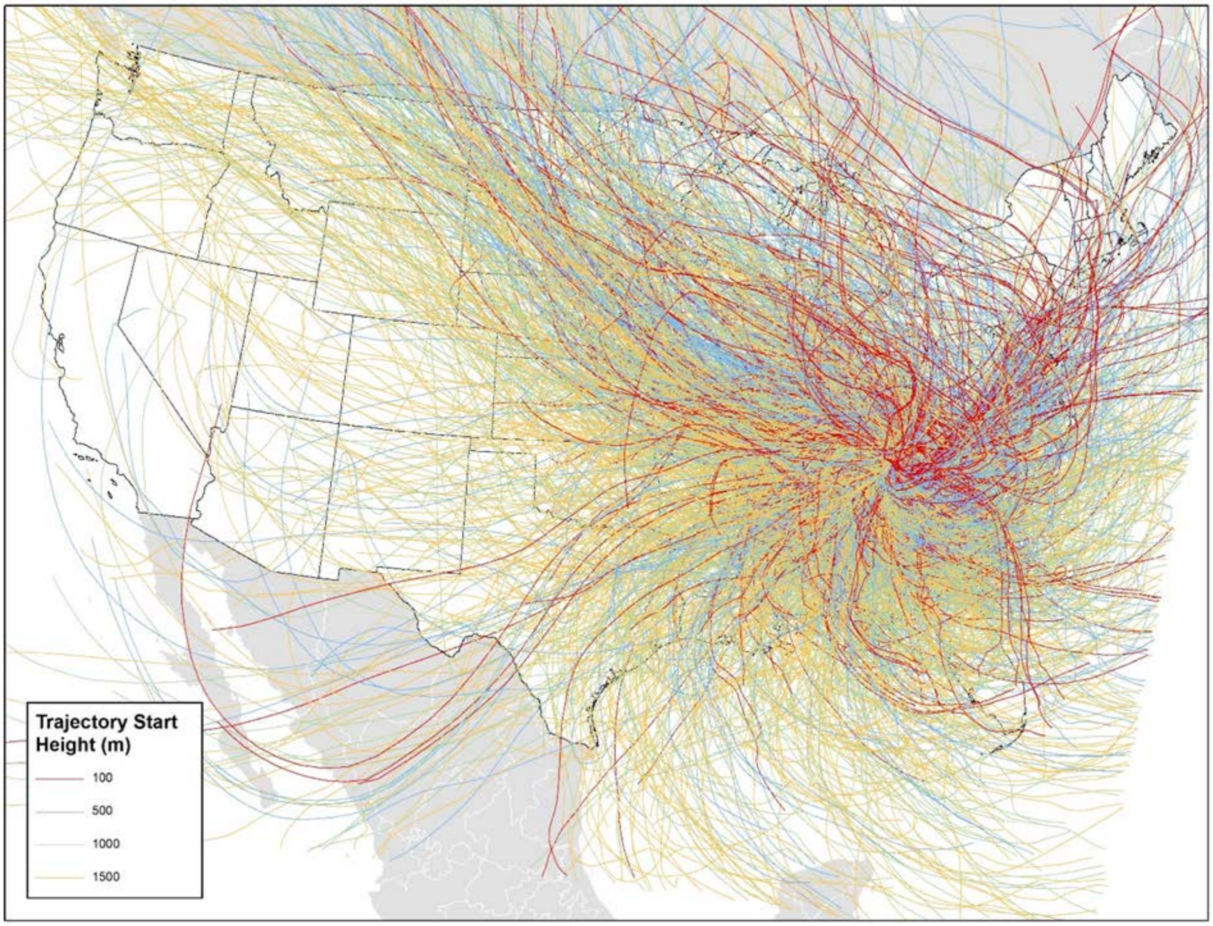


Figure 7-41: 100-Meter, 500-Meter, 1000-Meter, and 1500-Meter Back Trajectories for the 20% Most Impaired Days (2011-2016) from Joyce Kilmer-Slickrock Wilderness Area

7.5.2. Residence Time Plots

The next step was to plot 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 7-42 and Figure 7-43 contain the RT (counts per 12-km modeling grid cell) for Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. Figure 7-44 and Figure 7-45 contain the residence time (percent of total counts per 12-km modeling grid cell) for Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. As illustrated in these figures, winds influencing Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area on the 20% most impaired days come from all directions. and there is no single predominant wind direction influencing the 20% most impaired visibility days. It should be noted that there are lower residence times in western North Carolina in grid cells that are east, southeast, and northeast of Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area due to the meteorological impacts associated with the Southern Appalachian Mountains.

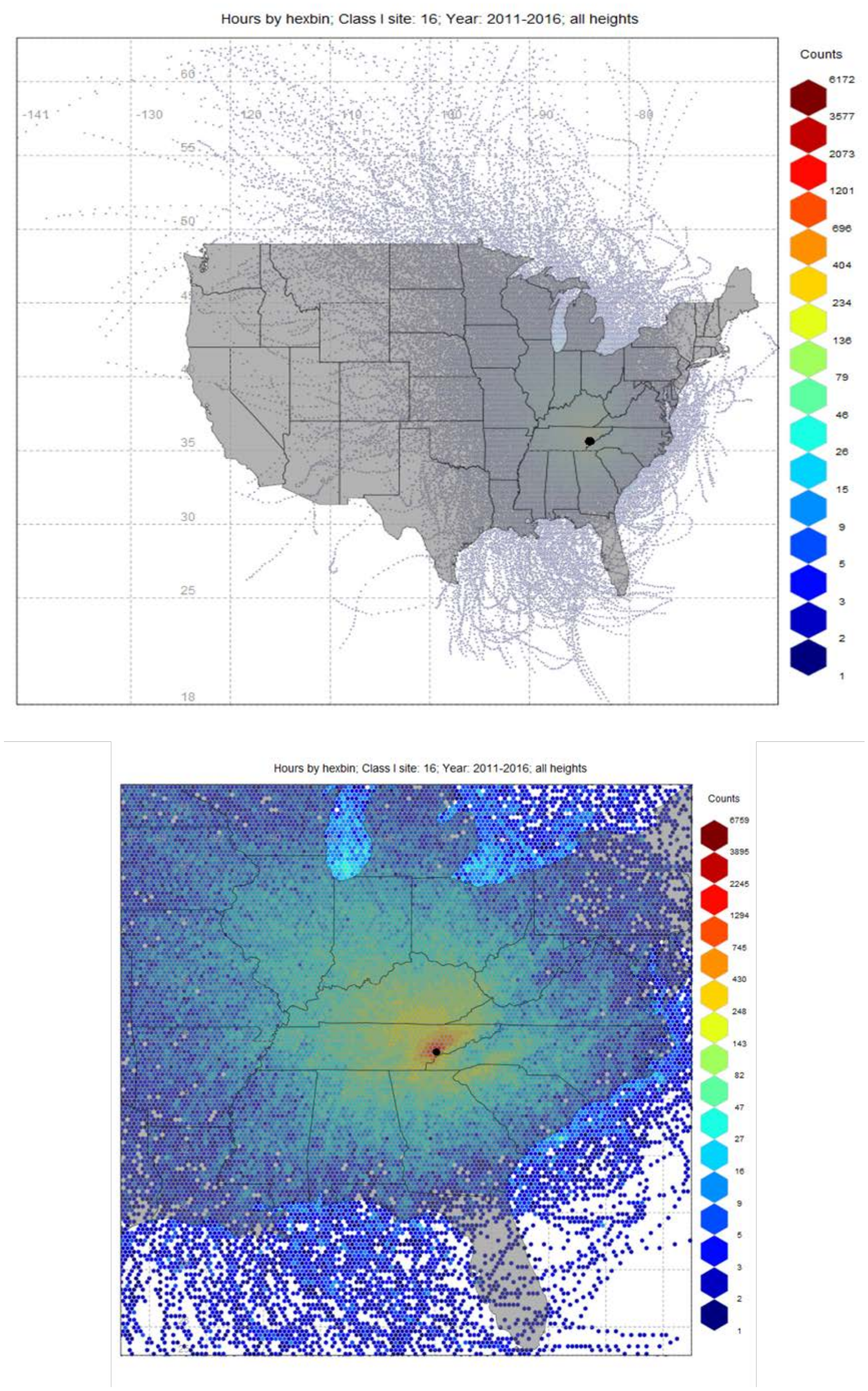
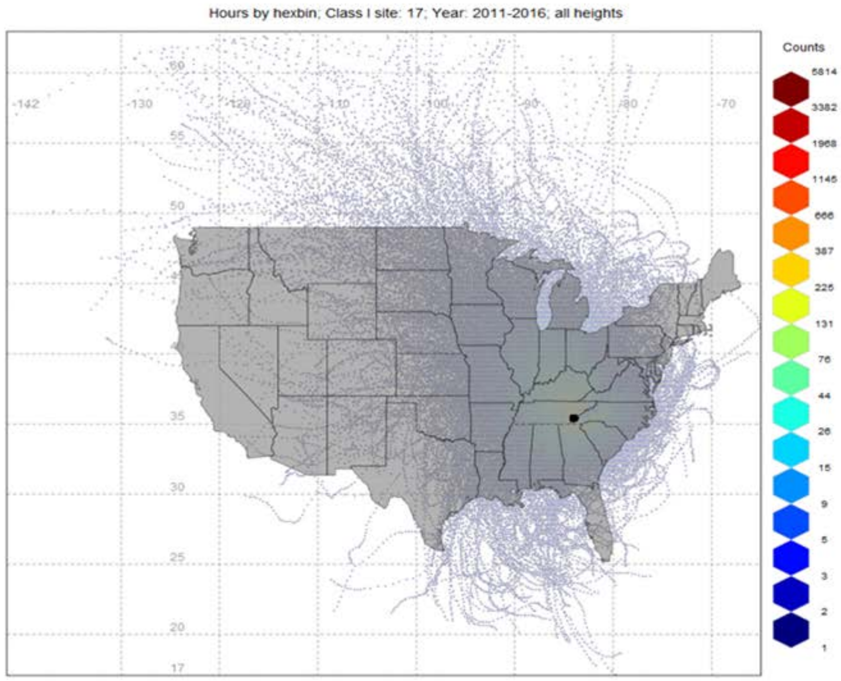


Figure 7-42: Residence Time (Counts per 12km Modeling Grid Cell) for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)



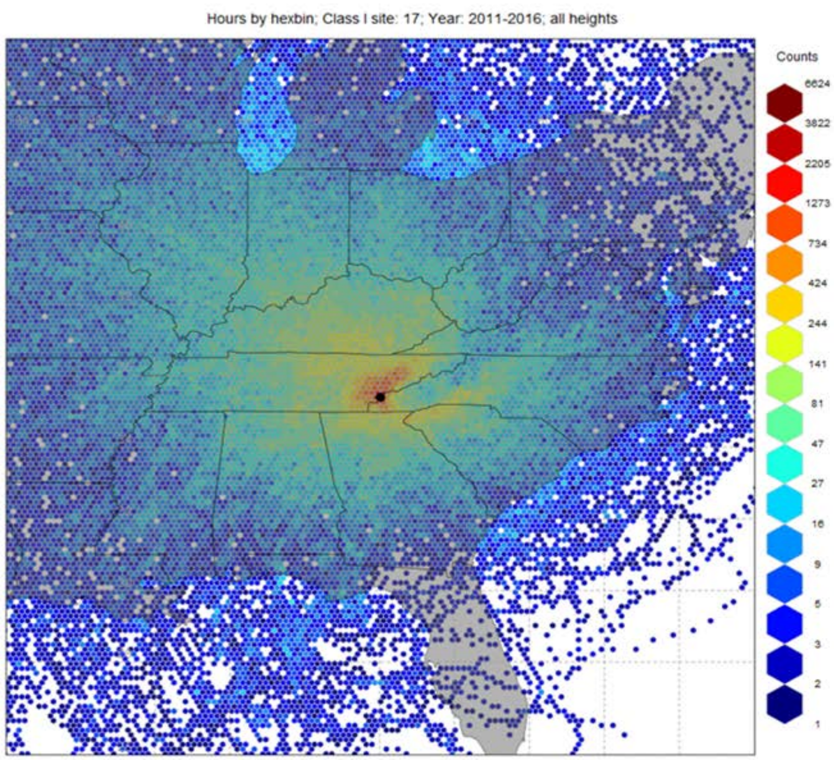
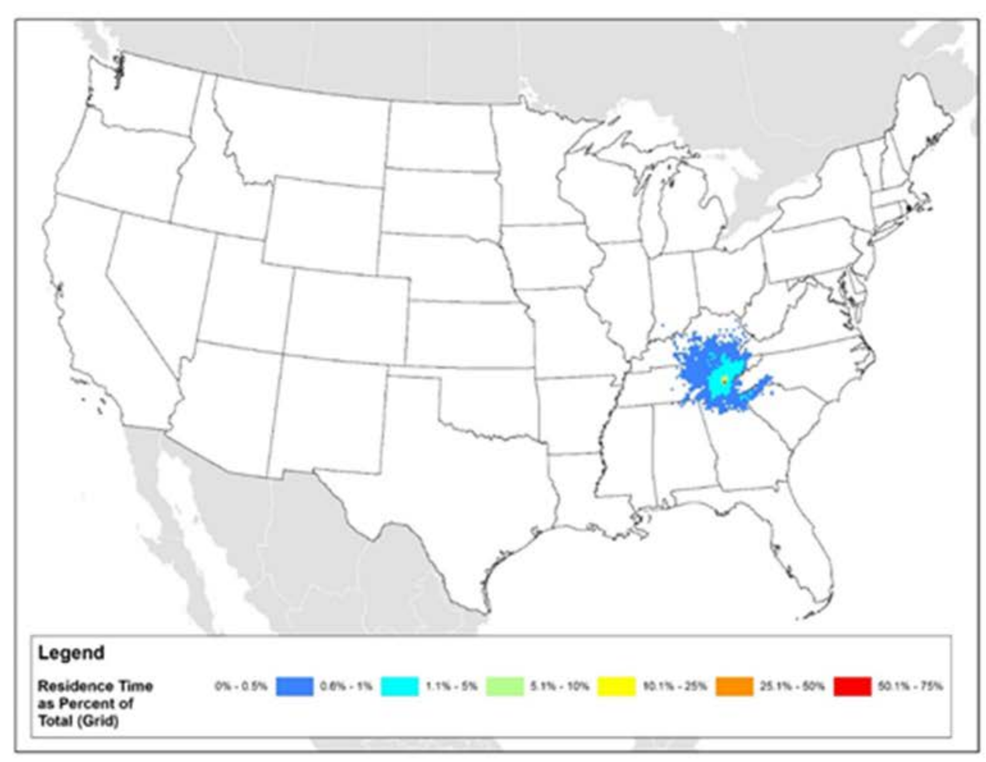


Figure 7-43: Residence Time (Counts per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area – Full View (top) and Class I Zoom (bottom)



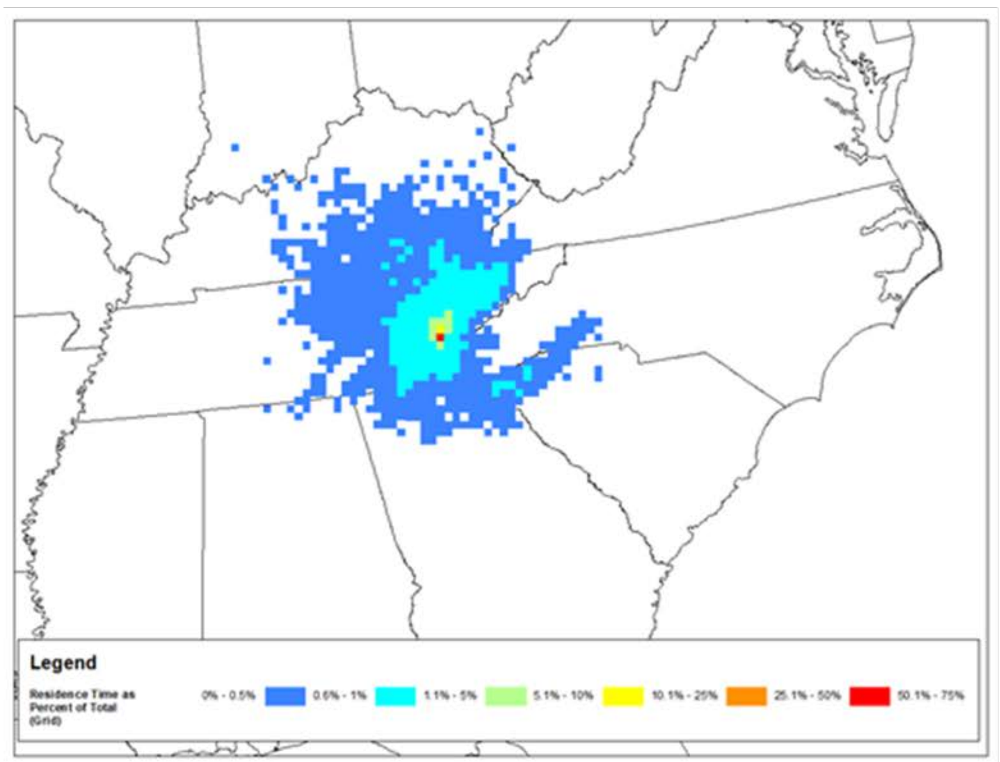
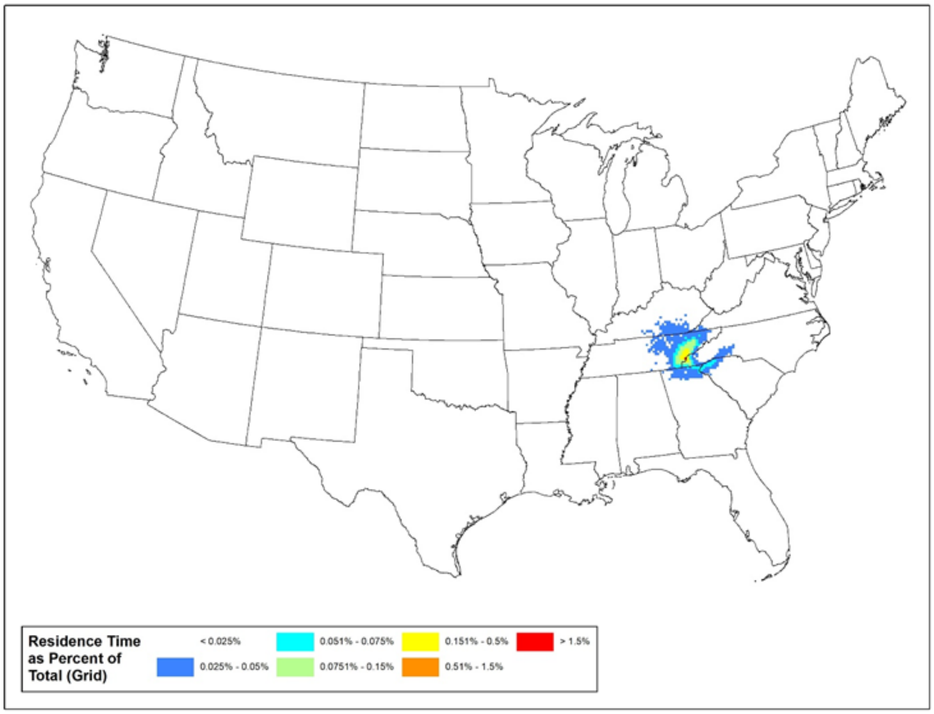


Figure 7-44: Residence Time (% of Total Counts per 12km Modeling Grid Cell for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)



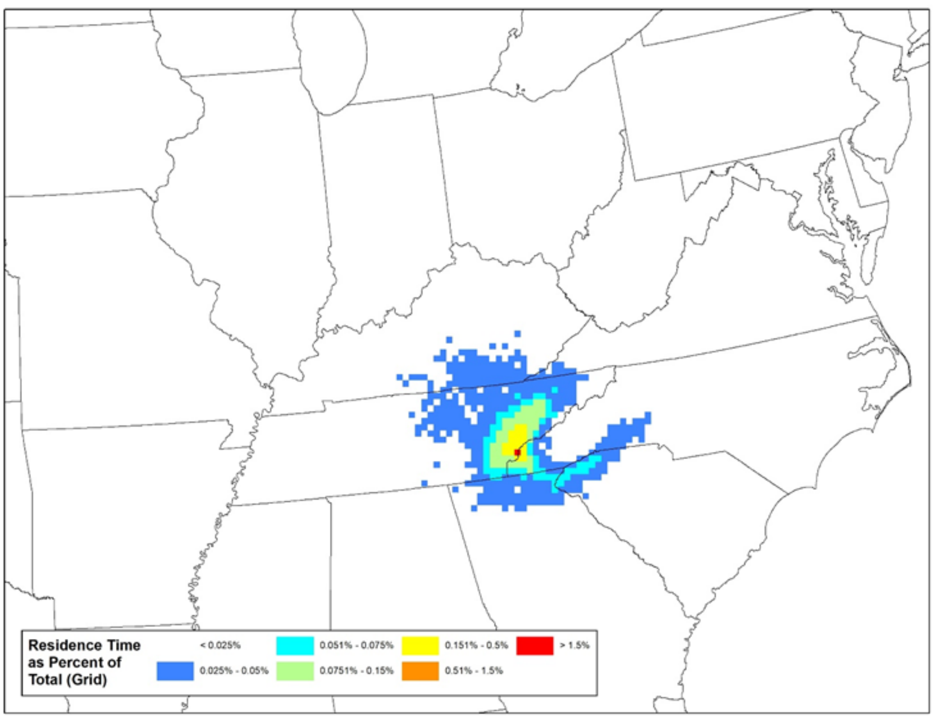


Figure 7-45: Residence Time (% of Total Counts per 12km Modeling Grid Cell for Joyce Kilmer-Slickrock Wilderness Area – Full View (top) and Class I Zoom (bottom)

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)[57] 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 7-46 and Figure 7-47 contain the sulfate extinction weighted residence time (sulfate EWRT per 12-km modeling grid cell) for Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively, for the 20% most impaired days from 2011 to 2016. Figure 7-48 and Figure 7-49 contain the nitrate extinction weighted residence time (nitrate EWRT per 12-km modeling grid cell) for Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively, for the 20% most impaired days from 2011 to 2016. It should be noted that the sulfate extinction weighted residence times are significantly

[57] 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

higher (approximately ten times higher) than the nitrate extinction weighted residence times, demonstrating the importance of focusing on SO_2 emission reductions.

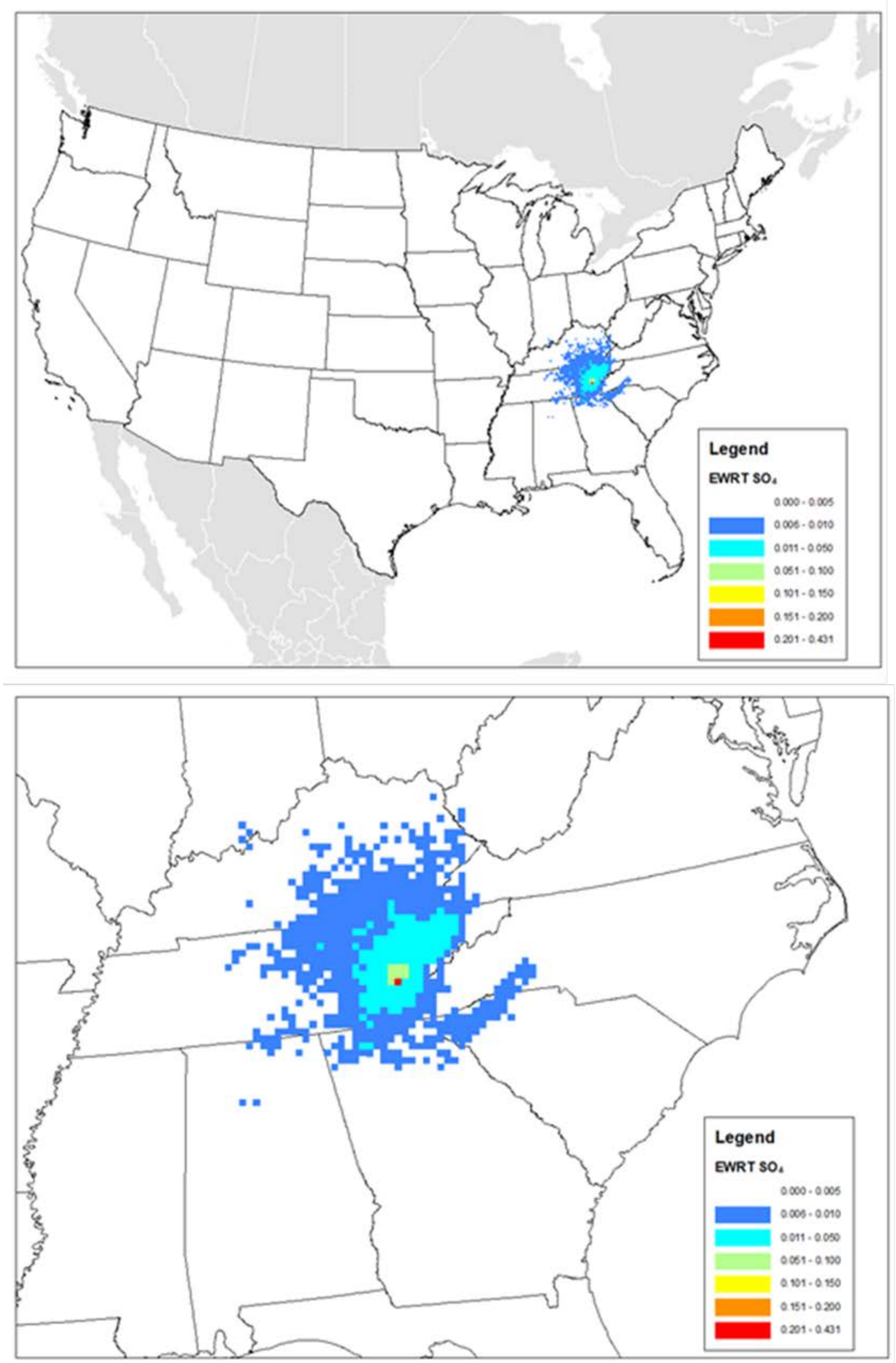
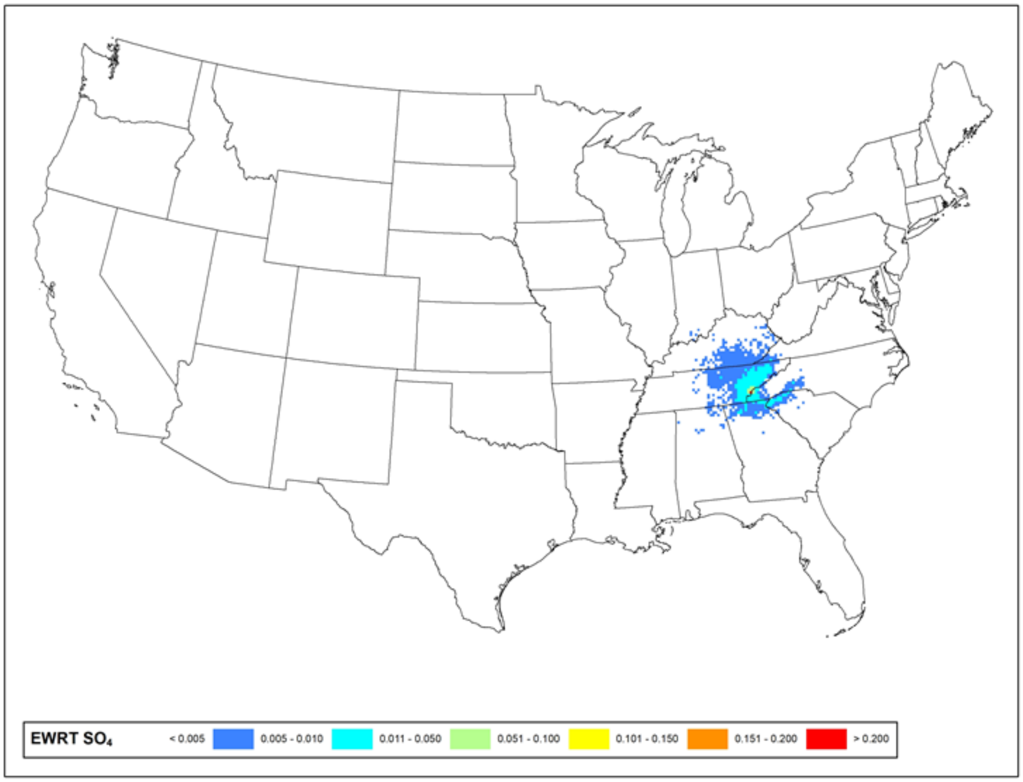


Figure 7-46: Sulfate Extinction Weighted Residence Time (Sulfate EWRT per 12km Modeling Grid Cell) for Great Smoky Mountains National Park - Full View (top) and Class I Zoom (bottom)



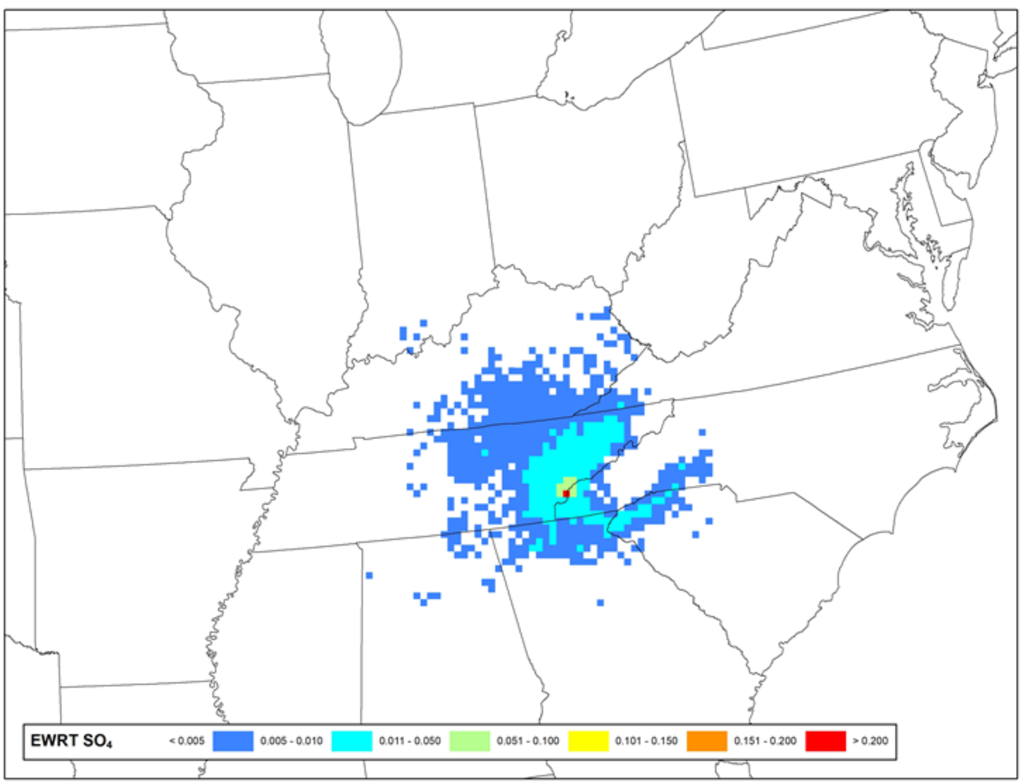


Figure 7-47: Sulfate Extinction Weighted Residence Time (Sulfate EWRT per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area - Full View (top) and Class I Zoom (bottom)

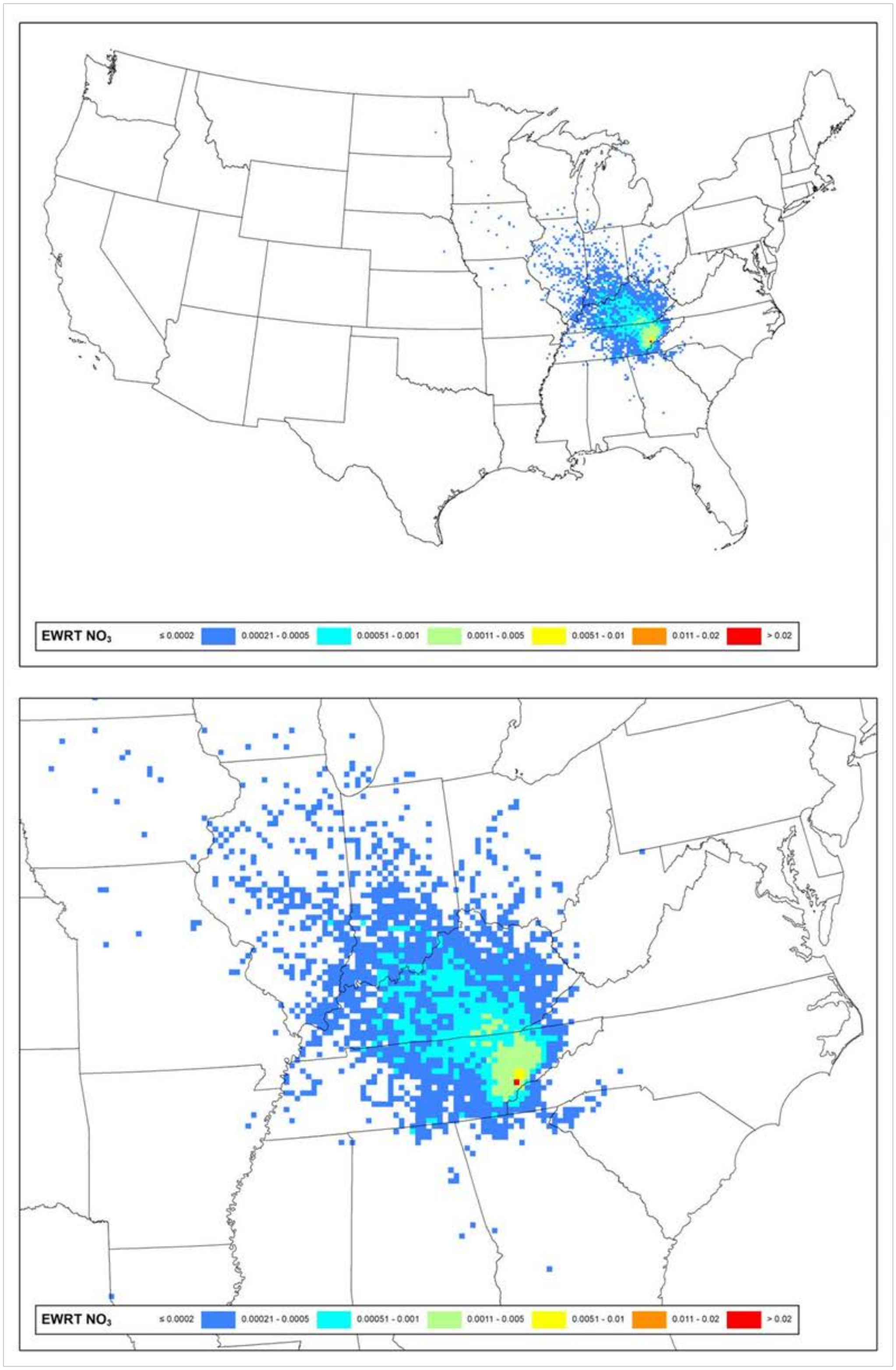


Figure 7-48: Nitrate Extinction Weighted Residence Time (Nitrate EWRT per 12-km Modeling Grid Cell) for Great Smoky Mountains National Park - Full View (top) and Class I Zoom (bottom)

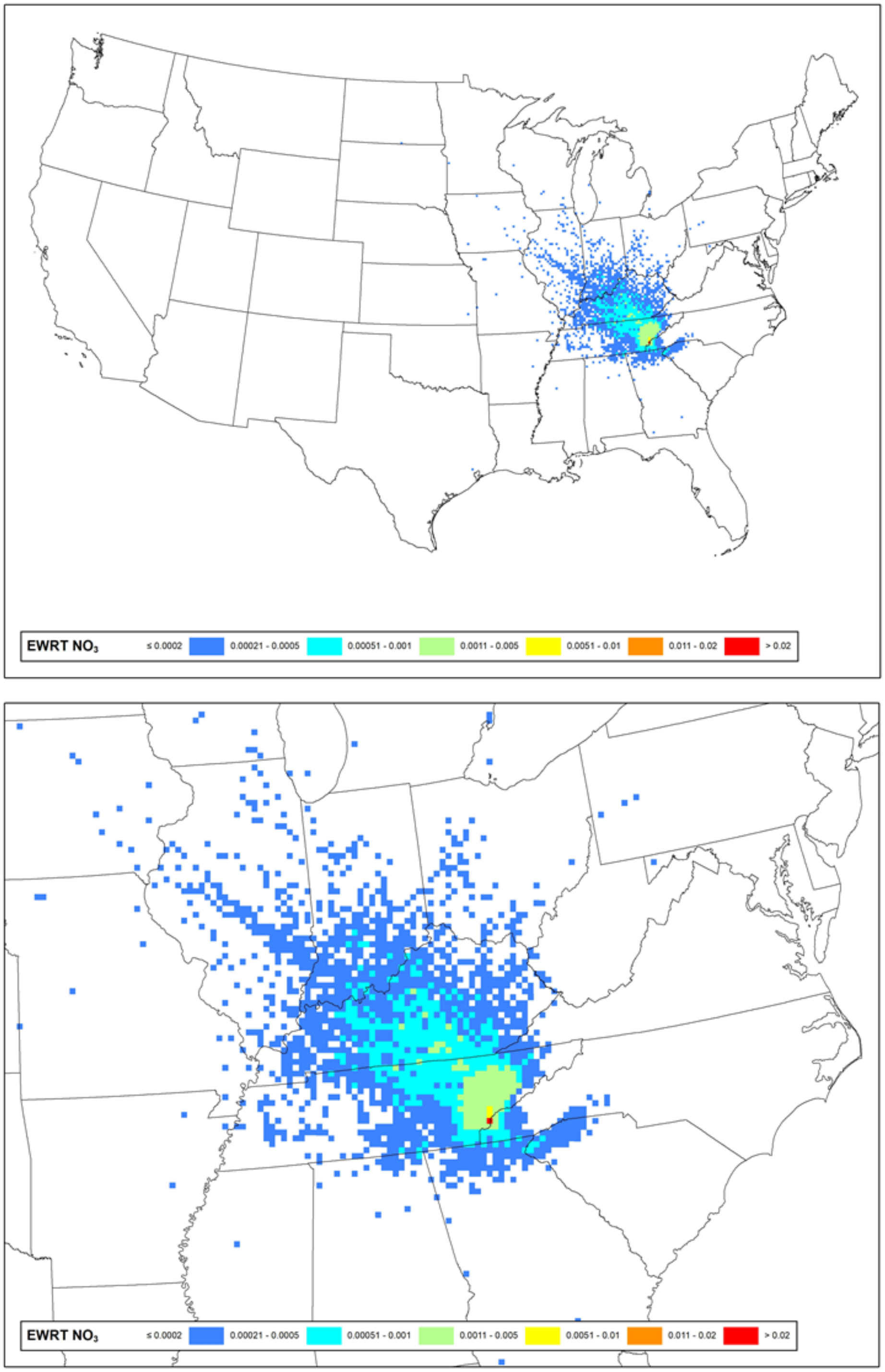


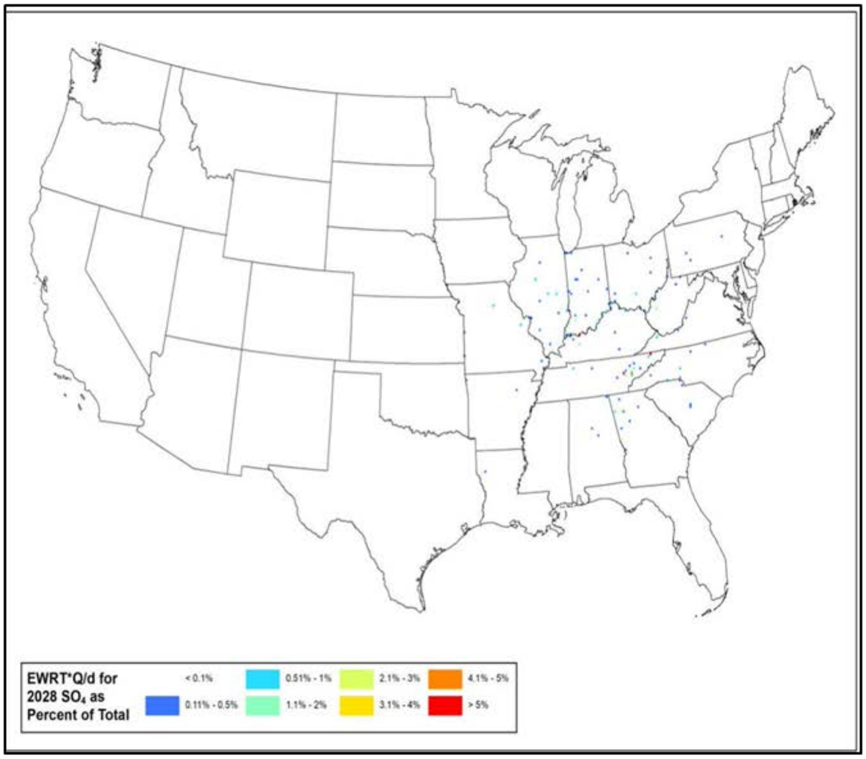
Figure 7-49: Nitrate Extinction Weighted Residence Time (Nitrate EWRT per 12-km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area - Full View (top) and Class I Zoom (bottom)

7.5.4. Emissions/Distance Extinction Weighted Residence Time Plots

Extinction weighted residence times were then combined with 12-km gridded SO_2 and NOx 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 7-50 and Figure 7-51 contain the sulfate emissions/distance extinction weighted residence time (percent of total Q/d*EWRT per 12-km modeling grid cell) for Great Smoky Mountain National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. Figure 7-52 and Figure 7-53 contain the nitrate emissions/distance extinction weighted residence time (percent of total Q/d*EWRT per 12-km modeling grid cell) for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, respectively. These maps help visualize where the sources of the largest visibility impacts are located. Figure 7-50, Figure 7-51, Figure 7-52, and Figure 7-53 illustrate the relative importance of Tennessee sources of SO_2 and NO_X, respectively, compared to sources in neighboring states.



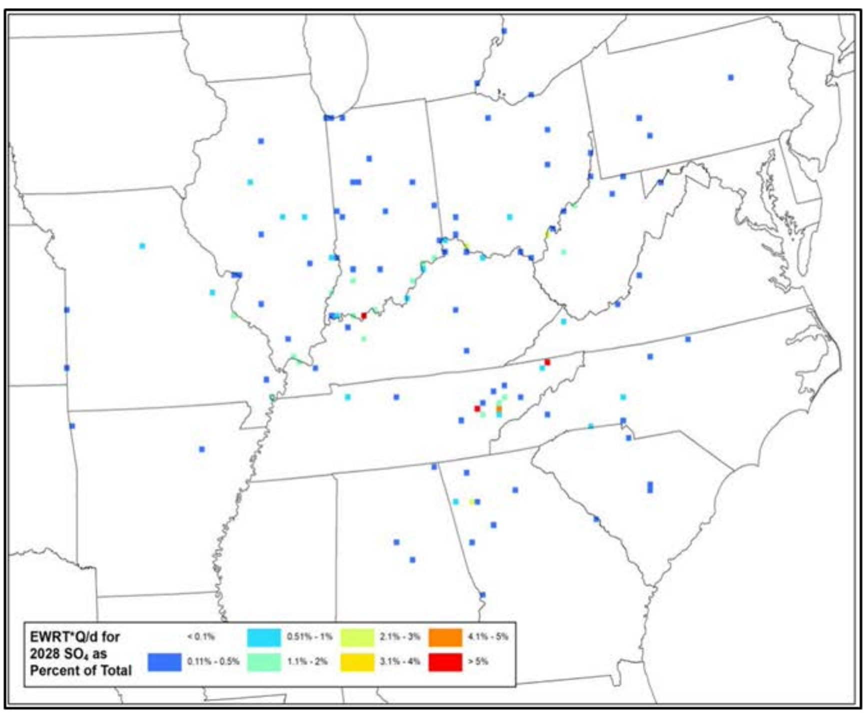
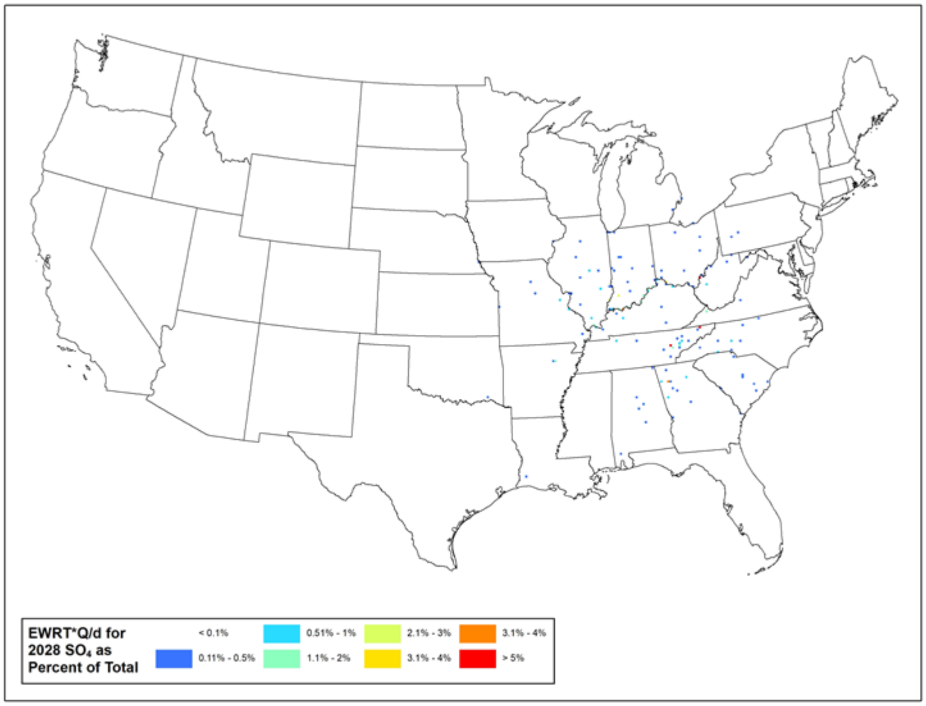


Figure 7-50: Sulfate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)



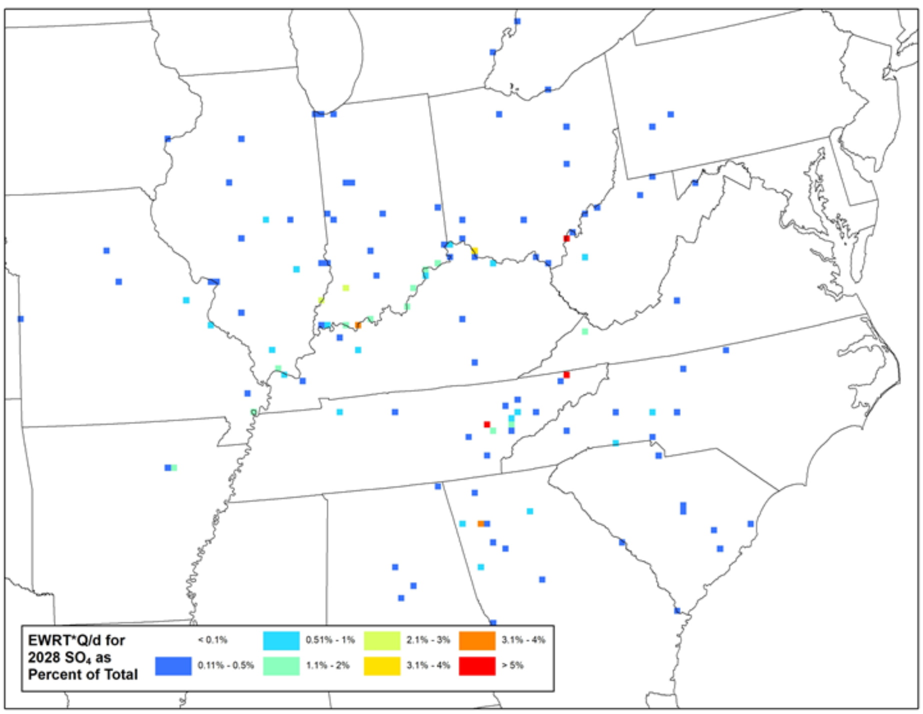
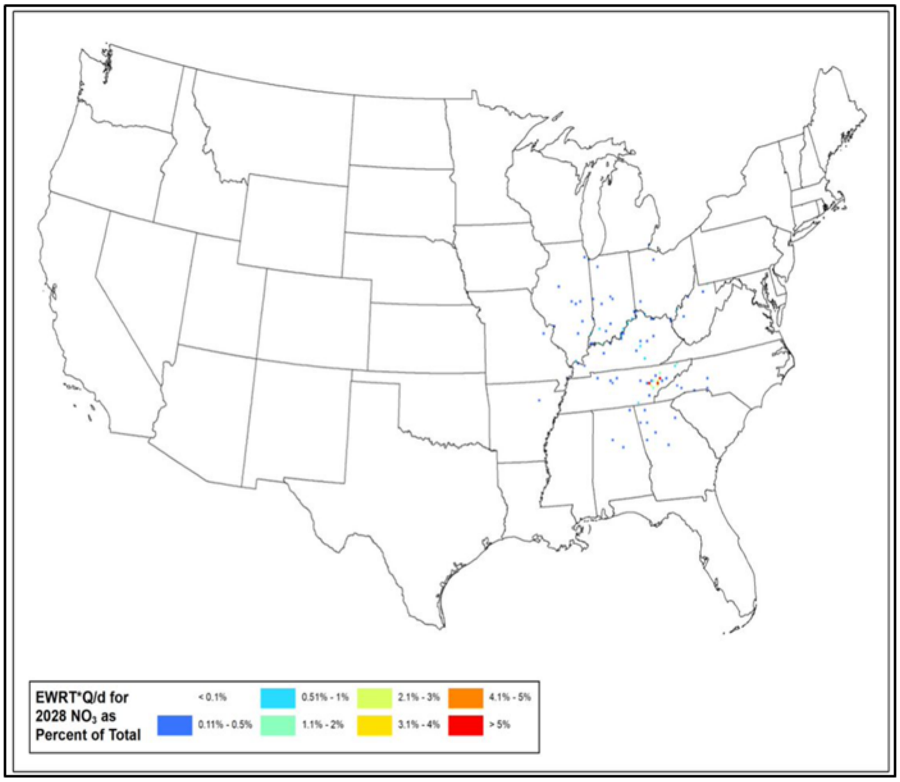


Figure 7-51: Sulfate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area– Full View (top) and Class I Zoom (bottom)



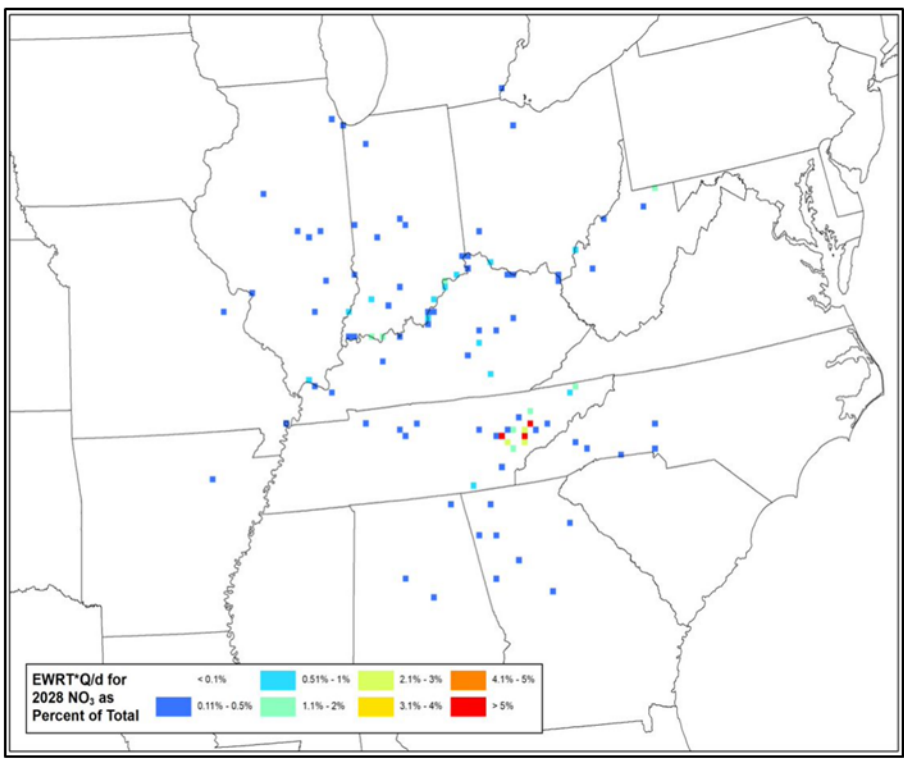


Figure 7-52: Nitrate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)

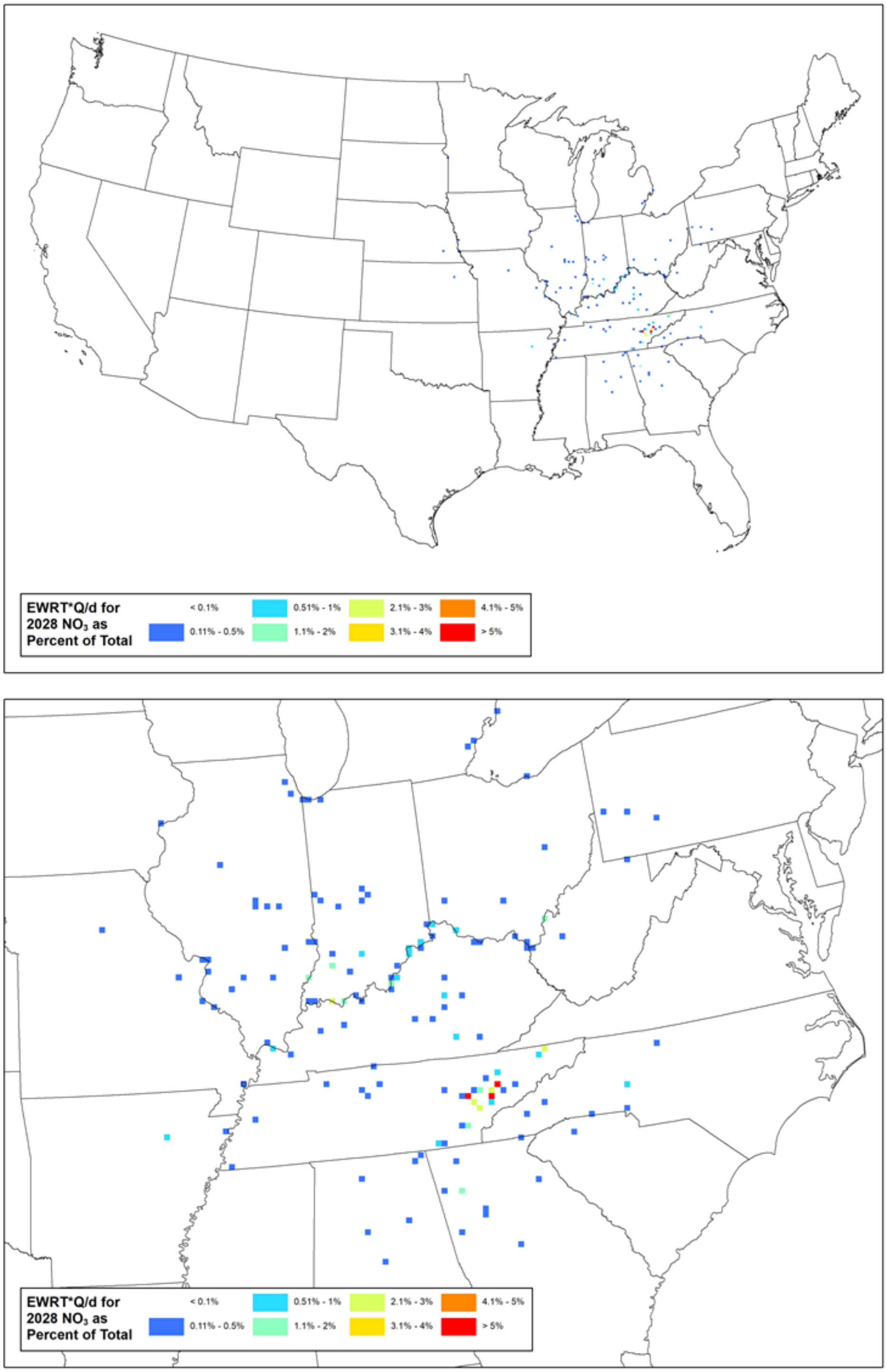


Figure 7-53: Nitrate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area– Full View (top) and Class I Zoom (bottom)

7.5.5. Ranking of Sources for Tennessee Class I Areas

The Q/d*EWRT data was further paired with additional point source metadata that identified 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 potential visibility impacts from 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 7-13 contains the NO_X and SO_2 source contributions to visibility impairment on the 20% most impaired days at Great Smoky Mountains National Park. Table 7-14 contains the NO_X and SO_2 source contributions to visibility impairment on the 20% most impaired days at Joyce Kilmer-Slickrock Wilderness Area. Based on these contributions, it is clear that SO_2 from point sources is the dominant source category at Great Smoky Mountains National Park (49.54%) and Joyce Kilmer-Slickrock Wilderness Area (63.84%).

Table 7-13: NO_X and SO_2 Source Contributions to Visibility Impairment on the 20% Most Impaired Days at Great Smoky Mountains National Park

Category	NO_X	SO_2	Total
Nonpoint	8.55%	10.78%	19.33%
Non-Road, MAR	3.16%	0.10%	3.26%
Non-Road, Other	4.76%	0.29%	5.05%
Onroad	11.65%	1.53%	13.18%
Point	6.99%	49.54%	56.53%
Pt_Fires_Prescribed	0.31%	2.34%	2.65%
Total	35.42%	64.58%	100.00%

Table 7-14: NO_X and SO_2 Source Contributions to Visibility Impairment on the 20% Most Impaired Days at Joyce Kilmer-Slickrock Wilderness Area

Category	NO_X	SO_2	Total
Nonpoint	4.79%	7.75%	12.54%
Non-Road, MAR	2.26%	0.11%	2.37%
Non-Road, Other	2.73%	0.21%	2.94%
Onroad	7.39%	0.85%	8.24%
Point	6.23%	63.84%	70.07%
Pt_Fires_Prescribed	0.44%	3.39%	3.83%
Total	23.84%	76.16%	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 7-15 contains the AoI NO_X and SO_2 facility contributions to visibility impairment on the 20% most impaired days at Great Smoky Mountains National Park. Table 7-16 contains the AoI NO_X and SO_2 facility contributions to visibility impairment on the 20% most impaired days at Joyce Kilmer-Slickrock Wilderness Area. These tables only show the facilities contributing more than 1.00% sulfate + 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 7-15: AoI NO_X and SO_2 Facility Contributions to Visibility Impairment on the 20% Most Impaired Days at Great Smoky Mountains National Park

State	Facility ID	Facility Name	Distance (km)	2028 NOx (tpy)	2028 SO2 (tpy)	Nitrate (%)	Sulfate (%)	Sulfate + Nitrate (%)
TN	47145-4979111	TVA KINGSTON FOSSIL PLANT	60	1,687	1,886	5.54%	8.48%	8.11%
TN	47009-9159211	Mc Ghee Tyson	20	595	79	23.58%	4.95%	7.33%
TN	47163-3982311	EASTMAN CHEMICAL COMPANY[58]	160	6,900	6,420	1.51%	6.90%	6.21%
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT	375	8,807	30,536	1.64%	5.35%	4.88%
TN	47093-4979911	Cemex - Knoxville Plant	44	712	121	7.07%	1.97%	2.62%
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)	401	8,123	41,596	0.34%	2.58%	2.30%
GA	13015-2813011	Ga Power Company - Plant Bowen	190	6,643	10,453	0.29%	2.41%	2.14%
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	360	7,150	22,134	0.70%	2.12%	1.94%
IN	18077-7744211	INDIANA KENTUCKY ELECTRIC CORPORATION	369	6,188	9,038	0.99%	1.84%	1.73%
IL	17127-7808911	Joppa Steam	474	4,706	20,509	0.34%	1.87%	1.67%
IN	18125-7362411	INDIANAPOLIS POWER & LIGHT PETERSBURG	436	10,665	18,142	0.94%	1.70%	1.60%
KY	21041-5198511	KY Utilities Co - Ghent Station	359	7,940	10,169	0.73%	1.64%	1.52%
TN	47105-4129211	TATE & LYLE, Loudon	36	253	110	1.82%	1.40%	1.46%
KY	21145-6037011	Tennessee Valley Authority (TVA) - Shawnee Fossil Plant	465	7,007	19,505	0.14%	1.53%	1.36%
IN	18051-7363111	Gibson	456	12,280	23,117	0.55%	1.44%	1.32%
KY	21183-5561611	Big Rivers Electric Corp - Wilson Station	346	1,152	6,934	0.22%	1.34%	1.20%
WV	54073-4782811	MONONGAHELA POWER CO-PLEASANTS POWER STA	476	5,497	16,817	0.12%	1.22%	1.08%
KY	21091-7352411	Century Aluminum of KY LLC	360	198	5,044	0.03%	1.23%	1.07%
WV	54079-6789111	APPALACHIAN POWER COMPANY - JOHN E AMOS PLANT	367	4,878	10,984	0.11%	1.20%	1.06%
TN	47009-4143611	ALCOA INC. - SOUTH PLANT	16	109	5	5.19%	0.40%	1.01%

[58] The SO_2 and NO_X emission projections for 2028 in this table were estimated by TDEC-APC and are lower than the emission projections that Eastman used in their four-factor analysis. Eastman's four-factor analysis states that historical SO_2 emissions from Eastman's coal-fired boilers are generally proportional to production levels, which cycle with economic activity and other factors (e. g., product mix). Eastman projected that 2028 SO_2 emissions could be as high as the highest production year in the past ten years, which was calendar year 2011. Eastman's projections represent a best estimate of maximum projected actual emissions of SO_2 from the coal-fired powerhouses for 2028, not including any future changes that are necessary to attain the SO_2 NAAQS.

Table 7-16: AoI NO_X and SO_2 Facility Contributions to Visibility Impairment on the 20% Most Impaired Days at Joyce Kilmer-Slickrock Wilderness Area

State	Facility ID	Facility Name	Distance (km)	2028 NOx (tpy)	2028 SO2 (tpy)	Nitrate (%)	Sulfate (%)	Sulfate + Nitrate (%)
TN	47145-4979111	TVA KINGSTON FOSSIL PLANT	74	1,687	1,886	6.36%	8.78%	8.56%
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	179	6,900	6,420	1.80%	6.58%	6.15%
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)	425	8,123	41,596	0.54%	5.29%	4.86%
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT	391	8,807	30,536	1.55%	4.85%	4.55%
GA	13015-2813011	Ga Power Company - Plant Bowen	166	6,643	10,453	1.10%	4.03%	3.77%
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	385	7,150	22,134	0.68%	4.06%	3.75%
IN	18125-7362411	INDIANAPOLIS POWER & LIGHT PETERSBURG	453	10,665	18,142	1.51%	2.42%	2.33%
IN	18051-7363111	Gibson	472	12,280	23,117	1.19%	2.23%	2.14%
TN	47009-9159211	Mc Ghee Tyson	44	595	79	7.75%	1.49%	2.06%
KY	21091-7352411	Century Aluminum of KY LLC	377	198	5,044	0.06%	1.77%	1.62%
TN	47093-4979911	Cemex - Knoxville Plant	70	712	121	5.76%	0.94%	1.38%
KY	21111-7353711	Louisville Gas & Electric Co., Mill Creek Station	341	4,169	4,335	1.31%	1.36%	1.35%
TN	47105-4129211	TATE & LYLE, Loudon	48	253	110	1.98%	1.13%	1.21%
KY	21041-5198511	KY Utilities Co - Ghent Station	383	7,940	10,169	0.80%	1.23%	1.19%
IN	18077-7744211	INDIANA KENTUCKY ELECTRIC CORPORATION	392	6,188	9,038	0.50%	1.18%	1.12%
IN	18019-8198511	ESSROC CEMENT CORP	370	2,365	4,681	0.47%	1.15%	1.09%
IL	17127-7808911	Joppa Steam	482	4,706	20,509	0.09%	1.15%	1.05%
VA	51027-4034811	Jewell Coke Company LLP	267	520	5,091	0.03%	1.11%	1.01%

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 an SO_2 reasonable progress analysis. If the nitrate contribution was greater than or equal to 1.00%, then the facility was considered for a NO_X reasonable progress 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

The TDEC-APC approached selecting Tennessee facilities for tagging from a regional perspective. Based on the AoI results, several of the facilities with the highest AoI impacts at Class I areas in Tennessee are located outside of Tennessee. This is in part attributable to the TVA consent decree finalized in 2011 that required shut downs, new controls, and a switch from coal to natural gas at certain facilities. From 2008 to 2019, there was a 94.6% reduction in SO_2 emissions and a 90.3% reduction in NO_x emissions from TVA's coal and natural gas plants in Tennessee. The consent decree is discussed in more detail in Section 7.2.2.1. Therefore, it is not unexpected that several power plants outside of Tennessee have higher AoI impacts on Tennessee Class I areas than power plants in Tennessee.

Since SO_2 emissions from point sources were estimated to have the largest contribution to visibility impairment at Great Smoky Mountains National Park (GRSM) and Joyce Kilmer-Slickrock Wilderness Area (JOYC) (see Table 7-13 and Table 7-14), Tennessee used the fraction of total sulfate visibility impairment (projected to 2028) from individual point source facilities as the metric for which an AoI threshold would be chosen to select sources for PSAT tagging. Since Tennessee shares its two Class I areas with North Carolina, Tennessee consulted with North Carolina on an appropriate AoI threshold. Several thresholds were considered, and

Tennessee determined that a 3% AoI threshold would capture a sufficient number of sources to accurately reflect the significant impact on Tennessee's Class I areas but not strain the available resources needed for reviewing reasonable progress analyses. Regional haze rules require states to address visibility impairment for each Class I area within the state and for each Class I area located outside the state that may be affected by emissions from the state. As such, Tennessee determined which Tennessee sources would be selected and which non-Tennessee sources impacted a Tennessee Class I area. That information is shown in Table 7-17. Note that for selected Tennessee sources, the table displays the percent sulfate contribution to Tennessee Class I areas regardless of their AoI percentage, but only displays the percentage of sulfate contribution for Tennessee sources impacting non-Tennessee Class I areas when the percentage is above the 3% threshold. Percentages above 3% are shown in bold.

Table 7-17: Sources Selected by Tennessee for PSAT Tagging and Percentage of Point Source Sulfate Impairment at each Class I Area

State	Facility ID	Facility Name	GRSM Sulfate (%)*	JOYC Sulfate (%)	SIPS Sulfate (%)	LIGO Sulfate (%)	SHRO Sulfate (%)
TN	47145-4979111	TVA KINGSTON FOSSIL PLANT	**8.48%**	**8.78%**	n/a	n/a	n/a
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	**6.90%**	**6.58%**	n/a	**20.2%**	**5.21%**
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT	**5.35%**	**4.85%**	n/a	n/a	n/a
TN	47009-9159211	Mc Ghee Tyson Airport	**4.95%**	1.49%	n/a	n/a	n/a
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)	2.58%	**5.29%**	n/a	n/a	n/a
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	2.41%	**4.06%**	n/a	n/a	n/a
GA	13015-2813011	Ga Power Company - Plant Bowen	2.12%	**4.03%**	n/a	n/a	n/a
TN	47161-4979311	TVA CUMBERLAND FOSSIL PLANT	0.09%	0.07%	**4.28%**	n/a	n/a

Table 7-17 shows that selection of a 3% AoI threshold results at eight facilities, four in Tennessee and four in other states, for PSAT tagging. This captured an estimated 32.88% of the point source sulfate visibility impairment for GRSM and 35.15% for JOYC. It would also result in a manageable number of sources needed to be reviewed by state staff.

Since NO_x emissions from point sources are also a significant contributor to visibility impairment to Tennessee's Class I areas, Tennessee conducted a similar analysis using sulfate plus nitrate visibility impairment. This analysis indicated that the inclusion of NO_x in the AoI selection analysis would not have resulted in any additional facilities tagged for PSAT analysis.

These eight sources were added to VISTAS list of PSAT Tags as listed in Table 7-19 through Table 7-22. Following receipt of the PSAT modeling, Tennessee selected sources for reasonable progress analysis. As stated in Section 7.6.2, Tennessee and the rest of the VISTAS states selected sources with either sulfate or nitrate contribution of greater than or equal to 1.00% of the total sulfate and nitrate contribution from point sources. As indicated below, Tennessee selected a total of ten sources for reasonable progress analysis, three in Tennessee and seven outside Tennessee.

McGhee Tyson is a regional airport near Knoxville, Tennessee. The majority of SO_2 (98%) and NOx (87%) emissions from the airport are from commercial aircraft fuel combustion during taxiing, takeoff, and landing. McGhee Tyson Airport was eventually removed from the PSAT tag list since conducting PSAT on an airport was outside the scope of the contract with ERG. Airport emissions were processed in the base case with emissions not escaping layer 1 of the simulation. In order to tag these emissions, ERG would have needed to reprocess the low level file and regenerate a new base case with this tagged source included explicitly from the simulation. The rework would have been time consuming and outside of the scope of the contract. TDEC-APC has no authority to regulate emissions from aircraft. Additionally, as discussed in Section 7.6.3 below, AoI tends to overestimate impacts from sources that are close to the Class I area. In fact, if the facility is less than 100 km from the Class I area, the AoI results are almost always at least three times higher than the PSAT results. McGhee Tyson Airport is only 20 km from Great Smoky Mountains National Park so the AoI is likely at least 3 times higher than PSAT. For these reasons, TDEC-APC decided not to request a reasonable progress analysis from McGhee Tyson Airport. While reviewing the EPA's draft 2016v2 modeling platform, it was noted that NO_X and SO_2 emissions from McGhee Tyson airport were projected to be 299 tpy and 40 tpy, respectively, in 2026. These values are much lower than the VISTAS modeling projections for 2028 of 595 tpy for NO_X and 79 tpy for SO_2. It is not clear why the 2016v2 modeling platform has a much lower projection than the VISTAS modeling.

As stated previously, Tennessee considered several AoI thresholds for PSAT tagging. One of the thresholds considered, but not chosen, was a 2% threshold. Several VISTAS states did select a 2% AoI threshold (while others chose AoI thresholds that were higher or lower). With this in mind, Tennessee evaluated if there would have been any difference in the number of facilities selected for reasonable progress analysis if Tennessee had used a 2% AoI threshold for PSAT tagging. Sources with an AoI above 2% but below 3% are listed in Table 7-18. Note that the table listed all sources between 2% and 3% for Tennessee Class I areas but only Tennessee sources for non-Tennessee Class I areas.

Table 7-18: Sources that Would have been Selected by Tennessee for PSAT Tagging if a 2% AoI Threshold Had Been Used

State	Facility ID	Facility Name	GRSM Sulfate (%)	JOYC Sulfate (%)	COHU Sulfate (%)	MACA Sulfate (%)
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)	2.58%			
GA	13015-2813011	Ga Power Company - Plant Bowen	2.41%			
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	2.12%			
IN	18125-7362411	INDIANAPOLIS POWER & LIGHT PETERSBURG		2.41%		
IN	18051-7363111	Gibson		2.23%		
TN	47145-4979111	TVA KINGSTON FOSSIL PLANT			2.42%	
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT				2.61%

Of the seven facilities that had an AoI between 2% and 3% percent, five had been tagged by Tennessee because they had AoI above 3% for Class I areas other than the ones indicated in Table 7-18. The other two facilities, Indianapolis Power & Light's Petersburg Generating Station and Cinergy's Gibson Generating Station, both located in Indiana, were not tagged for PSAT modeling by Tennessee. However, as shown in Table 7-22, both of those sources were selected for PSAT analysis by other states. Therefore, the PSAT results for both of these sources, as well as all of the sources listed in Table 7-19 through Table 7-22 could be used by Tennessee for selecting sources for reasonable progress analysis. As a result, Tennessee ended up selecting ten facilities for reasonable progress analysis, three in Tennessee and seven in other states. This is slightly higher than the number of facilities (8) that were identified using the 3% AoI threshold. Therefore, Tennessee has concluded that both the two-step process and the AoI and PSAT thresholds used by Tennessee to identify sources for reasonable progress were valid.

In addition to sources selected by Tennessee, 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 Tennessee 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 7-19 lists PSAT tags selected for facilities in AL and FL. Table 7-20 lists PSAT tags selected for facilities in GA, KY, MS, NC, SC, and TN. Table 7-21 lists PSAT tags selected for facilities in VA and WV. Table 7-22 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.

Finally, the TDEC-APC also considered the fact that emissions are continuing to decline early in the second planning period and are expected to maintain a rate that is parallel with the URP for each of Tennessee's Class I areas based on the federal and state control programs and actions discuss in Section 7.2 of this SIP. Given these considerations, and the fact that the regional haze planning is an iterative process that requires the state to evaluate and adjust the LTS as needed during future planning periods, the TDEC-APC believes that the facilities selected by Tennessee and other VISTAS states for PSAT modeling is a reasonable number of facilities for which to evaluate further for reasonable progress analyses.

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 7-19: 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 7-20: 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 7-21: 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 7-22: 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	CENSARA	05063-1083411	ENTERGY ARKANSAS INC-INDEPENDENCE PLANT	32,050.48	14,133.10
MO	CENSARA	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

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 4.3 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.

Table 7-23 contains PSAT results for Great Smoky Mountains National Park. Seven (7) facilities where sulfate contributions are above 1.00% are included in the table and address more than 11.3% of the entire sulfate plus nitrate point source visibility impact in 2028. Table 7-24 contains PSAT results for Joyce Kilmer-Slickrock Wilderness Area. Eight (8) facilities where sulfate contributions are above 1.00% are included in the table and address more than 12.1% of the entire sulfate plus nitrate point source visibility impact in 2028. For both Class I areas located in Tennessee, the TDEC-APC believes the 1.00% threshold captures a reasonable set of sources of emissions to assess for determining what measures are necessary to make reasonable progress.

Table 7-25 through Table 7-29 contain the PSAT results for Tennessee facilities significantly impacting (sulfate contributions of at least 1.00%) Linville Gorge Wilderness Area (NC), Shining Rock Wilderness Area (NC), Cohutta Wilderness Area (GA), Sipsey Wilderness Area (AL), and Breton Wilderness Area (LA), respectively.

Eastman Chemical Company (47163-3982311) impacts five Class I areas (two inside Tennessee and three outside Tennessee). TVA Cumberland impacts four Class I areas (all four outside Tennessee). Eastman Chemical Company and TVA Cumberland's projected 2028 SO_2 emissions are 6,420 TPY and 8,427 TPY, respectively. The TDEC-APC believes that by selecting these two facilities for reasonable progress analysis this captures a meaningful portion of the Tennessee's total contribution to visibility impairment to Class I areas.

Table 7-30 through Table 7-39 contain the PSAT results for Eastman Chemical Company, TVA Cumberland, TVA Kingston, Cemex Knoxville, and Tate and Lyle and are sorted beginning with the highest PSAT percentage. The PSAT results for TVA Bull Run are not included since they are all zero percent since TVA Bull Run's emissions were set to zero in the second modeling run for 2028. Table 7-30 and Table 7-31 contain PSAT sulfate and nitrate results for Eastman Chemical Company. Table 7-32 and Table 7-33 contain PSAT sulfate and nitrate results for TVA Cumberland. Table 7-34 and Table 7-35 contain PSAT sulfate and nitrate results for TVA Kingston. Table 7-36 and Table 7-37 contain PSAT sulfate and nitrate results for Cemex Knoxville. Table 7-38 and Table 7-39 contain PSAT sulfate and nitrate results for Tate and Lyle.

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

Table 7-23: PSAT Results for Great Smoky Mountains National Park

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised Total EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised Total EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)	401	0.520	13.226	3.93%	0.003	13.226	0.02%
KY	21145-6037011	Tennessee Valley Authority (TVA) - Shawnee Fossil Plant	465	0.183	13.226	1.38%	0.011	13.226	0.08%
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	160	0.170	13.226	1.29%	0.007	13.226	0.05%
PA	42005-3866111	GENON NE MGMT CO/KEYSTONE STA	688	0.166	13.226	1.26%	0.001	13.226	0.01%
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT	375	0.166	13.226	1.25%	0.035	13.226	0.26%
IN	18051-7363111	Gibson	456	0.146	13.226	1.11%	0.037	13.226	0.28%
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	360	0.136	13.226	1.03%	0.003	13.226	0.02%

Table 7-24: PSAT Results for Joyce Kilmer-Slickrock Wilderness Area

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)	425	0.473	13.031	3.63%	0.002	13.031	0.02%
KY	21145-6037011	Tennessee Valley Authority (TVA) - Shawnee Fossil Plant	472	0.189	13.031	1.45%	0.014	13.031	0.11%
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	179	0.178	13.031	1.37%	0.003	13.031	0.02%
PA	42005-3866111	GENON NE MGMT CO/KEYSTONE STA	711	0.154	13.031	1.18%	0.000	13.031	0.00%
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT	391	0.154	13.031	1.18%	0.030	13.031	0.23%
GA	13015-2813011	Ga Power Company - Plant Bowen	166	0.152	13.031	1.17%	0.001	13.031	0.01%
IN	18051-7363111	Gibson	472	0.139	13.031	1.07%	0.029	13.031	0.22%
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	385	0.137	13.031	1.05%	0.002	13.031	0.01%

Table 7-25: PSAT Results for Tennessee Facilities Significantly Impacting Linville Gorge Wilderness Area (NC)

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	81	0.522	12.266	4.26%	0.013	12.266	0.11%
TN	47161-4979311	TVA Cumberland Fossil Plant	516	0.154	12.266	1.26%	0.001	12.266	0.01%

Table 7-26: PSAT Results for Tennessee Facilities Significantly Impacting Shining Rock Wilderness Area (NC)

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
TN	47161-4979311	TVA Cumberland Fossil Plant	454	0.162	11.746	1.38%	0.002	11.746	0.02%
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	127	0.128	11.746	1.09%	0.003	11.746	0.03%

Table 7-27: PSAT Results for Tennessee Facilities Significantly Impacting Cohutta Wilderness Area (GA)

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
TN	47163-3982311	EASTMAN CHEMICAL COMPANY	270	0.165	12.558	1.31%	0.012	12.558	0.10%

Table 7-28: PSAT Results for Tennessee Facilities Significantly Impacting Sipsey Wilderness Area (AL)

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
TN	47161-4979311	TVA Cumberland Fossil Plant	229	0.242	15.470	1.56%	0.028	15.470	0.18%

Table 7-29: PSAT Results for Tennessee Facilities Significantly Impacting Breton Wilderness Area (LA)

State	Facility ID	Facility Name	Distance (km)	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
TN	47161-4979311	TVA Cumberland Fossil Plant	730	0.152	15.046	1.01%	0.028	15.470	0.18%

Table 7-30: PSAT Sulfate Results for Eastman Chemical Company

Class I Area	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %
Linville Gorge Wilderness Area	0.522	12.266	4.26%
Joyce Kilmer-Slickrock Wilderness Area	0.178	13.031	1.37%
Cohutta Wilderness Area	0.165	12.558	1.31%
Great Smoky Mountains National Park	0.170	13.226	1.29%
Shining Rock Wilderness Area	0.128	11.746	1.09%
Swanquarter Wilderness Area	0.075	10.292	0.73%
Cape Romain Wilderness Area	0.090	13.483	0.67%
Wolf Island Wilderness Area	0.077	12.508	0.62%
Okefenokee Wilderness Area	0.077	12.955	0.59%
James River Face Wilderness Area	0.065	13.557	0.48%
Everglades National Park	0.004	1.303	0.31%
Sipsey Wilderness Area	0.046	15.470	0.30%
Otter Creek Wilderness Area	0.051	17.919	0.28%
Acadia National Park	0.009	3.363	0.27%
Dolly Sods Wilderness Area	0.046	18.173	0.25%
Lye Brook Wilderness Area	0.020	8.708	0.23%
Shenandoah National Park	0.033	14.387	0.23%
Chassahowitzka Wilderness Area	0.022	9.760	0.23%
Great Gulf Wilderness Area	0.012	5.491	0.22%
Presidential Range-Dry River Wilderness Area	0.012	5.491	0.22%

Table 7-31: PSAT Nitrate Results for Eastman Chemical Company

Class I Area	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
Linville Gorge Wilderness Area	0.013	12.266	0.11%
Cohutta Wilderness Area	0.012	12.558	0.10%
Great Smoky Mountains National Park	0.007	13.226	0.05%
Swanquarter Wilderness Area	0.005	10.292	0.05%
Cape Romain Wilderness Area	0.006	13.483	0.04%
Brigantine Wilderness Area	0.005	13.524	0.04%
Moosehorn Wilderness Area	0.001	2.821	0.04%
Roosevelt Campobello International Park	0.001	2.821	0.04%
Wolf Island Wilderness Area	0.004	12.508	0.03%
Acadia National Park	0.001	3.363	0.03%
James River Face Wilderness Area	0.004	13.557	0.03%
Sipsey Wilderness Area	0.004	15.470	0.03%
Shining Rock Wilderness Area	0.003	11.746	0.03%
Okefenokee Wilderness Area	0.003	12.955	0.02%
Joyce Kilmer-Slickrock Wilderness Area	0.003	13.031	0.02%
Theodore Roosevelt National Park	0.001	4.785	0.02%
Great Gulf Wilderness Area	0.001	5.491	0.02%
Presidential Range-Dry River Wilderness Area	0.001	5.491	0.02%
Seney Wilderness Area	0.002	13.458	0.01%
Lye Brook Wilderness Area	0.001	8.708	0.01%

Table 7-32: PSAT Sulfate Results for TVA Cumberland

Class I Area	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %
Sipsey Wilderness Area	0.242	15.470	1.56%
Shining Rock Wilderness Area	0.162	11.746	1.38%
Linville Gorge Wilderness Area	0.154	12.266	1.26%
Breton Wilderness Area	0.152	15.046	1.01%
Otter Creek Wilderness Area	0.179	17.919	0.99%
Dolly Sods Wilderness Area	0.167	18.173	0.92%
Mammoth Cave National Park	0.210	23.835	0.88%
Cohutta Wilderness Area	0.089	12.558	0.71%
Wolf Island Wilderness Area	0.086	12.508	0.69%
Shenandoah National Park	0.092	14.387	0.64%
Chassahowitzka Wilderness Area	0.062	9.760	0.64%
Okefenokee Wilderness Area	0.081	12.955	0.63%
Joyce Kilmer-Slickrock Wilderness Area	0.079	13.031	0.61%
Great Smoky Mountains National Park	0.080	13.226	0.60%
Mingo Wilderness Area	0.102	21.023	0.49%
Great Gulf Wilderness Area	0.026	5.491	0.47%
Presidential Range-Dry River Wilderness Area	0.026	5.491	0.47%
Cape Romain Wilderness Area	0.061	13.483	0.45%
James River Face Wilderness Area	0.059	13.557	0.44%
St. Marks Wilderness Area	0.049	11.390	0.43%

Table 7-33: PSAT Nitrate Results for TVA Cumberland

Class I Area	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
Sipsey Wilderness Area	0.028	15.470	0.18%
Mammoth Cave National Park	0.041	23.835	0.17%
Mingo Wilderness Area	0.027	21.023	0.13%
Chassahowitzka Wilderness Area	0.006	9.760	0.06%
Joyce Kilmer-Slickrock Wilderness Area	0.006	13.031	0.05%
Cape Romain Wilderness Area	0.006	13.483	0.04%
Seney Wilderness Area	0.005	13.458	0.04%
Great Smoky Mountains National Park	0.004	13.226	0.03%
Acadia National Park	0.001	3.363	0.03%
Okefenokee Wilderness Area	0.003	12.955	0.02%
Lye Brook Wilderness	0.002	8.708	0.02%
Hercules-Glades Wilderness Area	0.004	17.771	0.02%
Upper Buffalo Wilderness Area	0.003	13.400	0.02%
Theodore Roosevelt National Park	0.001	4.785	0.02%
Great Gulf Wilderness Area	0.001	5.491	0.02%
Presidential Range-Dry River Wilderness Area	0.001	5.491	0.02%
Shining Rock Wilderness Area	0.002	11.746	0.02%
Otter Creek Wilderness Area	0.003	17.919	0.02%
Dolly Sods Wilderness Area	0.003	18.173	0.02%
Wolf Island Wilderness Area	0.002	12.508	0.02%

Table 7-34: PSAT Sulfate Results for TVA Kingston

Class I Area	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %
Joyce Kilmer-Slickrock Wilderness Area	0.0535	13.031	0.41%
Great Smoky Mountains National Park	0.0535	13.226	0.40%
Cohutta Wilderness Area	0.0445	12.558	0.35%
Shining Rock Wilderness Area	0.0216	11.746	0.18%
Linville Gorge Wilderness Area	0.0225	12.266	0.18%
Okefenokee Wilderness Area	0.0110	12.955	0.09%
Wolf Island Wilderness Area	0.0106	12.508	0.08%
Cape Romain Wilderness Area	0.0103	13.483	0.08%
St. Marks Wilderness Area	0.0072	11.390	0.06%
Swanquarter Wilderness Area	0.0054	10.292	0.05%
James River Face Wilderness Area	0.0054	13.557	0.04%
Chassahowitzka Wilderness Area	0.0031	9.760	0.03%
Sipsey Wilderness Area	0.0045	15.470	0.03%
Bosque del Apache Wilderness Area	0.0002	0.805	0.03%
Breton Wilderness Area	0.0029	15.046	0.02%
Otter Creek Wilderness Area	0.0034	17.919	0.02%
Dolly Sods Wilderness Area	0.0031	18.173	0.02%
Everglades National Park	0.0002	1.303	0.02%
Shenandoah National Park	0.0025	14.387	0.02%
White Mountain Wilderness Area	0.0002	1.341	0.02%

Table 7-35: PSAT Nitrate Results for TVA Kingston

Class I Area	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
Joyce Kilmer-Slickrock Wilderness Area	0.0043	13.031	0.033%
Great Smoky Mountains National Park	0.0036	13.226	0.027%
Cohutta Wilderness Area	0.0025	12.558	0.020%
Cape Romain Wilderness Area	0.0009	13.483	0.007%
Sipsey Wilderness Area	0.0009	15.470	0.006%
Shining Rock Wilderness Area	0.0007	11.746	0.006%
Theodore Roosevelt National Park	0.0002	4.785	0.005%
Swanquarter Wilderness Area	0.0004	10.292	0.004%
Chassahowitzka Wilderness Area	0.0002	9.760	0.002%
St. Marks Wilderness Area	0.0002	11.390	0.002%
Mammoth Cave National Park	0.0004	23.835	0.002%
Linville Gorge Wilderness Area	0.0002	12.266	0.002%
Wolf Island Wilderness Area	0.0002	12.508	0.002%
Okefenokee Wilderness Area	0.0002	12.955	0.002%
Brigantine Wilderness Area	0.0002	13.524	0.002%

Table 7-36: PSAT Sulfate Results for Cemex Knoxville

Class I Area	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %
Great Smoky Mountains National Park	0.0150	13.226	0.113%
Joyce Kilmer-Slickrock Wilderness Area	0.0140	13.031	0.107%
Cohutta Wilderness Area	0.0060	12.558	0.048%
Linville Gorge Wilderness Area	0.0050	12.266	0.041%
Shining Rock Wilderness Area	0.0040	11.746	0.034%
Theodore Roosevelt National Park	0.0010	4.785	0.021%
Wolf Island Wilderness Area	0.0020	12.508	0.016%
Okefenokee Wilderness Area	0.0020	12.955	0.015%
Cape Romain Wilderness Area	0.0020	13.483	0.015%
Sipsey Wilderness Area	0.0020	15.470	0.013%
Chassahowitzka Wilderness Area	0.0010	9.760	0.010%
Swanquarter Wilderness Area	0.0010	10.292	0.010%
St. Marks Wilderness Area	0.0010	11.390	0.009%
Brigantine Wilderness Area	0.0010	13.524	0.007%
Shenandoah National Park	0.0010	14.387	0.007%
Breton Wilderness Area	0.0010	15.046	0.007%
Otter Creek Wilderness Area	0.0010	17.919	0.006%

Table 7-37: PSAT Nitrate Results for Cemex Knoxville

Class I Area	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
Great Smoky Mountains National Park	0.0060	13.226	0.045%
Cohutta Wilderness Area	0.0040	12.558	0.032%
Joyce Kilmer-Slickrock Wilderness Area	0.0040	13.031	0.031%
Theodore Roosevelt National Park	0.0010	4.785	0.021%
Shining Rock Wilderness Area	0.0020	11.746	0.017%
Chassahowitzka Wilderness Area	0.0010	9.760	0.010%
Swanquarter Wilderness Area	0.0010	10.292	0.010%
Linville Gorge Wilderness Area	0.0010	12.266	0.008%
Wolf Island Wilderness Area	0.0010	12.508	0.008%
Okefenokee Wilderness Area	0.0010	12.955	0.008%
Cape Romain Wilderness Area	0.0010	13.483	0.007%
Brigantine Wilderness Area	0.0010	13.524	0.007%
Sipsey Wilderness Area	0.0010	15.470	0.006%

Table 7-38: PSAT Sulfate Results for Tate & Lyle

Class I Area	Final Revised Sulfate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Sulfate PSAT, %
Great Smoky Mountains National Park	0.0092	13.226	0.069%
Joyce Kilmer-Slickrock Wilderness Area	0.0081	13.031	0.062%
Cohutta Wilderness Area	0.0074	12.558	0.059%
Linville Gorge Wilderness Area	0.0042	12.266	0.034%
Shining Rock Wilderness Area	0.0039	11.746	0.033%
Okefenokee Wilderness Area	0.0025	12.955	0.019%
Wolf Island Wilderness Area	0.0021	12.508	0.017%
Cape Romain Wilderness Area	0.0021	13.483	0.016%
Swanquarter Wilderness Area	0.0014	10.292	0.014%
Sipsey Wilderness Area	0.0018	15.470	0.011%
Chassahowitzka Wilderness Area	0.0011	9.760	0.011%
Acadia National Park	0.0004	3.363	0.010%
St. Marks Wilderness Area	0.0011	11.390	0.009%
Theodore Roosevelt National Park	0.0004	4.785	0.007%
Great Gulf Wilderness Area	0.0004	5.491	0.006%
Presidential Range-Dry River Wilderness Area	0.0004	5.491	0.006%
James River Face Wilderness Area	0.0007	13.557	0.005%
Breton Wilderness Area	0.0007	15.046	0.005%
Lye Brook Wilderness Area	0.0004	8.708	0.004%
Otter Creek Wilderness Area	0.0007	17.919	0.004%

Table 7-39: PSAT Nitrate Results for Tate & Lyle

Class I Area	Final Revised Nitrate PSAT (Mm^{-1})	Final Revised EGU+NEG (Mm^{-1})	Final Revised Nitrate PSAT, %
Cohutta Wilderness Area	0.0018	12.558	0.015%
Great Smoky Mountains National Park	0.0016	13.226	0.012%
Joyce Kilmer-Slickrock Wilderness Area	0.0013	13.031	0.010%
Theodore Roosevelt National Park	0.0003	4.785	0.005%
Chassahowitzka Wilderness Area	0.0003	9.760	0.003%
Swanquarter Wilderness Area	0.0003	10.292	0.003%
Shining Rock Wilderness Area	0.0003	11.746	0.002%
Wolf Island Wilderness Area	0.0003	12.508	0.002%
Okefenokee Wilderness Area	0.0003	12.955	0.002%
Cape Romain Wilderness Area	0.0003	13.483	0.002%
Brigantine Wilderness Area	0.0003	13.524	0.002%
Sipsey Wilderness Area	0.0003	15.470	0.002%

7.6.3. AoI versus PSAT Contributions

After the PSAT modeling was completed, a comparison was made of PSAT results to AoI results. The PSAT results used in this comparison did not incorporate any PSAT adjustments discussed in Appendix E-7b to better match the emissions used in the AoI analysis. Only PSAT contributions greater than or equal to 1.00% were included in the analysis. Figure 7-54 shows three plots of the ratio of AoI/PSAT contributions for sulfate, nitrate, and sulfate + nitrate, respectively, as a function of distance from the facility to the Class I area. Figure 7-55 shows three plots of the fractional bias for sulfate, nitrate, and sulfate + nitrate, respectively, as a function of distance from the facility to the Class I area. Fraction bias (FB) is equal to 2*(AoI – PSAT)/(AoI + PSAT). Fractional bias gives equal weight to over predictions and under predictions. If FB equals 100%, then the AOI contribution is three times higher than the PSAT contribution.

Based on Figure 7-54 and Figure 7-55, AoI tends to overestimate impacts for facilities near the Class I area. In fact, if the facility is less than 100 km from the Class I area, the AoI results are generally (with a few exceptions for nitrates) three times or more higher than the PSAT results. Even in those exceptions, those AoI-computed nitrate impacts for facilities close to a Class I area were always higher than PSAT-computed nitrate impacts.

As a result, some sources near a Class I area were tagged for PSAT but were found to not have a significant contribution to visibility impairment. PSAT is the most reliable modeling tool for tracking facility contributions to visibility impairment at Class I areas. Therefore, AoI impacts for nearby sources can be adjusted downward to remove the systematic bias in the contributions. Also, AoI tends to underestimate impacts for facilities in other states that are far away from the Class I area. Although AoI may underestimate the impact of some far away sources, the visibility impairment of those sources were likely included in the PSAT analysis and found to be significantly contributing to visibility impairment in the Class I area because they were tagged for PSAT analysis by states with Class I areas that are closer to those sources.

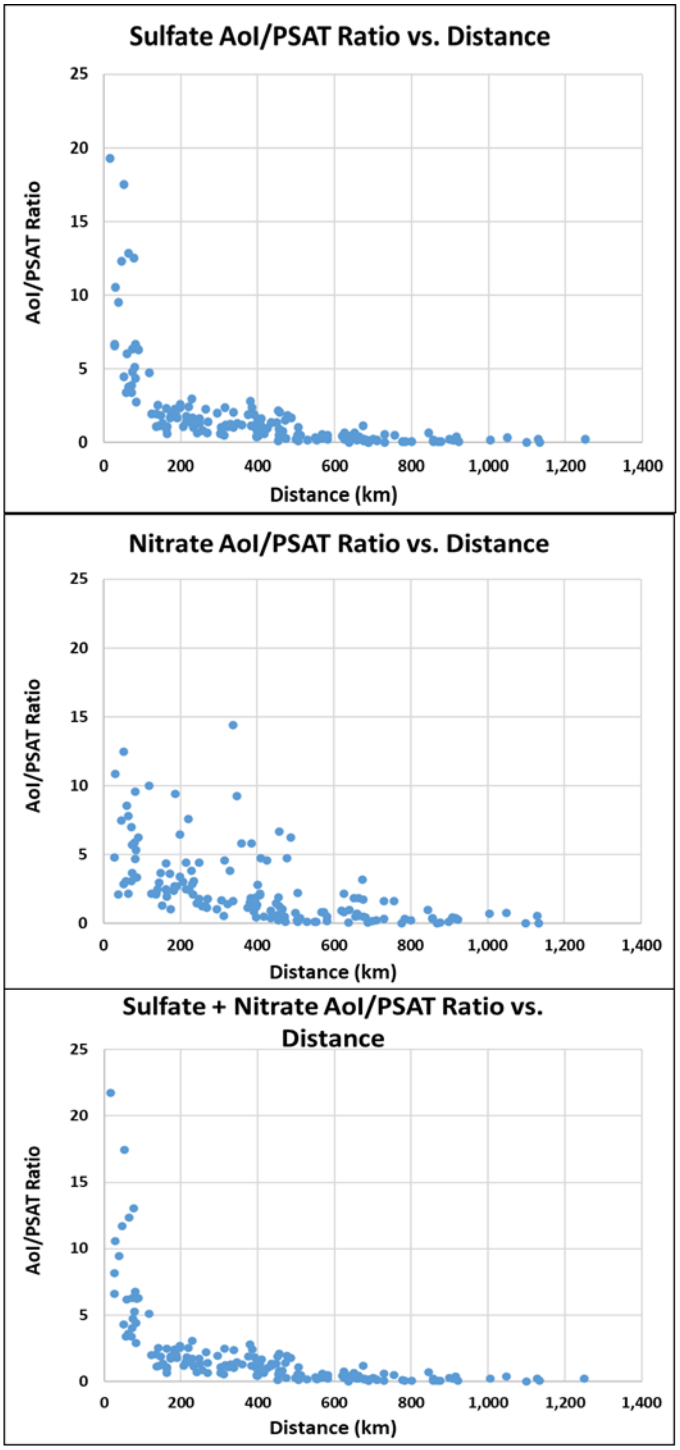


Figure 7-54: Ratio of AoI/PSAT % Contributions for Sulfate as a Function of Distance from the Facility to the Class I Area

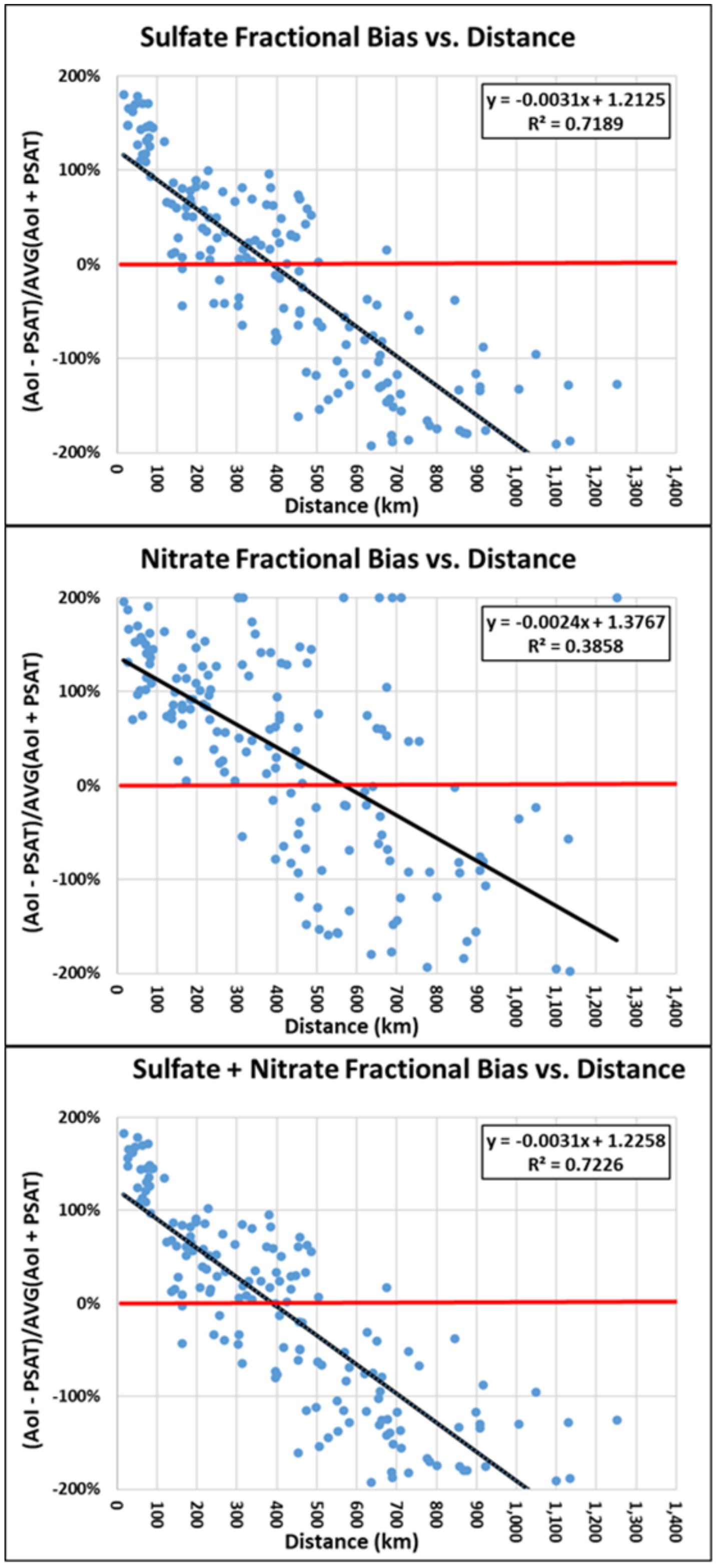


Figure 7-55: Fractional Bias for Sulfate as a Function of Distance from the Facility to the Class I Area

7.6.4. 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 EPA guidance (on page 10) 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 goes on to discuss which pollutants to consider. The 2019 EPA guidance discusses methods for estimating baseline visibility impacts for selected sources, including residence time analysis and photochemical modeling, both of which were used by Tennessee 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. Tennessee, as well as the other 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. 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. This process also resulted in selecting a number of sources that Tennessee, and states that contribute to Tennessee Class I areas, could analyze with the limited resources available to the state. Sources selected for analysis by Tennessee include sources that contribute to visibility impairment in both Tennessee and non-Tennessee Class I areas. Thresholds selected by Tennessee for each of the steps are discussed in this document. As explained in Section 7.6.3, PSAT modeling resulted in significantly different results than the AoI analysis. Therefore, it is appropriate to have different percentage thresholds for these two steps in the selection process. EPA's guidance states, "Whatever threshold is used, the state must justify why the use of that threshold is a reasonable approach…" The justification for the thresholds used in both steps of the selection process are described in this plan.

In the regional haze SIPs developed for the first round of planning, many VISTAS states used the AoI approach and a 1% threshold by unit. In this second round of planning for regional haze SIPs, all VISTAS states are using the AOI/PSAT approach and a ≥ 1.00% PSAT threshold by facility for screening sources for reasonable progress evaluation. Using a facility basis for emission estimates will pull in more facilities as compared to a unit basis for emission estimates. Overall, the VISTAS screening approach results in a reasonable number of sources that can be evaluated with limited state resources and focuses on the sources and pollutants with the largest impacts.

Based on the analysis above, nine facilities were identified to evaluate additional controls for reasonable progress for Tennessee's Class I areas. Table 7-40 contains a list of facilities in Tennessee selected for reasonable progress analysis. Table 7-41 contains a list of facilities in VISTAS states (not including Tennessee) selected for reasonable progress analysis. Table 7-42 contains a list of facilities in non-VISTAS states selected for reasonable progress analysis.

Table 7-40: Facilities in Tennessee Selected for Reasonable Progress Analysis

State	Facility ID	Facility Name
TN	47163-3982311	EASTMAN CHEMICAL COMPANY
TN	47161-4979311	TVA CUMBERLAND FOSSIL PLANT

Table 7-41: Facilities in VISTAS States (not including Tennessee) Selected for Reasonable Progress Analysis

State	Facility ID	Facility Name
GA	13015-2813011	Ga Power Company - Plant Bowen
KY	21145-6037011	Tennessee Valley Authority (TVA) - Shawnee Fossil Plant

Table 7-42: Facilities Located Outside of VISTAS States Selected for Reasonable Progress Analysis

State	Facility ID	Facility Name
IN	18051-7363111	Gibson
IN	18147-8017211	INDIANA MICHIGAN POWER DBA AEP ROCKPORT
OH	39025-8294311	Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)
OH	39053-8148511	General James M. Gavin Power Plant (0627010056)
PA	42005-3866111	GENON NE MGMT CO/KEYSTONE STA

TVA was contacted on February 13, 2020, and asked to perform a reasonable progress analysis on TVA Cumberland and TVA Kingston. Eastman Chemical Company was contacted on May 15, 2020, and asked to perform a reasonable progress analysis.

Initial PSAT results showed that TVA Kingston was above the 1.00% PSAT threshold for Great Smoky Mountains National Park, Joyce Kilmer-Slickrock Wilderness Area, and Cohutta Wilderness Area. In a letter dated February 28, 2020, TVA provided projected 2028 SO_2 emissions (435 TPY) for TVA Kingston that were substantially below the projected 2028 SO_2 emissions (1,886 TPY) used in the VISTAS modeling, which was based on ERTAC projections. In the letter, TVA stated that emission estimates were based on TVA's Strategic Power Supply Plan, which includes both capacity and generation projections for all of TVA's assets through 2040. Also, TVA stated that TVA Kingston is currently TVA's most expensive coal asset to operate. TVA's letter states that based on capacity factors, TVA Kingston is considered a "Base Dispatchable/Intermediate" asset now, but is scheduled to transition to a "Peaking Economic/Reliability" asset beginning in 2026. As stated in Section 7.2.2.1, the TVA proposed the retirement of three units at TVA Kingston as early as 2026, but no later than 2031, and the remaining six units as early as 2027, but no later than 2033. The TDEC-APC believes that TVA Kingston is well-controlled, will continue to implement its existing measures, and will not increase its emission rate. More information about TVA Kingston can be found in Appendix G-1. The PSAT results for TVA Kingston were linearly scaled to reflect these updated 2028 emissions in the same manner that other PSAT results were adjusted as described in section 7.6.2. As a result, the final revised PSAT sulfate percentages were 0.40% for Great Smoky Mountains National Park, 0.41% for Joyce Kilmer-Slickrock Wilderness Area, and 0.35% for Cohutta Wilderness Area. In a letter dated March 30, 2020, TDEC-APC notified TVA that the TVA Kingston facility would not be required to perform a reasonable progress analysis since the PSAT value was well below the 1.00% threshold based on the revised emissions projection.

TVA Cumberland and Eastman Chemical Company both performed a reasonable progress analysis. These analyses are discussed in detail in Section 7.8.

The states of Kentucky and Georgia were contacted on October 23, 2020, and asked to perform a reasonable progress analysis for the facilities listed in Table 7-41. The states of Indiana, Ohio, and Pennsylvania were contacted on June 22, 2020, and asked to perform a reasonable progress analysis for the facilities listed in Table 7-42.[59] A copy of these letters can be found in Appendix F.

7.6.5. 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.

Tennessee examined the 2017, 2018, and 2019 emission information that has been reported to EPA and compared these emissions to the 2028 emissions that were used in the modeling. Table 7-43 shows all the facilities with SO_2 emissions greater than 100 tpy in 2017, and Table 7-44 shows all the facilities with NO_X emissions greater than 100 tpy in 2017. Table 7-43 is sorted from highest SO_2 in 2017 to lowest. Table 7-44 is sorted from highest NO_X in 2017 to lowest. In addition to 2017 emissions, the tables have 2018 and 2019 emissions, if available. Projected emissions for 2028 are also shown. One column has the 2028 original value that was used in the first run on the model, and another column has the 2028 remodel value that was used in the second run of the model. The last three column show the difference between the 2028 remodel value and 2017, 2018, and 2019 values, respectively.

Large differences (greater than 1,000 tpy) between 2028 and 2017/18/19 emissions are noted for the following reasons:

- Eastman Chemical repowered five coal-fired boilers to natural gas with the last repower occurring in October 2018. As a result, projected 2028 SO_2 value is lower than 2017 and 2018 emissions. Eastman also added temporary SO_2 controls[60] on two boilers on June 1, 2019. Therefore, projected 2028 SO_2 value is higher than 2019 emissions. This facility,

[59] VISTAS sent letters to IN, OH, and PA. URL: https://www.metro4-sesarm.org/content/consultation-non-vistas-states

[60] A trailer-mounted temporary rental system is currently in operation and has achieved an overall control efficiency rate of approximately 50% since its deployment on June 1, 2019. Eastman estimates the permanent system will achieve an overall average removal efficiency of 60%. Eastman expects the permanent DSI system to be more reliable and perform at a higher rate than the rental system. The rental system consists of one train serving two boilers whereas the permanent system will consist of one train for each boiler plus a spare train. It will also have a dehumidifier on each train which will reduce plugging incidents.

including the two boilers with temporary SO_2 controls, is subject to four-factor analysis requirements.

- TVA Allen recently retired the coal-fired units (on March 31, 2018), so 2028 SO_2 and NO_X values are much lower than 2017 and 2018 values.

- TVA Johnsonville recently retired the coal-fired units, so 2028 SO_2 and NO_X values are much lower than 2017 values. Units 5-10 were retired on December 31, 2015, and Units 1-4 were retired on December 31, 2017.

- TVA Bull Run will retire by the end of 2023, so 2028 SO_2 and NO_X values are much lower than 2017, 2018, and 2019 values.

- Based on information provided by the company, TVA Kingston will be dispatched less frequently than in the recent past. As a result, 2028 SO_2 and NO_X values are much lower than 2017/18/19 values. Documentation regarding this operation change is included in Appendix G-1.

- TVA Gallatin recently installed NO_X controls, so 2028 NO_X values are much lower than 2017 values. All SCRs were installed and operational by December 2017.

- TVA Cumberland is expected to be dispatched more frequently in the future according to ERTAC predictions, so 2028 SO_2 and NO_X values are much higher than 2017, 2018, and 2019 values. TVA Cumberland is subject to four-factor analysis requirements.

- Holston Army was issued a PSD construction permit numbered 974192 on October 8, 2018, for the replacement of the facility's coal-fired boilers with natural gas-fired boilers. As a result, the 2028 SO_2 value is much lower than the 2017, 2018, and 2019 values.

- Based on EPA projections from the 2011 modeling platform, NOx emissions from Memphis Intl. Airport are expected to grow from 1728 tpy in 2017 and 2018 to 3457 tpy in 2028. As stated in Section 4.2.1.2, EPA based airport emissions in 2028 on projected itinerate information available from the FAA's TAF system. However, EPA’s draft 2016v2 modeling platform projects NO_X emissions to be only 2021 tpy for 2026. This is significantly lower than the 2028 projection from the 2011 modeling platform.

- Tennessee Gas Pipeline (Station 860) has a projected 2028 NO_X value that is lower than 2017, 2018, and 2019 values. However, even at the highest emission rate (2018), the maximum visibility contribution to any Class I area would be below the threshold used to select sources for reasonable progress analysis discussed in Section 7.6.1.

Changes at the TVA facilities and Holston Army are discussed in more detail in Section 7.2.2. Tennessee primarily relied on evaluation of 2028 emissions for screening sources for reasonable progress analysis and developing a long-term strategy. While there are some facilities where the most recent 2017, 2018, and/or 2019 emissions are significantly higher than the 2028 emissions used in the modeling and for the selection of sources for reasonable progress analysis, all of these differences, except for Tennessee Gas Pipeline, are due to 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. The recent NO_X emissions at Tennessee Gas Pipeline Station 860 is not significant enough to alter Tennessee's conclusion that this facility does not significantly contribute to visibility impairment at any Class I area. In summary, review of the 2017, 2018, and 2019 emissions data does not change Tennessee's conclusions regarding reasonable progress or the long-term strategy.

Table 7-43: SO_2 Emissions Comparison Between 2017, 2018, 2019, and 2028

EIS Facility ID	Facility	SO_2 2017 (tpy)	SO_2 2018 (tpy)	SO_2 2019 (tpy)	SO_2 2028 Original (tpy)	SO_2 2028 Remodel (tpy)	SO_2 2028 Remodel minus 2017 (tpy)	SO_2 2028 Remodel minus 2018 (tpy)	SO_2 2028 Remodel minus 2019 (tpy)
3982311	EASTMAN CHEMICAL COMPANY	10,747	9,116	4,510	6,420	6,420	-4,326	-2,696	1,910
5720111	Allen Fossil Plant	7,636	902	14	39	39	-7,597	-863	25
4979311	TVA CUMBERLAND FOSSIL PLANT	6,649	7,408	7,209	8,427	8,427	1,778	1,019	1,218
5720911	TVA JOHNSONVILLE FOSSIL PLANT	6,312	3	3	0	0	-6,312	-3	-3
4979111	TVA KINGSTON FOSSIL PLANT	1,999	1,327	1,917	1,886	424	-1,574	-903	-1,493
5018911	HOLSTON ARMY AMMUNITION PLANT (HSAAP)	1,768	1,621	1,389	6	6	-1,761	-1,615	-1,383
5610411	TVA GALLATIN FOSSIL PLANT	1,112	1,828	1,735	1,116	1,116	4	-712	-619
4963011	PACKAGING CORPORATION OF AMERICA	616	616	348	638	638	22	22	290
6196011	TVA BULL RUN FOSSIL PLANT	563	199	308	623	0	-563	-199	-308
2934811	AGC INDUSTRIES - GREENLAND PLANT	441	441	421	442	442	1	1	21
4964211	NYRSTAR CLARKSVILLE, INC.	401	324	233	402	402	1	78	169
6194311	Lucite International Inc	333	366	N/A	343	343	10	-23	N/A
9171111	Memphis Intl	231	231	N/A	314	314	83	83	N/A
6444111	Resolute Forest Products - Calhoun Operations	218	328	308	322	322	104	-7	13
4759811	Carlex Glass America, LLC	203	203	N/A	104	104	-99	-99	N/A
4129211	TATE & LYLE, Loudon	170	173	156	473	167	-4	-6	11
7156311	FLORIM USA, INC.	150	150	N/A	106	106	-44	-44	N/A
4979911	Cemex Construction Materials Atlantic, LLC - Knoxville Plant	122	114	N/A	121	121	0	7	N/A
3100911	Owens Corning Composite Materials, LLC	106	106	107	127	127	21	22	21

Table 7-44: NOx Emissions Comparison Between 2017, 2018, 2019, and 2028

EIS Facility ID	Facility	NO_x 2017 (tpy)	NO_x 2018 (tpy)	NO_x 2019 (tpy)	NO_x 2028 Original (tpy)	NO_x 2028 Remodel (tpy)	NO_x 2028 Remodel minus 2017 (tpy)	NO_x 2028 Remodel minus 2018 (tpy)	NO_x 2028 Remodel minus 2019 (tpy)
3982311	EASTMAN CHEMICAL COMPANY	6,585	6,123	4,302	6,900	6,900	315	777	2,598
5610411	TVA GALLATIN FOSSIL PLANT	5,253	1,304	1,345	1,316	1,316	-3,937	12	-29
4979311	TVA CUMBERLAND FOSSIL PLANT	3,380	4,303	3,932	4,917	4,917	1,537	613	984
2934811	AGC INDUSTRIES - GREENLAND PLANT	2,068	2,068	1,992	2,068	2,068	0	0	76
5720911	TVA JOHNSONVILLE FOSSIL PLANT	1,901	245	66	102	102	-1,799	-143	36
9171111	Memphis Intl	1,728	1,728	N/A	3,457	3,457	1,730	1,730	N/A
4979111	TVA KINGSTON FOSSIL PLANT	1,692	1,158	1,259	1,687	380	-1,313	-778	-879
5720111	Allen Fossil Plant	1,590	277	227	393	393	-1,197	116	166
2897111	TENNESSEE GAS PIPELINE COMPANY, L.L.C., STATION 860	1,484	1,630	965	588	588	-896	-1,042	-377
4979911	Cemex Construction Materials Atlantic, LLC - Knoxville Plant	1,462	656	N/A	712	712	-751	56	N/A
4963011	PACKAGING CORPORATION OF AMERICA	1,416	1,416	1,437	1,364	1,364	-52	-52	-73
6196011	TVA BULL RUN FOSSIL PLANT	1,312	794	741	964	0	-1,312	-794	-741
4761511	Signal Mountain Cement Company d/b/a Buzzi Unicem USA	1,263	1,263	N/A	1,357	1,357	94	94	N/A
6193211	TENNESSEE GAS PIPELINE COMPANY, L.L.C., STATION 87	1,076	1,090	982	185	185	-891	-906	-797
6444111	Resolute Forest Products - Calhoun Operations	920	1,212	1,133	961	961	41	-251	-172
3982611	DOMTAR PAPER COMPANY, LLC - KINGSPORT MILL	815	815	N/A	771	771	-44	-44	N/A
4963911	E I Dupont De Nemours & Company Inc	810	816	N/A	887	887	77	71	N/A
4759811	Carlex Glass America, LLC	764	764	N/A	851	851	88	88	N/A
9179011	Nashville Intl	504	504	N/A	936	936	432	432	N/A
5720811	Hood Container Corporation	363	434	407	0	0	-363	-434	-407
7156111	Valero Refining Co. (Prev. Premcor Refining, Prev. Williams Refining Llc)	362	384	N/A	354	354	-8	-30	N/A

EIS Facility ID	Facility	NO_x 2017 (tpy)	NO_x 2018 (tpy)	NO_x 2019 (tpy)	NO_x 2028 Original (tpy)	NO_x 2028 Remodel (tpy)	NO_x 2028 Remodel minus 2017 (tpy)	NO_x 2028 Remodel minus 2018 (tpy)	NO_x 2028 Remodel minus 2019 (tpy)
5018911	HOLSTON ARMY AMMUNITION PLANT (HSAAP)	357	340	299	235	235	-122	-105	-64
4964011	O-N MINERALS (LUTTRELL) COMPANY	350	350	N/A	350	350	0	0	N/A
4188011	TENNESSEE GAS PIPELINE COMPANY, L.L.C., STATION 555	315	502	609	0	0	-315	-502	-609
4129211	TATE & LYLE, Loudon	275	447	270	883	230	-45	-217	-40
9159211	Mc Ghee Tyson	229	229	N/A	595	595	366	366	N/A
5706111	PMC Biogenix (formerly Crompton Corporation/ Enenco)	222	226	N/A	189	189	-33	-37	N/A
3094311	COLUMBIA GULF TRANSMISSION COMPANY - HAMPSHIRE COMPRESSOR STATION	203	203	N/A	580	580	377	377	N/A
4188311	TVA JOHN SEVIER FOSSIL PLANT	183	176	174	121	121	-62	-55	-53
2972711	Johns Manville 54-0132	166	153	155	51	51	-115	-102	-104
4143611	ARCONIC INC. - TENNESSEE OPERATIONS	164	154	112	109	109	-54	-44	-3
4014511	GERDAU AMERISTEEL	162	187	167	168	168	6	-19	2
6193311	MIDWESTERN GAS TRANSMISSION, STATION 2101	140	140	N/A	146	146	6	6	N/A
3063711	TVA BROWNSVILLE COMBUSTION TURBINE PLANT	135	243	N/A	234	234	99	-10	N/A
7156311	FLORIM USA, INC.	119	119	N/A	88	88	-30	-30	N/A
3428511	TVA GLEASON COMBUSTION TURBINE PLANT	112	216	N/A	199	199	87	-17	N/A
9177011	Springfield Robertson C	108	108	N/A	2	2	-105	-105	N/A
5863711	Solae LLC	103	111	N/A	114	114	11	3	N/A
2896511	ANR PIPELINE COMPANY, COTTAGE GROVE	103	275	637	623	623	520	348	-14

7.7. Evaluating the Four Statutory Factors for Specific Emissions Sources

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.

On August 20, 2019, EPA issued a memorandum entitled "Guidance on Regional Haze State Implementation Plan for the Second Implementation Period." 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), characterizing remaining useful life of the source (statutory factor 4), characterizing visibility benefits, and reliance on previous analysis and previously approved approaches. The memorandum also contains guidance on decisions on what control measures are necessary to make reasonable progress. This guidance was used in evaluating the four statutory factors for the facilities in Tennessee selected for reasonable progress analysis as identified in Table 7-40. The results of these analyses are found in Section 7.8.

7.8. Control Measures Representing Reasonable Progress for Individual Sources to be Included in the Long Term Strategy

The following summarizes the process for determining reasonable progress for Tennessee sources. For a detailed discussion of the reasonable progress assessments for all units' contributions greater than or equal to 1.00% to any Class I area in Tennessee or in neighboring states, see Appendix G.

7.8.1. Eastman Chemical Company

The Eastman Chemical Company submitted reasonable progress analyses for B-83 Boilers 18 through 24 and B-325 Boiler 30 on August 13, 2020. TDEC-APC reviewed the analyses and concluded that reasonable progress for Eastman Chemical Company is the permanent shutdown of B-83 Boilers 18, 19, and 20 and the installation of permanent dry sorbent injection (without upgrading the existing ESPs) on Boilers 23 and 24. These emission reduction measures are projected to result in a reduction of 2,608 tons of SO_2 per year, which represents a 41% reduction from the projected 2028 SO_2 emissions used in the 2028 visibility modeling. This conclusion does not constitute a determination that additional SO_2 reductions at Eastman Chemical

Company will not be required for any subsequent regional haze SIP review period beyond 2028 and does not constitute a determination for any other regulatory program or requirement.

TDEC-APC's full evaluation of Eastman Chemical Company's reasonable progress analyses can be found in Appendix G-2. A draft permit for these emission reduction measures can also be found in Appendix G-2. Through this SIP revision, the TDEC-APC is proposing to incorporate into the regulatory portion of Tennessee's SIP at 40 CFR 52.5220, table (d), the source-specific SO_2 emission limits and permit conditions contained in Appendix G-2g.

7.8.2. TVA Cumberland

TVA submitted reasonable progress analysis on Units 1 and 2 at TVA's Cumberland Fossil Plant on July 29, 2020. TVA identified four control technologies (increase limestone stoichiometric ratio, organic acid buffering, install wall rings along the scrubber walls, and redesign/replace spray headers and nozzles). Two of these options (wall rings and redesign/replace spray headers and nozzles) were determined to be technically feasible. All control options identified for TVA Cumberland were deferred to a future review period based on review of the four statutory factors. The lowest-cost control option (installation of wall rings) is 4.9 times higher than the median cost identified by VISTAS for similar options and 3.2 times higher than the average value. TDEC-APC reviewed the analysis and is making a formal declaration that additional SO_2 reductions at Cumberland Fossil Plant are not needed during this Regional Haze SIP review period. This declaration does not constitute a determination that additional SO_2 reductions at Cumberland will not be required for any subsequent regional haze SIP review period beyond 2028 and does not constitute a determination for any other regulatory program or requirement.

TDEC-APC's full evaluation of TVA's reasonable progress analysis for TVA Cumberland can be found in Appendix G-1.

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 7.9.2 and Section 7.9.1, respectively.

Factor A and Factor 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 emission inventories discussed in Section 4. For Factor C, specific existing and planned emission controls are explained in Section 7.2.

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 reflected in the reasonable progress goals discussion located in Section 8.

7.9.1. Smoke Management

Prescribed fire is an important tool in forest health management. Prescribed fires help reduce the catastrophic damage of wildfire by safely reducing excessive brush, shrubs, and trees. In 2012, the State of Tennessee passed the Tennessee Prescribed Burning Act, which requires a written prescription be prepared and followed by a certified prescribed burn manager for each prescribed burn. The Tennessee Division of Forestry within the Tennessee Department of Agriculture has promulgated regulations (in Tenn. Rules and Regulations 0080-07-06) for certification of prescribed burn managers and guidelines for a prescribed burn prescription. TDEC-APC has promulgated regulations (in Tenn. Rules and Regulations 1200-03-04) that lists the specific circumstances in which open burning is permissible. Among other things, the regulation prohibits the burn site from being within one-half mile of a national reservation, national or state park, wildlife area, national or state forest. On November 24, 2021, the State of Tennessee, Department of Environment and Conservation, Divisions of Air Pollution Control, State Park Operations, and Natural Areas and the State of Tennessee, Department of Agriculture, Division of Forestry entered into a Memorandum of Understanding (MOU). The MOU states that all parties will follow Basic Smoke Management Practices (BSMP) when utilizing prescribed burning. For purposes of the MOU, BSMP are defined as those specified by Table 1 to 40 CFR 50.14. Since significant fire impacts are infrequent at Tennessee Class I areas, these management practices are adequate visibility protection for this SIP submittal period.

7.9.2. Dust and Fine Soil from Construction Activities

As discussed in Section 2.4.2 and demonstrated in Figure 2-1, fine soils were a relatively minor contributor to visibility impairment at the Class I areas in Tennessee during the baseline period of 2000-2004. Figure 2-2, and Figure 2-3 show that no VISTAS Class I areas experienced significant visibility impairment from soils during this timeframe. Figure 2-7 shows that fine soils continue to be only a minor contributor to visibility at the Class I areas in Tennessee during the most current period of monitoring data (2014-2018). Figure 2-8 and Figure 2-9 show that no VISTAS Class I areas experienced significant visibility impairment from soils during the 2014-2018 timeframe.

In addition, Tenn. Rules and Regulations 1200-3-8-.03 requires additional control measures on source operating permits to control dust emissions. That rule and the entire Chapter 1200-3-8 for controlling fugitive dust may be seen at: https://publications.tnsosfiles.com/rules/1200/1200-03/1200-03-08.20180904.pdf . The citation of Rule 1200-3-8-.03 is offered only for reference purposes. It is not offered for inclusion into the Tennessee Regional Haze SIP. Note that benefits from the rule have not been included in the VISTAS modeling runs.

8. Reasonable Progress Goals

The rule at 40 CFR 51.308(f)(3) requires states to establish RPGs in units of dv 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.

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).)

It is notable that the RPGs established in this 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).)

8.1. RPGs for Class I Areas within Tennessee

In accordance with the requirements of 40 CFR 51.308(f)(3), this regional haze SIP establishes RPGs for the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. To calculate the rate of progress represented by each goal, Tennessee compared baseline visibility conditions (2000 to 2004) to natural visibility conditions in 2064 at the Great Smoky Mountains National Park and determined the uniform rate of visibility improvement (in dv) that would need to be maintained during each implementation period in order to attain natural visibility conditions by 2064. Through the VISTAS modeling, Tennessee estimated the expected visibility improvements by 2028 in the Great Smoky Mountains National Park resulting from existing federal and state regulations expected to be implemented and facility closures expected to occur by 2028 in Tennessee and neighboring states. The VISTAS baseline modeling demonstrated that the 2028 base case control scenario provides for an improvement in visibility below the URP for the Great Smoky Mountains National Park for the 20% most impaired days and ensures no degradation in visibility for the 20% clearest days over the 2000 to 2004 baseline period. These controls and facility closures, to the extent known and quantifiable, were modeled as part of the long-term strategy. The results of this modeling are shown in Section 7.2.6.

As detailed in Section 7.6, seven facilities were identified for reasonable progress analysis based on PSAT modeling for Great Smoky Mountains National Park. One facility is located in Tennessee and six facilities are located in Kentucky, Ohio, Pennsylvania, and Indiana. Eight facilities were identified for reasonable progress analysis based on PSAT modeling for Joyce Kilmer-Slickrock Wilderness Area. One facility is located in Tennessee and seven facilities are located in Georgia, Kentucky, Ohio, Pennsylvania, and Indiana. These analyses showed some emission reductions, but TDEC-APC has chosen not to adjust the RPGs beyond that quantified in the baseline 2028 modeling.

Table 8-1 provides the RPGs for Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area. The table lists the 2028 reasonable progress goals, the uniform rates of progress for 2028, and natural visibility conditions. The numbers in brackets contain the projected improvement from the baseline, the amount of improvement from the baseline needed to meet the 2028 uniform rate of progress, and the additional improvement needed to achieve natural conditions, respectively. Since there is not an IMPROVE monitor located at Joyce Kilmer-Slickrock Wilderness Area, the Great Smoky Mountains National Park uniform rate of progress and reasonable progress goals are being used as a surrogate for Joyce Kilmer-Slickrock. Table 8-2 provides the expected visibility in 2028 on 20% clearest days as compared to the 2000-2004 baseline 20% clearest day values. This table shows that projected visibility on the 20% clearest days will not degrade but rather will improve significantly by 2028. The number in the brackets indicates the projected improvement from baseline conditions.

Table 8-1: Tennessee RPGs – 20% Most Impaired Days

Class I Area	2000-2004 Baseline Visibility (dv)[(1)]	2028 Reasonable Progress Goals (dv) [2004 – 2028 decrease, (dv)]	2028 Uniform Rate of Progress (dv) [2004 – 2028 decrease to meet uniform progress, (dv)]	Natural Visibility (dv) [2028 – 2064 decrease needed from 2028 goal]
Great Smoky Mountains National Park	29.11	15.03 [14.08]	21.49 [7.62]	10.05 [4.98]
Joyce Kilmer Slickrock Wilderness Area	29.11	15.03 [14.08]	21.49 [7.62]	10.05 [4.98]

[(1)] The 2000-2004 baseline visibility data reflect values 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."[61]

Table 8-2: Tennessee Class I Area 20% Clearest Day Comparisons

Class I Area	2000-2004 Baseline Visibility (dv)[(1)]	2028 Reasonable Progress Goal (dv) [2004 – 2028 improvement goal]	Natural Visibility (dv) [2028 – 2064 decrease needed from 2028 goal]
Great Smoky Mountains National Park	13.58	8.96 [4.62]	4.62 [4.34]
Joyce Kilmer Slickrock Wilderness Area	13.58	8.96 [4.62]	4.62 [4.34]

[(1)] The 2000-2004 baseline visibility data reflect values 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."[62]

Tennessee has determined that the RPGs will be at least as stringent as the expected glide path prediction for Great Smoky Mountains National Park and Joyce Kilmer Slickrock Wilderness Area. In addition, there are no sources in Tennessee 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 is slower than the URP.

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

8.2. Reductions Not Included in the 2028 RPG Analysis

Additional reductions in visibility impairing pollutants have occurred since VISTAS conducted the modeling analyses for the 2028 RPGs. These reductions, described below, will help to ensure that the Tennessee Class I areas will meet these projected RPGs and that additional visibility improvement is likely.

8.2.1. In-State Reasonable Progress Evaluation Reductions

The reasonable progress analysis of Eastman Chemical Company will result in implementing additional controls by 2028 that would decrease SO_2 emissions at this facility by 2,608 tons per year, which represents a 41% reduction from the projected 2028 SO_2 emissions used in the 2028 visibility modeling. This reduction was not included in the VISTAS 2028 RPG modeling and thus will help ensure that the RPGs provided in Table 8-1 are met for 20% most impaired days and that no visibility degradation on the 20% clearest days occurs.

8.2.2. Out of State Reasonable Progress Evaluation Reductions

Table 7-41 and Table 7-42 provide the listing of facilities that were estimated to impact Tennessee's Class I areas that are located outside of Tennessee within VISTAS and outside of VISTAS, respectively. As required by the RHR, Tennessee notified these states of the findings of significant contribution and asked those states for information regarding the results of the reasonable progress evaluations performed at those facilities. Section 10.1 provide a description of each response. Some of those responses indicated emission reductions that are expected as part of their reasonable progress analyses. This includes the permanent shutdown of the Zimmer Power Station in Ohio that will result in the reduction of 22,134 tons/year or SO_2 emissions[63]. These reductions were not included in the VISTAS 2028 RPG modeling and thus will help ensure that the RPGs provided in Table 8-1 are met for 20% most impaired days and that no visibility degradation on the 20% clearest days occurs.

8.2.3. CSAPR Update Rule Reductions

As stated in Section 7.2.1.1, the amended CSAPR Update Rule was published in the Federal Register on April 30, 2021. 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 NO_x combustion controls beginning in the 2022 ozone season. EPA estimates the Revised CSAPR Update will reduce summertime NO_x emissions

[63] See Table 7-16

from power plants in the 12 linked upwind states by 17,000 tons in 2021 compared to projections without the rule.

9. Monitoring Strategy

The SIP is to be accompanied by a strategy for monitoring regional haze visibility impairment. Specifically, the 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, both nationwide and in Tennessee, is the IMPROVE network. 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, Tennessee intends to rely on the IMPROVE network for complying with the regional haze monitoring requirement in the rule.

As shown in Table 9-1, there is currently one IMPROVE site in the state, in the Great Smoky Mountains National Park. The Great Smoky Mountains National Park is in North Carolina and Tennessee, and the IMPROVE monitor for the Park is located just across the border in Tennessee at Look Rock. The Joyce Kilmer-Slickrock Wilderness Area relies on data from the Great Smoky Mountains National Park IMPROVE monitoring site (GRSM1) because it does not have an IMPROVE monitor. Figure 9-1 shows the IMPROVE monitoring network for the VISTAS Region.

Table 9-1: Tennessee Class I Areas and Representative IMPROVE Monitors

Class I Area	IMPROVE Site Designation
Great Smoky Mountains National Park	GRSM1 (TN)
Joyce Kilmer-Slickrock Wilderness Area	GRSM1 (TN)

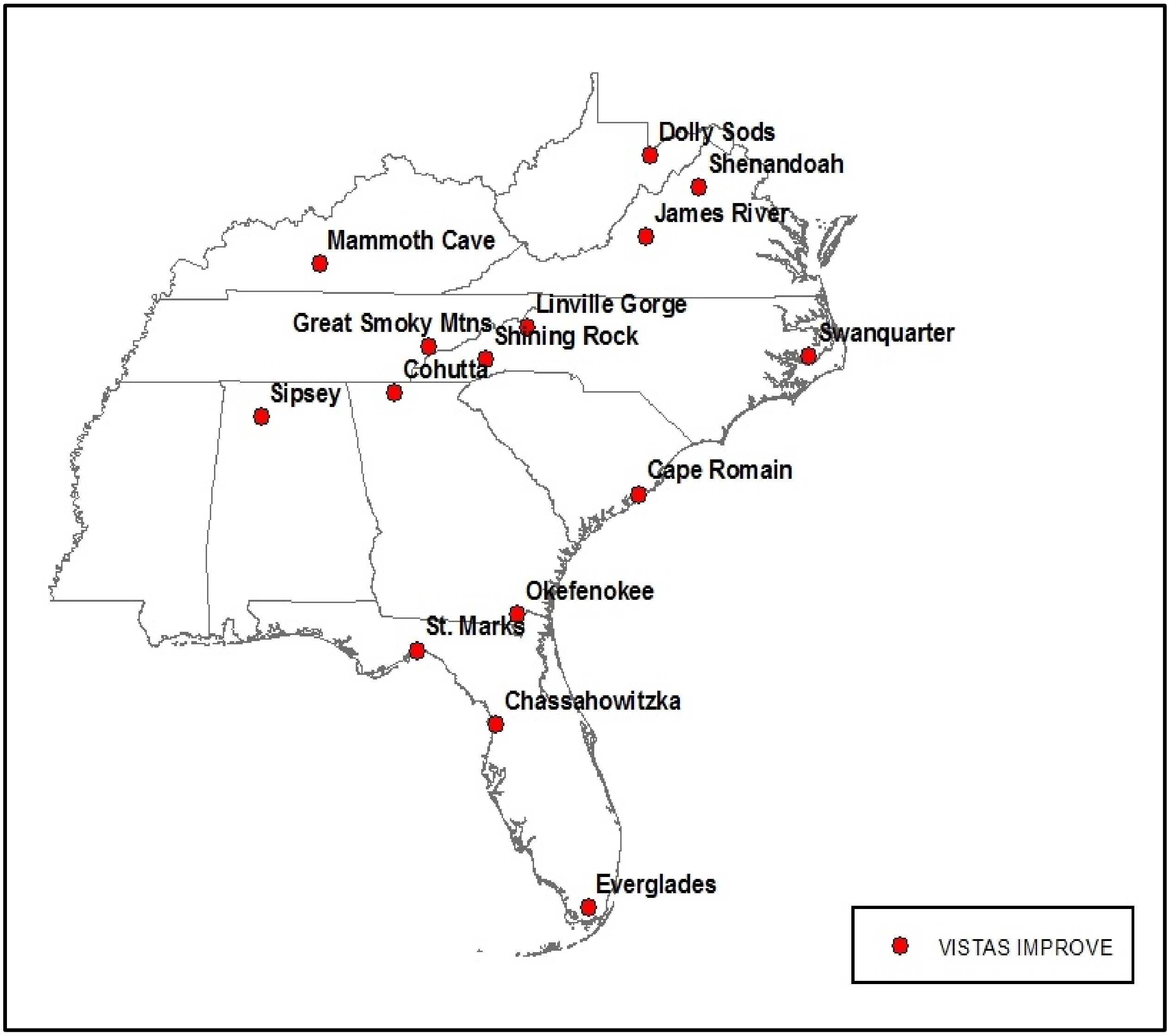


Figure 9-1: VISTAS States IMPROVE Monitoring Network

The IMPROVE measurements are central to Tennessee's regional haze monitoring strategy because the IMPROVE monitor in Tennessee represents unique air sheds, and it is difficult to visualize how the objectives listed above could be met without the monitoring provided by IMPROVE. Any reduction in the scope of the IMPROVE network in Tennessee and neighboring Class I areas would jeopardize the state's ability to demonstrate reasonable progress toward visibility improvement in its Class I areas and plan for appropriate future programs. In particular, Tennessee's regional haze strategy relies on emission reductions that will result from federal and state programs in Tennessee 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 monitor in Tennessee represents a unique airshed 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. If any of these IMPROVE monitors are shut down, Tennessee, in consultation with the EPA and FLMs, will develop an alternative approach for meeting the tracking goal, perhaps by seeking contingency funding to carry out limited monitoring or by relying on data from nearby urban monitoring sites to demonstrate trends in speciated $PM_{2.5}$ mass.

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). Tennessee relies on the IMPROVE monitoring network to fulfill the requirements in paragraphs 40 CFR 51.308(f)(6)(i) through (iv) and paragraph (vi).

- 51.803(f)(6)(i): Tennessee believes the existing IMPROVE monitors for the state's Class I areas are adequate and does not believe any additional monitoring sites or equipment are needed to assess whether RPGs for all mandatory Class I Federal areas within the state are being achieved.

- 51.308(f)(6)(ii): 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 rely on analysis of the preceding five years of IMPROVE monitor data.

- 51.308(f)(6)(iii): This provision for states with no mandatory Class I Federal areas does not apply to Tennessee.

- 51.308(f)(6)(iv): Tennessee believes the existing IMPROVE monitors for the State's Class I areas are sufficient for the purposes of this SIP revision. 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). Tennessee, which is an active member of NACAA, believes that participation of the state organizations in the IMPROVE Steering Committee adequately represents the needs of the state. 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. (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/.

- 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. Tennessee will continue to participate in SESARM/VISTAS efforts for projecting future emissions and continue to comply with the requirements of the AERR to periodically update emissions inventories.

- 51.308(f)(6)(vi): There are no elements, including reporting, recordkeeping, or other measures, necessary to address and report on visibility for Tennessee's Class I areas or Class I areas outside the state that are affected by sources in Tennessee.

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

This section addresses paragraph 40 CFR 51.308(f)(2) of the RHR that requires each state to addresses in its LTS visibility impairment for each mandatory Class I Federal area located outside the State that may be affected by emissions from the State. The LTS must include the enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress, as determined pursuant to paragraphs 40 CFR 51.308(f)(2)(i) through (iv). Section 10.1.1 documents Tennessee's consultation with other states with emission sources that impact Class I Areas in Tennessee, and Section 10.1.2 addresses Tennessee impacts on Class I areas outside of the state. The TDEC-APC agrees with all of the decisions made by other state agencies concerning the emission sources listed in Section 10.1.1.

10.1.1. Emission Sources in Other States with Impacts on Class I Areas in Tennessee

In evaluating controls needed to assess reasonable progress, VISTAS states with a Class I area initiated a consultation process with other VISTAS states with one or more facilities identified as having greater than or equal to 1.00% of the total sulfate plus nitrate point source visibility impairment on the 20% most impaired days. TDEC-APC sent letters to VISTAS states requesting that they provide a response indicating their plans for conducting a reasonable progress analysis for each facility.

In addition, VISTAS sent a letter to each non-VISTAS state with one or more facilities identified as having greater than or equal to 1.00% of the total sulfate plus nitrate point source visibility impairment on the 20% most impaired days in one or more VISTAS Class I areas. The letter requested that the non-VISTAS state verify if the 2028 SO_2 and NO_X emissions modeled for each facility identified in the letter were correct. If the emissions have decreased since the modeling was initiated, the non-VISTAS state was asked to provide updated emissions so that the facility contribution could be adjusted using the PSAT results to determine if additional analysis of controls would be necessary. If a non-VISTAS state did not decrease the 2028 emissions modeled, the non-VISTAS state was asked to provide a response indicating its plans for conducting a reasonable progress analysis for each facility.

There are several sources for which PSAT modeling indicated a contribution to visibility impairment of ≥1.00% for sulfate in one or more of Tennessee's Class I areas. TDEC-APC sent letters to each state requesting reasonable progress assessments for the facilities. For sources outside of the VISTAS states, a similar letter was sent by VISTAS to obtain the analyses.

Table 10-1 provides a summary of the VISTAS and non-VISTAS states to which a letter was sent and identifies the total number of facilities impacting each Class I area in Tennessee. Table 10-2 identifies each facility and its PSAT contribution to each Class I area in Tennessee. Appendix F-1 provides the consultation letters from TDEC-APC to each VISTAS state and the responses to the letters. Appendix F-2 provides the consultation letters from VISTAS to each non-VISTAS state and the responses to the letters.

Table 10-1: Number of Out-of-State Facilities with ≥ 1.00% Sulfate Contribution to Tennessee Class I Areas in 2028

Class I Area	Region	States
Great Smoky Mountains National Park	VISTAS	KY, TN
	Non-VISTAS	IN, PA, OH
	Total States	5
	Total Facilities	7
Joyce Kilmer – Slickrock Wilderness Area	VISTAS	GA, KY, TN
	Non-VISTAS	IN, PA, OH
	Total States	6
	Total Facilities	8

Table 10-2: Out-of-State Facilities with ≥1.00% Sulfate Contributions in 2028 in Tennessee Class I Areas

Facility	State	Class I Area Impacted	Percent Impairment Impact	Letter Sent by and Date	Response Received
Georgia Power Company – Plant Bowen	GA	Joyce Kilmer –Slickrock	1.17%	TN, October 23, 2020	December 16, 2021

Facility	State	Class I Area Impacted	Percent Impairment Impact	Letter Sent by and Date	Response Received
Tennessee Valley Authority – Shawnee Fossil Plant	KY	Great Smoky Mountains	1.38%	TN, October 23, 2020	April 23, 2021
		Joyce Kilmer –Slickrock	1.45%		
Gibson	IN	Great Smoky Mountains	1.11%	VISTAS, June 22, 2020, and TN, November 4, 2021	December 22, 2021
		Joyce Kilmer –Slickrock	1.07%		
Indiana Michigan Power	IN	Great Smoky Mountains	1.25%	VISTAS, June 22, 2020, and TN, November 4, 2021	December 22, 2021
		Joyce Kilmer –Slickrock	1.18%		
Genon NE Mgmt Co/Keystone Station	PA	Great Smoky Mountains	1.26%	VISTAS, June 22, 2020	July 8, 2020
		Joyce Kilmer –Slickrock	1.18%		
General James M. Gavin Power Plant	OH	Great Smoky Mountains	3.93%	VISTAS, June 22, 2020	October 29, 2020, and December 27, 2021
		Joyce Kilmer –Slickrock	3.63%		
Duke Energy Ohio, Wm. H. Zimmer Station	OH	Joyce Kilmer –Slickrock	1.05%	VISTAS, June 22, 2020	October 29, 2020, and December 27, 2021
		Great Smoky Mountains	1.03%		

The following summarizes the response received for each facility.

<u>Georgia Power Company – Plant Bowen, GA:</u>

- The most recent version of Georgia Power Company's reasonable progress analysis, as submitted to the Georgia EPD in October 2021, is in Appendix F-1. The facility concluded that none of the additional control technologies or emission reduction measures identified are necessary to make reasonable progress toward meeting the national visibility goal. Additionally, the facility stated that Plant Bowen Units 1-4 are already fully controlled with wet FGD scrubber systems that are optimized not only for SO_2 emissions removal but also for other environmental compliance programs. The facility recommends Georgia EPD adopt the MATS alternative SO_2 limit of 0.20 lb/MMBtu for Plant Bowen Units 1-4 in the Georgia Regional Haze SIP for the second implementation period. Georgia EPD has yet to propose its Regional Haze SIP revision for the second planning period.

<u>Tennessee Valley Authority – Shawnee Fossil Plant, KY:</u>

- The State of Kentucky requested that this facility perform a reasonable progress analysis. Kentucky provided the facility's reasonable progress analysis, dated February 19, 2021, which is included in Appendix F-1. TVA proposes to accept a facility-wide emission limitation of no more than 8,719 tons of SO_2 per 12-month rolling total starting on December 31, 2034. This represents a 7,028 ton per year reduction in SO_2 emissions when compared to projected 2028 emissions. At the time of writing this SIP, TDEC-APC is not aware that an emission limitation has been finalized. Kentucky has yet to propose its Regional Haze SIP revision for the second planning period

<u>Gibson, IN:</u>

- The Indiana Department of Environmental Management (IDEM) is not requiring 4-factor analyses from its EGU's, including Gibson and Indiana Michigan Power. In their letter, IDEM states that "IDEM is intently evaluating other emission sectors for this second implementation period to determine their visibility impacts on Class I areas. IDEM will conduct a review of all its emission sources, with focus on the EGU sector, for its January 31, 2025, progress report; pursuant to 40 CFR 51.308(g). IDEM will evaluate EGUs for the third implementation period of the RH rule, as necessary, to be submitted in 2028." Additionally, IDEM cites the EPA's 2019 Guidance that states a "key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period." IDEM submitted their final Regional Haze SIP to EPA on December 30, 2021.

<u>Indiana Michigan Power, IN:</u>

- The Indiana Department of Environmental Management (IDEM) is not requiring 4-factor analyses from its EGU's. See above information for Gibson.

<u>Genon NE Mgmt Co/Keystone Station, PA:</u>

- The State of Pennsylvania requested that this facility perform a reasonable progress analysis. Pennsylvania provided the facility's reasonable progress analysis, dated January 11, 2021. The facility stated that emissions of SO_2 and NO_x from Units 1 and 2 at the Station are already well controlled by wet FGD and SCR and that substantial SO_2 and NO_x emission reductions have already been achieved with the existing emission controls. The facility concluded that, for Keystone Generating Station's Units 1 and 2, no additional controls are needed in order for PA DEP to meet their reasonable progress goal for the Second Decadal Review.

<u>General James M. Gavin Power Plant, OH:</u>

- TDEC-APC received an email from Ohio EPA on December 27, 2021, which included a weblink to Ohio EPA's Regional Haze SIP for the Second Implementation Period. That SIP, dated July 2021, contains a four-factor analysis for the General James M. Gavin

Power Plant. Ohio EPA concluded that no technically feasible control measures were identified for SO_2 control at Gavin Power Plant beyond existing wet FGD systems

Duke Energy Ohio, Wm. H. Zimmer Station, OH:

- TDEC-APC received an email from Ohio EPA on December 27, 2021, which included a weblink to Ohio EPA's Regional Haze SIP for the Second Implementation Period. That SIP, dated July 2021, contains an enforceable commitment, in the form of a Director's Final Findings and Orders, requiring the permanent shutdown of the coal-fired boilers at the Zimmer Power Station by no later than January 1, 2028.

10.1.2. Tennessee Emission Source Impacts on Class I Areas in Other States

Tennessee consulted with each VISTAS state during the development of its LTS. TDEC-APC has received letters from other states requesting a reasonable progress analysis for certain facilities in Tennessee. Table 10-3 summarizes these requests from other states.

Table 10-3: State Requests for Reasonable Progress Analyses for Facilities in Tennessee

TN Facility	Requesting State	Class I Area Impacted	Percent Sulfate Impairment Impact in 2028	Letter Sent by and Date	TDEC-APC Response
TVA Cumberland	MO	Mingo	N/A	MO, September 11, 2020	January 14, 2021
Eastman Chemical Company	GA	Cohutta	1.31%	GA, November 23, 2020	January 14, 2021
TVA Cumberland	NC	Linville Gorge	1.26%	NC, February 1, 2021	February 18, 2021
		Shining Rock	1.38%		
Eastman Chemical Company	NC	Great Smoky Mountains	1.29%	NC, February 1, 2021	February 18, 2021
		Joyce-Kilmer Slickrock	1.37%		
		Linville Gorge	4.26%		
		Shining Rock	1.09%		

Additionally, on April 12, 2021, the TDEC-APC and Alabama held a consultation call to discuss TVA Cumberland, which had a 1.56% sulfate impairment impact in 2028 on Sipsey Wilderness Area. As discussed in Section 10.2 of this SIP, VISTAS held a webinar on April 21, 2020, to present to the RPOs and their member states the VISTAS modeling analysis and results to make them aware of the impacts on Class I areas in their states. This information was also made available upon request from states outside of VISTAS and provided on the SESARM website. As discussed in Section 7.6.4, Tennessee selected TVA Cumberland and Eastman Chemical Company for reasonable progress analysis.

10.2. Outreach

The VISTAS states 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 10-4.

Table 10-4: 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
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 reasonable progress 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, Tennessee 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. Tennessee was part of a southeastern state breakout session with FLMs and EPA discussing the modeling and future expectations from all parties.

10.3. Consultation with MANE-VU

The following information documents the VISTAS states' participation in Mid-Atlantic/Northeast Visibility Union (MANE-VU) consultation meetings. Table 10-6 provides the correspondence and meetings that occurred during the consultation process. MANE-VU prepared the *MANE-VU Regional Haze Consultation Report*, which contains a record of the consultation meetings, comments received, and responses to comments.[64] Appendix F-4 provides documentation of Tennessee's consultation with MANE-VU including Tennessee's and VISTAS' comments on the MANE-VU Ask.

In a letter dated August 25, 2017, MANE-VU sent Tennessee an Inter-RPO Ask that identified emissions from Tennessee as reasonably anticipated to contribute to visibility impairment in MANE-VU Class I areas. On October 16, 2017, MANE-VU notified Alabama, Florida,

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[64] "MANE-VU Regional Haze Consultation Report," July 27, 2018, MANE-VU Technical Support Committee, URL: https://otcair.org/MANEVU/Upload/Publication/Correspondence/MANE-VU_RH_ConsultationReport_Appendices_ThankYouLetters_08302018.pdf

Kentucky, North Carolina, Tennessee, Virginia, and West Virginia that its analysis of upwind emissions from these states may contribute to visibility impairment at one or more MANE-VU Class I areas located in Maine, New Hampshire, New Jersey, and Vermont. MANE-VU invited each aforementioned VISTAS state to participate in its consultation process involving five conference calls from October 20, 2017 to March 23, 2018 to explain their methodologies, data sources, and assumptions used in its contribution analyses. MANE-VU's technical analyses were based on actual 2015 emissions for EGUs and 2011 emissions for other emission sources. MANE-VU's criteria for identifying upwind states for consultation included:

- Point Source Emissions Analysis: Kentucky, North Carolina, Virginia, and West Virginia were identified as having at least one facility estimated to contribute ≥3 Mm^{-1} to light extinction in at least one MANE-VU Class I area based on CALPUFF modeling of the facility's SO_2 and NO_x emissions.

- Statewide Emissions Analysis for all Sectors: Alabama, Florida, Kentucky, North Carolina, Tennessee, Virginia, and West Virginia were estimated to contribute ≥2% of the visibility impairment at one or more MANE-VU Class I areas and/or an average mass impact of over 1% (0.01 $\mu g/m^3$). This methodology involved a weight-of-evidence approach based on emissions (tons per year) divided by distance (kilometers) (Q/d) calculations, CALPUFF modeling, and the use of HYSPLIT back trajectories as a quality check.

All seven VISTAS states participated in MANE-VU's five consultation calls and reviewed the technical information supporting MANE-VU's conclusions. On January 27, 2018, VISTAS submitted a letter to MANE-VU documenting its appreciation for the opportunity to participate in the consultation process and identified the following concerns and recommendations:

- <u>Timing:</u> At the time the consultation calls were held, the MANE-VU states indicated that they planned to submit their regional haze SIPs to EPA by the original July 2018 deadline. VISTAS noted that its states planned to complete their regional haze technical analysis in 2019 with the intention of submitting regional haze SIPs by July 31, 2021. The differing schedules resulted in the seven VISTAS states included in MANE-VU's Ask being requested to assess the MANE-VU analysis without the benefit of the forthcoming VISTAS technical work. Subsequently, schedules were delayed and VISTAS has shared the results of its emissions inventory and modeling analyses with the MANE-VU states during consultation calls in 2020 (see Table 10-6). VISTAS's technical analyses, which are based on more recent emissions inventory data and robust modeling tools, indicate that VISTAS state contributions to MANE-VU Class I areas are below the thresholds established by MANE-VU.

- Technical Analysis – Inventories, Modeling, and Evaluation: The MANE-VU states' analysis used emission inventories that are inconsistent with the recent EPA regional haze modeling platform. These inventories do not fully reflect emission reductions expected from southeastern EGUs by 2028 and other sources as well. Modeling results derived from use of the outdated emissions inventories may not allow conclusive determinations of impacts, if any, from VISTAS states on Class I areas in the MANE-VU region.

  In many cases, the sources of the alleged contributions to downwind receptors are located thousands of miles away from the MANE-VU Class I areas. The MANE-VU states used the CALPUFF model and the Q/d screening approach to identify contributions that they allege are significant. CALPUFF should not be used for transport distances greater than 300 km since there are serious conceptual concerns with the use of puff dispersion models for very long-range transport which can result in overestimations of surface concentrations by a factor of three to four.[65]

  The preamble to the recent Revisions to the Guideline on Air Quality Models that modified Appendix W of 40 CFR Part 51 states, in part, "the EPA has fully documented the past and current concerns related to the regulatory use of the CALPUFF modeling system and believes that these concerns, including the well documented scientific and technical issues with the modeling system, support the EPA's decision to remove it as a preferred model in Appendix A of the Guideline." "[66]

  The reliability of the Q/d screening approach diminishes over distance and especially beyond 300 km. If the MANE-VU states wish to evaluate emission impacts more than 300 km downwind from sources, a scientifically reliable approach is essential such as the CAMx model with the PSAT source apportionment method.

  In response to VISTAS concerns about inaccuracies in the MANE-VU analysis that were shared during the December 18, 2018 technical call, the MANE-VU states suggested that the seven VISTAS states could reassess contributions using their own information to correct the MANE-VU analysis. The VISTAS states affirmed their commitment to conduct a thorough technical review of emission impacts during their forthcoming analysis. However, it was incumbent on the MANE-VU states to correct the errors inherent in their own analysis and reassess the states with which consultation would be necessary.

  The MANE-VU Ask included year-round use of effective control technologies on EGUs;

[65] *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (December 1998).
[66] *Federal Register,* Vol. 82, No. 10, Tuesday, January 17, 2017, Page 5195.

a four-factor analysis on sources with potential for visibility impacts of ≥3.0 Mm^{-1} at any MANE-VU Class I area; establishment of an ultra-low sulfur fuel oil standard; updated permits, enforceable agreements, and/or rules to lock in lower emission rates for EGUs and other large emission sources that had recently reduced emissions or were scheduled to do so; and efforts to decrease energy demand through use of energy efficiency and increased use of combined heat and power and other clean distributed generation technologies. The MANE-VU Ask failed to recognize fully the improved controls, fuel switches, retirements, and energy demand reductions that had already been achieved in the Southeast. Further, the MANE- VU states suggested that the Southeast adopt control measures that would produce little if any visibility improvement at MANE-VU Class I areas. VISTAS recommended that the MANE-VU states refine their analyses and establish a sound basis for any actions requested of the seven VISTAS states and incorporate such expectations in MANE-VU SIPs.

- Permanent and Enforceable: The MANE-VU states should only include in their regional haze SIPs emission control presumptions for the seven VISTAS states that are clearly necessary and effective and have been adopted via state rulemaking or permit revisions. For MANE-VU states to include within their regional haze SIPs emission controls in other states that are not state-enforceable, and which the state in question has no intention of adopting, would be inconsistent with the CAA and RHR and could result in adverse comments from the seven VISTAS states during the MANE-VU regional haze SIP public comment period.

During the consultation process, Florida, North Carolina, Tennessee, Virginia, and West Virginia submitted to MANE-VU updated information on emissions associated with facilities identified in the MANE-VU Ask and documenting concerns with MANE-VUs approach and conclusions. As a result of their active participation the MANE-VU consultation process, the VISTAS states fulfilled the consultation requirements specified in the RHR (51.308(f)(2)(ii)).

In a letter dated January 13, 2021, TDEC-APC responded to the MANE-VU Ask letter dated August 25, 2017. The MANE-VU Ask identified emissions from Tennessee as reasonably anticipated to contribute to visibility impairment in MANE-VU Class I areas. This was based on MANE-VU's data that showed Tennessee contributed greater than or equal to 2% of the visibility impairment to a Class I area and had an average mass impact of over 1% (0.01 microgram per cubic meter). As stated in Section 7 of this document, VISTAS used CAMx and PSAT to evaluate statewide contributions of emissions to visibility impairment in Class I areas. In the January 13, 2021, letter, TDEC-APC provided the PSAT results in Table 10-5, which show that Tennessee's total sulfate and nitrate contribution to visibility impairment in 2028 is at or below 0.24% for the 20% most impaired days and at or below 0.03% for the 20% clearest days for all of the MANE-VU Class I areas. Thus, the TDEC-APC believes that Tennessee emissions are not reasonably anticipated to contribute to visibility impairment in any MANE-VU

Class I area since the total sulfate and nitrate contributions are significantly below the 2% contribution threshold that the MANE-VU states used to identify upwind states as contributing to visibility impairment in MANE-VU Class I areas. TDEC-APC concluded its letter by stating that it believes that MANE-VU's screening methodologies are less accurate in several areas and overstate upwind contributions to downwind state Class I areas, and TDEC-APC will not be taking the measures outlined in the MANE-VU Ask.

In a letter dated February 17, 2021, MANE-VU reaffirmed the merits of its technical analysis and maintained its request in the initial MANE-VU Ask letter dated August 25, 2017. The TDEC-APC does not agree with MANE-VU’s conclusion that emissions from Tennessee are reasonably anticipated to contribute to visibility impairment in the Class I areas in MANE-VU. Although there is a disagreement between the TDEC-APC and MANE-VU, the coal-fired EGU’s in Tennessee are already satisfying two of the strategies (#1 and #4) in MANE-VU’s August 17, 2017, Ask letter. As stated in Section 7.2.2.1, all of the coal-fired EGU’s in Tennessee have SO_2 and NO_X control devices, and these control devices are required to operate continuously. The coal-fired EGU’s that have switched to natural gas (which includes TVA Allen, TVA John Sevier, and TVA Johnsonville) are not permitted to burn coal. The TDEC-APC notes that there were no Tennessee facilities identified in strategy #2 in MANE-VU’s August 17, 2017, Ask letter. The TDEC-APC participated in MANE-VU's consultation calls and reviewed the technical information supporting MANE-VU's conclusions, and VISTAS invited MANE-VU to the VISTAS’ consultation calls. The TDEC-APC tried to resolve the disagreement with MANE-VU by way of the VISTAS letter dated January 27, 2018, and the TDEC-APC letter dated January 13, 2021.

Table 10-5: Tennessee 2028 Contribution of all sources to light extinction (Mm^{-1}) from Sulfate + Nitrate

Class I Area	20% Clearest Days		20% Most Impaired Days	
	Extinction (Mm^{-1})	Percentage (%)	Extinction (Mm^{-1})	Percentage (%)
Brigantine Wilderness, NJ	0.009	0.03	0.109	0.16
Acadia National Park, ME	0.000	0.00	0.038	0.08
Great Gulf Wilderness, NH	0.002	0.01	0.074	0.19
Lye Brook Wilderness, VT	0.001	0.01	0.113	0.24
Moosehorn Wilderness, ME	0.000	0.00	0.019	0.04
Presidential Range Dry River Wilderness, NH	0.002	0.01	0.074	0.19
Roosevelt Campobello International Park ME/NB	0.000	0.00	0.019	0.04

Table 10-6: MANE-VU Consultation with VISTAS States - Correspondence and Meetings

Date	Description
August 25, 2017	Letter from Dave Foerter, Executive Director, MANE-VU/OTC, to Commissioner Bob Martineau, Tennessee Department of Environment and Conservation. Purpose: Tennessee identified as reasonably anticipated to contribute to visibility impairment in MANE-VU Class I areas and asked to do five measures.
October 16, 2017	Letter from Dave Foerter, Executive Director, MANE-VU/OTC, to Commissioner Bob Martineau, Tennessee Department of Environment and Conservation. Purpose: Invitation to join State-to-State consultation meetings starting October 20, 2017.
October 20, 2017	MANE-VU Conference Call. Inter-RPO Consultation #1, Introduction and Overview of MANE-VU Analyses and Ask.
December 1, 2017	MANE-VU Conference Call. Inter-Regional Consultation #2, Discussion of the Ask and listening to upwind states and FLM questions.
December 18, 2017	MANE-VU Conference Call. Inter-Regional Consultation #3, Overview of technical analyses behind the Ask, source contributions, 4-factor analysis, and available technical products.
December 22, 2017	Email from Mark A. Reynolds, Environmental Consultant, Tennessee Department of Environment and Conservation to Joseph Jakuta, MANE-VU/OTC. Purpose: Provided additional information on EGU emissions and Cargill Corn Milling facility.
January 12, 2018	MANE-VU Conference Call. Inter-Regional Consultation #4, Reasonable Progress Overview.
January 27, 2018	Letter from John E. Hornback, Executive Director, Metro 4/SESARM/VISTAS, to Dave Foerter, Executive Director, MANE-VU/OTC. Purpose: Comments on timing; technical analysis – inventories, modeling, and evaluation; and permanence and enforceability of control measures not adopted by VISTAS states.
March 23, 2018	MANE-VU Conference Call. Inter-RPO Consultation #5. Executive Summaries, SIP submittal plans, and perspectives from upwind states.
May 8, 2018	Letter from Clark Freise, MANE-VU Chair (NH DES) and David Foerter, MANE-VU Executive Director, to Commissioner Bob Martineau, Tennessee Department of Environment and Conservation. Purpose: Acknowledgement of participation in MANE-VU consultation calls and receipt of comments on MANE-VU Ask.
January 13, 2021	Letter from Michelle Owenby, Director of TDEC-APC to Paul Miller, Lead Manager of MANE-VU. Purpose: Respond to MANE-VU Ask letter dated August 25, 2017. TDEC-APC disagreed with MANE-VU's conclusion that Tennessee was greater than a 2% impact on Class I areas in MANE-VU and provided PSAT data to show that impacts were less than 0.25%. TDEC-APC stated that it will not be taking the measures outlined in the MANE-VU Ask letter.
February 17, 2021	Letter from Heidi Hales, MANE-VU Chair's Representative to Michell Owenby, Director of TDEC-APC. Purpose: Respond to TDEC-APC letter dated January 13, 2021. MANE-VU reaffirmed the merits of its technical analysis and maintained its request in the initial MANE-VU Ask letter dated August 25, 2017.

10.4. Federal Land Manager Consultation

The TDEC-APC sent a draft SIP to the NPS, FS, and FWS on July 2, 2021, to start the mandatory consultation required by 40 CFR Section 51.308(i)(2). On August 24, 2021, the TDEC-APC and NPS had a conference call to discuss the NPS' comments on the draft SIP. EPA, FS, and FWS were also on the call. On August 31, 2021, the NPS sent their written comments to the TDEC-APC. On August 31, 2021, the FS sent their written comments to the TDEC-APC. The FWS did not send any written comments to the TDEC-APC. The complete set of NPS and FS comments is included in Appendix H-1. A summary of the NPS and FS comments is included here with the TDEC-APC responses.

10.4.1. Exclusion of NO_x from Four-Factor Analysis

NPS Comments

Ammonium nitrate from NO_X emissions is a significant anthropogenic haze causing pollutant. Over the past ten years the importance of ammonium nitrate on the 20% most-impaired days has increased for many Class I areas in the VISTAS region, including at Great Smoky Mountains NP. As SO_2 emissions decline and the seasonality of most-impaired days shifts, NO_X emissions are increasingly important for many VISTAS Class I areas.

The Tennessee rationale for excluding NO_X emissions from reasonable progress four-factor analyses is based solely on modeling results. We recognize that the VISTAS modeling methods follow EPA guidance and are technically sound, however given the outdated base year and the recent changes in pollutant composition on the 20% most impaired days, the result is not representative of current conditions and likely underestimates the future contribution of nitrate impairment.

The NPS recommends that Tennessee acknowledge more recent monitoring data in their source selection process and consider NO_X emission reduction opportunities to address regional haze during this planning period. Reducing NO_X emissions would have additional regional co-benefits for ozone and nitrogen deposition. Great Smoky Mountains NP is currently part of two limited maintenance plans for ozone and has 12 acidified streams on the Clean Water Act 303(d) list for pH-impaired surface waters from excessive atmospheric nitrogen and sulfur deposition. A total maximum daily load (TMDL) of nitrogen and sulfur deposition was established to restore these streams which will require additional nitrogen and sulfur reductions to reach these protective critical loads. While much of the region's NO_X emissions come from mobile sources, emissions inventories also show a significant quantity of NO_X emissions from point sources in Tennessee that could be addressed under the regional haze program.

USFS Comments

The draft RH SIP only evaluates SO_2 emission sources for reasonable progress evaluations / four-factor analyses. USDA Forest Service appreciates the discussion within the draft RH SIP regarding nitrate formation in the VISTAS region. We understand that nitrate formation in the VISTAS region is limited by the availability of ammonia (which preferentially reacts with SO_2 and sulfates before reacting with NOx) and by temperature, with particulate nitrate concentrations highest in the winter months. We also recognize that sulfates have been the main contributor to visibility impairment at Class I Areas within the southern US. The emissions data show that most NO_X emissions within TN are from the mobile sector. However, the nitrate contribution to visibility impairment is increasing as sulfur dioxide emissions decrease, and there are still significant NO_X sources within the point sector in TN. IMPROVE monitoring data from Great Smoky Mountains National Park (used as a surrogate for nearby Joyce-Kilmer-Slickrock Wilderness Area operated by the Forest Service) and nearby Class I areas in NC (Shining Rock and Linville Gorge Wilderness Areas) show that some of the highest rates of light extinction from ammonium nitrate have occurred within the last several years (Figure 1). EPA's 2019 Regional Haze Guidance states that "because regional haze results from a multitude of sources over a broad geographic area, a measure may be necessary for reasonable progress even if that measure in isolation does not result in perceptible visibility improvement." Widespread emissions controls, particularly for SO_2 and NO_X, are essential for making reasonable progress at Class I areas both near to, and more distant from, emissions sources. Further, small visibility improvements, even those that may be imperceptible by themselves, are essential as we continue to make progress towards the national goal of restoring natural conditions at Class I areas by 2064. We request that TDEC-APC consider evaluating NO_X sources, along with SO_2 sources, for reasonable progress during this planning period.

TDEC-APC Response

In preparing its response to these comments, the TDEC-APC documents in the following sections its review of the IMPROVE monitoring data, SO_2 and NO_x emissions trends from 2011 – 2028, and PSAT modeling for 2028 for Class I areas in Tennessee. The TDEC-APC's summary and conclusions of the data regarding these comments is presented at the end of this section. Because IMPROVE monitoring data from GSMNP is used to represent visibility impairment at Joyce Kilmer-Slickrock Wilderness Area (see Section 1.4), the discussion of the IMPROVE monitoring data for the GSMNP also applies to the Joyce Kilmer-Slickrock Wilderness Area, except where noted.

Review of IMPROVE Monitor Data for Great Smoky Mountains National Park

For the Great Smoky Mountains National Park, Figure 10-1 compares the relative particle contributions to light extinction for the five-year average of 2009 – 2013 and 2015 – 2019 measured by IMPROVE monitors for the 20% most impaired days. When preparing the projected RPG for 2028, based on EPA's modeling guidance, the species-specific RRF was applied to the 2009 – 2013 average measured by the monitor for the Great Smoky Mountains National Park. Comparison of these five-year periods show that while total impairment has declined significantly in the Great Smoky Mountains National Park, the relative percentage of PM species contributions has also changed somewhat. The relative ammonium nitrate and organic carbon contributions have increased from the first to the second five-year period for the Great Smoky Mountains National Park. During the 2015 – 2019 period, the ammonium nitrate and organic carbon contributions are equal for the Great Smoky Mountains National Park.

However, during the 2015 – 2019 period, ammonium sulfate continues to be the dominant visibility impairing species at the Great Smoky Mountains National Park.

For the Great Smoky Mountains National Park, Figure 10-2 shows particle contributions to light extinction from 2011 through 2019 for the 20% most impaired days. For the Great Smoky Mountains National Park, ammonium nitrate levels increased in 2017 and 2018 but returned to 2015 levels in 2019. It is unclear why the ammonium nitrate contribution to total impairment has fluctuated in recent years and further research is needed to understand the factors contributing (e.g., emission sources, weather, and meteorology) to the nitrate fraction at this Class I area.

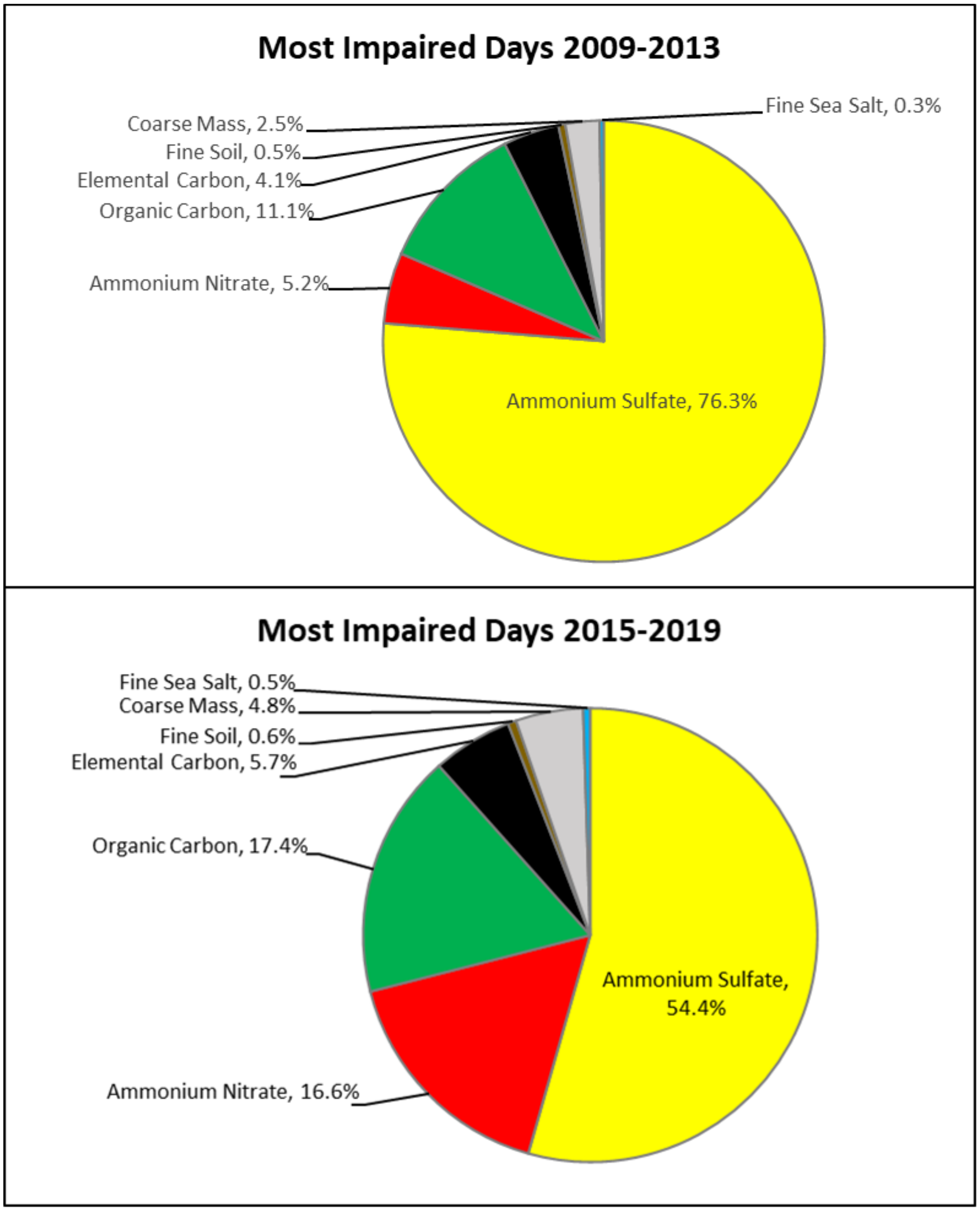

Figure 10-1: Comparison of Five-Year Average (2009-2013 vs. 2015-2019) Particle Contributions to Light Extinction for 20% Most Impaired Days at Great Smoky Mountains National Park

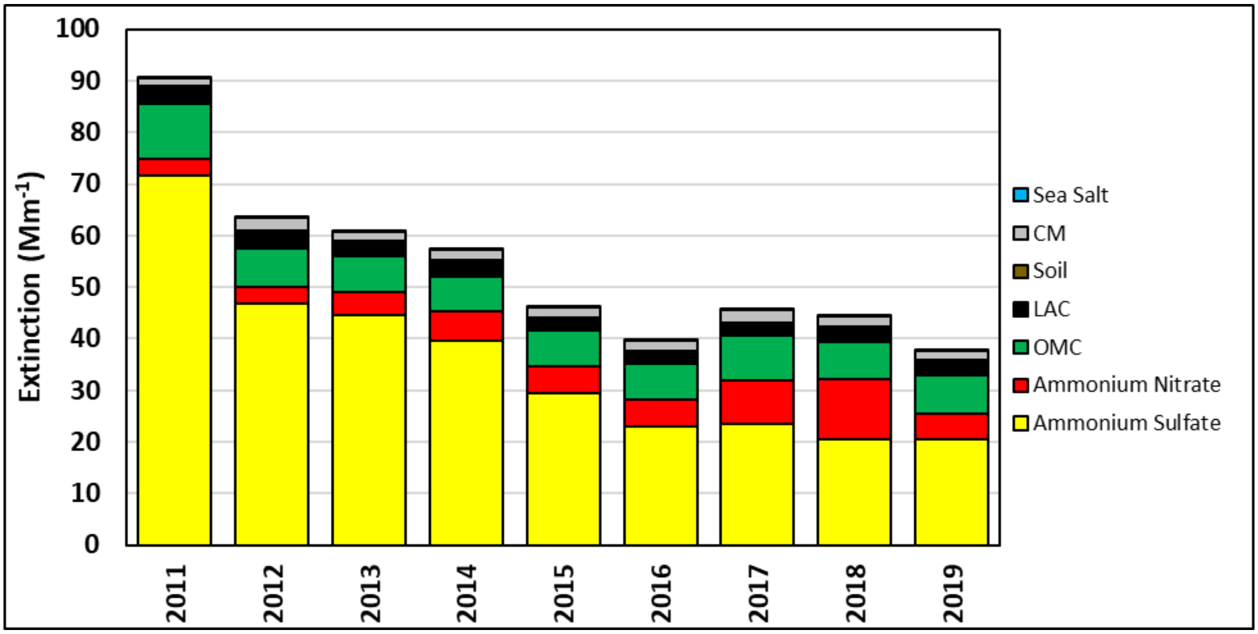

Figure 10-2: Particle Contributions to Light Extinction for 20% Most Impaired Days at Great Smoky Mountains National Park for 2011-2019

Figure 10-3 compares the five-year average of 2009 – 2013 and 2015 – 2019 for ammonium sulfate and ammonium nitrate contributions to visibility impairment for all Class I areas in the VISTAS region. These data clearly show that although ammonium nitrate contributions have increased slightly for some Class I areas, ammonium sulfate remains as the dominant visibility impairment species through 2019.

The NPS points to the shift in the 20% most impaired days from primarily summer months to fall, winter, and spring months which is illustrated in Table 10-7. Table 10-8 shows the number of days where nitrate exceeded sulfate concentrations. The NPS notes that use of 2011 as the basis for the 20% most impaired days does not reflect current trends. Although the days and seasons that make up the 20% most impaired days have shifted somewhat from 2011 to 2016 – 2019, the total number of days that are dominated by sulfate still exceeds the total number of days dominated by nitrate for each year. For example, 23 days of IMPROVE monitoring data make up the 20% most impaired days for the Great Smoky Mountains National Park. In 2011, all 23 days were dominated by sulfate. In 2016, 2017, 2018, and 2019 the total number of days where nitrate exceeded sulfate impairment were 1, 3, 7, and 5 days, respectively. This illustrates that sulfate is still the dominant visibility impairing pollutant for the Great Smoky Mountains National Park for this second planning period. Additional research will be needed to understand why nitrate contributions are fluctuating from year to year and shifting between seasons within a given year. This fluctuation does not necessarily mean that the higher nitrate fractions are associated with EGU and non-EGU point sources.

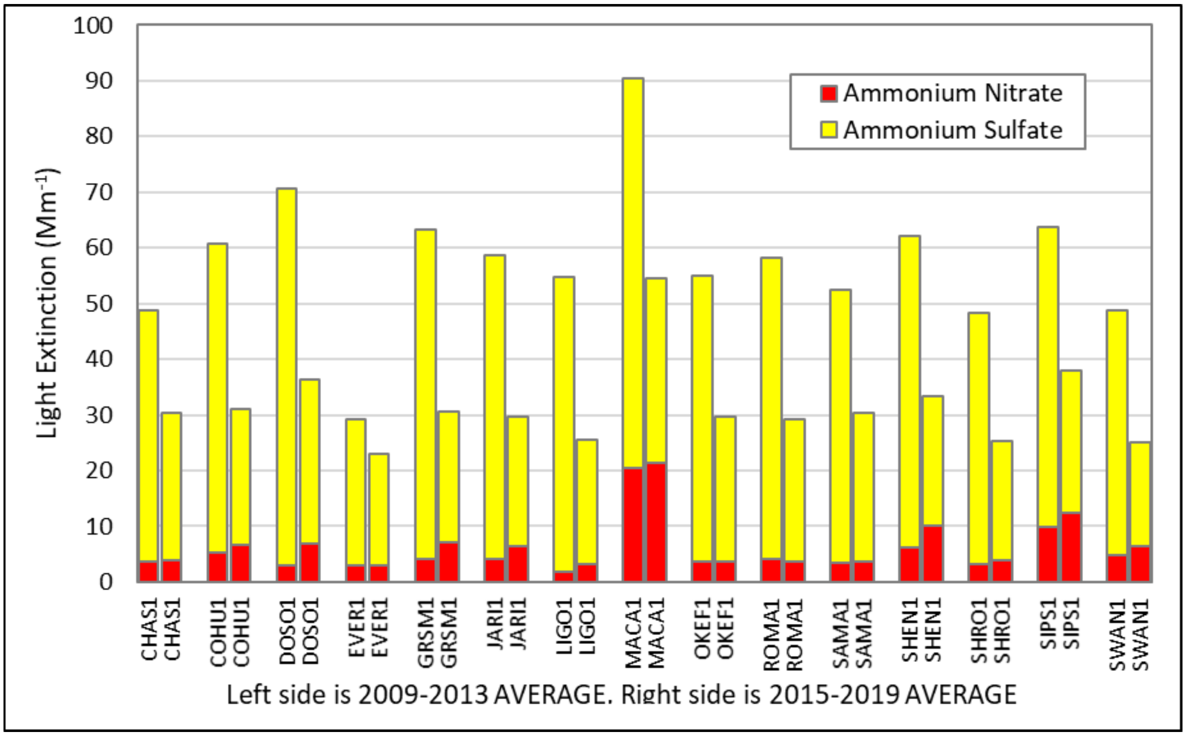

Figure 10-3: Comparison of Ammonium Sulfate and Ammonium Nitrate Five-Year Average (2009 – 2013 vs. 2015 – 2019) Contributions to Visibility Impairment for 20% Most Impaired Days

Table 10-7: Number of Days by Month Included in 20% Most Impaired Days for 2011 and 2016 – 2019 for Great Smoky Mountains National Park

	Winter			Spring			Summer			Fall			Total
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Days**
Great Smoky Mountains National Park													
2011		2	1	1			1	7	9	1		1	23
2016		3	3			2	3	2	5	3	1	1	23
2017	4	1	1	1		2	1	3	3	5		2	23
2018	1	5		3	1	1		5	1	2	1	3	23
2019		2	1	4		1		2	4	7	1	1	23

Table 10-8: Days on Which Nitrate Exceeded Sulfate Concentrations for the 20% Most Impaired Days for Great Smoky Mountains National Park

Class I Area	**2011**	**2016**	**2017**	**2018**	**2019**
Great Smoky Mountains National Park					
		Jan. 19	Jan. 7	Jan. 2, 5, & 17	Jan. 15 & 24
			Dec. 12 & 15	Mar. 9 & 21	Mar. 7 & 22
				Nov. 28	Nov. 20
				Dec. 2	
Total Days	0	1	3	7	5

Emissions Trends and PSAT Modeling for 2028

For Tennessee, Figure 10-4 and Figure 10-5 show statewide sector-level contributions to total emissions for SO_2 and NO_X, respectively. The 2011 and 2028 emissions are from the modeling platform used for modeling RPGs for Class I areas in Tennessee. The 2017 emissions are from the 2017 National Emissions Inventory (NEI). Table 10-9 summarizes the emissions by the major source categories [i.e., mobile (onroad and nonroad), stationary point (all point sources), and miscellaneous (includes predominately prescribed fires and wildfires)]. From 2011 – 2017, SO_2 and NO_X emissions have been reduced by 71% and 37%, respectively. From 2017 – 2028, SO_2 and NO_X emissions are projected to decline an additional 49% and 33%, respectively, due to federal and state control programs. Point sources that combust coal and oil containing sulfur (EGUs and non-EGUs) and industries that emit SO_2 (e.g., pulp and paper) are the major sources of SO_2 emissions and, therefore, can be easily linked to sulfate contributions at Class I areas. However, NO_X emissions are associated with fuel combustion in both the mobile and stationary source sectors. Unlike SO_2, it is difficult to identify the specific sources of NO_X that contribute to nitrate at an IMPROVE monitor on a given day of the year. For Tennessee, in 2017, highway (on-road) and off-highway (nonroad) vehicles considered together account for about 69% of total statewide emissions for all sectors.

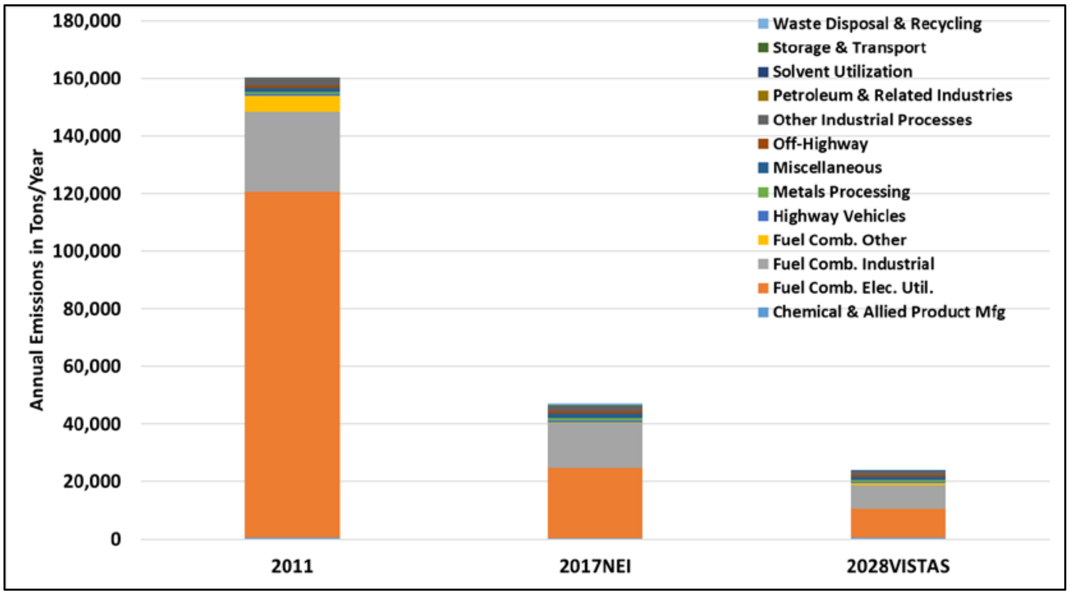

Figure 10-4: Tennessee SO_2 Emissions Trends by Sector

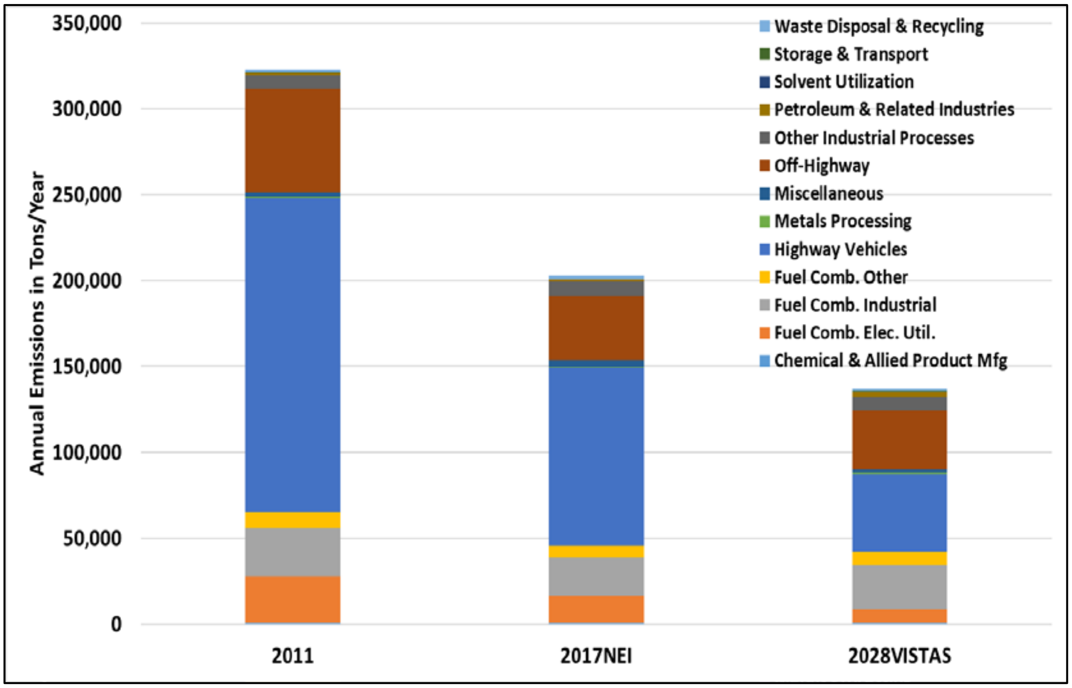

Figure 10-5: Tennessee NO_x Emissions Trends by Sector

Table 10-9 Comparison of Emission Sectors for 2011, 2017 and 2028 Emissions and Total Reductions

Emission Inventory Year	Onroad and Nonroad	Stationary Point	Miscel-laneous*	Total Emissions	Onroad and Nonroad	Stationary Point	Miscel-laneous*
	NO_x Emissions (TPY)				Percent of Total Emissions		
2011	243,180	76,547	2,840	322,567	75%	24%	1%
2017 NEI	140,660	58,629	3,614	202,903	69%	29%	2%
2028 VISTAS	78,523	55,983	2,450	136,956	57%	41%	2%
	SO_2 Emissions (TPY)						
2011	1,536	157,440	1,347	160,323	1%	98%	1%
2017 NEI	1,474	43,909	1,685	47,068	3%	93%	4%
2028 VISTAS	963	21,857	1,162	23,982	4%	91%	5%
			NO_x	SO_2			
Total Reduction from 2011 to 2017			37%	71%			
Total Reduction from 2017 to 2028			33%	49%			

* Miscellaneous emissions include predominately prescribed fires and wildfires.

Section 7.4 (Relative Contributions to Visibility Impairment: Pollutants, Source Categories, and Geographic Areas) of this SIP presents the PSAT modeling results for 2028 for the most impaired days for Class I areas in the VISTAS region. Figure 7-30 (2028 Nitrate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas) shows that contributions to nitrate impairment from the CENRAP, LADCO, and MANE-VU sources, as well as the sum contributions from the other VISTAS states, are significantly larger than contributions from Tennessee sources. Figure 7-34 (2028 Contribution to Light Extinction on the 20% Most Impaired Days at Great Smoky Mountains) shows that in 2028 the nitrate contribution is associated primarily with mobile (on-road and nonroad) and nonpoint stationary sources and point sources (EGU and non-EGU) outside of Tennessee. As shown in the right-most two columns in this figure, nitrate contributions from point sources (EGU or non-EGU) in Tennessee are negligible. Requiring additional NO_x controls on point sources in Tennessee would have little to no impact on improving visibility in the Great Smoky Mountains National Park. Further research is needed to understand which sources are contributing to the nitrate fraction both in Tennessee and out-of-state.

<u>Summary and Conclusions</u>

The TDEC-APC reviewed all available IMPROVE monitoring data for the Great Smoky Mountains National Park during the development of this SIP. Both SO_2 and NO_x emissions sources (both stationary and mobile) were analyzed during the AoI and PSAT modeling work to consider in the source selection step. The TDEC-APC also considered the flexibilities provided to the states in deciding how to prioritize pollutants and emission sources for improving visibility during the second planning period as documented in EPA's 2019 regional haze guidance. In so doing, for the second planning period, the TDEC-APC concluded that ammonium sulfate is the dominant pollutant followed by organic carbon and ammonium nitrate.

The NPS stated in their comments: "The Tennessee rationale for excluding NOx emissions from reasonable progress four-factor analyses is based solely on modeling results. We recognize that the VISTAS modeling methods follow EPA guidance and are technically sound, however given the outdated base year and the recent changes in pollutant composition on the 20% most impaired days, the result is not representative of current conditions and likely underestimates the future contribution of nitrate impairment."

The TDEC-APC agrees that the VISTAS modeling methods followed EPA guidance and are technically sound, but disagrees with the NPS comment for the following reasons:

- 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.

- About 18 months after VISTAS started its modeling using the 2011 platform, EPA released a new platform with a 2016 base year and then decided to conduct regional haze modeling for 2028 using the 2016 platform. The EPA modeling used 2016 meteorology and calculated RRFs (percent reduction between 2016 and 2028), which were applied to 2014 – 2017 IMPROVE data to calculate RPGs for 2028. Figure 10-6 compares the projected speciated modeling results from the EPA and VISTAS modeling for the Great Smoky Mountains National Park. The 2028 visibility impairment projection for the 20% most impaired days is generally similar, not only the sum of all the pollutants -- the RPG -- but also how much visibility impairment comes from each species. A common takeaway from both model projections is ammonium sulfate is expected to remain the dominant pollutant through 2028, and by a factor of 4 or greater, over ammonium nitrate at the Great Smoky Mountains National Park in Tennessee. It is also worth noting that VISTAS' projected total light extinction for 2028 is lower than EPA's projected 2028 visibility at the Great Smoky Mountains National Park (which is due to differences in the emission projections and size of the modeling domains). However, this analysis demonstrates that sulfate remains the dominant pollutant and will remain so over the coming planning period, whether 2011 or 2016 meteorology, and associated 20% most impaired days, are used.

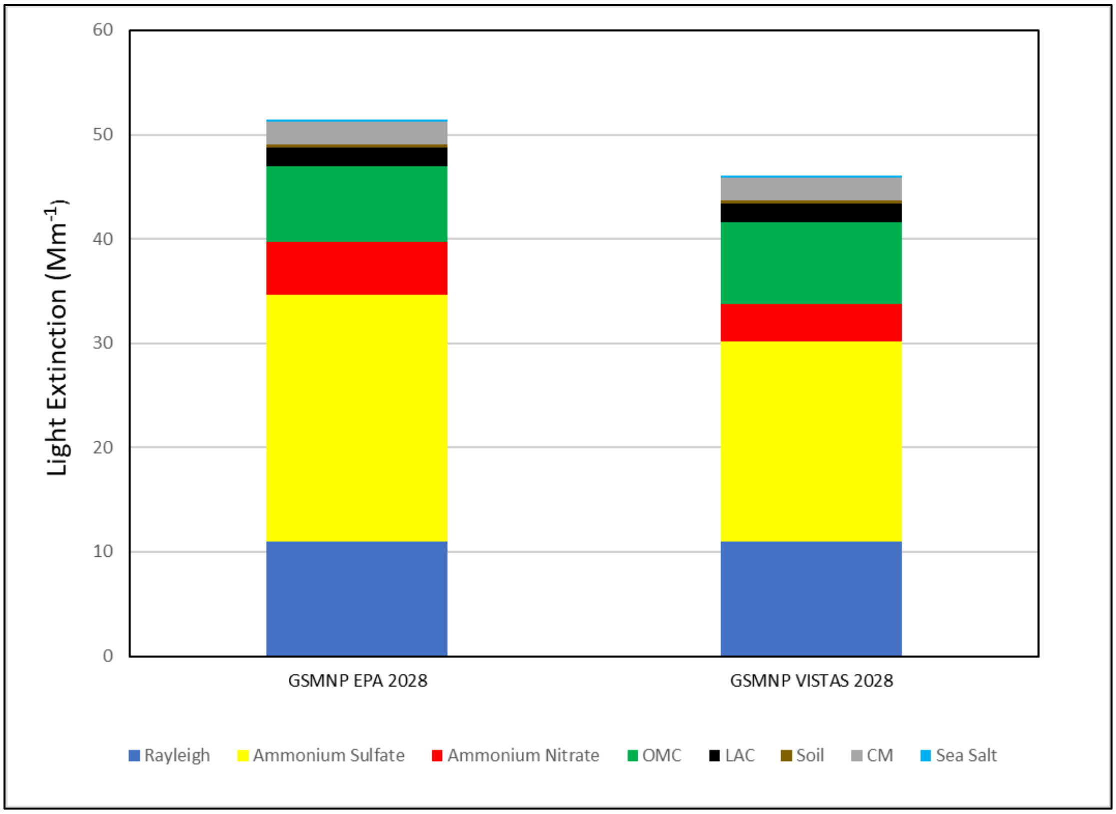

Figure 10-6: Projected 2028 Speciated Visibility Impairment for 20% Most Impaired Days at Great Smoky Mountains National Park (GSMNP)

- The TDEC-APC analyzed visibility impairment per ton of sulfate and nitrate emissions, respectively, at all Tennessee facilities selected for reasonable progress analysis (see Table 7-40), as well as all facilities outside of Tennessee selected by the TDEC-APC for reasonable progress analysis (see Table 7-41 and Table 7-42). The visibility impairment per ton of emissions for sulfate was compared against the same for nitrate as a ratio as follows:

$$ratio(facility, Class\ I\ area) = \frac{\left[\frac{Sulfate\ Visibility\ Impairment\ in\ Mm-1}{2028\ SO2\ Emissions\ in\ tpy}\right]}{\left[\frac{Nitrate\ Visibility\ Impairment\ in\ Mm-1}{2028\ NOx\ Emissions\ in\ tpy}\right]}$$

The sulfate to nitrate ratios by facility to the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area are shown in Table 10-10 (the cells with “N/A” indicate a nitrate PSAT visibility impact of zero associated with NO_x emissions). Visibility impacts from sulfate as a function of Mm^{-1} per ton are universally higher than the same for nitrate, in some cases by a factor of 96 or more. These results indicate that reducing one ton of SO_2 has a significantly higher impact on improving visibility at these Class I areas rather than controlling one ton of NO_x supporting the TDEC-APC's decision, in part, to focus on requesting facilities to perform four-factor analyses on only SO_2 emissions for this second planning period.

Table 10-10 Facility-Level Comparison of Sulfate versus Nitrate Visibility Impairment for the Great Smoky Mountains National Park

Facility	Great Smoky Mountains National Park	Joyce Kilmer-Slickrock Wilderness Area
Eastman Chemical Company	26.1	63.8
TVA – Cumberland Fossil Plant	11.7	7.7
Genon NE Mgmt Co/Keystone Station	51.9	N/A
Georgia Power Company – Plant Bowen	79.4	96.6
TVA – Shawnee Fossil Plant	6.0	4.9
Gibson	2.6	3.2
Indiana Michigan Power - Rockport	3.8	4.1
Duke Energy Ohio, Wm. H. Zimmer Station	31.3	47.3
General James M. Gavin Power Plant	64.4	87.9

"N/A" indicates a nitrate PSAT visibility impact of zero associated with NOx emissions.

- The regional haze planning process is iterative (with SIPs due every 10 years and progress reports due every 5 years) which provides an opportunity to further evaluate source contributions and meteorological conditions that contribute to the nitrate concentrations on specific days at each Class I area. The TDEC-APC believes that further research is needed to understand what emission sources and meteorology conditions are contributing to the variability in the nitrate from 2016 – 2019. Further research is also needed to understand what emission sources and meteorology conditions are contributing to the organic carbon fraction as well. The 2028 PSAT modeling completed for this SIP indicates that EGUs and non-EGU facilities in Tennessee have an insignificant contribution to the ammonium nitrate fraction at Class I areas in Tennessee. The modeling suggests that mobile sources in-state and out-of-state and point sources located out-of-state are the main contributors to the nitrate fraction. During the next planning period, the TDEC-APC commits to working with the NPS and other interested state and federal agencies to understand the emission sources that are contributing to nitrate and organic carbon concentrations at Class I areas in Tennessee.

10.4.2. Source Selection

NPS Comment

VISTAS states, including Tennessee, used a two-part screening process to select sources starting with the Area of Influence (AOI) and followed by source apportionment modeling. Both steps used an individual-facility-percent-of-total impact screening metric. This type of metric biases the results against the more visibility-impacted Class I areas. In fact, source impacts would have to be 80 times larger to identify a source for analysis in the most-visibility-impaired VISTAS Class I area compared to the least-visibility-impaired Class I area in the VISTAS region. The absolute value of the VISTAS thresholds to identify a source affecting Great Smoky Mountains NP is 19 times higher than was needed to identify a source affecting Everglades NP in Florida (the least-visibility-impaired VISTAS Class I area). We advised VISTAS states of this concern in April 2020.

We recommend that Tennessee reconsider their source selection decisions and address the sources identified by the NPS in their RH SIP. We developed our revised list of sources using the VISTAS AOI results. We compiled a list of sources for each state that comprises 80% of the combined AOI visibility impact from sulfur and nitrogen compounds at each NPS Class I area in the VISTAS region. This resulted in 17 Tennessee facilities affecting visibility at Great Smoky Mountains NP and other NPS Class I areas. We narrowed this list to 7 by removing sources that have either converted to natural gas, shutdown, or have low actual emissions. Each of the sources we are now recommending for four-factor analysis were included on the original list we shared with Tennessee for consideration in 2019.

According to the Regional Haze Rule and recently emphasized in the EPA 2021 Clarification Memorandum Section 2.1: "…given the interstate nature of regional haze, other states that also contribute at a given Class I area and FLMs play important roles in addressing visibility impairment. Pursuant to the RHR, states must, therefore, consider selecting sources identified by other states or by FLMs. A state receiving a request to select a particular source(s) should either perform a four-factor analysis on the source(s) or provide a well-reasoned explanation as to why it is choosing not to do so."

USFS Comment

Section 7.6 of TN's draft RH SIP discusses the methodology that TDEC-APC used to determine which sources to analyze for additional controls. Sources both within and out of TN were included in the screening (i.e., in the 'denominator' of the contribution evaluation), and a source was selected for reasonable progress evaluation / four-factor analysis if the facility was estimated to have a ≥ 1.00% sulfate contribution to visibility impairment in 2028 at one or more TN and NC Class I Areas. This process resulted in three TN facilities being selected for further evaluation. USDA Forest Service understands and recognizes that EPA has afforded states the flexibility to screen facilities for additional analysis if that screening is based on reasonable methods. However, we request that TN consider only in-state facilities in the denominator of the contribution equation when screening for sulfate and nitrate visibility contributions at a Class I Area, as outlined in the July 2021 EPA Regional Haze Clarification Memorandum (https://www.epa.gov/visibility/clarifications-regarding-regional-haze-state-implementation-plans-second-implementation). This methodology would result in a more robust reasonable progress evaluation by focusing on sources permitted by TDEC-APC. Additionally, since evaluations / four-factor analyses are time consuming and require additional resources, we would also suggest that TDEC-APC consider conducting four-factor analysis on a source category basis rather than on an individual facility basis when warranted.

TDEC-APC Response

The TDEC-APC appreciates the analyses the NPS prepared using the Q/d*EWRT values generated by VISTAS. This approach is superior to the Q/d approach which does not account for meteorology or properly weight SO_2 vs. NO_x impacts on visibility impairment. At some locations, 1 ton of SO_2 reduction can have anywhere from twice to more than 96 times the impact on visibility impairment as 1 ton of NO_x reduction (see Section 10.4.1 and Table 10-10).

The TDEC-APC reviewed the NPS analysis and, although it is informative, has taken a different approach to source selection. This approach does recognize the significant progress Tennessee has and is expected to achieve in the future toward improving visibility in its Class I areas which is consistent with EPA's August 20, 2019, guidance. Regarding the selection of sources for analysis (Step 3), EPA states:

> Page 5, Table 1: *Select the emission sources for which an analysis of emission control measures will be completed in the second implementation period and explain the bases for these selections. For the purpose of this source selection step, a state may consider estimated visibility impacts (or surrogate metrics for visibility impacts), the four statutory factors, the five required factors listed in section 51.308(f)(2)(iv), and other factors that are reasonable to consider.*
>
> Page 9: "*A key flexibility of the regional haze program is that a state is not required to evaluate all sources of emissions in each implementation period. Instead, a state may reasonably select a set of sources for an analysis of control measures. The guidance that an analysis of control measures is not required for every source in each implementation period is based on CAA section 169A(b)(2), which requires each SIP to contain emission limits, schedules of compliance, and other measures as may be necessary to make reasonable progress, but …does not provide direction regarding the particular sources or source categories to which such emission limits, etc., must apply. Selecting a set of sources for analysis of control measures in each implementation period is also consistent with the Regional Haze Rule, which sets up an iterative planning process and anticipates that a state may not need to analyze control measures for all its sources in a given SIP revision. Specifically, section 51.308(f)(2)(i) of the Regional Haze Rule requires a SIP to include a description of the criteria the state has used to determine the sources or groups*

of sources it evaluated for potential controls. Accordingly, it is reasonable and permissible for a state to distribute its own analytical work, and the compliance expenditures of source owners, over time by addressing some sources in the second implementation period and other sources in later periods. For the sources that are not selected for an analysis of control measures for purposes of the second implementation period, it may be appropriate for a state to consider whether measures for such sources are necessary to make reasonable progress in later implementation periods."

Consistent with the RHR, the TDEC-APC followed a process (documented in Sections 7.5 and 7.6) for narrowing the list of sources to consider for selecting for a four-factor analysis. In so doing, the TDEC-APC relied on the latest available tools (i.e., PSAT) to understand source impacts on visibility impairment in each Class I area. From the comparison of AoI to PSAT modeling of stationary sources, it became apparent that the AoI methodology overstates impacts close to Class I areas (i.e., <100 Km) and understates impacts associated with stationary sources located further away (i.e., >100 Km) from Class I areas.

As discussed in Section 7.2.2.1, the TVA consent decree finalized in 2011 required shut downs, new controls, and a switch from coal to natural gas at certain EGU facilities. From 2008 to 2019, there was a 94.6% reduction in SO_2 emissions and a 90.3% reduction in NO_x emissions from TVA's coal and natural gas plants in Tennessee. This action along with significant SO_2 and NO_x emission reductions from federal and state measures implemented during this timeframe has significantly improved visibility throughout Tennessee and border states. These actions have led to the situation that exists today where, as demonstrated from the PSAT modeling, stationary sources outside of Tennessee have a much higher impact on Class I areas in Tennessee than sources in the state. The TDEC-APC selected facilities for a reasonable progress/four-factor analysis if the facility's PSAT contribution was ≥1.00% for sulfate or nitrate. This threshold identified 7 out-of-state facilities in 5 states and 2 Tennessee facilities for reasonable progress/four-factor analysis. Given that this is a "regional" program, the TDEC-APC determined that selection of a total of 9 facilities impacting Tennessee Class I areas is reasonable and that it is important to engage with the 5 states with facilities with some of the highest impacts on Class I areas in Tennessee.

The factors that contribute to visibility impairment in each Class I area are unique to each Class I area. These factors include geographic location (coastal plain vs. mountains), meteorological patterns, location of emission sources relative to the Class I area, and the types and amounts of the pollutants from both anthropogenic and natural sources. For example, the factors that influence visibility impairment in the Everglades National Park are much different than the factors that impact the Great Smoky Mountains National Park. These are the reasons why the baseline condition (2000-2004) varies between Class I areas.

Table 10-11 shows baseline conditions, 2018 observed conditions vs. the URP, and 2028 modeled visibility vs. the URP for the Everglades National Park and the Great Smoky Mountains National Park. The baseline condition for the Everglades National Park is 9.6 dv lower than baseline condition for the Great Smoky Mountains National Park. Although natural conditions for the Everglades National Park is 1.72 dv lower than natural conditions for the Great Smoky Mountains National Park, the Great Smoky Mountains National Park still needs to achieve a much more significant reduction in emissions to achieve natural conditions as compared to other areas like the Everglades National Park.[67] Tennessee recognized this challenge early on which is reflected in the significant improvement in visibility in the Class I areas in the state. For example, in comparing the difference between the 2018 URP minus observed data for each Class I area, the Great Smoky Mountains National Park has achieved 5.3 dv more improvement than the Everglades National Park. For 2028, the Everglades National Park is just 1.57 dv below the URP. The 2028 modeled RPGs for the Great Smoky Mountains National Park is less than the 2028 URP for the Everglades National Park. Thus, for a given Class I area, it is reasonable for a state to select more sources for four-factor analysis if the Class I area is just below or at the URP, and to select fewer sources if the Class I area is well below the URP. The last column of Table 10-11 shows the amount of visibility improvement projected for 2028 relative to the 2028 URP for each Class I area. These data show that the Great Smoky Mountains National Park is expected to continue to achieve significantly more progress than the Everglades National Park. Thus, the TDEC-APC does not agree that the methods it used for source selection resulted in any bias toward Class I areas in Tennessee.

Table 10-11 Comparison of Baseline Conditions to 2018 Observed and 2028 Modeled Visibility for 20% Most Impaired Days for Everglades National Park versus Great Smoky Mountains National Park

Class I Area	Baseline Average (2000-2004)	2014-2018 Average Observed[1]	2018 URP	2018 URP minus Observed	2028 Modeled RPG	2028 URP	2028 URP minus Modeled
Everglades National Park	19.52	14.82	16.91	2.09	13.95[2]	15.52	1.57
Great Smoky Mountains National Park	29.11	17.28	24.66	7.38	15.03	21.49	6.46

[1] These values represent the average of IMPROVE monitoring data for 2014-2018.
[2] Based on EPA's regional haze modeling for 2028.

10.4.3. Specific Facilities in Tennessee

NPS Comment

After review of the Tennessee draft SIP, we ask that Tennessee conduct, or expand and revise four-factor analyses exploring both SO_2 and NO_X emission reduction opportunities in this planning period for the following sources:

[67] Table 2-2 and Table 2-3 of this SIP present natural and baseline conditions for Class I areas, respectively.

- TVA Cumberland Fossil Plant
- TVA Kingston Fossil Plant
- Eastman Chemical Company
- TVA Gallatin Fossil Plant
- Cemex - Knoxville Plant
- AGC Industries - Greenland Plant
- O-N Minerals (Luttrell) Company

In general, we encourage Tennessee to evaluate potential scrubber upgrades and optimization of SCR controls to improve SO_2 and NO_X control efficiencies for the identified EGUs. We request that Tennessee implement any cost-effective reasonable controls identified in this planning period, including the scrubber/SO_2 control upgrades evaluated for the Cumberland and Tennessee Eastman facilities. Such action would demonstrate Tennessee's commitment to substantively addressing regional haze requirements and making reasonable progress towards clean air and clear views in this planning period.

USFS Comment

Though the TVA Kingston facility exceeds the 1% sulfate threshold used by TDEC-APC for three Class I areas, a follow-up letter from TVA indicated that their projected 2028 emissions will be lower than the modeled estimates and TDEC-APC adjusted the PSAT results to reflect the updated emissions. As a result, the modeled impact from TVA Kingston fell below the 1% threshold and TDEC-APC did not request a 4-factor analysis for the facility. We appreciate that TVA has provided an updated emissions inventory to better reflect the 2028 emissions for this particular facility. This is an admirable first step, but these assumptions should be made enforceable. We also extend this to assumptions regarding:

- operating scenarios for emission units that represent a reduced capacity, for example a reduced number of operating hours per year,
- pollution control equipment efficiency used to designate a unit as "effectively controlled."

We ask that TDEC-APC include within the Regional Haze SIP federally enforceable operational or emission limitations on the TVA Kingston facility that reflect the emission scenario set forth above for 2028. Without such federally enforceable limitations, TDEC-APC should conduct a 4-factor analysis for the TVA Kingston facility.

TDEC-APC Response

The TDEC-APC stands by the analysis made in Sections 7.5 and 7.6. Based on that analysis, nine facilities were identified to evaluate additional controls for reasonable progress for Tennessee's Class I areas and Class I areas outside Tennessee that are impacted by Tennessee facilities. For both Class I areas located in Tennessee, the TDEC-APC believes the 1.00% threshold captures a reasonable set of sources of emissions to assess for determining what measures are necessary to make reasonable progress. The two Tennessee facilities are TVA Cumberland and Eastman Chemical Company. The TDEC-APC believes that by selecting these two Tennessee facilities for reasonable progress analysis this captures a meaningful portion of the Tennessee's total contribution to visibility impairment to Class I areas.

TVA Cumberland

TVA Cumberland was above the 3.0% AoI threshold so it was chosen for PSAT modeling. Table 7-32 and Table 7-33 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-32, the highest adjusted sulfate PSAT results were 1.56%, 1.38%, and 1.26% for Sipsey Wilderness Area, Shining Rock Wilderness Area, and Linville Gorge Wilderness Area, respectively. The sulfate PSAT results were above the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Thus, the TDEC-APC requested that TVA Cumberland perform an SO_2 reasonable progress analysis. As shown in the Table 7-33, the highest adjusted nitrate PSAT results were 0.18%, 0.17%, and 0.13% for Sipsey Wilderness Area, Mammoth Cave National Park, and Mingo Wilderness Area, respectively. The nitrate PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC did not request TVA Cumberland to perform a NOx reasonable progress analysis.

Where appropriate, the TDEC-APC followed the recommendations in the *EPA Air Pollution Control Cost Manual*. As recommended by EPA, the TDEC-APC expressed the costs of compliance in terms of a cost/ton of emissions reduction metric. The TDEC-APC took into consideration the FLM and EPA's comments on TVA's cost analysis and made adjustments, where appropriate, and recalculated the cost of compliance. These adjustments are detailed in Appendix G-1g. The TDEC-APC did not use a cost threshold. Instead, the cost of compliance for the different control options were compared to cost statistics that were compiled for facilities that had previously implement BART and reasonable progress controls. TDEC-APC agrees with the use of a 10-year equipment life in the cost calculations because the scrubbers are over 25 years old. TDEC-APC also notes that TVA's analysis states that retirement in 2035 would represent less than ten years of remaining life after additional controls would be installed. All control options identified for TVA Cumberland were deferred to a future review period based on cost, which includes the energy impacts and remaining useful life. The lowest-cost control option (installation of wall rings) is 4.9 times higher than the median cost identified by VISTAS for similar options and 3.2 times higher than the average value.

Eastman Chemical Company

Eastman Chemical Company was above the 3.0% AoI threshold so it was chosen for PSAT modeling. Table 7-30 and Table 7-31 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-30, the highest adjusted sulfate PSAT results were 4.26%, 1.37%, and 1.31% for Linville Gorge Wilderness Area, Joyce Kilmer Slick-Rock Wilderness Area, and Cohutta Wilderness Area, respectively. The sulfate PSAT results were above the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Thus, the TDEC-APC requested that Eastman Chemical Company perform an SO_2 reasonable progress analysis. As shown in the Table 7-31, the highest adjusted nitrate PSAT results were 0.11%, 0.10%, and 0.05% for Linville Gorge Wilderness Area, Cohutta Wilderness Area, and Great Smoky Mountains National Park, respectively. The nitrate PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC did not request Eastman Chemical Company to perform a NOx reasonable progress analysis.

Where appropriate, the TDEC-APC followed the recommendations in the *EPA Air Pollution Control Cost Manual*. As recommended by EPA, the TDEC-APC expressed the costs of compliance in terms of a cost/ton of emissions reduction metric. The TDEC-APC took into consideration the FLM and EPA's comments on Eastman's cost analysis and made adjustments, where appropriate, and recalculated the cost of compliance. These adjustments are detailed in Appendix G-2f. The TDEC-APC did not use a cost threshold. Instead, the cost of compliance for the different control options were compared to cost statistics that were compiled for facilities that had previously implemented BART and reasonable progress controls. Reasonable progress for this facility is based on the planned shutdowns of B-83 Boilers 18 through 20 and the installation of dry sorbent injection (without upgrading the existing ESPs) on Boilers 23 and 24. For all other reductions considered in the analysis, the cost was considered too high compared to comparable projects.

TVA Kingston

TVA Kingston was above the 3.0% AoI threshold so it was chosen for PSAT modeling. As discussed in Section 7.6.4, and Appendix G-1, the projected 2028 emissions for TVA Kingston were revised based on TVA's Strategic Power Supply Plan projections. Table 7-34 and Table 7-35 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-34, the highest adjusted sulfate PSAT results were 0.41%, 0.40%, and 0.35% for Joyce Kilmer Slick-Rock Wilderness Area, Great Smoky Mountains National Park, and Cohutta Wilderness Area, respectively. As shown in the Table 7-35, the highest adjusted nitrate PSAT results were 0.033%, 0.027%, and 0.020% for Joyce Kilmer Slick-Rock Wilderness Area, Great

Smoky Mountains National Park, and Cohutta Wilderness Area, respectively. These PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC does not think it is necessary to conduct a reasonable progress analysis for TVA Kingston. Additionally, TVA is planning on retiring all of the units at TVA Kingston by 2033. The TDEC-APC has consulted with EPA Region 4 and has concluded that a reasonable progress analysis is not warranted given TDEC-APC's conclusion that the source's impacts fall below the State's source selection threshold under the State's selection methodology. The rationale for not requiring enforceable SIP limits is described in detail in Appendix G-1h.

Cemex Knoxville

Cemex Knoxville was not above the 3.0% AoI threshold for any Class I area. The TDEC-APC chose to select Cemex Knoxville for PSAT modeling at the request of the Knoxville Local Program. Table 7-36 and Table 7-37 show the adjusted sulfate and nitrate PSAT modeling results, respectively. As shown in the Table 7-36, the highest adjusted sulfate PSAT results were 0.113%, 0.107%, and 0.048% for Great Smoky Mountains National Park, Joyce Kilmer Slick-Rock Wilderness Area, and Cohutta Wilderness Area, respectively. As shown in the Table 7-37, the highest adjusted nitrate PSAT results were 0.045%, 0.032%, and 0.031% for Great Smoky Mountains National Park, Cohutta Wilderness Area, and Joyce Kilmer Slick-Rock Wilderness Area, respectively. These PSAT results fell well below the 1.00% PSAT threshold for a facility to be deemed significantly impacting a Class I area. Therefore, the TDEC-APC does not think it is necessary to conduct a reasonable progress analysis for Cemex Knoxville.

TVA Gallatin, O-N Minerals, and AGC Industries

These three facilities were below the 3.0% AoI threshold that was used as a cutoff to determine which facilities would be chosen for PSAT modeling. None of these facilities were even above 2.0%. From Table 10-12, the highest AoI sulfate + nitrate facility contributions for TVA Gallatin, O-N Minerals, and AGC Industries are 0.695%, 0.377%, and 1.98%, respectively. Therefore, the TDEC-APC does not think it is necessary to conduct a reasonable progress analysis for TVA Gallatin, O-N Minerals, and AGC Industries.

Table 10-12: AoI Sulfate + Nitrate Facility Contributions to Visibility Impairment on the 20% Most Impaired days for 3 Tennessee Facilities

	Great Smoky Mountains NP	Joyce Kilmer-Slick Rock Wilderness Area	Sipsey Wilderness Area	Mammoth Cave NP	Cohutta Wilderness Area	Linville Gorge Wilderness Area	Shining Rock Wilderness Area
TVA Gallatin	0.424%	0.339%	0.695%	0.596%	0.418%	0.0703%	0.0922%
O-N Minerals	0.377%	0.237%	0.00823%	0.00162%	0.0604%	0.0613%	0.0565%
AGC Industries	0.672%	0.504%	0.00373%	0.00644%	0.190%	1.98%	0.487%

10.4.4. Four Factor Analysis

NPS Comments

TVA Cumberland

The TVA Cumberland facility is located approximately 145 km southwest of Mammoth Cave NP and 345 km northwest of Great Smoky Mountains NP. The NPS re-sorted and ranked the VISTAS Area of Influence (AOI) results to develop source lists that capture 80% of the AOI impact (total extinction-weighted residence times * Q/d) for each NPS Class I area in the VISTAS region. TVA Cumberland is on the 80% impact list for both Mammoth Cave NP and Great Smoky Mountains NP and is the number one facility in Tennessee contributing to haze in NPS Class I areas based on the sum of the AOI results across all NPS Class I areas in the VISTAS region. Likewise, it is the number one facility in Tennessee based on the sum of the PSAT source apportionment results across affected NPS Class I areas in the VISTAS region (Great Smoky Mountains, Mammoth Cave, and Shenandoah NPs). Therefore, we recommend that emissions from this source should be addressed in this round of regional haze planning.

Based on facility data provided in the EPA's Clean Air Markets Division (CAMD) database, the scrubbers on the two boilers at the Cumberland facility, which were installed in 1995, are currently achieving 97% control. The cost-effectiveness of the scrubber upgrades evaluated ranges from $3100 - $6,500/ton—as estimated by TVA. These costs are well within the range of cost-effective thresholds selected by other states in this round of regional haze planning.

As we noted in our previous input on the TVA Cumberland four-factor analysis "the costs of control measures selected during this second implementation period are likely to exceed those during the first implementation period when one considers inflation and the need to control emission units with lower emissions. We are now seeing cost-effectiveness thresholds of $4,500 - $10,000/ton (ND and OR, respectively), and expect to see most in the $5,000 - $7,000/ton range." We have since learned that other states are considering a $10,000/ton threshold or a threshold between $7,000-$10,000 ton. TDEC-APC discussed "median costs" in their SIP determination for TVA Cumberland. It is not clear what "median costs" TDEC-APC is referencing, but we note that RP determinations and BART determinations are not directly comparable[68] and that cost thresholds will need to increase to continue making further reasonable progress as we move into later planning periods. If cost thresholds are held constant, further progress will not be feasible. TDEC-APC did not identify a cost-effectiveness threshold in the SIP. What cost-effectiveness

[68] EPA addressed this in their final FIP for Arizona noting: "Given the ***differences between the BART factors and RP factors*** and the nature of the applicability criteria that would trigger BART and RP analyses, we do not necessarily consider the ***cost-effectiveness*** and visibility benefit values from BART determinations ***to be directly comparable*** to RP analyses."

threshold did TDEC apply to determine that scrubber upgrades were not necessary in this planning period and what is the rationale for this determination?

In addition, we noted several errors in the Cumberland analysis including unsupported assumptions for remaining useful life. When corrected, the controls considered would likely be even more cost-effective than evaluated by TVA.

Finally, in our initial feedback on the Cumberland facility (March 2021) we agreed that SCR is the top tier control for determining whether coal-fired units are effectively controlled for NO_x. However, after an in-depth review of CAMD data, we note that the SCRs on the two Cumberland units, which were installed in 2003, are achieving 84% and 87% control efficiency on units 1 and 2, respectively, with corresponding emission rates of 0.076 and 0.074 lb/MMBtu. The top performing SCRs on coal-fired boilers are achieving emission rates of 0.04 lb/MMBtu or better. We request that TDEC-APC address whether optimization of the SCRs to improve control efficiencies for the two Cumberland units is feasible to attain emission rates of 0.04 lb/MMBtu. (See attached spreadsheet TVA_units_emiss_reccord_CAMD_final.xlsx.)

TVA Kingston

Kingston is located approximately 60 km to the west of Great Smoky Mountains National Park. The NPS re-sorted and ranked the VISTAS Area of Influence (AOI) results to develop source lists that capture 80% of the AOI impact (total extinction-weighted residence times * Q/d) for each NPS Class I area in the VISTAS region. TVA Kingston facility is on the 80% impact list for Great Smoky Mountains NP and is the second largest impacting facility in Tennessee based on the sum of the AOI results across all NPS Class I areas in the VISTAS region. Similarly, it is the second largest impacting facility in Tennessee based on the sum of the PSAT source apportionment results across the three affected NPS Class I areas in the VISTAS region (Great Smoky Mountains, Mammoth Cave, and Shenandoah NPs). Therefore, we recommend that emissions from this source should be addressed in this round of regional haze planning.

The source was ‘tagged’ in the VISTAS source apportionment PSAT modeling, but as described in the SIP, was eliminated from further review based on future emission assumptions which were used to “scale” the individual facility impact. Based on the information provided in the SIP, the scaled impacts reflect a 78% reduction from the original modeled impacts. How will the assumed emission reductions be achieved?

The 2028 SO_2 emission reductions assumed in the SIP and relied on to determine that the Kingston facility does not need to go through a four-factor analysis should be enforceable and permanent. In the absence of this information, which was not documented in the SIP, we recommend that a four-factor analysis should be required for the facility. In their July 8, 2021 Memorandum, Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period, EPA states:

"Therefore, on-the-way measures, including anticipated shutdowns that are relied on to forgo a four-factor analysis or to shorten the remaining useful life of a source, are necessary to make reasonable progress and must be included in a SIP."

And

"As explained in the August 2019 Guidance, reasonable bases for projecting that future emissions will be significantly different than past emissions are enforceable requirements and energy efficiency, renewable energy, or other similar programs, where there is a documented commitment to participate and a verifiable basis for quantifying changes in future emissions. However, in some cases states may have projected significantly lower total emissions due to unenforceable utilization or production assumptions and those projections are dispositive of the four-factor analysis."

Based on information provided in appendix G, the 2028 emission reductions are not based on an enforceable requirement. From Appendix G-1; TVA letter to TDEC-APC dated February 28, 2020 [Redacted Copy]: "TVA's Strategic Power Supply Plan (SPSP) includes both capacity and generation projections for all of TVA's assets through 2040. The fiscal year (FY) 2021 plan should be considered when determining the most reasonable estimate for projected 2028 SO_2 emissions." We could not find the Strategic Power Supply Plan referenced by TVA. However, in their most recent 2019 Integrated Resource Plan that is available online, TVA indicates that they intend to continue operation of the Kingston, Cumberland, and Gallatin facilities within this RH planning period. The IRP does not address an anticipated reduction in capacity at these facilities.

TVA further makes the case that the Kingston units are already "effectively controlled" by meeting the MATS limits, and therefore, it is unlikely that an analysis would result in cost-effective controls. We note that TDEC-APC rejected this option as an offramp for analysis (Appendix G-1; TDEC-APC letter to TVA dated March 30, 2020). We agree that this alone should not be used to exclude sources from four-factor analyses. As discussed in the 2021 EPA Clarification Memo, we recommend that upgrades to existing pollution control equipment should be evaluated for the Kingston facility. [69]

[69] The EPA Memorandum, *Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period*, released July 8th, 2021 addresses the need to consider potential upgrades to existing controls in Sections 2.3 and 3.2:

"Similarly, in some cases, states may be able to achieve greater control efficiencies, and, therefore, lower emission rates, using their existing measures. Considering efficiency improvements for an existing control (e.g., using additional reagent to increase the efficiency of an existing scrubber) as a potential measure is generally reasonable since in many cases such improvements may only involve additional operation and maintenance costs. States should

Based on facility data provided in the EPA's Clean Air Markets Division database, the scrubbers on the nine boilers at the Kingston facility, which were installed in 2009, are achieving 92%-93% control with SO_2 emission rates ranging from 0.071 to 0.087 lb/MMBtu. According to the control cost manual chapter for acid gas scrubbers, wet lime scrubbers can achieve 95%-99% control and an emission rate of 0.04 lb/MMBtu or lower for the 20% top performing facilities. Ranking all coal-fired boilers based on 2020 emission rates in the CAMD database, there are over 200 units that report lower SO_2 emission rates on a lb/MMBtu basis, with the lowest SO_2 emission rates reported at 0.001 lb/MMBtu.

Based on this, we recommend that the TVA Kingston facility may be able to "reasonably attain a lower rate" (per EPA guidance) and it would be appropriate to evaluate potential options to improve scrubber control efficiency on the Kingston units (as was done for the Cumberland facility). We note that the costs of scrubber upgrades were found to be very reasonable for the Cumberland facility.

Based on CAMD data, the SCRs on the Kingston units are achieving 84%-88% control efficiency with NO_x emission rates between 0.064 and 0.067 lb/MMBtu. Again, we note that the top performing SCRs on coal-fired boilers are achieving emission rates of 0.04 lb/MMBtu or better. We request that TDEC-APC address whether optimization of the SCRs to improve control efficiencies for the Kingston units is feasible. (See attached spreadsheet TVA_units_emiss_reccord_CAMD_final.xlsx.)

<u>TVA Gallatin</u>

The TVA Gallatin facility is located approximately 93 km from Mammoth Cave NP and 234 km from Great Smoky Mountains NP. The NPS re-sorted and ranked the VISTAS Area of Influence (AOI) results to develop source lists that capture 80% of the AOI impact (total extinction-weighted residence times * Q/d) for each NPS Class I area in the VISTAS region. The TVA Gallatin facility is on the 80% impact list for Mammoth Cave NP and Great Smoky Mountains NP and is the fourth largest impacting facility in Tennessee based on the sum of the AOI results across all NPS Class I

generally include efficiency improvements for sources' existing measures as control options in their four-factor analyses in addition to other types of emission reduction measures." (Section 3.2)

"The underlying rationale for the "effective controls" flexibility is that if a source's emissions are already well controlled, it is unlikely that further cost-effective reductions are available. A state relying on an "effective control" to avoid performing a four-factor analysis for a source should demonstrate why, for that source specifically, a four-factor analysis would not result in new controls and would, therefore, be a futile exercise. States should first assess whether the source in question already operates an "effective control" as described in the August 2019 Guidance. *<u>They should further consider information specific to the source, including recent actual and projected emission rates, to determine if the source could reasonably attain a lower rate</u>*." (Section 2.3) Based on CAMD data for existing similar sources, we recommend that the TVA facilities may be able to "reasonably attain a lower rate."

areas in the VISTAS region. (As described above, Gallatin was not 'tagged' for PSAT source apportionment modeling.) We recommend that emissions from this source should be addressed in this round of regional haze planning.

As noted in the SIP, the "TVA entered into a court settlement in 2011 for previous violations of the Clean Air Act." This settlement required the installation of scrubbers and SCR at the four Gallatin units. All SCRs were installed and operational by December 2017. FGD controls were installed on Units 1, 3 and 4 in 2015 and Unit 2 in 2016.

Based on facility data provided in the EPA's Clean Air Markets Division database, the recently installed dry lime FGDs and SCRs are achieving the following emission rates/control efficiencies:

Unit	SO_2 Emission Rate (lb/MMBtu)	SO_2 Control Efficiency	NO_x Emission Rate (lb/MMBtu)	NO_x Control Efficiency
1	0.06	90%	0.054	70%
2	0.07	89%	0.053	71%
3	0.05	91%	0.053	71%
4	0.05	92%	0.047	76%

We have several comments about the existing controls at the Gallatin facility.

First it appears that the dry FGDs and SCRs have not been optimized to achieve the highest degree of control feasible for these systems, which should be expected given that they were installed between four and six years ago.

According to the control cost manual chapter for acid gas scrubbers, dry FGD systems provide removal efficiency up to 95% and are "typically installed on smaller boilers, furnaces, and incinerators, although some newer dry FGD systems have been installed on combustion units larger than 500 MW (5,000 MMBtu/hour) burning bituminous and subbituminous coal. However, for combustion sources that exceed 200 MW (2,000 MMbtu/hour), operators are more likely to install a wet FGD system. Dry FGD systems typically have lower capital and operating costs and require less space than wet FGD systems."

We note that again, based on CAMD data, the units at Gallatin are larger than 200 MW gross generating capacity (based on the final Consent Decree these units are approximately 300 MW capacity). Can TDEC-APC clarify why TVA opted to install dry rather than wet FGDs on the Gallatin units under the 2011 consent decree?

According to the most recent 2020 CAMD data, the Gallatin units were ranked #260 to #282 among all coal-fired boilers in terms of their controlled SO_2 emission rate (lb/MMBtu) and #27 to

#36 among coal-fired units with dry lime FGDs, indicating that even among units controlled with dry lime FGDs, the Gallatin units are not among the top tier well-controlled facilities.

The CCM chapter on Selective Catalytic Reduction notes that "In practice, commercial coal-, oil-, and natural gas–fired SCR systems are often designed to meet control targets of over 90 percent. However, the reduction may be less than 90 percent when SCR follows other NO_x controls such as LNB or FGR that achieve relatively low emissions on their own. The outlet concentration from SCR on a utility boiler is rarely less than 0.04 lb/million British thermal units (MMBtu).
Based on 2020 CAMD data, there are three coal-fired units equipped with SCR with NO_x emissions just under 0.04 lb/MMBtu. In 2020, the Gallatin units ranked #47 (unit 3) up to #143 (unit 4) in terms of NO_x emission rates (lbs/MMBtu) among all coal-fired units. We note that NO_x emission rates for the Gallatin units were much higher in 2020 than in in 2018. Some of the Gallatin units achieved NO_x emission rates at or below the 0.04 lb/MMBtu rate in 2018 but reported 2020 emission rates were nearly double 2018 rates for some of the units.

Given this, we note the following recommendations with respect to achievable emission limits in the EPA July 8, 2021, Memorandum: "It may be difficult for a state to demonstrate that a four-factor analysis is futile for a source just because it has an "effective control" if it has recently operated at a significantly lower emission rate. In that case, a four-factor analysis may identify a lower emission rate (e.g., associated with more efficient use of the "effective existing controls") that may be reasonable and thus necessary for reasonable progress. If a source can achieve, or is achieving, a lower emission rate using its existing measures than the rate assumed for the "effective control," a state should further analyze the lower emission rate(s) as a potential control option."

Please provide the permitted NO_x emission limits for the Gallatin units on a lb/MMBtu basis. We request that TDEC-APC evaluate NO_x emission limitation reductions for the four Gallatin units that are consistent with the lowest rates achievable in practice for coal-fired boilers.

Second, based on the SIP, these controls are the result of a negotiated settlement for CAA violations in the TVA system, which highlights several concerns:

- The FLMs were not consulted with respect to the controls identified under this negotiated settlement, nor is it likely that the visibility impacts or benefits from these facilities and proposed controls were evaluated as part of the settlement agreement. This cut the NPS out of the process for determining effective control efficiencies for the Gallatin facility.

- The controlled emission rates under the settlement agreement likely do not reflect a Best Available Control Technology (BACT) level of control. Had the facilities involved in the settlement agreement been required to go through a BACT analysis when making upgrades rather than a negotiated settlement, they would have been required to consider emission rates associated with the highest level of control demonstrated in practice in the top-down BACT analysis.

- As recognized in the settlement agreement, emissions from the alleged TVA CAA violations resulted in excess pollution that harmed nearby national parks. Given that TVA has recently installed controls on the Gallatin units (rather than repower with biomass or retire, alternate options allowed under the CD), it is likely this facility will continue operating in the foreseeable future. Like Cumberland, TVA may increase utilization of the Gallatin units due to shutdowns elsewhere in the TVA system. In recognition of the history of impacts that TVA sources caused in NPS Class I areas, we recommend that the controls installed at this facility should be optimized to achieve a BACT-level of control.

- Controls installed because of CAA violations and associated civil penalties should not preclude an analysis of the facility to comply with reasonable progress requirements under the regional haze rule.

In conclusion, we request that TDEC-APC evaluate whether the existing controls could be optimized to improve SO_2 and NO_x control efficiency for the Gallatin units one through four.

Eastman Chemical Company

Tennessee Eastman is located approximately 157 km from Great Smoky Mountains National Park. The NPS re-sorted and ranked the VISTAS Area of Influence (AOI) results to develop source lists that capture 80% of the AOI impact (total extinction-weighted residence times * Q/d) for each NPS Class I area in the VISTAS region. The Tennessee Eastman facility is on the 80% impact list for Great Smoky Mountains NP and is the third largest impacting facility in Tennessee based on the sum of the AOI results across all NPS Class I areas in the VISTAS region (when excluding the Mc Ghee Tyson airport). Similarly, it is the third largest impacting facility in Tennessee based on the sum of the PSAT source apportionment results across the three affected NPS Class I areas in the VISTAS region (Great Smoky Mountains, Mammoth Cave, and Shenandoah NPs). Therefore, we recommend that emissions from this source should be addressed in this round of regional haze planning.

The four-factor analysis completed by Tennessee Eastman evaluated the following control options:

- Replacing the existing ESP with a fabric filter baghouse on boiler 30 to improve the SO_2 control efficiency of existing SDA controls (currently 70%).

- Replacing the existing ESP with a fabric filter baghouse on boilers 23 and 24 to improve the control efficiency of planned DSI controls. The DSI controls are required under the Contingency Plan for the Sullivan County SO_2 Nonattainment Plan and are currently under construction.

- Install a DSI system and replace the existing ESP with a fabric filter baghouse on boilers 21 and 22.

We found several errors the cost analyses completed by Eastman. These are documented below. The NPS corrected these errors and recalculated the control costs of the controls considered by Eastman—our calculations are provided in the attached spreadsheets.

1) Contingencies:

Eastman's contingency estimate is exceedingly high compared to CCM methods. Eastman's analysis notes that the contingency costs are based on a "Vendor/engineering study estimate." From the Eastman vendor information chapter provided to the NPS on August 20, 2021: Contingency accounts for unpredictable events and costs that could not be anticipated during the normal cost development of a project. The contingency cost category includes items such as possible redesign and equipment modifications, errors in estimation, **<u>unforeseen weather-related delays, strikes and labor shortages, escalation increases in equipment costs, increases in labor costs</u>**, delays encountered in startup, etc."

Please note, section 1 of Chapter 2—Cost Estimation: Concepts and Methodology of the 7th edition Control Cost Manual states: "contingency should not account for events such as price escalation, work stoppages, and disasters."

The NPS revised this value to reflect the contingency estimate methods in Section 6, Chapter 1—Baghouses and Filters of the CCM, which is 3% of Purchased Equipment Costs. Note the value estimated by the NPS is still higher than the CCM recommended method because our estimates are based on 3% of the TDCC rather than the PEC.

2) Escalation

Eastman included \$1.8 to \$3.4 million dollars in escalation costs in their control cost estimates citing a "Vendor /engineering study estimate." From the Eastman vendor information chapter provided to the NPS on August 20, 2021: "**Escalation is included in the cost estimates at the rate of 3% per year for 2 years (total of 6 percent**). The 3 percent rate is based on published indices from Global Insight, ENR, and the Bureau of Labor Statistics, as well as Black & Veatch experience. The 2-year duration is based on escalating from February 2011 to January 2013 (approximately the mid-point of construction, based on the current schedule). The mid-point of construction is a common industry standard point-in-time, for escalation purposes, to capture all costs for escalatable items, without overstating the effect.'

CCM does not allow for escalation. From Section 1 of Chapter 2—Cost Estimation: Concepts and Methodology of the 7th edition Control Cost Manual: "The capital cost **should be estimated for the time that the cost estimate is prepared**, and **should not be escalated to some future year**, such as an anticipated date that construction will be completed or some other future year unless the analyst has a robust method to forecast future inflation."

The NPS removed escalation costs from the analysis according to CCM guidance.

3) Maintenance Materials and Labor Costs

Eastman's estimates for Maintenance Materials and Labor Costs seem to be grossly inflated relative to estimates in the CCM. However, we left Eastman's estimates in our revised analysis given that we don't have the full vendor "quotes" and cost information (it is marked as CBI by Eastman and not available to the NPS). The revised costs of control are still very reasonable even with the potentially inflated values.

From the Eastman vendor information chapter provided to the NPS on August 20, 2021: "The annual maintenance materials and labor costs are typically estimated as a percentage of the total equipment costs of the system. Based on typical electrical utility industry experience, maintenance materials are estimated to be between 1 and 5 percent of the total direct capital costs according to the retrofit technology. Some initial recommended spare parts are included in the capital costs. An annual maintenance value of 3 percent of the total direct capital costs was used as the basis for the yearly maintenance materials and labor cost. For technologies that replace a similar existing technology in the current plant site, a determination of the additional maintenance requirements is performed. If the required maintenance materials and labor are similar to the existing technology, no additional maintenance costs are credited for the new control technology."

Note, Section 1 of Chapter 2—Cost Estimation: Concepts and Methodology of the 7th edition Control Cost Manual states: "Maintenance labor is calculated in the same way as operating labor and is influenced by the same variables. The maintenance labor rate, however, is normally higher than the operating labor rate, mainly because more skilled personnel are required. Many cost studies use a flat ten percent premium over the operations labor wage rate for maintenance labor costs. [13] A certain amount must also be added to operating labor to cover supervisory requirements. Generally, cost estimates include supervisory labor as a flat fifteen per cent of the operating labor requirement. [13] To obtain the annual labor cost, multiply the operating and supervisory labor requirements (labor-hr/operating-hr) by the respective wage rates (in $/labor-hr) and the system operating factor (number of hours per year the system is in operation). Wage rates also vary widely, depending upon the source category, geographical location, etc. These data are tabulated and periodically updated by the U.S. Department of Labor, Bureau of Labor Statistics, in its Monthly Labor Review and in other publications. This Manual uses labor rates that are representative of industries at the national level. For cost assessments, these wages (adjusted for inflation through an appropriate cost index) should be adequate for study level purposes."

- The RP goals identified for this facility were already slated to occur under the Contingency Plan for the Sullivan County SO_2 Nonattainment Plan and are currently under construction. The emission reductions for Eastman identified in the draft SIP are a positive step toward reducing SO_2 emissions in the region and improving visibility at our Class I areas. We recommend that the additional controls/reductions that were evaluated but not selected by Tennessee in the draft SIP are cost-effective and would further improve visibility in Great Smoky Mountains NP.

- The four-factor analysis completed by Tennessee Eastman evaluated the additional cost of replacing the existing ESPs with fabric filter baghouses on boilers 23-24 and boiler 30 to improve the control efficiency of existing/planned SO_2 controls. Eastman also evaluated the cost of a complete DSI + fabric filter baghouse system for boilers 21 and 22. There were several errors in the cost analyses completed by Eastman which inflated the costs of controls. Despite this, the costs estimated by the company are still within the bounds of cost thresholds selected by other states in this round of RH planning.

- When the errors in Eastman's analysis are corrected, the costs of adding fabric filters to these boilers reduce to:
    - $3,453/ton SO_2 for boiler #30
    - $4,506/ton SO_2 incremental costs for just a fabric filter and $2,510/ton SO_2 for the total system costs of DSI + a Fabric Filter on boilers 23 and 24.
    - $5,955/ton SO_2 for the total system costs of DSI + a Fabric Filter on boilers 21 and 22.
    - Please see the attached spreadsheets for the NPS cost calculations:
        - eastman_4FA_boiler30_FF.xlsx
        - eastman_4FA_boilers23&24_FF.xlsx
        - eastman_4FA_boilers21&22_FF+DSI.xlsx

<u>TDEC-APC Response</u>

<u>TVA Cumberland</u>

Tennessee did not apply a specific, bright-line cost metric to our analyses. Instead, we compared our costs to average and maximum costs compiled by VISTAS states and adjusted for inflation. In other words, VISTAS compiled a list of control technologies that had been used in the past, including costs. We sorted the control technologies by category (because an EGU is not comparable to an industrial boiler and a control technology retrofit is not comparable to an all-new control device). We adjusted these costs for inflation and compared TVA's calculations to see if they were comparable to the VISTAS numbers. When we compared TVA's possible controls with the appropriate metric (upgrade of existing controls at a large EGU) the cost/ton was not only higher than the VISTAS numbers but were several multiples of the highest observed cost for scrubber upgrades. Based on this information, a bright-line cost was not required to determine, in conjunction with other factors, that the control device upgrade at Cumberland should be deferred to a future planning period. Tennessee agrees that RP costs will increase by necessity *over time*, but it does not follow that "reasonable" costs for the second planning period must exceed the "best available" costs from the first period.

Tennessee also notes that substantial reductions have occurred in Tennessee and neighboring states since 2008 (submittal year for Tennessee' regional haze SIP). Most of these reductions have come from EGUs (Table 10-13).

Table 10-13: Change in SO_2 and NO_X Emissions, 2008 to 2020

State	SO_2 Emissions (tons)		NO_X Emissions (tons)		% Change	
	2008	2020	2008	2020	SO_2 Emissions	NO_X Emissions
AL	357,547	3,278	112,614	13,753	-99.1%	-87.8%
FL	263,952	15,259	153,466	29,632	-94.2%	-80.7%
GA	514,539	6,940	105,894	13,328	-98.7%	-87.4%
KY	344,356	37,977	157,847	28,605	-89.0%	-81.9%
MS	65,236	2,629	41,918	13,237	-96.0%	-68.4%
NC	227,030	9,823	54,652	21,502	-95.7%	-60.7%
SC	157,618	4,962	42,916	8,056	-96.9%	-81.2%
TN	208,069	9,349	85,543	6,849	-95.5%	-92.0%
VA	125,985	1,507	43,017	7,068	-98.8%	-83.6%
WV	301,574	31,787	97,331	28,474	-89.5%	-70.7%

These changes were driven by a mixture of factors including CAIR/CSAPR (which functioned as BART compliance for some units), repowering, and retirements. Given the magnitude of these changes, it follows that visibility improvements will occur at a lower RP cost. Tennessee also notes that planning is underway for a second round of repowering/retirement, which will lead to additional visibility improvements. The overall changes are not part of the four factors that are considered but they provide weight of evidence for the use of a lower cost threshold than recommended by NPS.

Tennessee reviewed the question of scrubber life with U. S. EPA, and the equipment life identified in the four-factor analysis may be potentially supportable based on either the remaining useful life of the existing scrubbers to which upgrades would be added or the expected life of the scrubber upgrade controls based on prior precedent. As noted on page 19 of Appendix G-1g, the State is relying upon the remaining useful life of the scrubbers as the basis for the 10-year equipment life given that their age is greater than 25 years. TVA is retrofitting an existing scrubber and not installing a new scrubber. As TDEC-APC indicated in the four-factor analysis, the 30-year scrubber life appears to represent the life of a new unit, not a retrofitted unit.

As discussed elsewhere, Tennessee declined to consider NO_X emissions for reasonable progress during the second planning period.

<u>TVA Kingston</u>

Kingston's 2028 projected emissions are appropriate based on the facility's Federal Register notice announcing NEPA planning for the retirement of all nine units. Tennessee believes, based on weight of evidence, that TVA's Kingston Fossil Plant is well-controlled, will continue to implement its existing measures, and will not increase its emission rate. A four-factor analysis is not required for Kingston.

Tennessee calculated a 95.3% control efficiency for 2015 based on the specific fuel mix burned (2015 was used as a basis because TVA's most recent application includes fuel usage for that year, including various coal ranks). Kingston burns a mix of Illinois Basin (ILB) and Powder River Basin (PRB) coal small amounts of light off-oil, and the control efficiency of TVA's wet limestone scrubber appears consistent with other coal-fired utilities. Although lower emission rates can be observed for some facilities (e. g., North Carolina's Asheville plant reports an SO_2 emission rate of 0.001 lb/MMBtu SO_2), these results do not appear consistent with increased control efficiencies, and Tennessee suspects that exceptionally low emission rates represent other factors, such as increased natural gas usage (i. e., coal is a secondary fuel only).

As discussed elsewhere in the SIP, Tennessee declined to consider NO_X emissions for reasonable progress during the second planning period.

TVA Gallatin

As indicated in section 10.4.3, the maximum AoI sulfate + nitrate facility contribution for TVA-Gallatin is 0.695%, which is well below the AoI threshold used to determine which facilities were chosen for PSAT modeling and thus considered for four-factor analysis.

Eastman Chemical Company

Tennessee has reviewed the information submitted by NPS, and we note here that several other changes not referenced here (use of a lower interest rate, increasing baghouse equipment life from 15 to 20 years) were included in the review of the four-factor analysis. For the reasons explained above, Tennessee declines to further revise the four-factor analysis provided by Eastman Chemical Company.

Contingencies: First, Tennessee notes that EPA's SIP guidance recommends states to use the Cost Control Manual or to justify departures from the manual's recommendations. Where appropriate, Tennessee has adjusted costs to account for differences between the manual and the four factor analyses. However, neither the SIP guidance nor the Cost Control Manual can require or prohibit specific approaches. Regarding the contingencies included with Eastman's costs, Eastman's four factor analyses noted several factors, including complexities associated with retrofitting, that justify a higher contingency.

Escalation: As noted above, the Cost Control Manual cannot disallow a specific approach. Tennessee believes that Eastman's approach is acceptable given ongoing concerns related to raw material price increases. For example, the Bureau of Labor Statistics September 10, 2021 news release (available online at https://www.bls.gov/news.release/pdf/ppi.pdf)

> Prices for final demand less foods, energy, and trade services moved up 0.3 percent in August after increasing 0.9 percent in July. For the 12 months ended in August, the index for final demand less foods, energy, and trade services rose 6.3 percent, the largest advance since 12-month data were first calculated in August 2014.

Maintenance Materials & Labor: The information provided by Eastman, including the Black & Veatch study, meets the requirements of 40 CFR §51.308(f)(2)(iii), which requires the state to document the technical basis, including modeling, monitoring, cost, engineering, and emissions information, on which the State is relying to determine the emission reduction measures that are necessary to make reasonable progress in each mandatory Class I Federal area it affects.

10.4.5. Prescribed Fire Emissions

USFS Comment

Fire plays an important role in shaping the vegetation and landscape in TN. Recurring fire has been a part of the landscape for thousands of years. Aggressive fire suppression, coupled with an array of other disturbances (e.g., logging and chestnut blight), has changed the historic composition and structure of the forests. Periodic prescribed burning and other vegetation management can recreate the ecological role of fire in a controlled manner. Fire and fuels management supports a variety of desired conditions and objectives across the Forests (e.g., community protection, hazardous fuels reduction, native ecosystems restoration, historic fire regimes restoration, wildlife openings, and open woodland creation, etc.). The 2017 Regional Haze Rule includes a provision to allow states to adjust the glidepath to account for prescribed fire. The draft TN RH SIP states that prescribed fire emissions were taken from the 2011 National Emissions Inventory (NEI) and were carried forward into the 2028 future year emissions without any changes. Recent data on prescribed fire activity, especially within the USDA Forest Service, show that the number of acres burned in prescribed fires during 2011 were lower than all other recent years. For example, within the southern region of the Forest Service a total of 749,080 acres were treated with prescribed fire in 2011, while the average number of acres treated annually from the years 2007-2019 was 980,422. The 2021 target for treatment by prescribed fire within the USDA Forest Service southern region is well over 1 million acres. Furthermore, the Land Management Plans for each of the southern Forests call for a cumulative total of up to 2.1 million acres per year to be treated with prescribed fire in the future. Therefore, keeping prescribed fire emissions steady from to 2028 undercounts emissions in the VISTAS states by up to fifty percent. At this point in the draft RH SIP review process, a quantitative analysis to adjust the glidepaths for actual prescribed fire projections is not practical. While prescribed fire is currently a minor contributor to visibility impairment on the 20% most impaired days, the USDA Forest Service would like assurances that TDEC-APC will continue to recognize the important ecological role of prescribed fire and in the future adjust the glidepath to account for prescribed fire emissions accordingly.

TDEC-APC Response

The TDEC-APC supports the use of prescribed fire as a landscape management tool throughout Tennessee. As discussed in Section 7.9.1 (Smoke Management), the State of Tennessee passed the Tennessee Prescribed Burning Act, which requires a written prescription be prepared and followed by a certified prescribed burn manager for each prescribed burn. The Tennessee Division of Forestry within the Tennessee Department of Agriculture has promulgated regulations for certification of prescribed burn managers and guidelines for a prescribed burn prescription. TDEC-APC has promulgated regulations that lists the specific circumstances in which open burning is permissible. Among other things, the regulation prohibits the burn site from being within one-half mile of a national reservation, national or state park, wildlife area, national or state forest.

The EPA's revised method for selecting the 20% most impaired days to a large extent eliminates days where light extinction is primarily associated with fire activity. This methodology helps to minimize impacts associated with fire activity in the 20% most impaired days evaluated during the development of this SIP. For future planning periods, should the 20% most impaired days show a significant increase in organic carbon that can be attributed to prescribed burning activity, the TDEC-APC will consult with the USFS and other Tennessee state and federal agencies as well as with North Carolina to determine if an adjustment to the glidepath in 2064 is necessary for Class I areas in the state.

11. Comprehensive Periodic Implementation Plan Revisions

40 CFR Section 51.308(f) requires Tennessee 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 Section 51.308(f) of the RHR, Tennessee commits to revising and submitting this regional haze SIP by July 31, 2028, and every ten years thereafter.

In addition, Section 51.308(g) requires periodic reports evaluating progress towards the RPGs established for each mandatory Class I area. The periodic reports are due by January 31, 2025, July 31, 2033, and every ten years thereafter. Tennessee 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 Tennessee and in each mandatory federal Class I area located outside Tennessee that may be affected by emissions from Tennessee sources. All requirements listed in Section 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 Tennessee is required to submit any progress reports to EPA, depending on the findings of the five-year progress report, Tennessee commits to taking one of the actions listed in 40 CFR Section 51.308(h). The findings of the five-year progress report will determine which action is appropriate and necessary.

List of Possible Actions - 40 CFR Section 51.308(h)

(1) If Tennessee 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 Tennessee 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 Tennessee 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 Tennessee 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 April 4, 2008, TDEC-APC submitted for approval its SIP for regional haze to the EPA Region 4. Subsequent to this submission, TDEC-APC amended its plan on November 22, 2017. Tennessee's regional haze plan documents Tennessee's long-term plan for improving visibility in the two Tennessee federal Class I areas as well as assisting with improvement of visibility in Class I areas located outside of the state. The SIP includes specific RPGs for visibility improvement at milestones that start in 2018. The ultimate goal is to reach background visibility levels in the Class I areas. Tennessee's Class I areas regulated for visibility are the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area.

Subparagraph 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. On April 10, 2013, Tennessee submitted the first regional haze progress report to EPA, which demonstrated that Tennessee was on track to meet the RPGs set in the regional haze SIP.

This progress report, in accordance with EPA's requirements, contains 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 Tennessee; and
- 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.

Although future planning periods will focus on the most anthropogenically impaired ("most impaired") visibility days, the work completed in the first planning period and the development of the 2018 RPGs focused on the worst visibility days. In order to properly compare current conditions to the 2018 RPGs, this progress report includes visibility data for the 20% worst visibility days, in addition to visibility data for the 20% most impaired days as required by the regional haze rule.

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

In Section 7.4 of Tennessee'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 Tennessee's long-term strategy for visibility improvement.

The bar charts in Figure 13-1 show the speciated average light extinction for Tennessee's Class I areas 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.

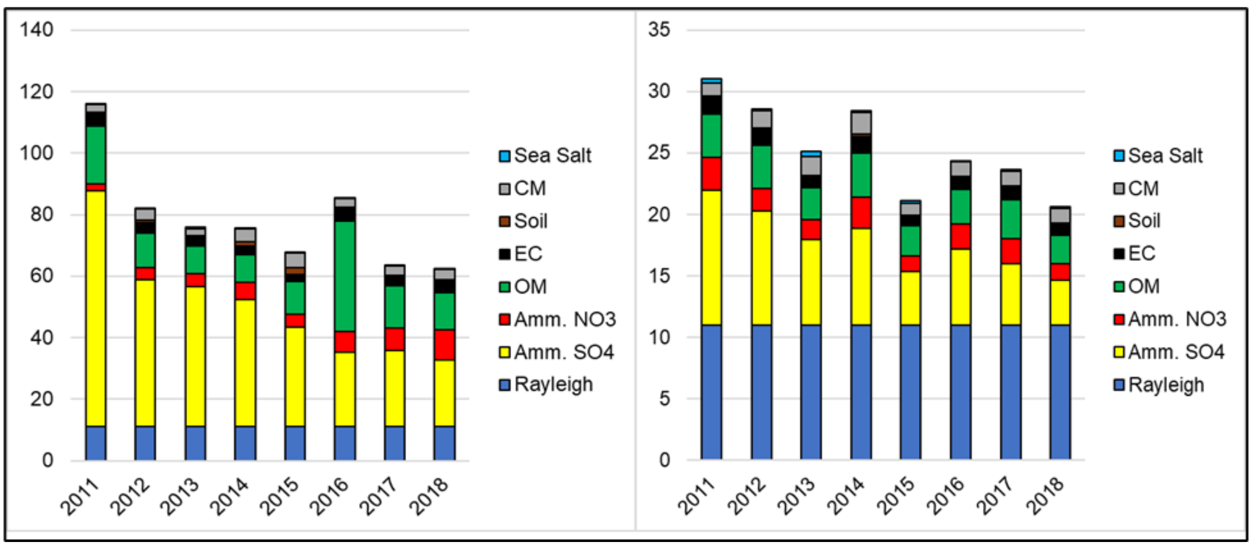

Figure 13-1: Annual Average Light Extinction for the 20% Worst Visibility Days (left) and the 20% Clearest Visibility Days (right) at Great Smoky Mountains National Park

13.1.2. 2018 Reasonable Progress Goals for Tennessee's Class I Areas

Table 13-1 and Table 13-2 show the 2018 RPGs for Tennessee's Class I areas on the 20% worst and 20% best visibility days, respectively. As seen in these tables, both Tennessee Class I areas have met the 2018 RPGs.

Table 13-1: 2018 RPGs for Visibility Impairment in Tennessee's Class I Areas, 20% Worst Days

Class I Area	Baseline Average dv (2000-2004)	2018 Average dv (2014-2018)	2018 Goal (dv)	Natural Background (dv)
Great Smoky Mtns	30.24	19.04	23.5	11.24
Joyce-Kilmer Slickrock	30.24	19.04	23.5	11.24

Table 13-2: 2018 RPGs for Visibility Impairment in Tennessee's Class I Areas, 20% Clearest Days

Class I Area	Baseline Average dv (2000-2004)	2018 Average dv (2014-2018)	2018 Goal (dv)	Natural Background (dv)
Great Smoky Mtns	13.58	8.35	<13.58	4.62
Joyce-Kilmer Slickrock	13.58	8.35	<13.58	4.62

*The regional haze requirement for the 20% clearest days is to maintain the visibility impairment at or below the baseline impairment.

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. Tennessee'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. Section 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;

(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. Summary of Emission Reductions Achieved Through 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 starting in the year 2014 to 2019, as required by 40 CFR 51.308(g)(1). 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), Tennessee has estimated the SO_2 and NO_X emissions reductions achieved through 2019 from measures implemented by the state. Where quantitative assessments of emission reductions are not available, a qualitative assessment is given.

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 RPG set in the regional haze SIP for 2018.

13.3.1. Emissions Reduction Measures Included in the Regional Haze SIP

Tennessee's regional haze SIP included the following types of measures for achieving reasonable progress goals:

- Federal programs and
- State reasonable progress and BART control measures

These emissions reduction strategies were included as inputs to the VISTAS modeling. The current status of the implementation of these measures is summarized in the following paragraphs and an estimate of the SO_2 and NO_X emissions reductions achieved is presented.

13.3.1.1. 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.

13.3.1.1.1. 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 different than the CAIR solution projected in the regional haze analysis, CSAPR and the CSAPR Update have continued reductions from large EGUs.

13.3.1.1.2. 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.

13.3.1.1.3. Consent Agreements and 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.

In October 2007, American Electric Power (AEP) agreed to spend $4.6 billion dollars to eliminate 72,000 tons of NO_x emissions each year by 2016 and 174,000 tons of SO_2 emissions each year by 2018 from sixteen coal-fired power plants located in Indiana, Kentucky, Ohio, 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.

13.3.1.1.4. One-hour Ozone SIPs (Atlanta/Birmingham/Northern Kentucky)

The regional haze SIP also included emissions reductions from one-hour ozone SIPs submitted to EPA to demonstrate attainment of the one-hour ozone NAAQS. These SIPs require NO_X reductions from specific coal-fired power plants and address transportation plans in these cities. These reductions further improve regional visibility.

13.3.1.1.5. NO_X RACT in 8-hour Nonattainment Area SIPs

The NCDAQ's SIP for the Charlotte / Rock Hill / Gastonia nonattainment area includes RACT for NO_X for two facilities located in the nonattainment area: Philip Morris USA and Norandal USA. These controls were also modeled for 2018. Additional RACT controls may be realized as other companies subject to RACT complete the determination, but RACT-level controls were assumed for just these two sources. These controls further improve regional visibility.

13.3.1.1.6. 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 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 Tennessee, thus, more directly affecting Tennessee Class I areas.

13.3.1.1.7. 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 on-road 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 Tennessee, and, thus, has a more direct impact on Tennessee Class I areas.

13.3.1.1.8. 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 Tennessee.

13.3.1.1.9. 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 Tennessee sources.

13.3.1.1.10. 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 13-3 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 13-3: 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

The Industrial/Commercial/Institutional (ICI) boiler MACT standard (40 CFR 63 Subpart DDDDD) was vacated by the U.S. Court of Appeals and remanded the regulation 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 Tennessee than were modeled in Tennessee's Regional Haze Plan.

13.3.1.2. 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.

13.3.1.2.1. 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.

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

Georgia rule 391-3-1.02(2)(sss), enacted in 2007, requires flue-gas desulfurization (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.

13.3.1.3. Tennessee Reasonable Progress and BART Control Measures

Tennessee completed source-specific reasonable progress and BART determinations for all applicable sources in the first-round regional haze SIP. For reasonable progress control analysis, Tennessee initially identified 10 emission units with a contribution of 1% or more to a Class I area based on an AoI analysis. Of those 10 emission units, two emission units were dropped from the list due to incorrect data, one emission unit was removed from service, one emission unit switched from coal to natural gas, four emission units were BART-eligible sources, and two emission units conducted a reasonable progress analysis. The two emission units (at Bowater, now named Resolute, and INVISTA) that underwent a reasonable progress analysis were not required to implement any controls or measures.

In total, Tennessee had 16 BART-eligible sources. Of the 16 BART-eligible sources, eight met the modeling exemption criteria, three shut down, one received a permit limit to avoid further BART analysis, and four were reviewed for BART determinations. Table 13-4 lists the four sources for which a BART review was made. Sources that were exempt from BART analysis or shut down prior to submission of the first-round regional haze SIP are not listed. All BART controls have been implemented as of December 31, 2018. Two of the four BART sources have shut down since the first-round regional haze SIP was submitted in 2008. Actual SO_2 and NOx emissions for 2008, 2018, and 2019 are listed in the table.

Table 13-4: Current Status of BART Sources

Facility	Emission Unit	Emission controls included in SIP	Required control date	Actual NOx Emissions (tpy)			Actual SO_2 Emissions (tpy)			Status of controls
				2008	2018	2019	2008	2018	2019	
Alcoa	Primary Aluminum Smelting Operation	Sulfur content of coke used to produce anodes shall not exceed 3 percent by weight on a monthly average	2017	72	0.0	0.0	3,649	0.0	0.0	Currently primary smelting is shut down. Title V Permit was surrendered on June 30, 2012.
Dupont Old Hickory	20, 24	SO_2 limit of 32,256 lb/day (summer) NOx limit of 6,120 lb/day (summer) SO_2 limit of 38,568 lb/day (winter) NOx limit of 6,768 lb/day (winter)	2017	836	0.0	0.0	4,515	0.0	0.0	Boilers shut down in 2012. Title V Permit surrendered in September 2014.
Eastman	Powerhouse B-253-1, Boilers 25-29	Sulfur dioxide (SO_2) emissions from Boilers 25-29 shall comply with the less stringent of the following limits: 1. 0.20 pounds of SO_2 per million British Thermal Units (lb/MMBtu) of heat input; or 2. Reduce uncontrolled SO_2 emissions by 92% Alternate control of converting to natural gas given to 2018	2017/2018	5,007	1,807	952	15,544	2,367	6.4	Boilers 25-29 were converted from coal to natural gas
TVA Cumberland	Boilers 1 & 2	Sulfur dioxide (SO_2) emissions from Boilers No. 1 and 2 shall comply with the following limit: 0.5 pounds of SO_2 per million British Thermal Units (lb/MMBtu) of heat input	Existing	30,680	4,355	3,932	14,701	7,408	7,209	Permit condition on current Title V permit. Wet scrubber in place since 1995

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

A number of laws, regulations, requirements, and consent decrees have been promulgated that were not included in Tennessee's original SIP submittal. These measures provided additional emission reductions to allow VISTAS Class I areas to meet their reasonable progress goals.

- 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.
- A 2007 agreement called for the Dupont James River plant, located in Virginia, to install dual absorption pollution control equipment by September 1, 2009, resulting in emission reductions of approximately 1,000 tons of SO_2 annually.
- A 2004 agreement called for Stone Container, located in West Point, Virginia, to control SO_2 emissions from the #8 Power Boiler with a wet scrubber. This device was installed and operational in October of 2007, resulting in emission reduction of approximately 3,000 tons of SO_2 annually.
- The Maryland Healthy Air Act (HAA) regulations became effective on July 16, 2007, and required reductions in NO_X, SO_2, and mercury emissions from large coal burning power plants in Maryland. Emission reductions from the HAA come in two phases. The first phase required reductions in the 2009/2010 timeframe, and compared to a 2002 emission baseline, reduced NO_X emission by almost 70 percent and SO_2 emission by 80 percent. The second phase of emissions controls occurs in the 2012/2013 time frame. At full implementation, the HAA will reduce NO_X emissions by approximately 75 percent from 2002 levels and SO_2 emissions by approximately 85 percent from 2002 levels. Maryland is not a VISTAS participant. However, Maryland borders two VISTAS states, and Maryland facilities have calculated sulfate visibility impairment contributions to several VISTAS Class I areas. Reductions associated with this program were included as part of the VISTAS 2018 Round 1 Best and Final modeling effort.

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 is not an IMPROVE monitor located at Joyce Kilmer Slickrock Wilderness area, the IMPROVE monitor at Great Smokey Mountains National Park serves as a surrogate monitor for that area.

Table 13-5 and Table 13-6 show the current visibility conditions and the difference between the current visibility and the baseline condition expressed in terms of five-year averages of observed visibility impairment for the 20% worst days and the 20% clearest days, respectively. The baseline conditions are for 2000 through 2004 and the current conditions are for 2014 through 2018. Because the RPGs in the first planning period were calculated for the 20% worst days, the table includes a comparison of the baseline average and current average for the 20% worst days. Table 2-6 shows the current visibility conditions and the difference between the current visibility and the baseline condition for the 20% most impaired days.

The data shows that the Class I area saw an improvement in visibility on the 20% worst days, the 20% most impaired days, and on the 20% clearest days. The current observed 5-year average values for the area on the 20% worst days is below the 2018 goal. On the 20% clearest days, the current observed 5-year average value for the area is below the 2018 goal of no degradation.

Table 13-5: Current Observed Visibility Impairment, Change from Baseline, and Comparison to 2018 RPGs, 20% Worst Days

Class I Area	Baseline Average dv (2000-2004)	Current Average, dv (2014-2018)	Change, current – baseline, (dv)	2018 Goal (dv)	Difference, current – goal, (dv)
Great Smoky Mtns	30.24	19.04	-11.20	23.5	-4.46

Table 13-6: Current Observed Visibility Impairment, Change from Baseline, and Comparison to 2018 RPGs, 20% Clearest Days

Class I Area	Baseline Average dv (2000-2004)	Current Average, dv (2014-2018)	Change, current – baseline, (dv)	2018 Goal (dv)	Difference, current – goal, (dv)
Great Smoky Mtns	13.58	8.35	-5.23	<13.58	-5.23

The previous progress report covered visibility through 2013. Table 13-7, Table 13-8, and Table 13-9 display the change in visibility impairment for the 20% worst, 20% most impaired days, and 20% clearest days since 2013 through 2018. The data shows that the Class I area saw an improvement in visibility on the 20% worst, 20% most impaired, and 20% clearest days.

Table 13-7: Observed Visibility Impairment for Five-Year Periods Through 2018, 20% Worst Days

Class I Area	2010-2014	2011-2015	2012-2016	2013-2017	2014-2018
Great Smoky Mtns	21.91	20.95	19.97	19.44	19.04

Table 13-8: Observed Visibility Impairment for Five-Year Periods Through 2018, 20% Most Impaired Days

Class I Area	2010-2014	2011-2015	2012-2016	2013-2017	2014-2018
Great Smoky Mtns	20.79 dv	19.71 dv	18.35 dv	17.76 dv	17.21 dv

Table 13-9: Observed Visibility Impairment for Five-Year Periods Through 2018, 20% Clearest Days

Class I Area	2010-2014	2011-2015	2012-2016	2013-2017	2014-2018
Great Smoky Mtns	10.68	9.61	9.12	8.73	8.35

Figure 13-2 and Figure 13-3 display the data listed in Table 13-5 through Table 13-9, for 20% worst days, 20% most impaired days, and the 20% clearest days, as well as the URP towards natural background for the 20% worst days. The URP and 2018 RPGs in the first implementation period were based on the 20% worst days; therefore, the figures below continue to look at the 20% worst days. Figure 7-25 shows the URP and observed visibility impairment for the 20% most impaired days.

Figure 13-2 shows the observed five-year average impairment values for the 20% worst days in the Great Smoky Mountains National Park, as well as the associated glide slope and the predicted impairment from the regional haze SIP. The 2018 RPG is included in the graph. The observed five-year average impairment for 2018 is below both the glide path and the predicted impairment.

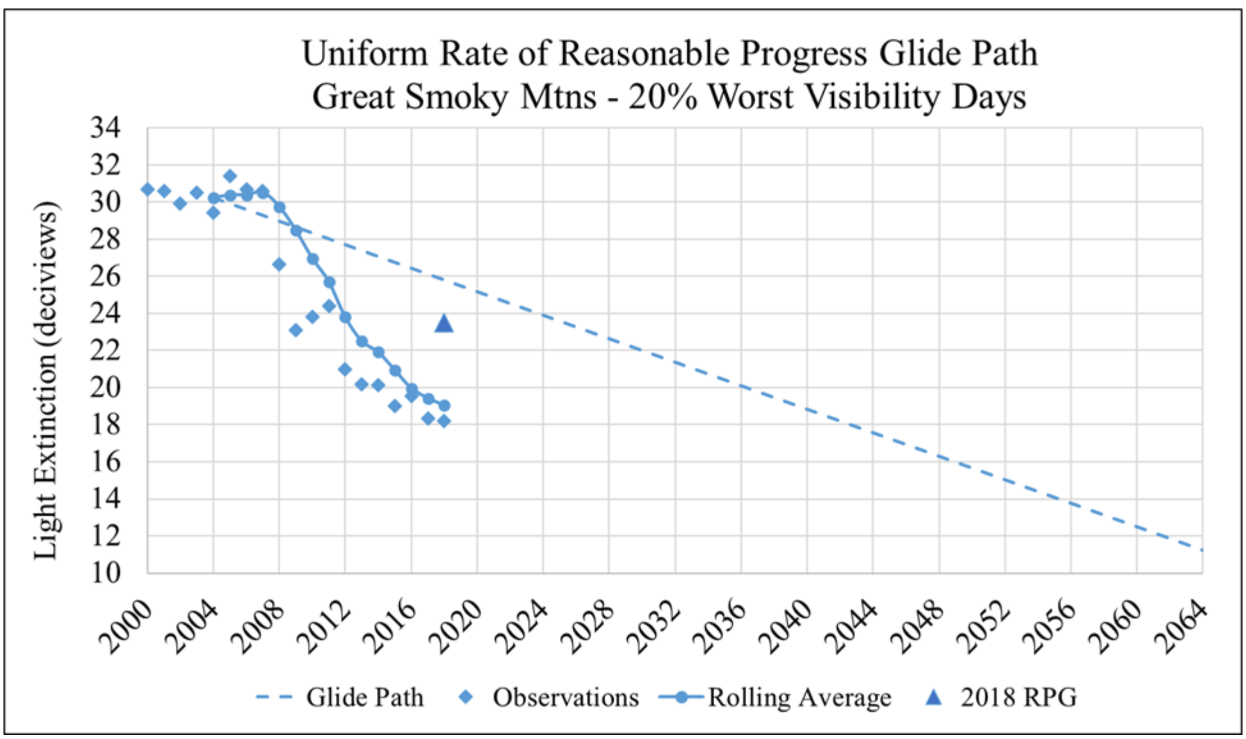

Figure 13-2: Great Smoky Mountains National Park Visibility Impairment on the 20% Worst Visibility Days, Glide Path, and 2018 RPG

Figure 13-3 shows the observed five-year average impairment values for the 20% clearest days in Great Smoky Mountains National Park, as well as the predicted impairment from the regional haze SIP. The observed five-year average impairment for the 20% clearest days of 2018 is below both the baseline and the predicted impairment.

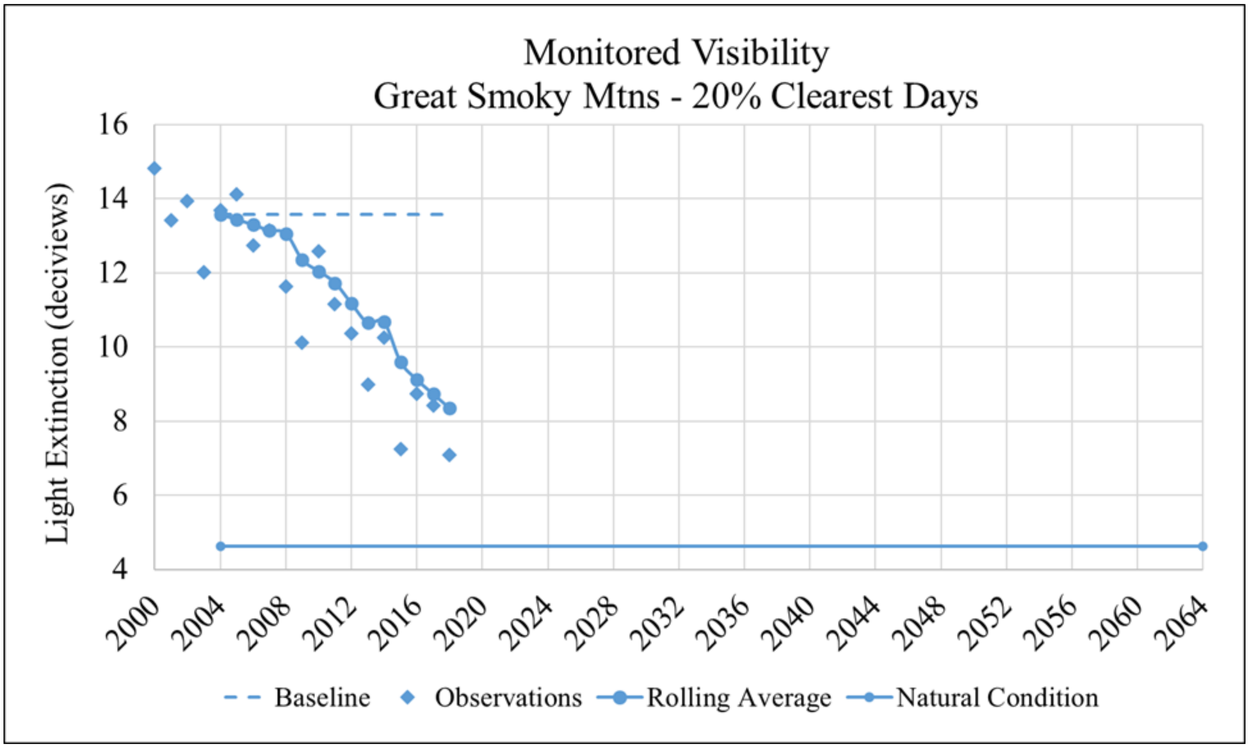

Figure 13-3: Great Smoky Mountains National Park Visibility Impairment on the 20% Clearest Days and Natural Conditions

Since there is not an IMPROVE monitor located at Joyce Kilmer Slickrock Wilderness Area, the IMPROVE monitor at Great Smokey Mountains National Park serves as a surrogate monitor for that area. Thus, Figure 13-2 and Figure 13-3 are representative of the Joyce Kilmer Slickrock Wilderness Area.

13.5. Emissions Analysis

This section includes an analysis tracking the change since 2012 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, Tennessee 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 13-10 shows how $PM_{2.5}$ emissions for each source category 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 and fires source categories. However, the overall $PM_{2.5}$ emissions across all categories in the 2017 NEI are 23% lower than what VISTAS projected for 2018.

Table 13-10: $PM_{2.5}$ Emissions (tons) for the 2014 NEI, 2017 NEI, and 2018 VISTAS Inventories

$PM_{2.5}$ Sector	NEI 2014 (tpy)	NEI 2017 (tpy)	VISTAS 2018G4 (tpy)
Point	12,648	13,346	46,680
Area	59,465	43,753	46,692
Onroad	4,335	2,903	1,544
Non Road	2,572	1,734	4,403
Fires	16,576	15,480	1,573
Total	**95,596**	**77,216**	**100,892**

For NO_X emissions (Table 13-11), there have been significant decreases in each source category, except the Fires category. The 2017 NEI emissions for area, fires, and onroad categories are higher than the 2018 projected emissions. However, the overall NO_X emissions from all categories for 2017 are approximately 21% lower than the 2018 projections.

Table 13-11: NO_X Emissions (tons) for the 2014 NEI, 2017 NEI, and 2018 VISTAS Inventories

NO_X Sector	NEI 2014 (tpy)	NEI 2017 (tpy)	VISTAS 2018G4 (tpy)
Point	56,727	46,828	94,234
Area	35,314	28,025	19,597
Onroad	147,638	103,407	69,385
Non Road	25,953	18,798	70,226
Fires	3,570	3,523	405
Total	**269,201**	**200,581**	**253,847**

For SO_2 emissions (Table 13-12), point sources show the most significant decrease since 2014, and actual emissions from point sources are already 77% lower than the projected 2018 emissions. This is largely due to a significant reductions from EGUs and non-EGU point sources. Overall, SO_2 emissions across all categories for 2017 are 77% below the 2018 projections.

Table 13-12: SO_2 Emissions (tons) for the 2014 NEI, 2017 NEI, and 2018 VISTAS Inventories

SO_2 Sector	NEI 2014 (tpy)	NEI 2017 (tpy)	VISTAS 2018G4 (tpy)
Point	90,283	41,191	169,354
Area	1,442	3,186	31,962
Onroad	711	678	948
Non Road	62	41	5,207
Fires	1,703	1,642	111
Total	**94,201**	**46,738**	**207,582**

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 Tennessee. Repowering or shifting to natural gas, as well as some reduced utilization of coal EGUs and increased utilization of natural gas EGUs and renewable energy has also significantly reduced emissions of SO_2. Table 13-13 shows the CAMD emissions from 2014 to 2019.

Table 13-13: Tennessee EGU SO_2 and NOx Emissions for CAMD (2014-2019)

	2014	2015	2016	2017	2018	2019
SO2 Emissions	58,434	59,697	31,270	24,312	11,735	11,224
NOx Emissions	22,382	21,822	22,610	18,201	11,629	10,263

Figure 13-4 below depicts the trends for units that report annual emissions to CAMD and are located in Tennessee. Since 2014, heat input has decreased about 22% over this period.

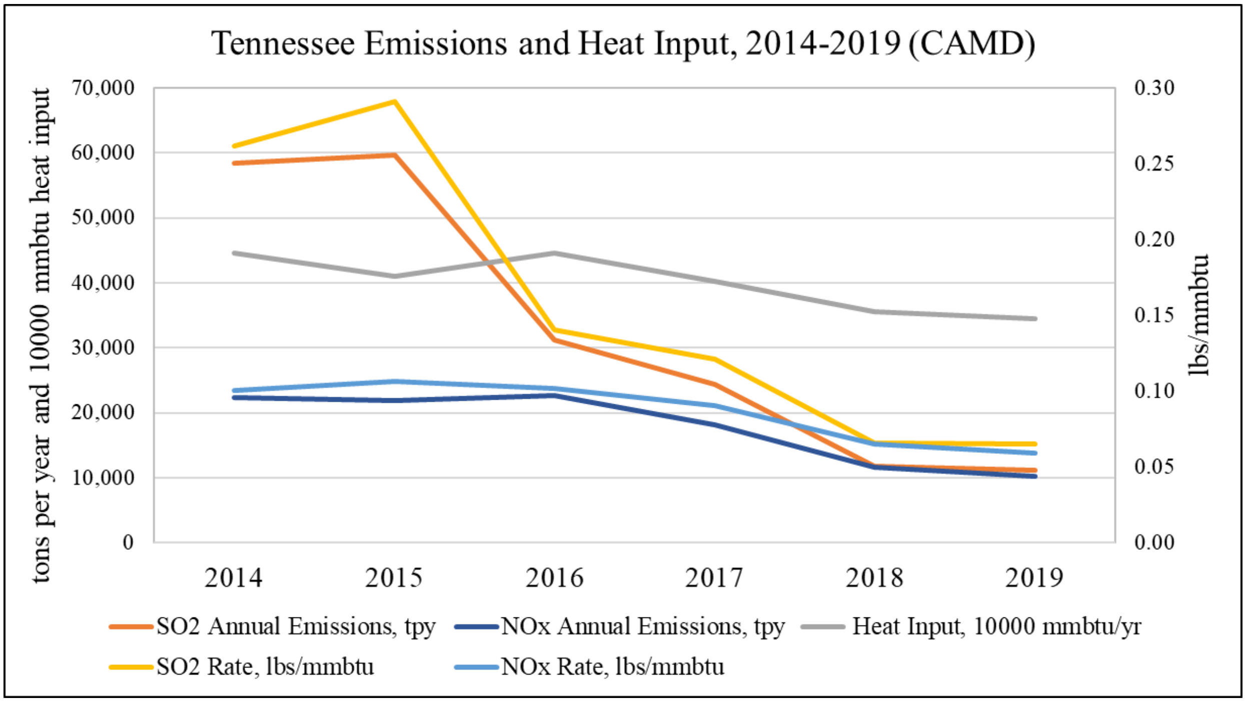

Figure 13-4: Tennessee CAMD Emissions and Heat Input Data *(Source: EPA CAMD Database)*

The SO_2 emissions from these units decreased from 58,434 tons annually in 2014 to 11,224 tons annually in 2019, a decrease of 81%. The average SO_2 emission rate from these units decreased from 0.262 lbs/mmbtu in 2014 to 0.065 lbs/mmbtu in 2019, a decrease of 75%. 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 22,382 tpy to 10,263 tpy, a drop of 54%.

Figure 13-5 shows the trends for units reporting to CAMD across all VISTAS states.

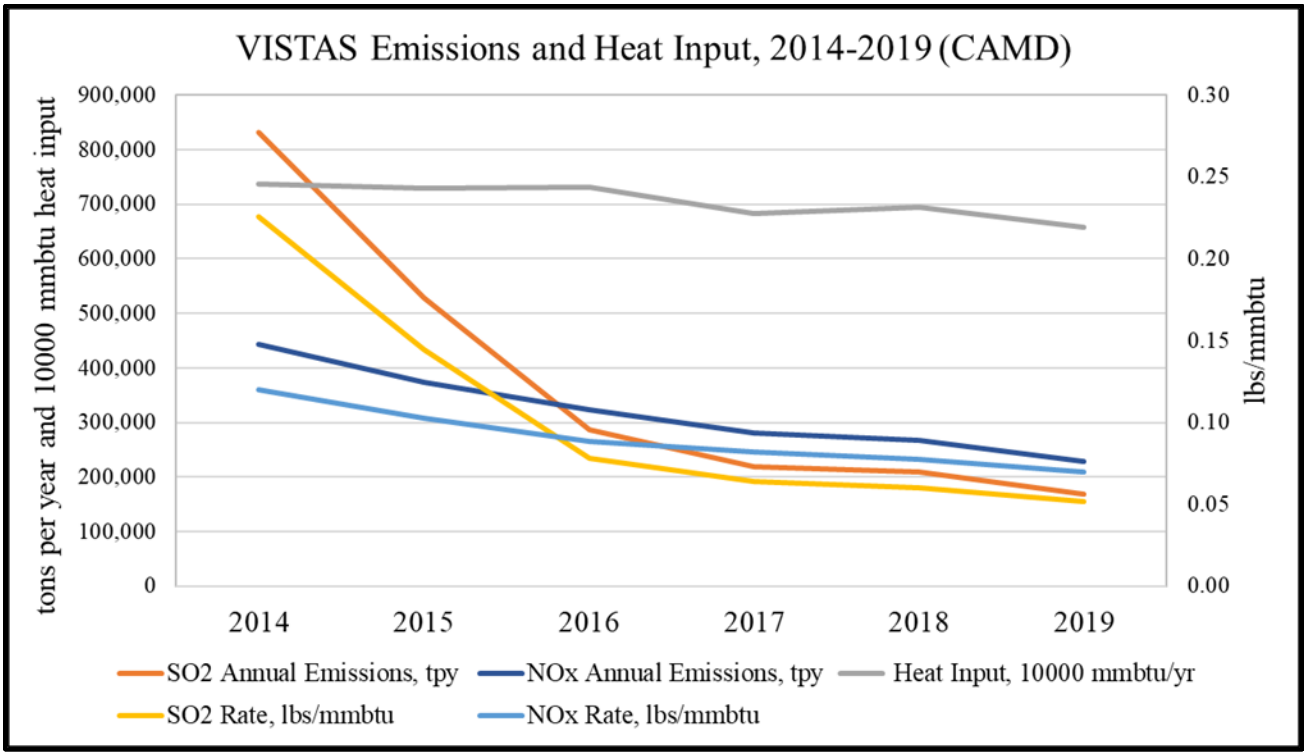

Figure 13-5: VISTAS CAMD Emissions and Heat Input Data *(source: EPA CAMD Database)*

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 MATS 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 Tennessee or outside the State that have occurred since the period addressed in the most recent plan that would limit or impede progress in reducing pollutant emissions or improving visibility. These changes in anthropogenic emission were anticipated in that most recent plan. In particular, SO_2 emissions from point sources have significantly decreased since 2014. There have also been decreases in emissions of NO_X and $PM_{2.5}$ since 2014. As stated in Section 2.6, the IMPROVE monitoring data for 2014-2018 for the 20% most impaired days shows that sulfate continues to be the predominant visibility impairing pollutant.

13.6. Conclusion

This progress report documents that all control measures outlined in Tennessee's regional haze SIP have been implemented and that Tennessee has met all RPGs projected for 2018. Reductions in SO_2 emissions have been significant and greater than VISTAS projected. In spite of 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 and will cover progress in the second implementation period.

TENNESSEE DEPARTMENT OF ENVIRONMENT & CONSERVATION
BUREAU OF ENVIRONMENT
DIVISION OF AIR POLLUTION CONTROL

IN THE MATTER OF

NON-REGULATORY REVISION TO THE REGIONAL HAZE STATE IMPLEMENTATION PLAN (SIP)	)))	ORDER NO. 22-002

BOARD ORDER

The following matter came before the Tennessee Air Pollution Control Board on February 9, 2022.

The Tennessee Department of Environment and Conservation (TDEC) has prepared a revision to the April 2008 Regional Haze SIP. The SIP revision represents commitments and enforceable actions taken by the TDEC to address the requirements of the Regional Haze Rule during the second implementation period from 2019 to 2028, towards the goal of attaining natural visibility conditions in Tennessee's designated federal Class I areas and those federal Class I areas in other states that may be affected by emissions from Tennessee. Pursuant to 40 CFR 51.308(f), Tennessee's Regional Haze SIP includes the following elements: (1) calculations of baseline, current, and natural visibility conditions; progress to date; and the uniform rate of progress for each Class I area; (2) documentation of the technical analysis on which Tennessee is relying to determine reasonable progress, including modeling, emissions, and data analysis; (3) source-specific reasonable progress four-factor analyses and documentation of the source selection process; (4) long-term strategy for regional haze resulting from the reasonable progress analyses; (5) reasonable progress goals; (6) monitoring strategy and other implementation plan requirements; and (7) documentation of consultation with other states, U.S. Environmental Protection Agency, and Federal Land Managers.

A public hearing notice of the proposed revisions was posted on the TDEC website on October 21, 2021. A Public Hearing was held on December 1, 2021. The end of the public comment period was December 10, 2021.

Following the Board's approval, the Regional Haze SIP shall be amended to incorporate these revisions.

Approved by the following members of the Air Pollution Control Board of the State of Tennessee, and entered on the 9th day of February 2022.