AGENDA
STATE OF TENNESSEE
REGULAR MEETING
IN-Person AIR POLLUTION CONTROL BOARD

Nashville Room, 3rd Floor Tennessee Tower
312 Rosa L. Parks Avenue
In Person and
Remote Access Via WebEx link

Wednesday October 13, 2021
9:30 A.M.

Note: There will be a Sign-In Sheet available for those who wish to speak for three minutes on a topic(s) shown here. Remote attendees may use the WebEx chat box to type their name and which topic(s) so that someone can call on them at the appropriate time to speak during the meeting.

	Item	Presenter	Page
1.	Roll Call		
	General Business		
2.	Domtar NOX SIP Revision	Travis Blake	**5**
3.	Regional Haze State Implementation Plan (SIP)	Mark Reynolds	**6**
4.	NESHAP Rule Revision	Mark Reynolds	**353**
5.	SBEAP Presentation	Donovan Grimwood	**513**

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.

Individuals with disabilities who require special accommodations or alternate communications formats should contact us at the Tennessee Department of Environment and Conservation, William R. Snodgrass Tennessee Tower, Division of Human Resources, 312 Rosa L. Parks Avenue 22nd Floor, Nashville, Tennessee 37243 at (615) 532-0200 (or TDD 1-800-848-0298 for hearing impaired callers) no less than five (5) days prior to the scheduled meeting so reasonable accommodations can be made.

Air Pollution Control Board
of the
State of Tennessee
Regular Meeting

On Wednesday August 11, 2021 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. John Benitez
Mr. Mike Haverstick
Dr. Shawn Hawkins
Mr. Richard Holland
Mayor Ken Moore
Ms. Caitlin Jennings
Ms. Amy Spann
Mayor Larry Waters
Mr. Jimmy West

The following Board member joined the meeting via WebEx

Dr. Joshua Fu

The following Board members did not attend the meeting

Dr. Chunrong Jia
Mr. Greer Tidwell

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

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

Dr. Adkins	present	Dr. Benitez	present

Dr. Fu	Remote	Mr. Haverstick	present
Dr. Hawkins	present	Mr. Holland	present
Dr, Jia	absent	Ms. Jennings	present
Mayor Moore	present	Ms. Spann	present
Mr. Tidwell	absent	Mayor Waters	present
Mr. West	present		

The next item on the agenda was the approval of the minutes from the June 9, 2021 Board meeting. The minutes were approved with one correction on page 5. Mr. Gossett and Mr. Holland's votes were reversed.

The Vice-Chair called for a roll call and the votes were as follows:

Dr. Adkins	yes	Dr. Benitez	yes
Mr. Haverstick	yes	Dr. Hawkins	yes
Mr. Holland	yes	Ms. Jennings	yes
Mayor Moore	yes	Spann	yes
Mayor Waters	yes	Mr. West	yes

The motion carried with ten (10) affirmative votes.

Mr. Travis Blake with the division presented the Board with a petition from Eastman Chemical for Alternative Monitoring, Board Order 21-078. After discussion Mr. Holland made a motion to approve and Ms. Spann seconded the motion.

The Vice-Chair called for a roll call and the votes were as follows:

Dr. Adkins	yes	Dr. Benitez	yes
Mr. Haverstick	yes	Dr. Hawkins	yes
Mr. Holland	yes	Ms. Jennings	yes

Mayor Moore	yes	Spann	yes
Mayor Waters	yes	Mr. West	yes

The motion carried with ten (10) affirmative votes.

Mr. Travis Blake with the division informed the Board of Pending Rulemaking , Revisions to TAPCR 1200-03-27-.12. Mr. Blake answered questions from the Board.

Mr. Jimmy Johnson with the division presented the Board with a power point presentation on the Draft Fiscal Year 2022-2023 Title V Workload Analysis. Dr. Adkin's with the Small Business Program gave a brief description of what the Small Business Program does in response to Mr. Holland's question. Mr. Johnston answered questions from the Board.

Mr. Jimmy Johnston with the division presented the Board with a power point presentation on the Notice of Pending Rulemaking, Revisions to TAPCR 1200-03-26. Mr. Johnston informed the Board they would be sent a copy of this presentation and answered questions from the Board.

Mr. Emily Urban with the Office of General Council presented the Board with a Legislative Update and answered questions from the Board.

There being no further business to discuss Dr. Hawkins made a motion to adjourn and Mr. Holland seconded the motion.

The meeting was adjourned at 11:36 a.m.

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TN Department of
Environment &
Conservation

MEMO

To: Air Pollution Control Board Members
From: Travis Blake
Date: September 30, 2021
Subject: NO_X SIP Call Permit for Domtar Paper Company

In 1998, the U. S. EPA adopted the NO_X SIP Call, which required 22 States and the District of Columbia to submit SIP revisions to reduce NO_X and ozone transport across State boundaries in the eastern half of the United States. In Tennessee, large industrial boilers and combustion turbines are subject to Tennessee Air Pollution Control Regulations (TAPCR) 1200-03-27-.12 (NO_X SIP Call Requirements for Stationary Boilers and Combustion Turbines). This rule requires affected units to comply with the applicable monitoring, recordkeeping, and reporting requirements provided in 40 CFR Part 75.

On March 8, 2019, EPA published a final rule revising the emissions monitoring provisions required under the NO_X SIP Call. The revised federal rule allows States to establish monitoring requirements that are different from 40 CFR Part 75 for units subject to the NO_X SIP Call. States that approve alternatives to Part 75 must continue to include some form of emissions monitoring requirements for these types of sources, consistent with the NO_X SIP Call's general enforceability and monitoring requirements.

The Division of Air Pollution control has received a request to allow the use of alternative monitoring for NO_X emissions from Domtar Paper Company in Kingsport. Domtar requests approval to monitor NO_X emissions in accordance with 40 CFR Part 60 Appendix B (Performance Specification 2 – Specifications and Test Procedures for SO_2 and NO_X Continuous Emission Monitoring Systems in Stationary Sources) as an alternative to the requirements of Part 75. Part 60 also uses continuous emissions monitoring to measure the NO_X concentration, but the NO_X emission rate is calculated differently[1].

The Division has reviewed the requested alternative and will propose approve the request as part of a non-regulatory SIP submittal to U. S. EPA.

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[1] Part 75 directly calculates NO_X emissions from the measured NO_X concentration and stack flow rate, while Part 60 measures the NO_X concentration and uses standard conversion factors to calculate NO_X emissions (i. e., the flow rate through the stack is not measured).

Regional Haze Draft SIP

The draft SIP consists of the main narrative and Appendices A through H. The main narrative is included in the Board package. 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

Tennessee Regional Haze
State Implementation Plan

Prepared by:

State of Tennessee
Department of Environment & Conservation
Division of Air Pollution Control
WRS Tennessee Tower
312 Rosa L. Parks Avenue, 15th Floor
Nashville, TN 37243

Draft
October 13, 2021

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

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[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.

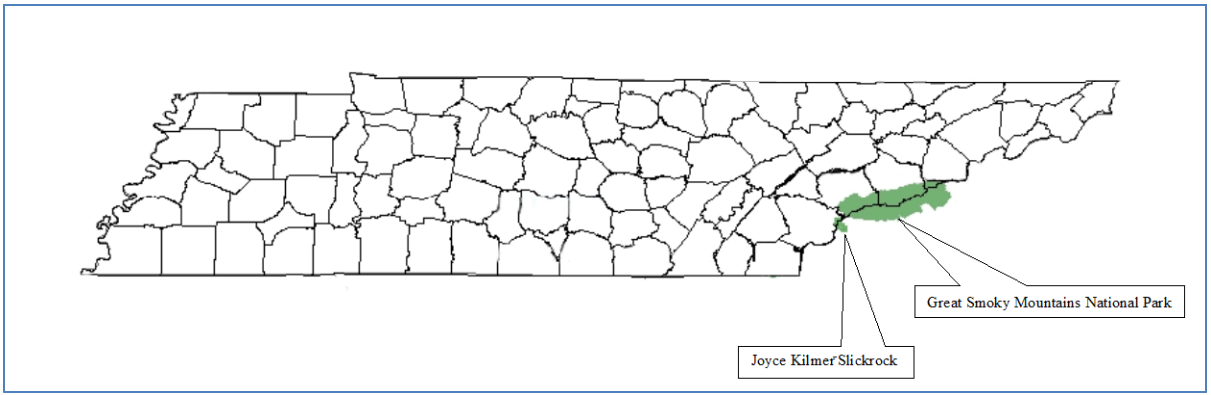

Figure ES-1: Tennessee Class I Areas

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.

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[6] Rule revision on January 10, 2017

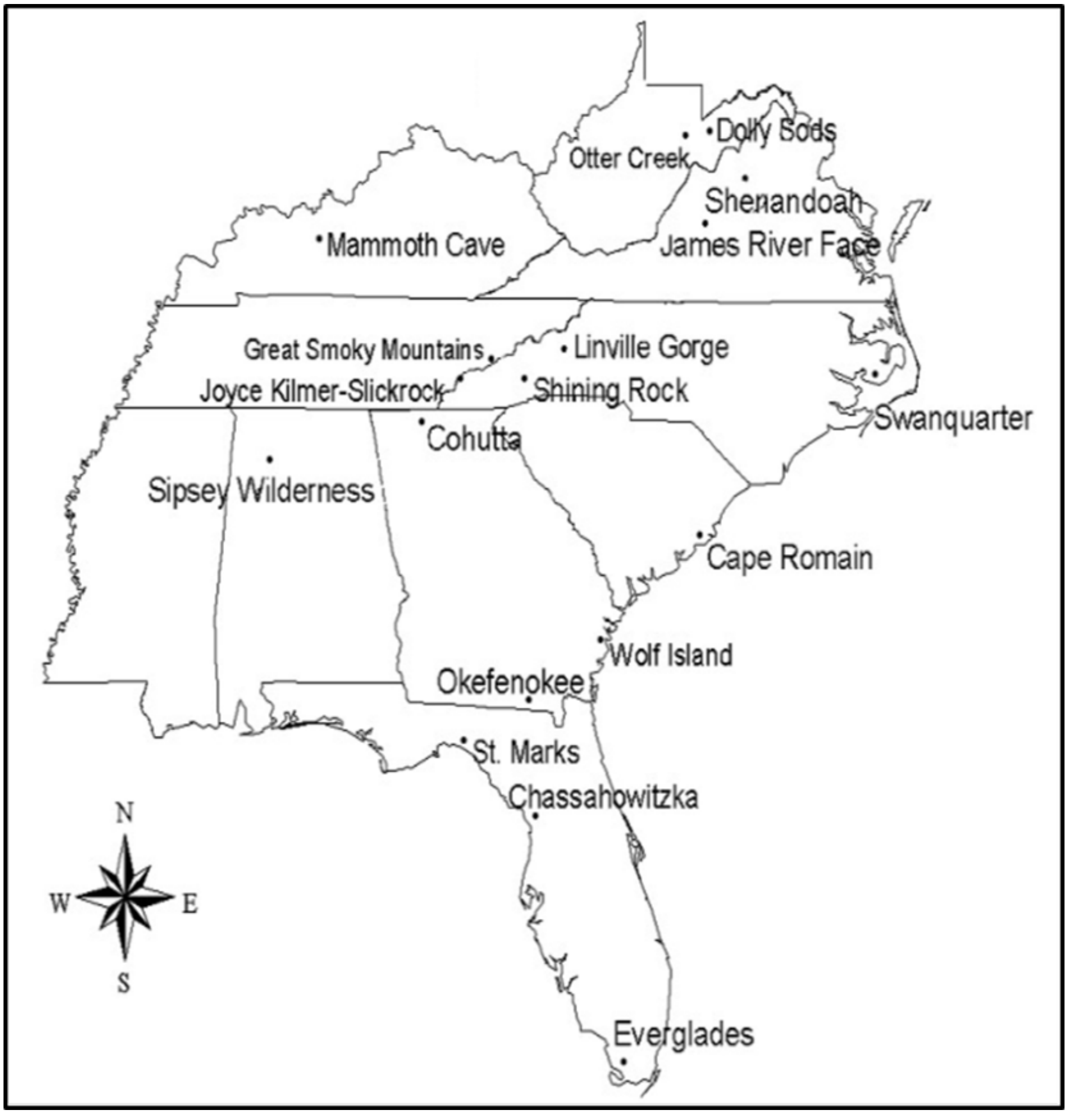

Figure ES-2: VISTAS Class I Areas

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

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[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

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[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.

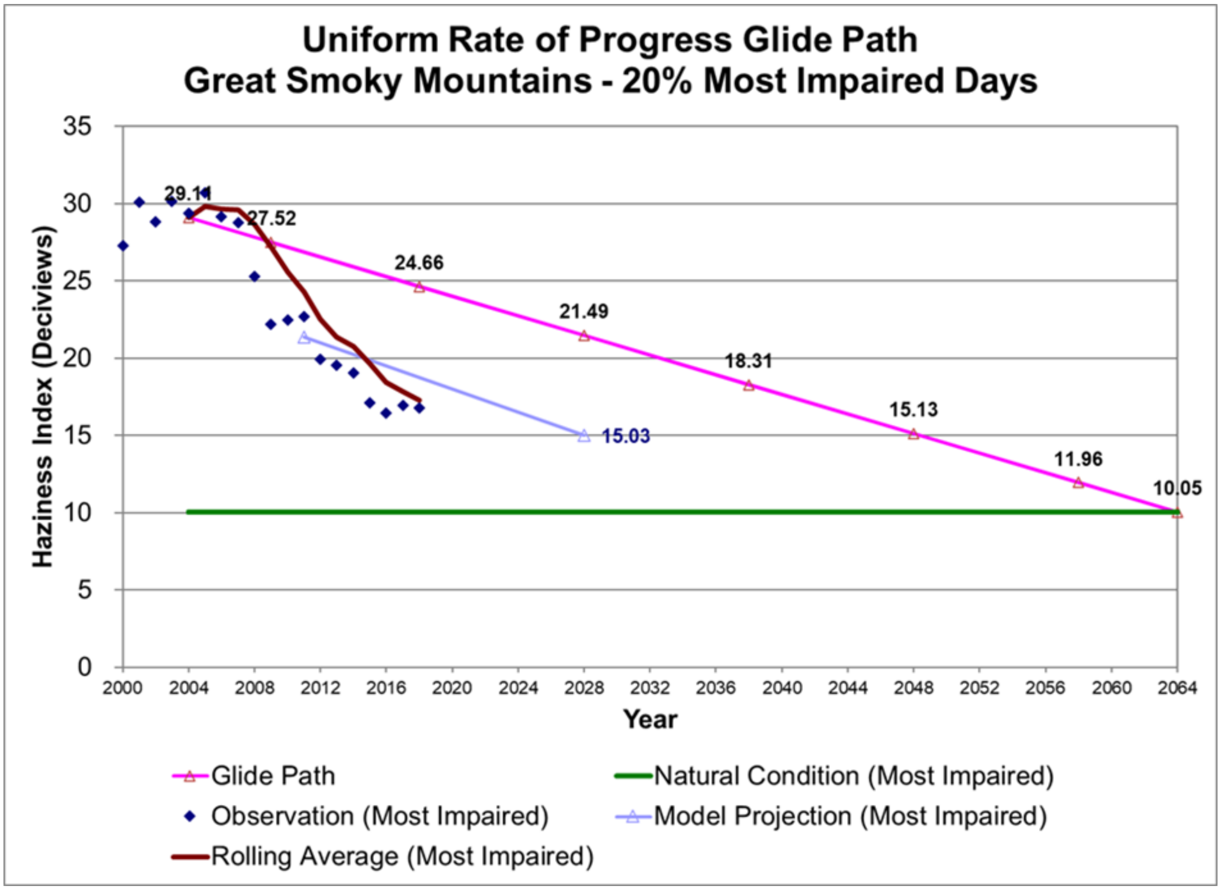

Figure ES-3: URP for Great Smoky Mountains National Park

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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Appendix A	Project Reports File Name: Appendix_A.1_A-2_A-3_for_SIP.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_D-1_for_SIP.pdf Appendix_D-2_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

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Appendix E	Visibility and Source Apportionment Projections File Name: Appendix_E-1a_Vistas Modeling Protocol_For_SIP.pdf Appendix_E-1b_Modeling_Protocol_Update_For_SIP.pdf Appendix_E-2a_BMR1_Runs1_2_For_SIP Appendix_E-2b_BMR2_Run3_For_SIP Appendix_E-2c_BMR3_Run5_For_SIP Appendix_E-2d_BMR4_Run4 Appendix_E-2e_BMR5_Run6_For_SIP Appendix_E-2f_BMR6_Run7_For_SIP Appendix_E-3_MPE PM and RH_For_SIP Appendix_E-4_(MPE Deposition)_For_SIP Appendix_E-5_MPE Ozone_For_SIP Appendix_E-6_(Future Year Model Projections)_For_SIP Appendix_E-7a_PSAT Model Results_For_SIP Appendix_E-7b_Roadmap_for_PSAT_Scaled_Adjustments_for_SIP.pdf Appendix_E-8_SMAT 2028 Bulk_For_SIP
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

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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
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F-1c	TDEC-APC letter to GA dated January 14, 2021
F-1d	NC letter to TDEC-APC dated February 1, 2021
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F-3c	Presentation to FLMs, EPA Region 4, CC/TAWG on January 31, 2018
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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 2021 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

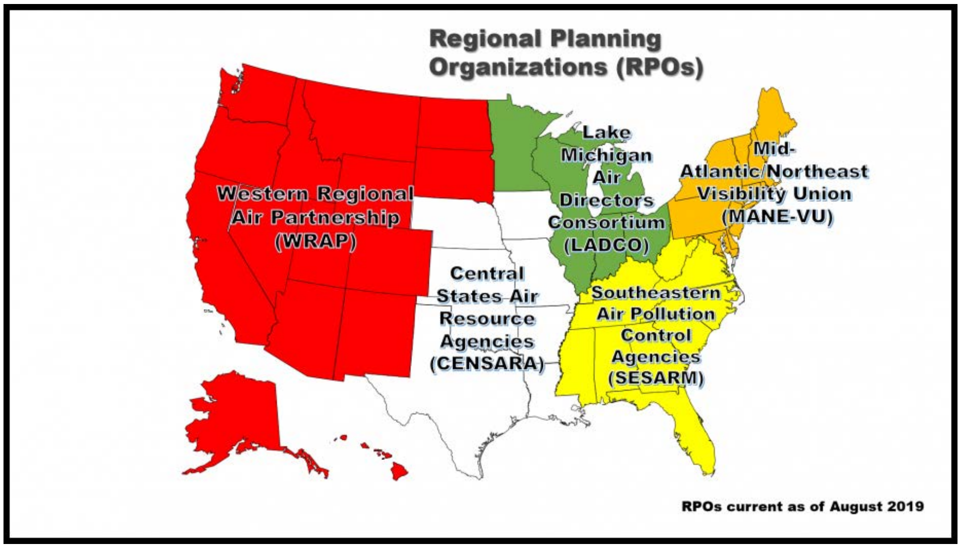

Figure 1-1: Geographical Areas of Regional Planning Organizations

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;

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[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.

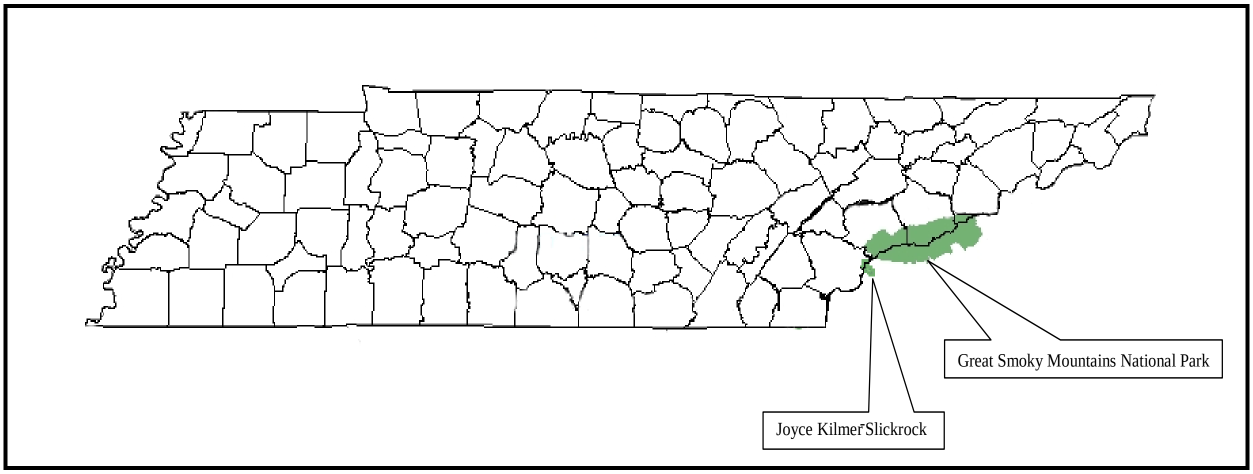

Figure 1-2: Tennessee's Mandatory Federal Class I Areas

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.

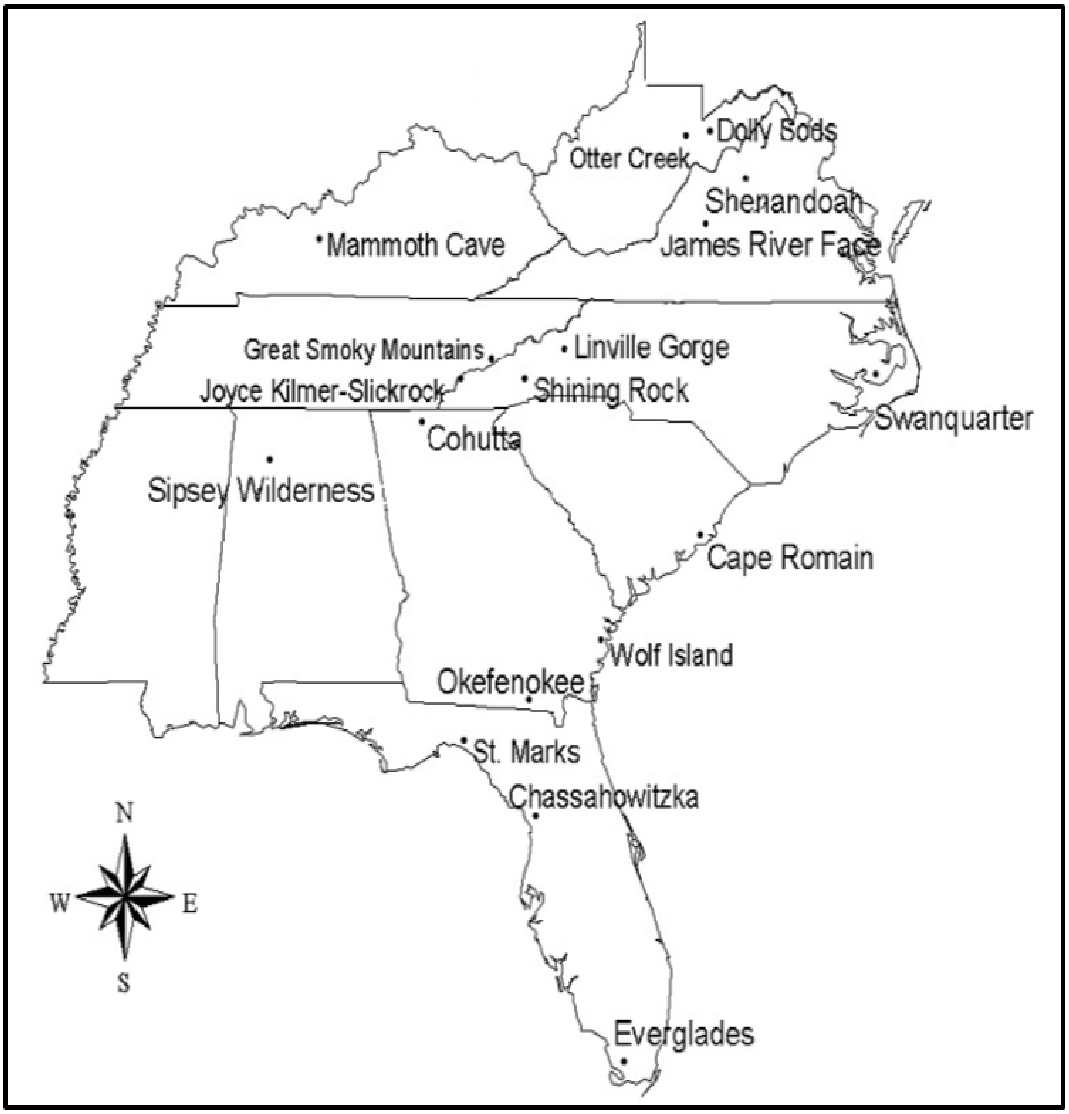

Figure 1-3: Mandatory Federal Class I Areas in the VISTAS Region

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 and TDEC-APC's response appears in Appendix F.

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
(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

Rule Section	Chapter/Section in SIP	Description
(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.

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

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

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.

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[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

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[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.

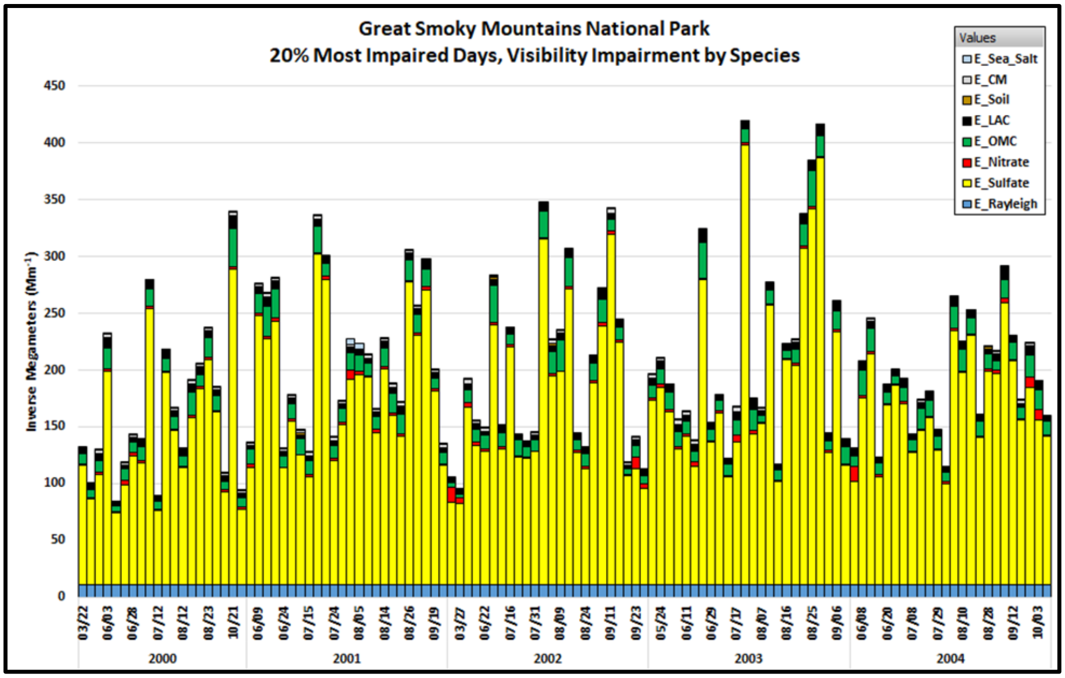

Figure 2-1: 2000-2004 Reconstructed Extinction for the 20% Most Impaired Days at the Great Smoky Mountains National Park

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.

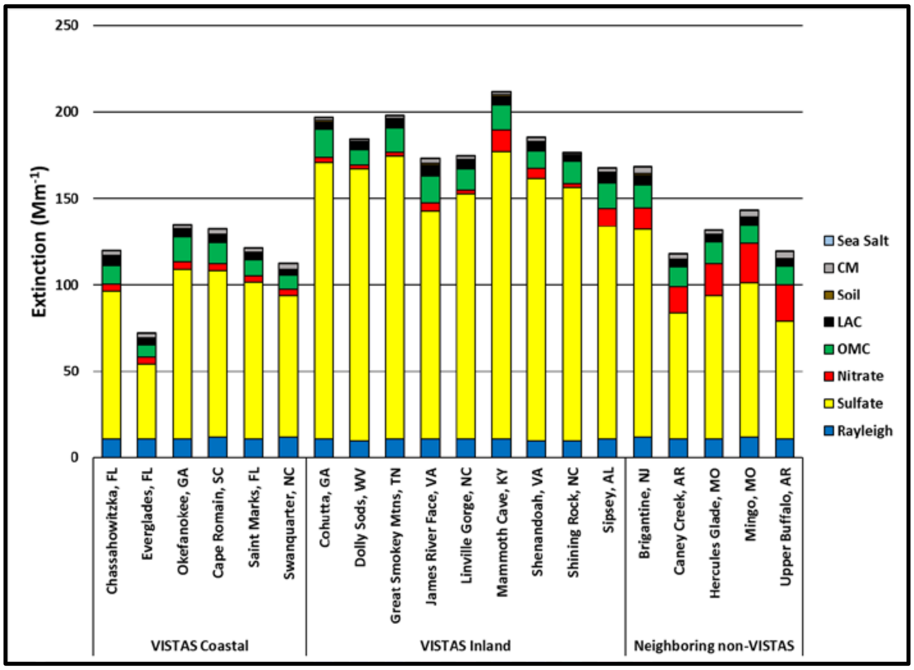

Figure 2-2: Average Light Extinction, 20% Most Impaired Days, 2000-2004, VISTAS and Neighboring Class I Areas

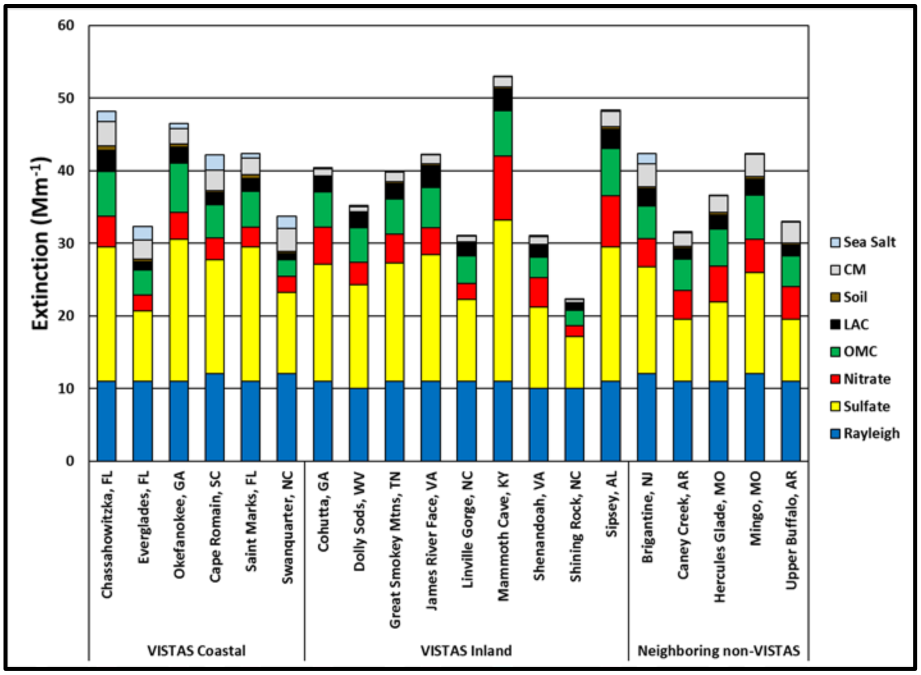

Figure 2-3: Average Light Extinction, 20% Clearest Days, 2000-2004, VISTAS and Neighboring Class I Areas

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

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[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.

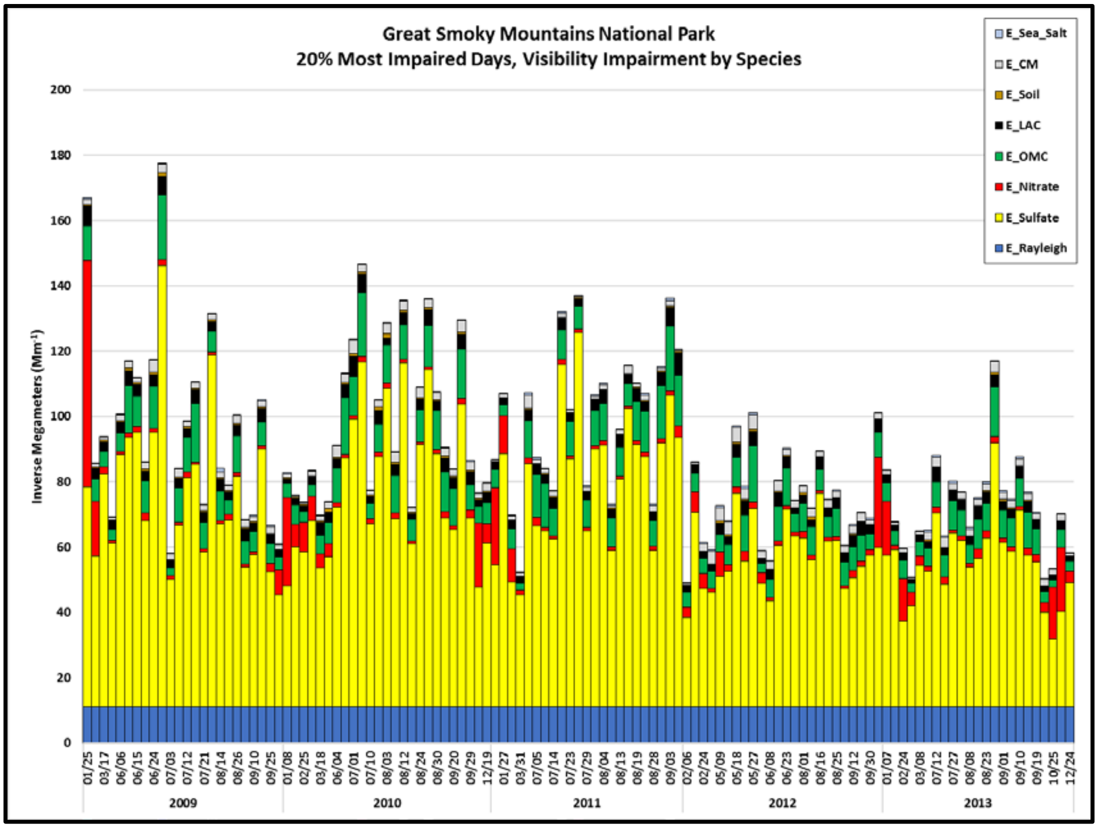

Figure 2-4: 2009-2013 Reconstructed Extinction for the 20% Most Impaired Days at the Great Smoky Mountains National Park

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.

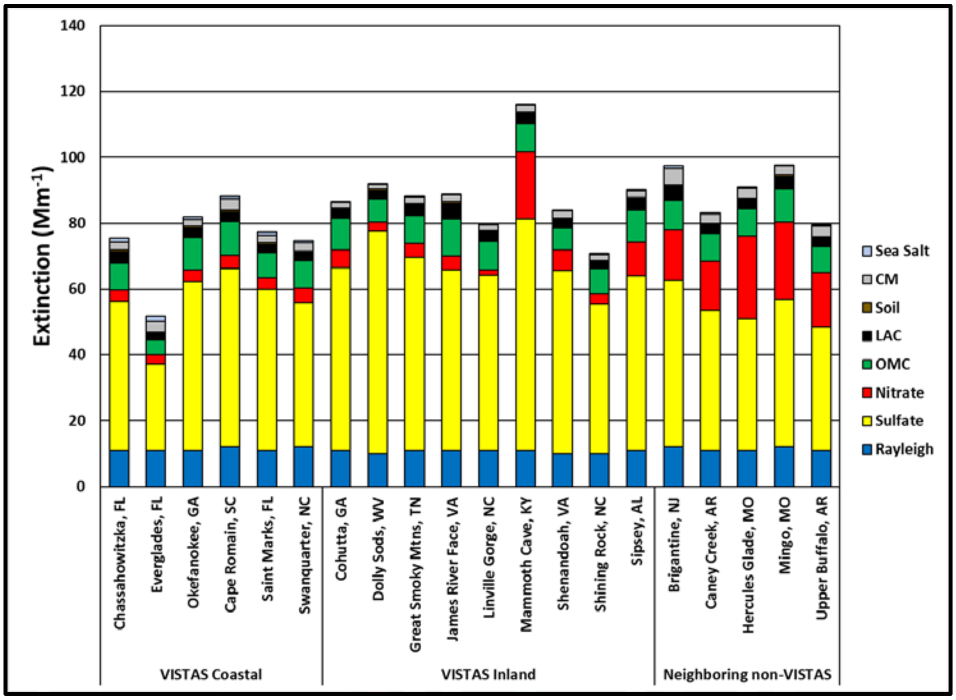

Figure 2-5: Average Light Extinction, 20% Most Impaired Days, 2009-2013, VISTAS and Neighboring Class I Areas

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.

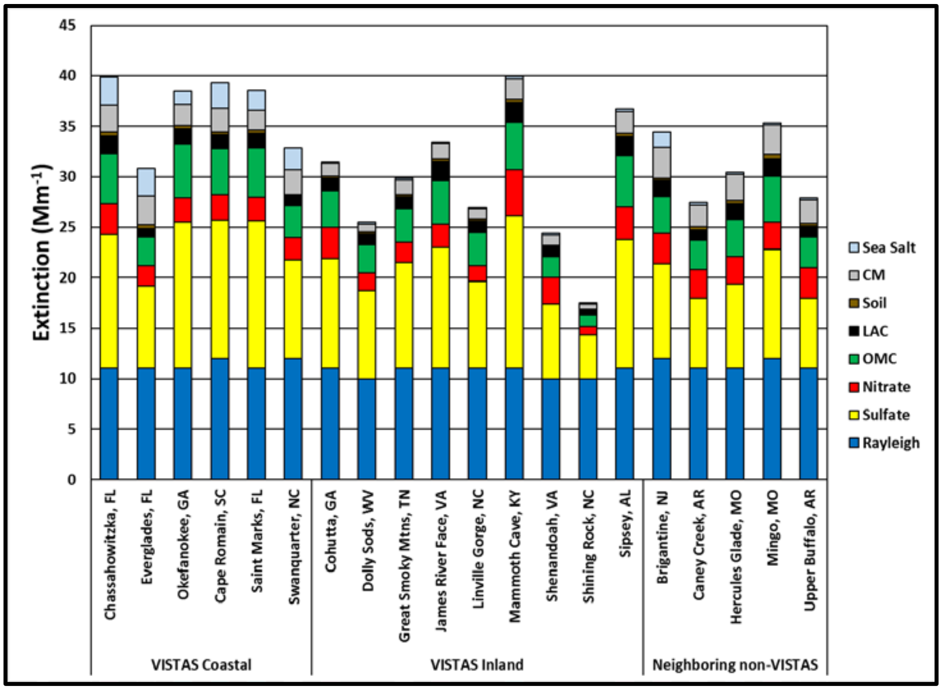

Figure 2-6: Average Light Extinction, 20% Clearest Days, 2009-2013, VISTAS and Neighboring Class I Areas

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]

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[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.

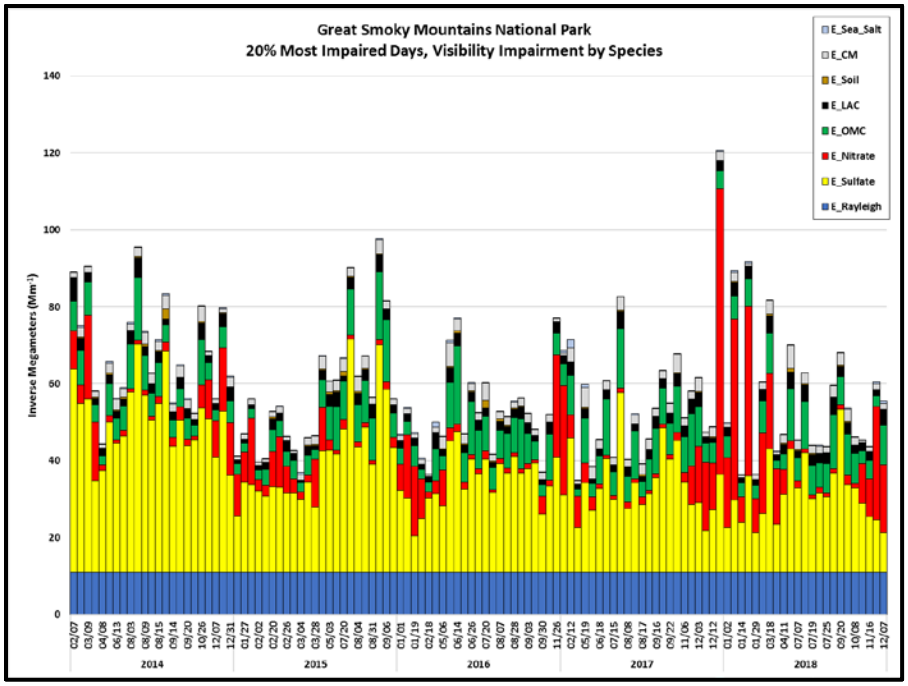

Figure 2-7: 2014-2018 Reconstructed Extinction for the 20% Most Impaired Days at the Great Smoky Mountains National Park

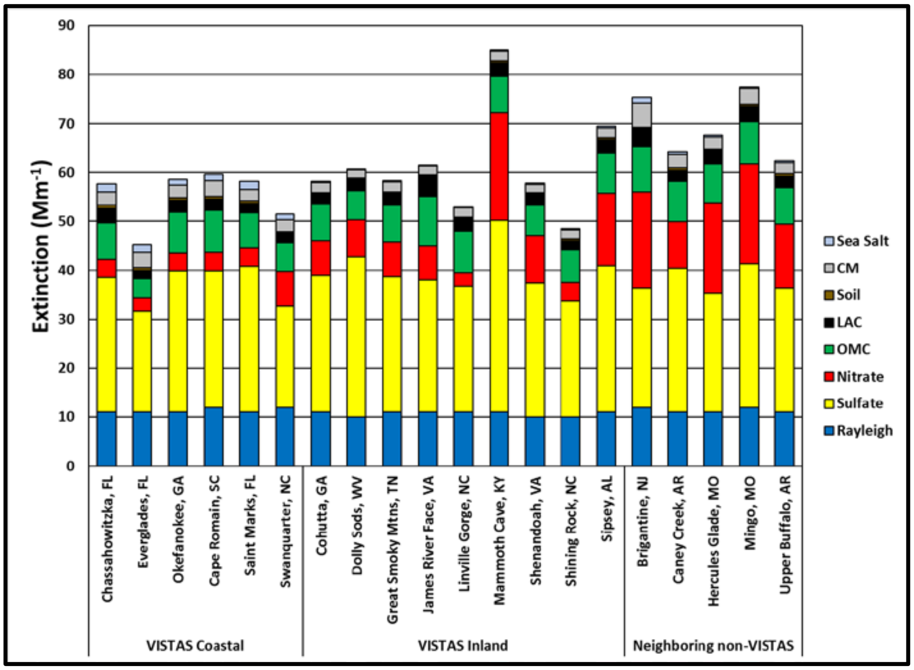

Figure 2-8: Average Light Extinction, 20% Most Impaired Days, 2014-2018, VISTAS and Neighboring Class I Areas

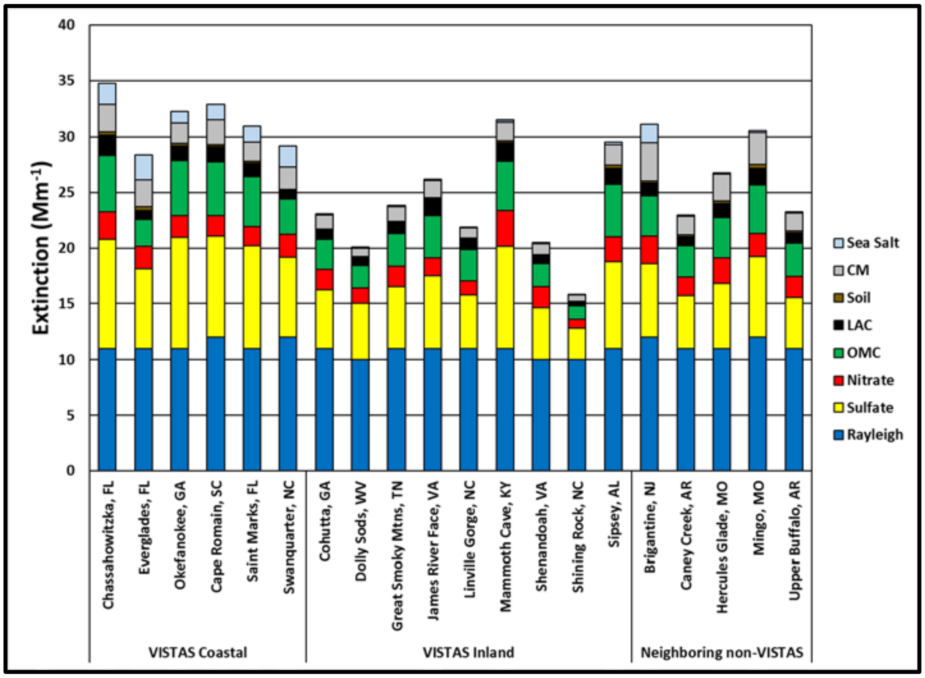

Figure 2-9: Average Light Extinction, 20% Clearest Days, 2014-2018, VISTAS and Neighboring Class I Areas

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]

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[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

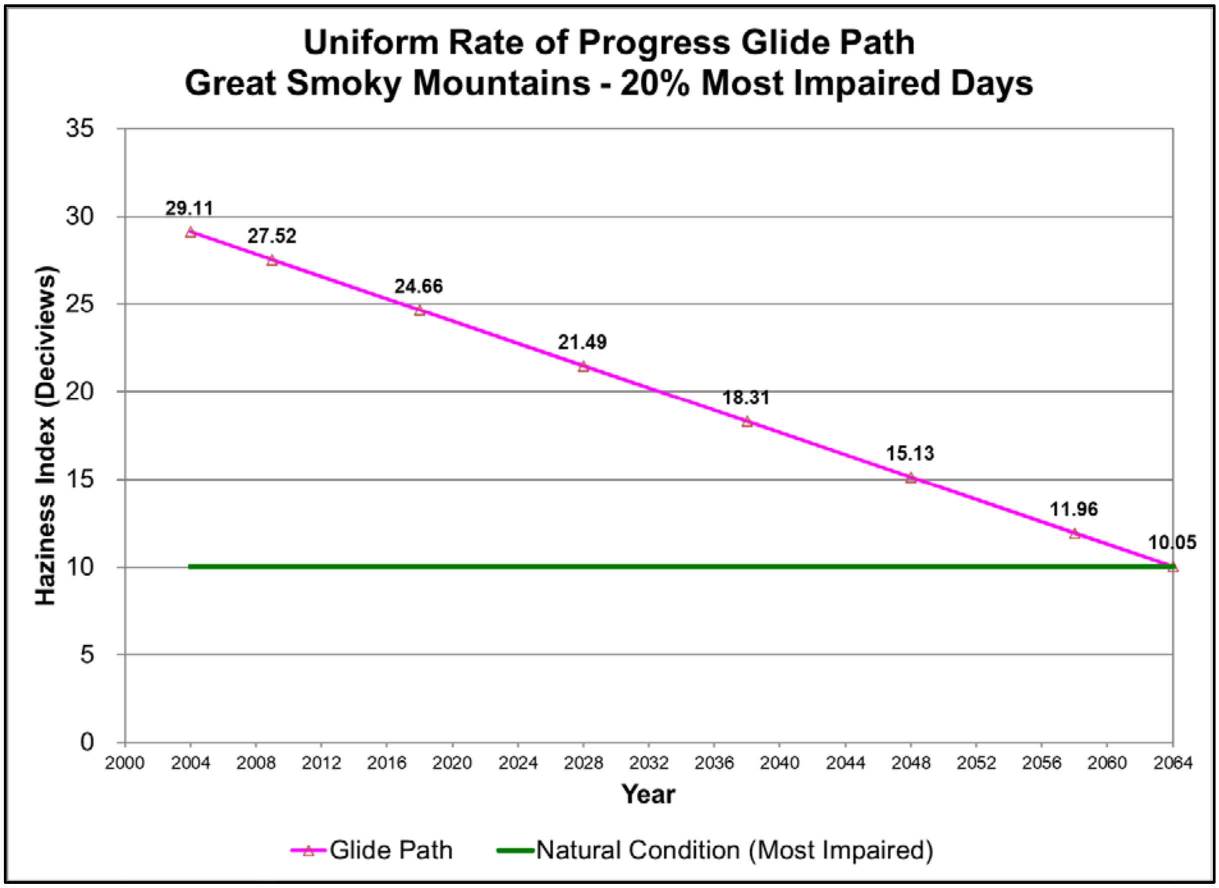

Figure 3-1: Uniform Rate of Progress Glide Path for 20% Most Impaired Days at Great Smoky Mountains National Park

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

Purpose	**Initial 2028 Inventory (version = elv3)**	**Revised / Final Inventory (version = elv5)***
Area of Influence Analysis (AoI)	Documentation provided in Appendices B-1a and B-1b of this SIP	
Initial PSAT Source Apportionment Modeling		
Adjusted PSAT Source Apportionment Modeling		Documentation provided in Appendices B-2a and B-2b of this SIP
Modeling of Reasonable Progress Goals (RPGs) for 2028		

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.

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[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

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[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).

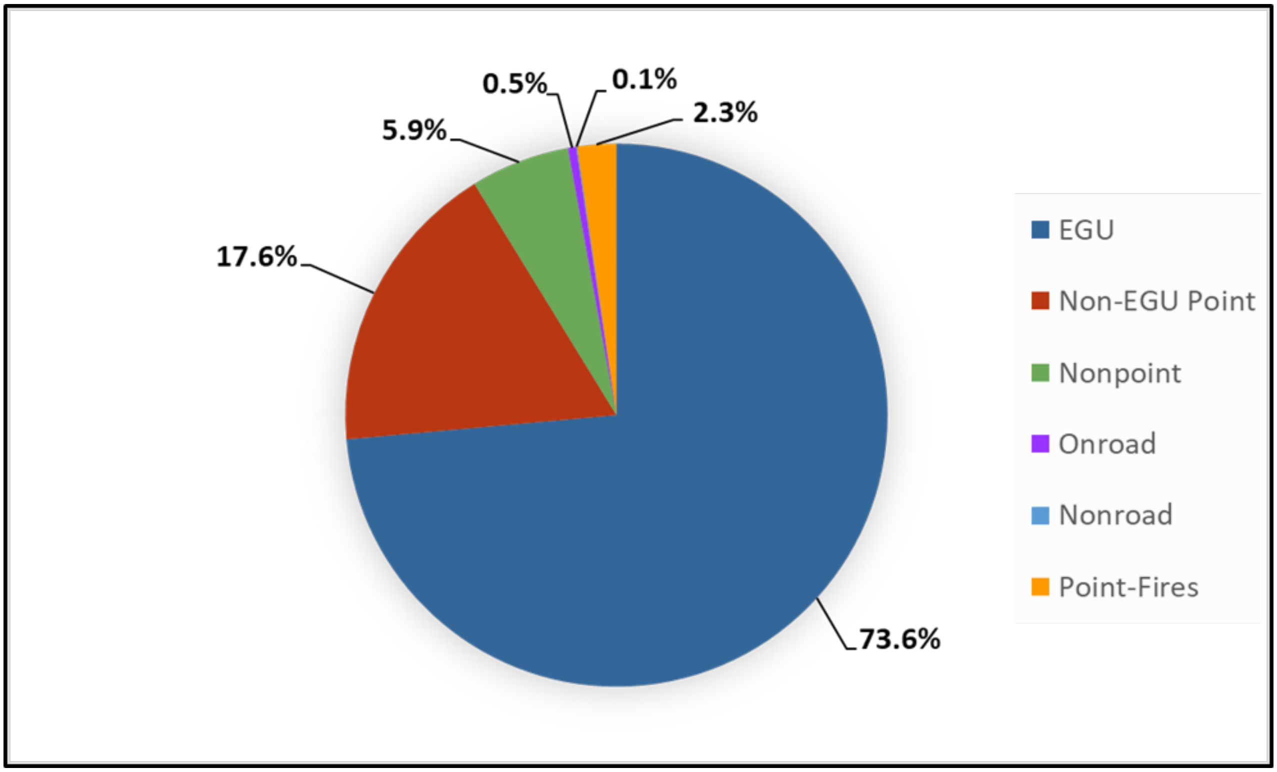

Figure 4-1: 2011 SO2 Emissions in the VISTAS States

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

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[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 bae 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.

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[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

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[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

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[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),

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[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

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[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.

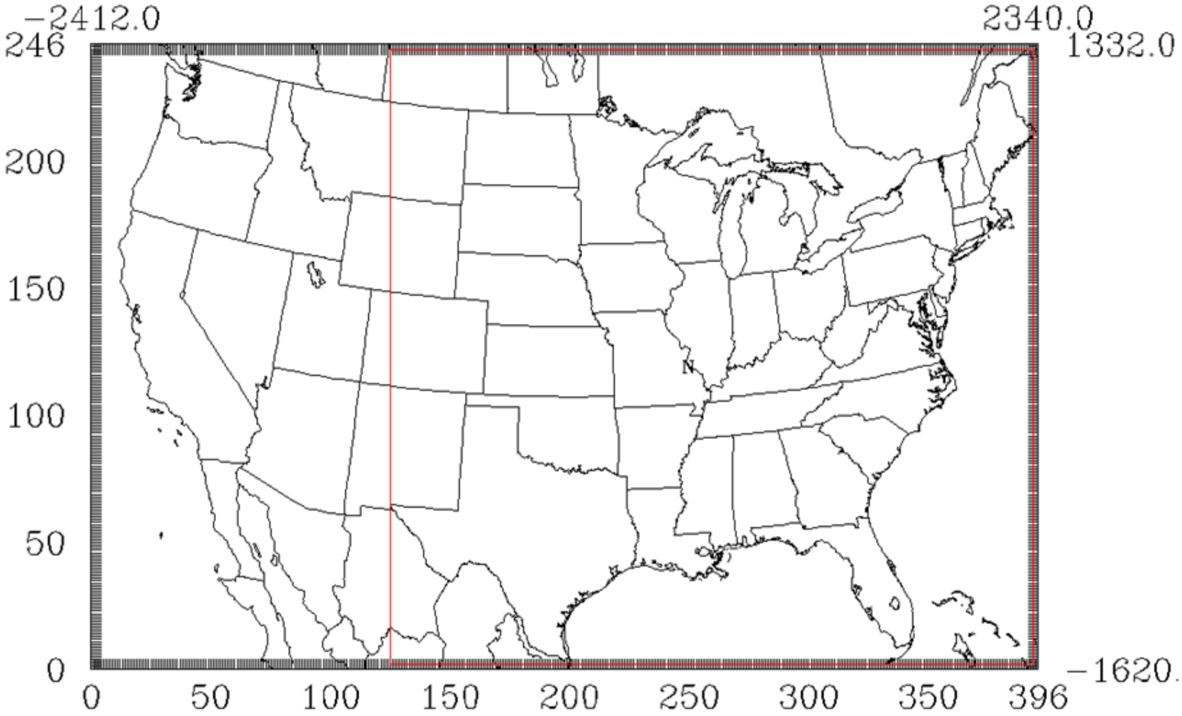

Figure 5-1: Map of 12-km CAMx Modeling Domains; VISTAS_12 Domain Represented as Inner Red Domain

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]

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[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

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[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.

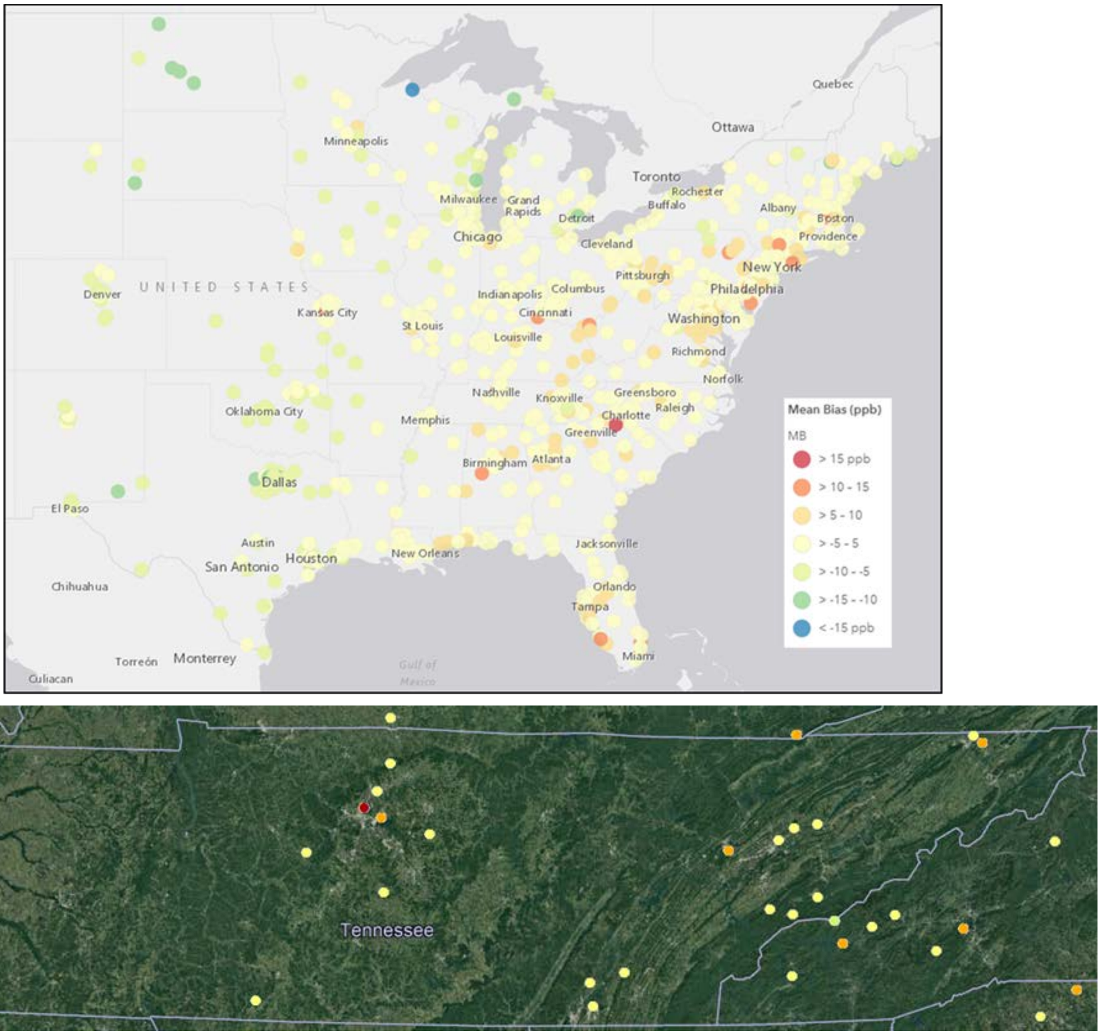

Figure 6-1: Mean Bias (ppb) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

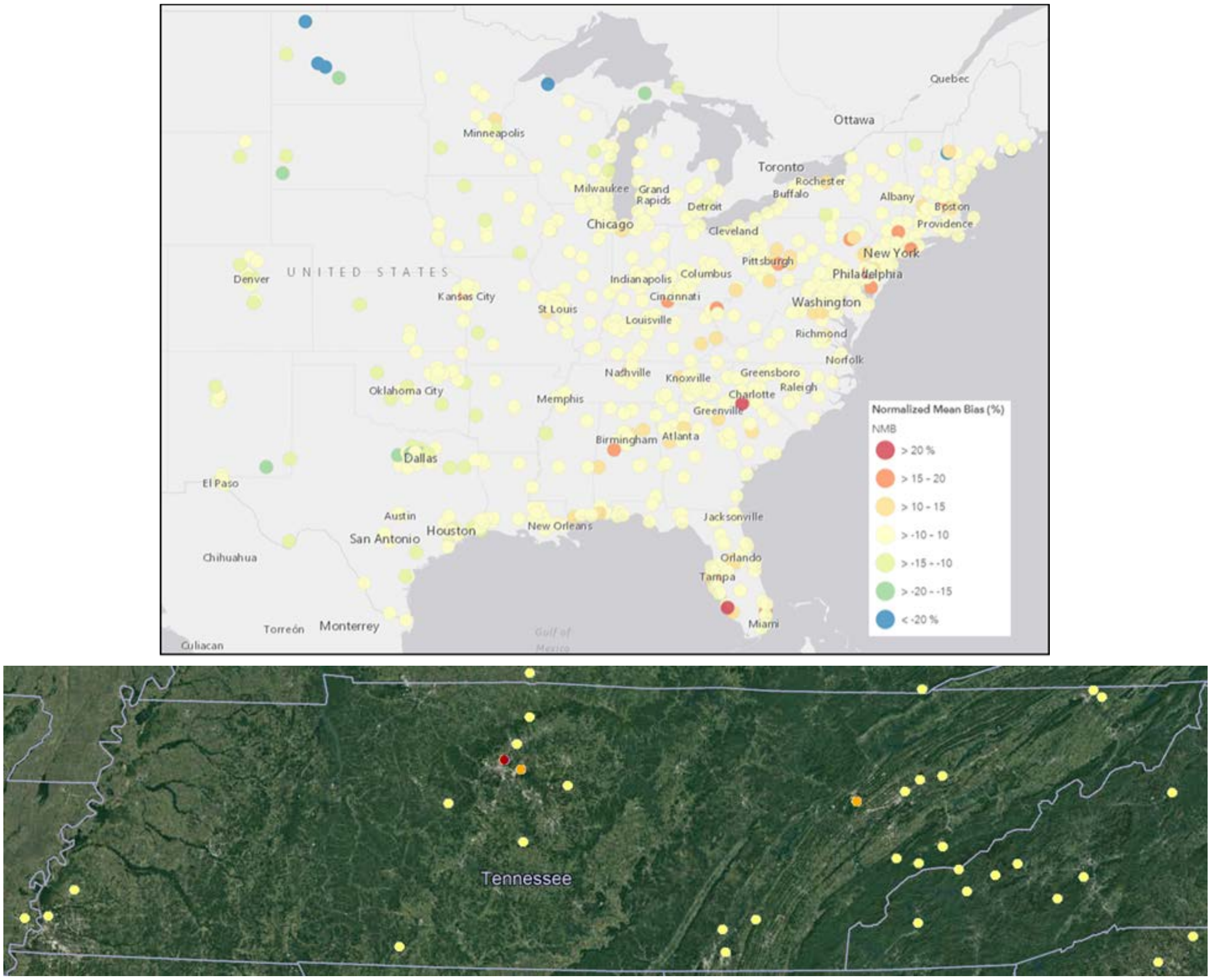

Figure 6-2: Normalized Mean Bias (%) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

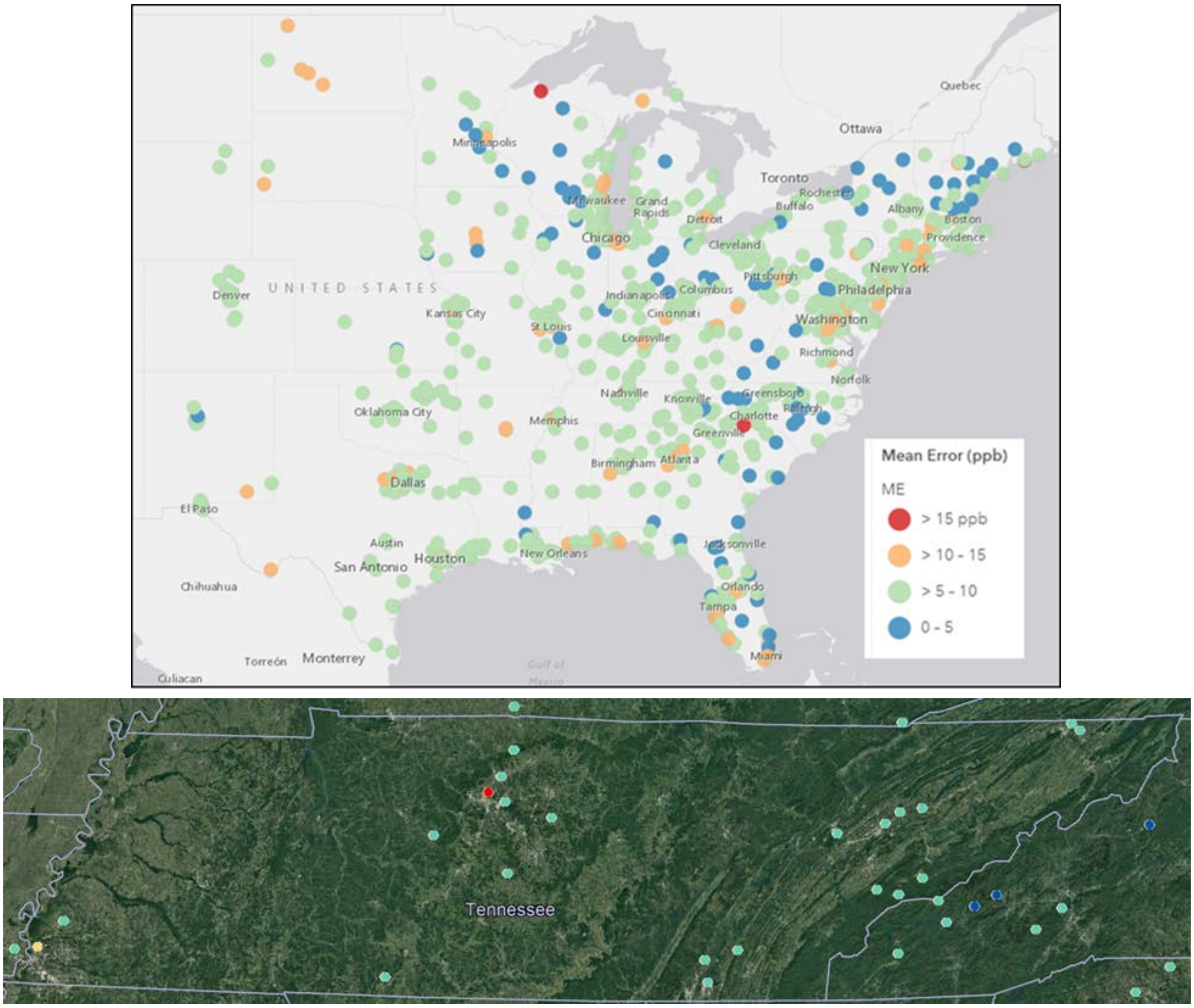

Figure 6-3: ME (ppb) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

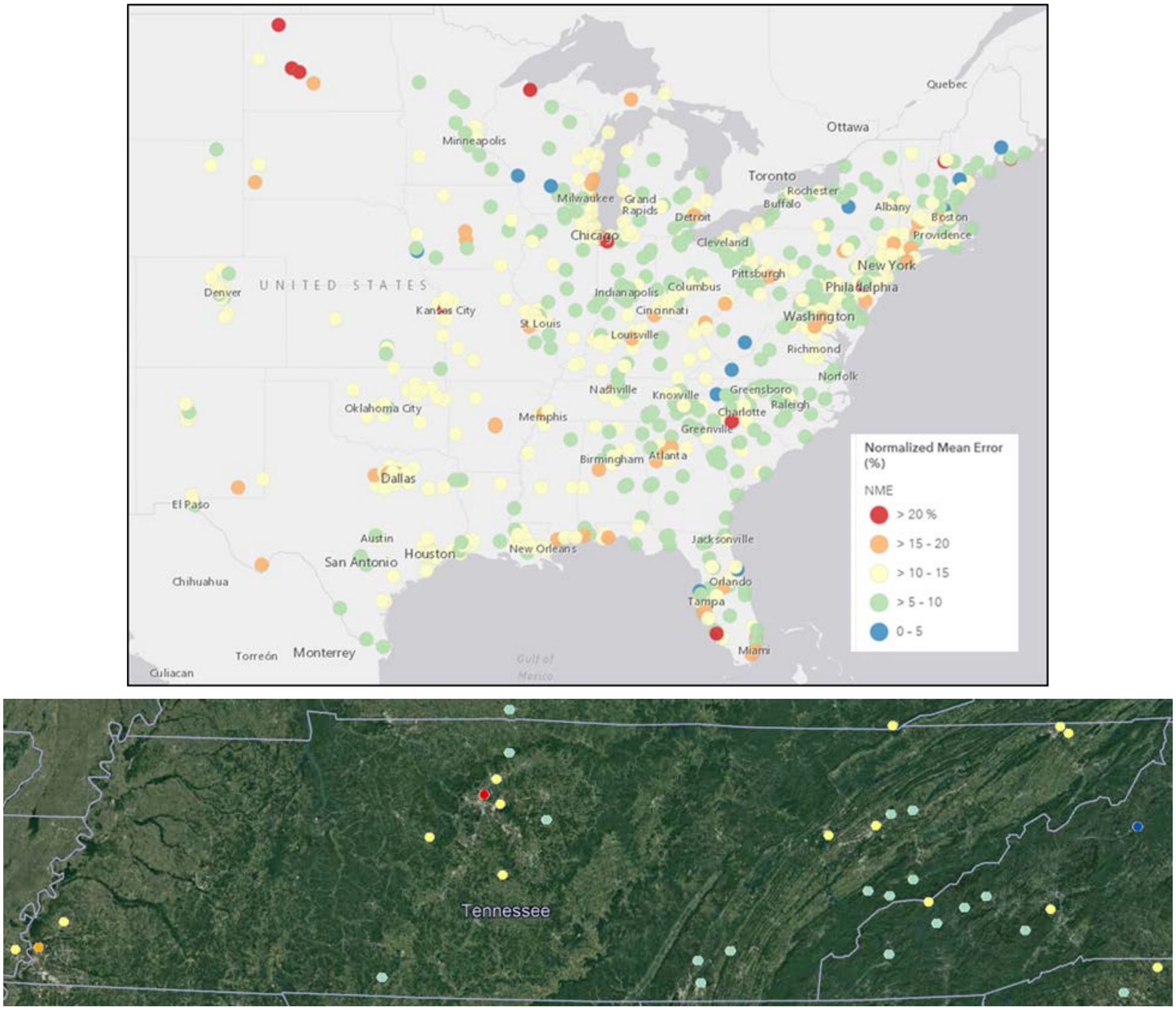

Figure 6-4: NME (%) of MDA8 Ozone ≥ 60 ppb Over the Period May-September 2011 at AQS Monitoring Sites in VISTAS12 Domain (top) and in Tennessee (bottom)

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)

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[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).

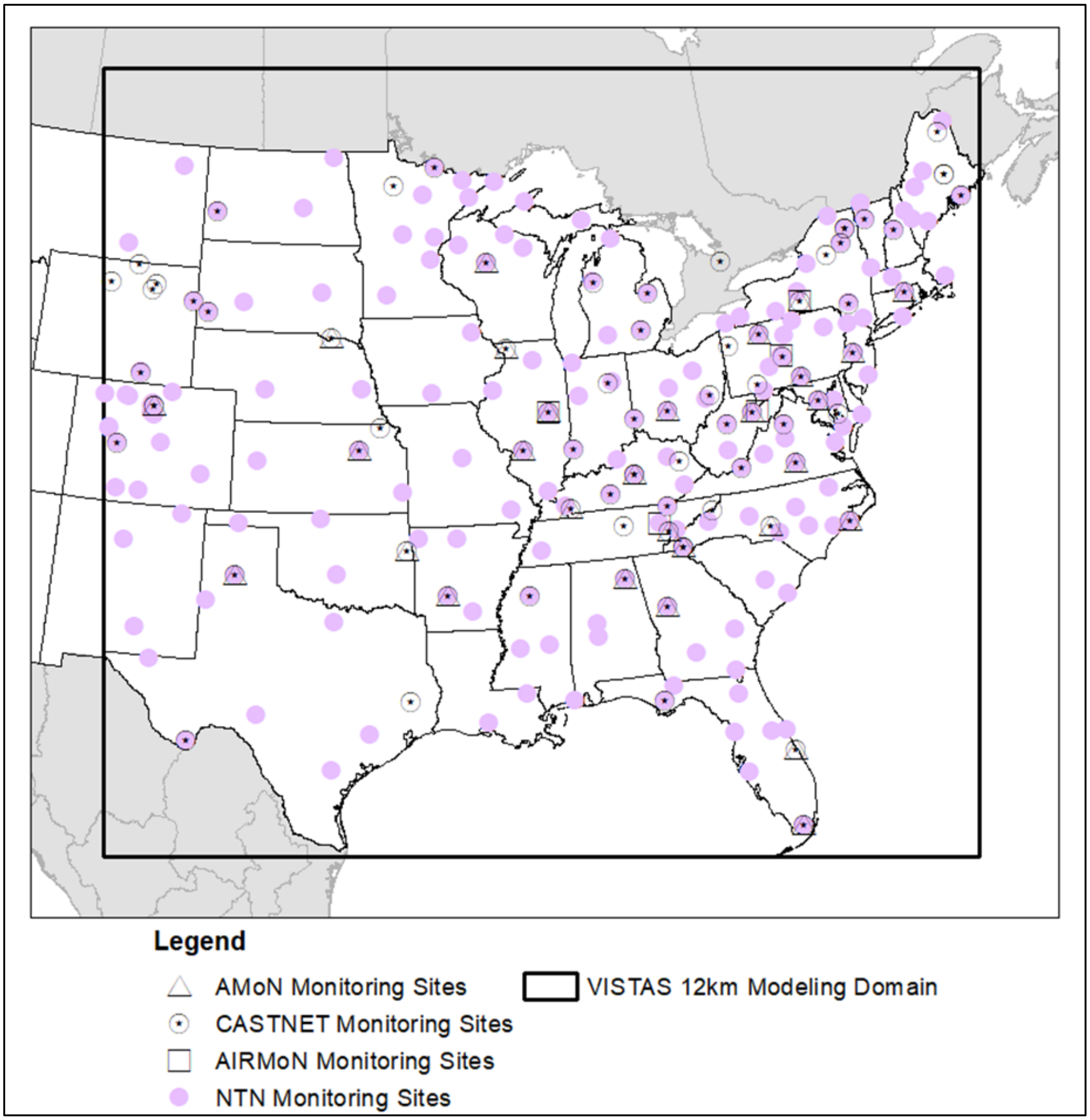

Figure 6-5: Deposition Monitors Included in the VISTAS 12 Domain

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

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[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.

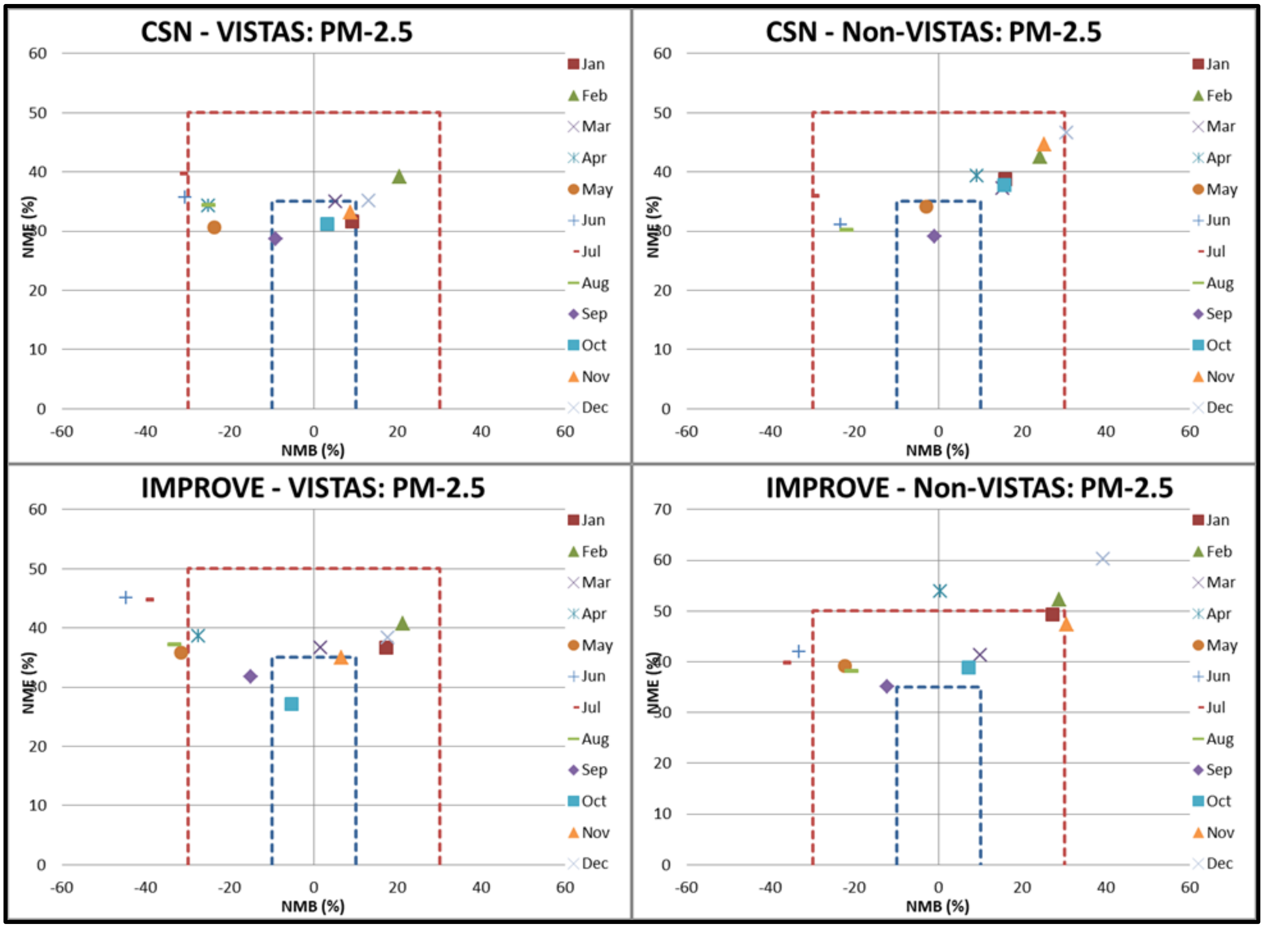


Figure 6-6: Soccer Plots of Total $PM_{2.5}$ by Network and Month for VISTAS and Non-VISTAS Sites

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.

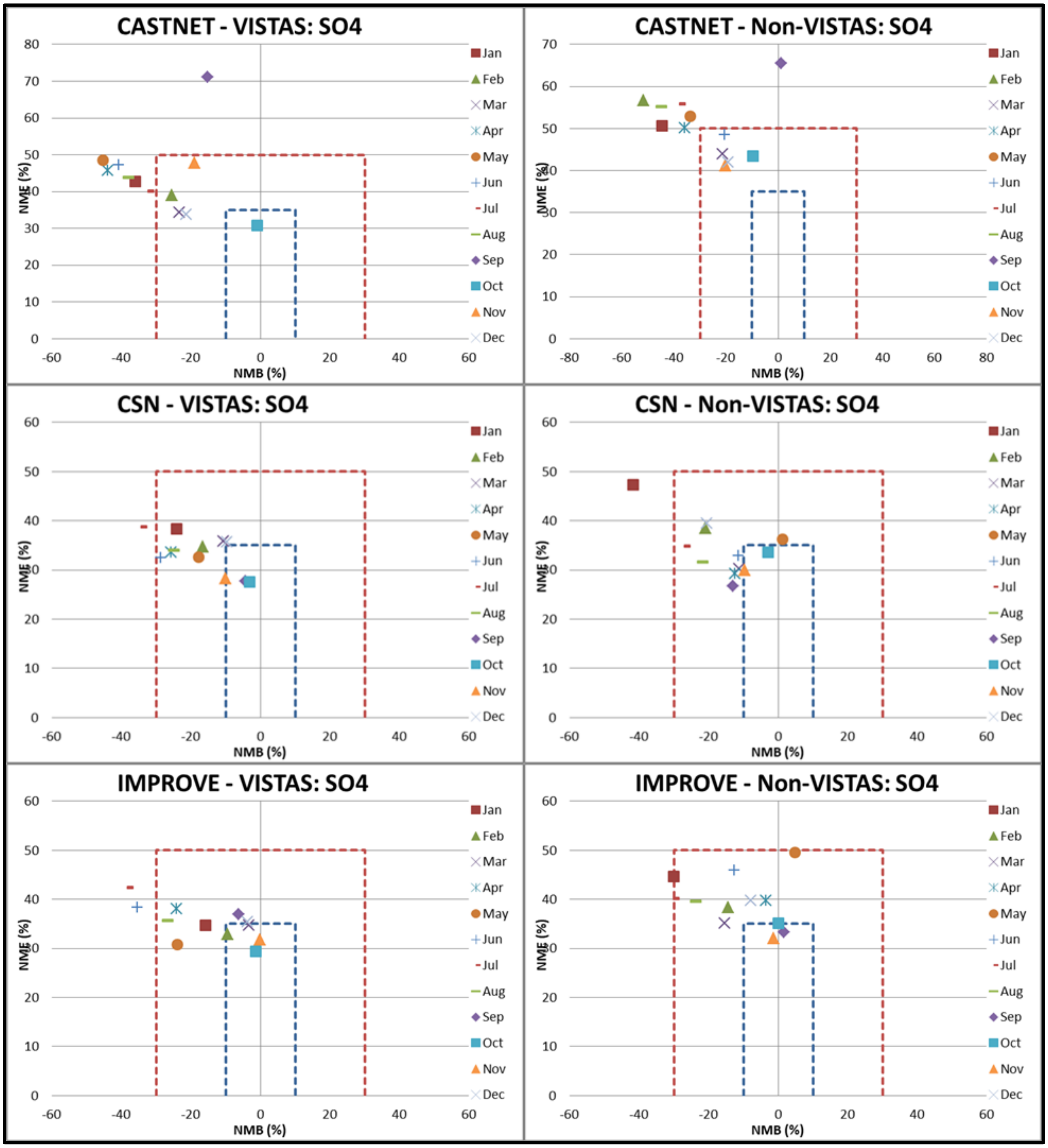
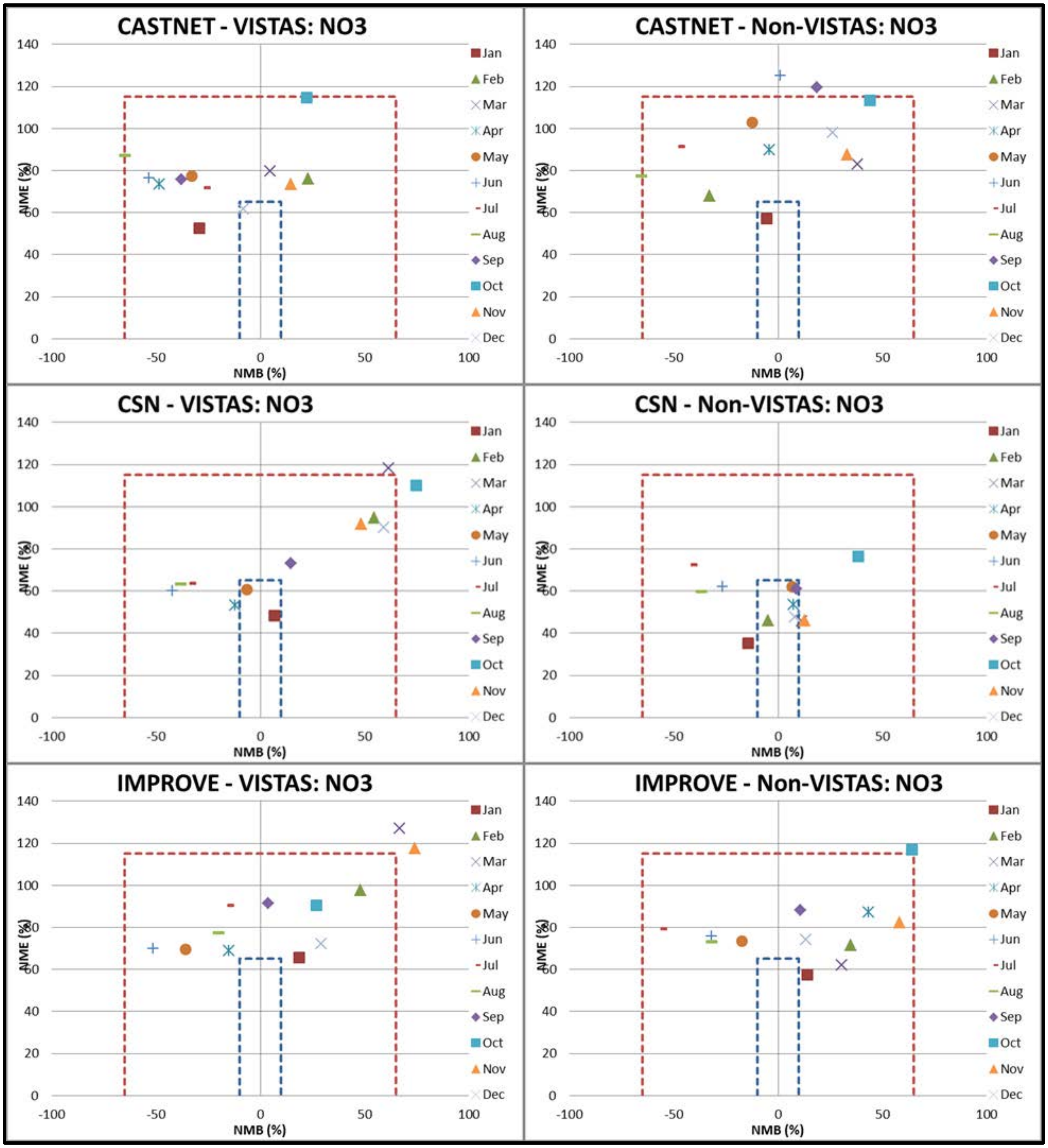


Figure 6-7: Soccer Plots by Network and Month for VISTAS and Non-VISTAS Sites

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.


CASTNET - VISTAS: NO3

CASTNET - Non-VISTAS: NO3

CSN - VISTAS: NO3

CSN - Non-VISTAS: NO3

IMPROVE - VISTAS: NO3

IMPROVE - Non-VISTAS: NO3

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.

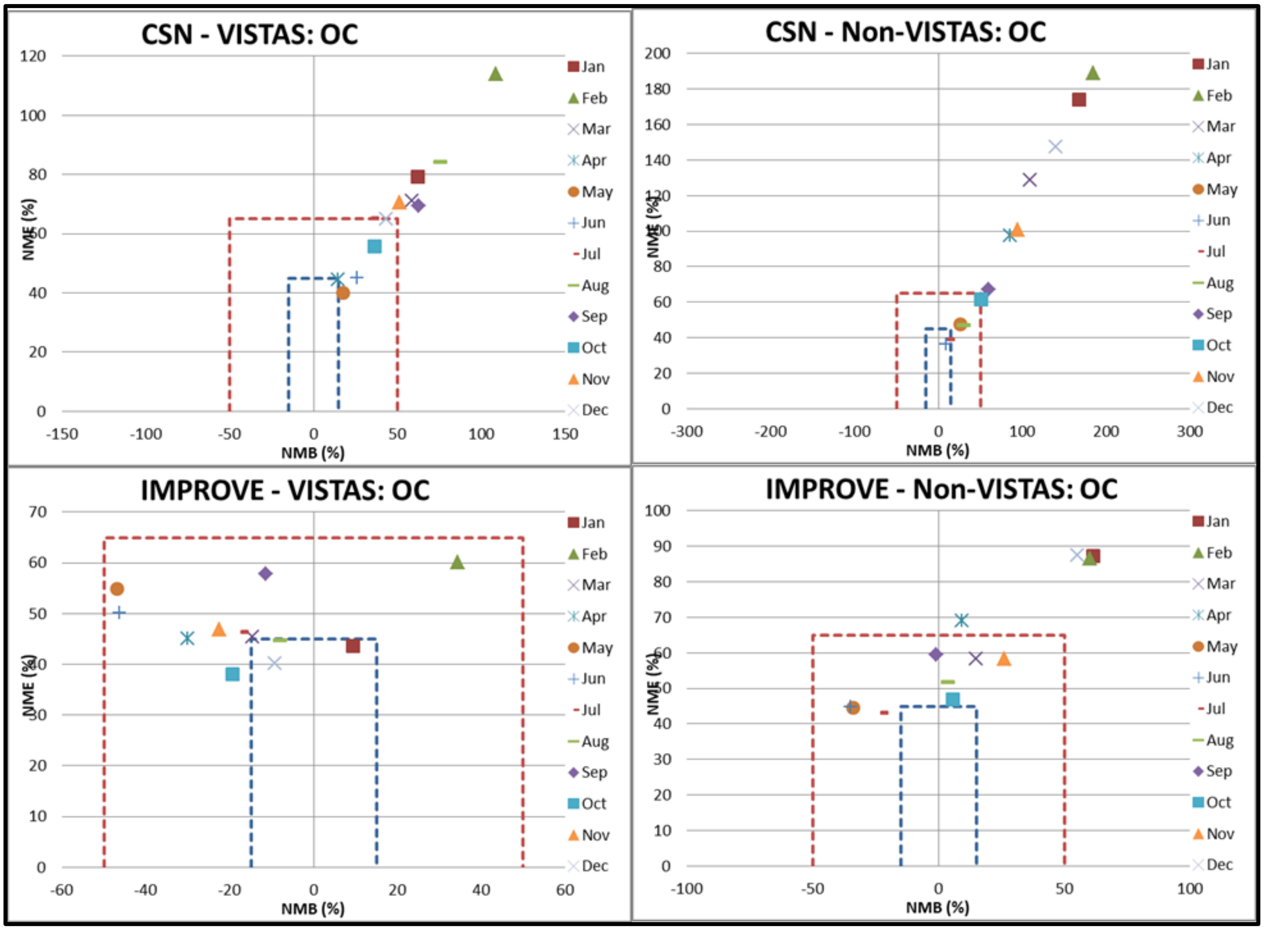


Figure 6-9: Soccer Plots of OC by Network and Month for VISTAS and Non-VISTAS Sites

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.

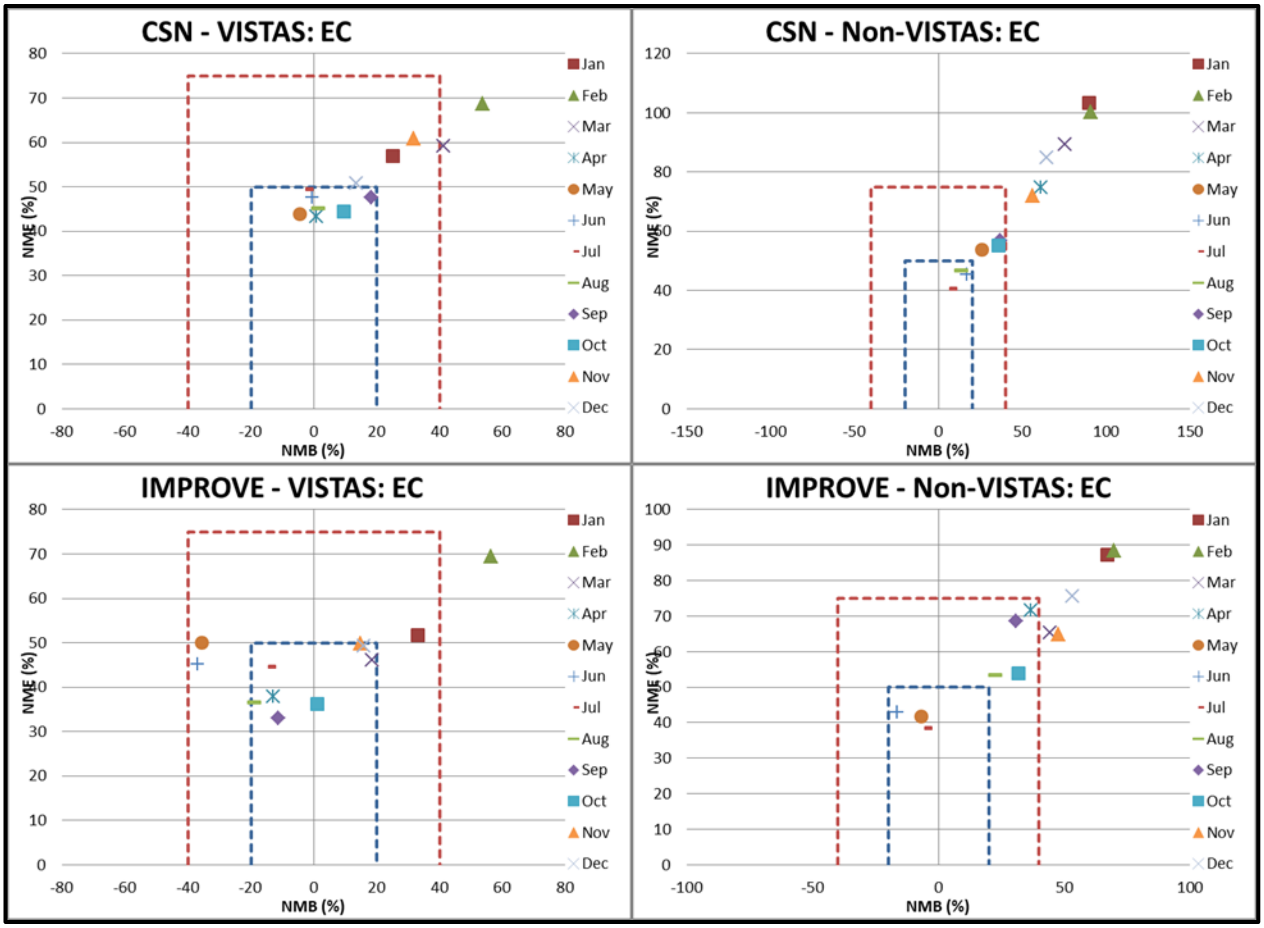


Figure 6-10: Soccer Plots of EC by Network and Month for VISTAS and Non-VISTAS Sites

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

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[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**

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

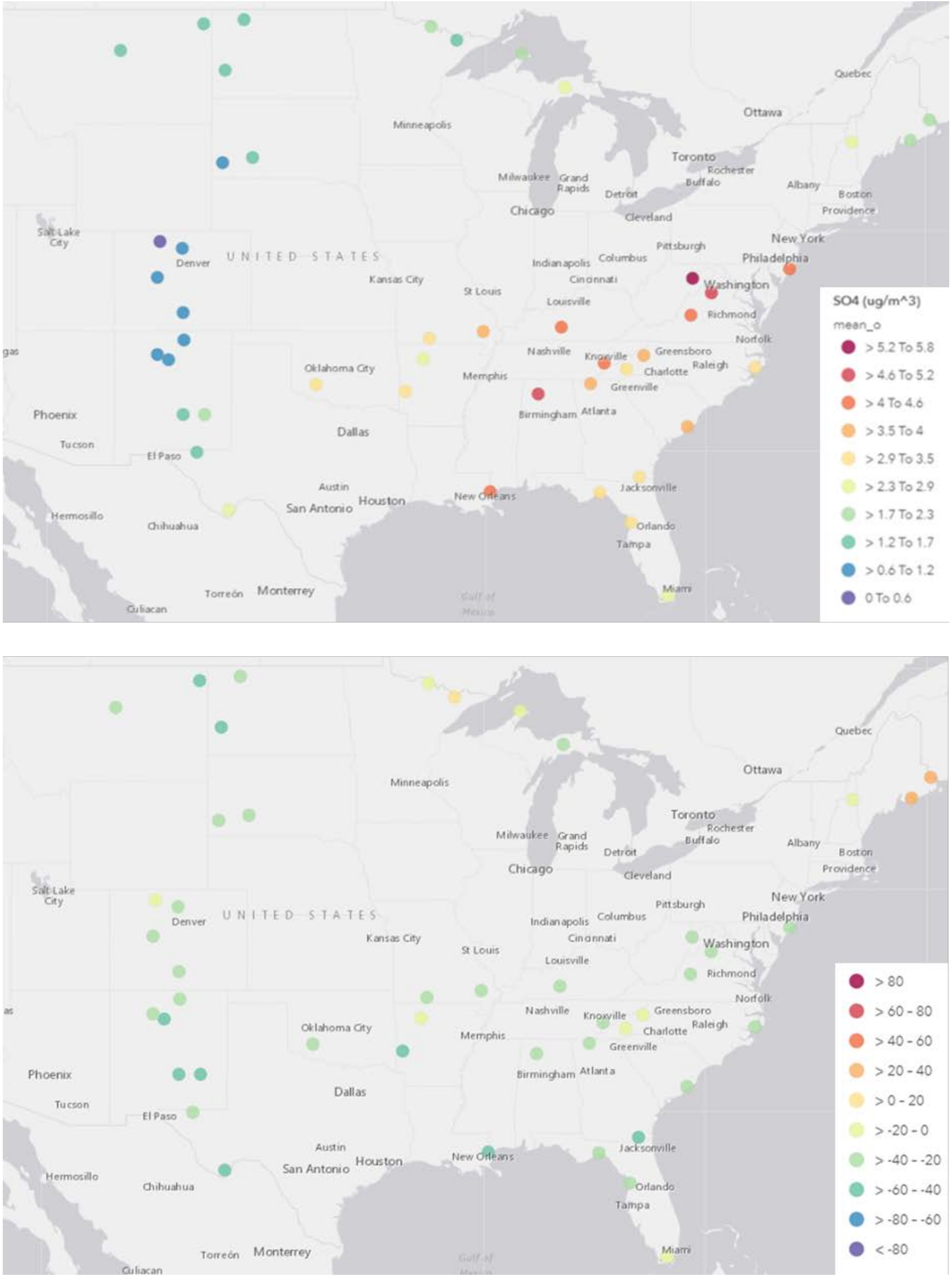


Figure 6-11: Observed Sulfate (Top) and Modeled NMB (Bottom) for Sulfate on the 20% Most-Impaired Days at IMPROVE Monitor Locations

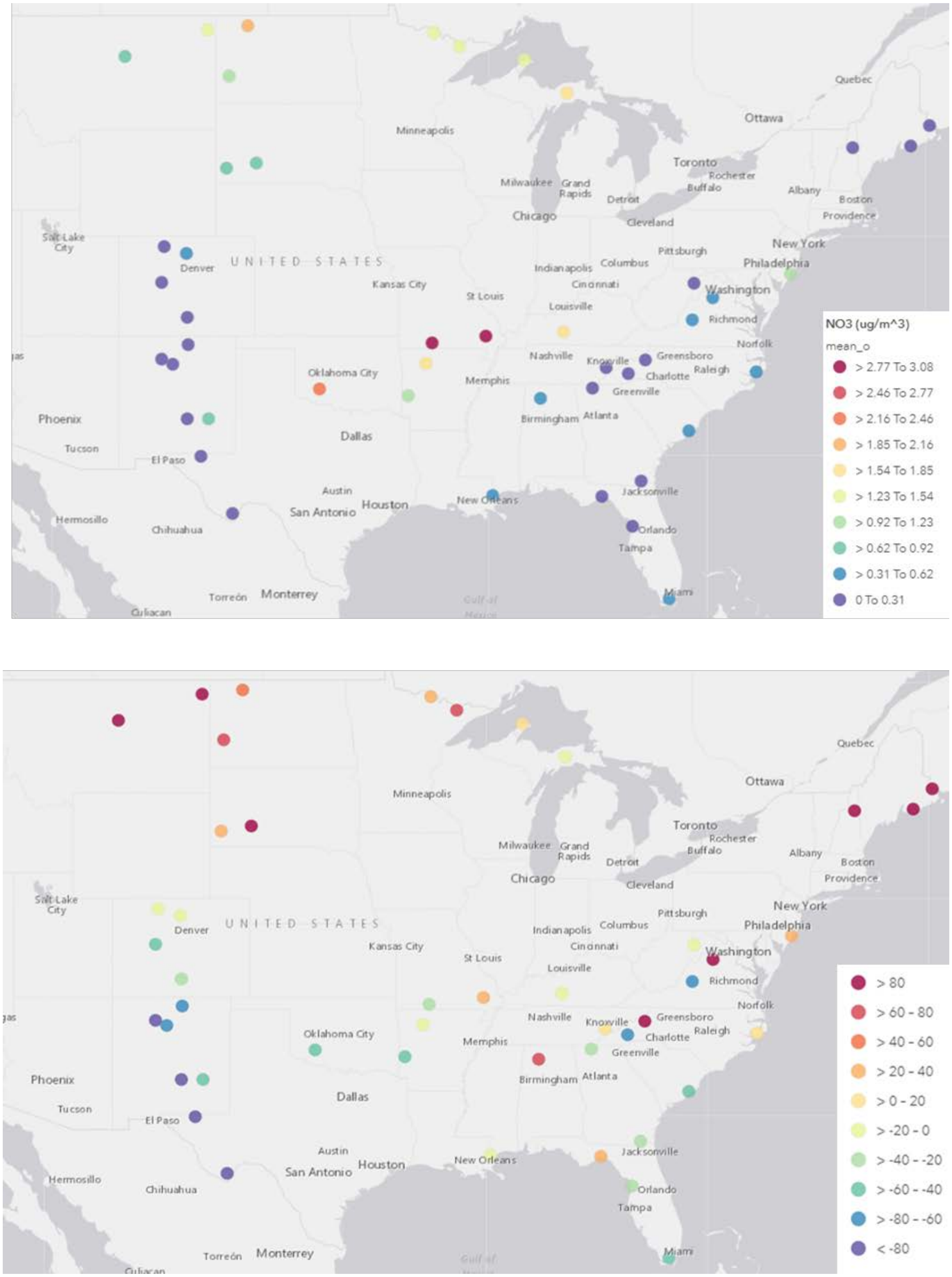


Figure 6-12: Observed Nitrate (Top) and Modeled NMB (Bottom) for Nitrate on the 20% Most Impaired Days at Improve Monitor Locations

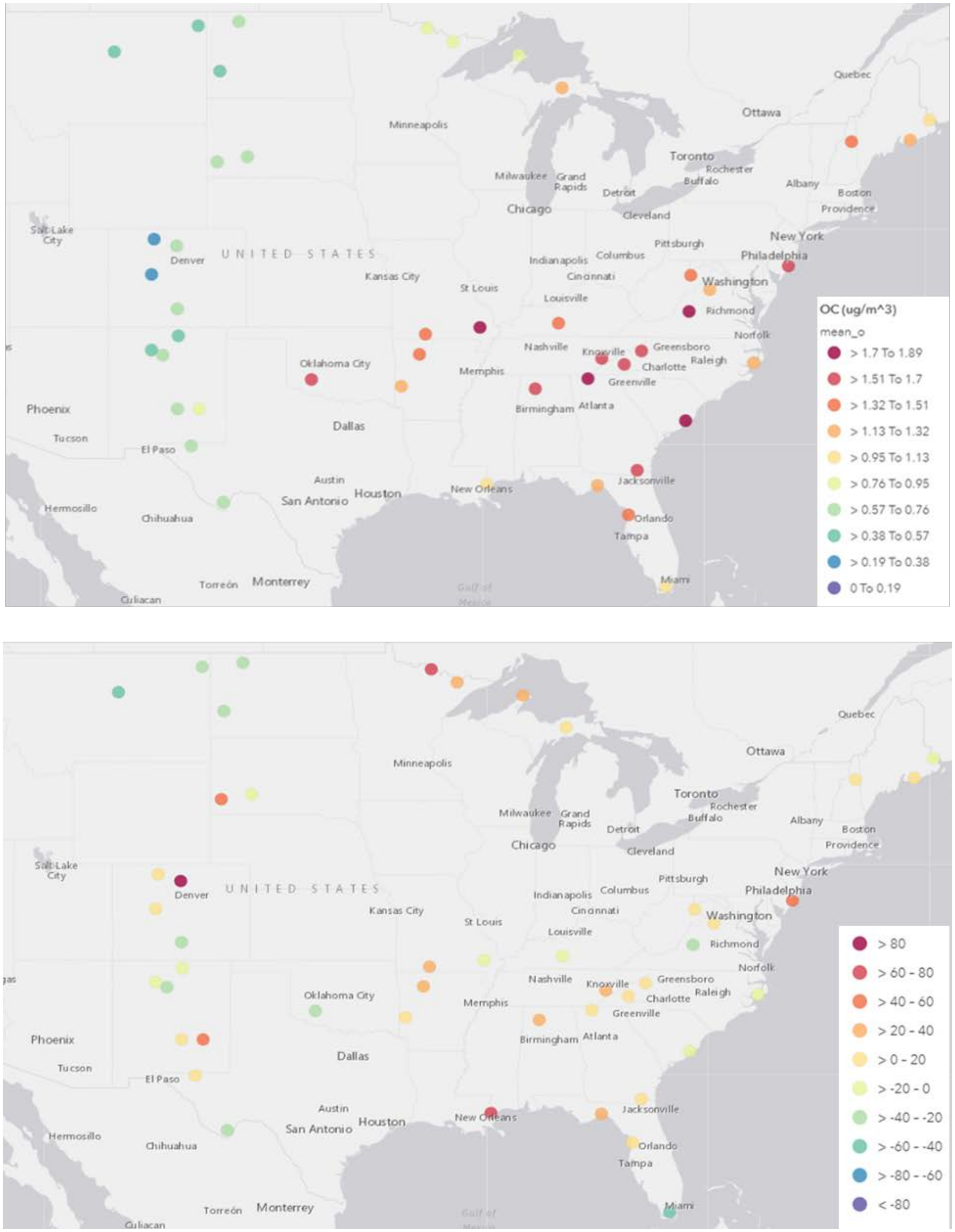


Figure 6-13: Observed OC (Top) and Modeled NMB (Bottom) for OC on the 20% Most-Impaired Days at IMPROVE Monitor Locations

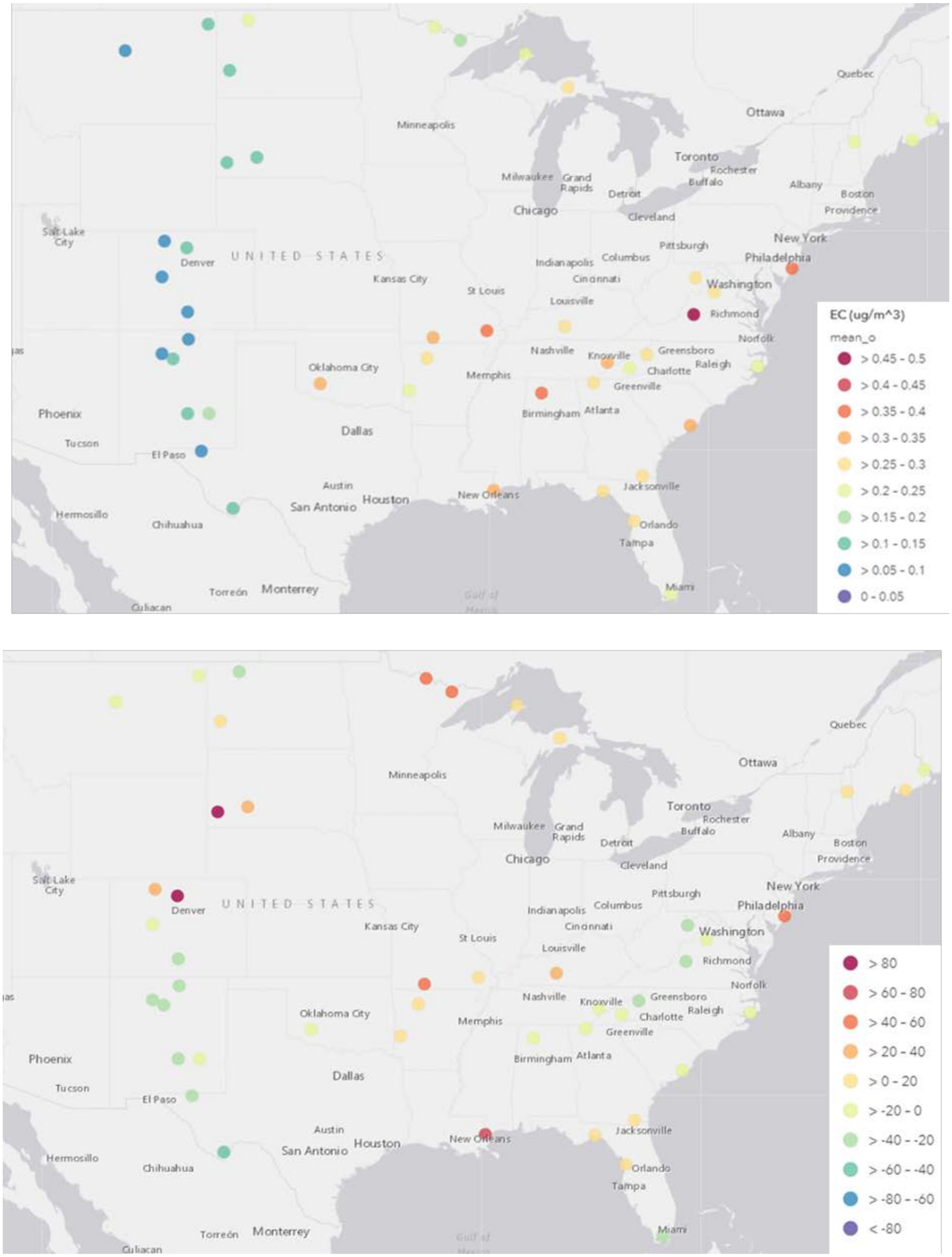


Figure 6-14: Observed EC (Top) and Modeled NMB (Bottom) for EC on the 20% Most-Impaired Days at IMPROVE Monitor Locations

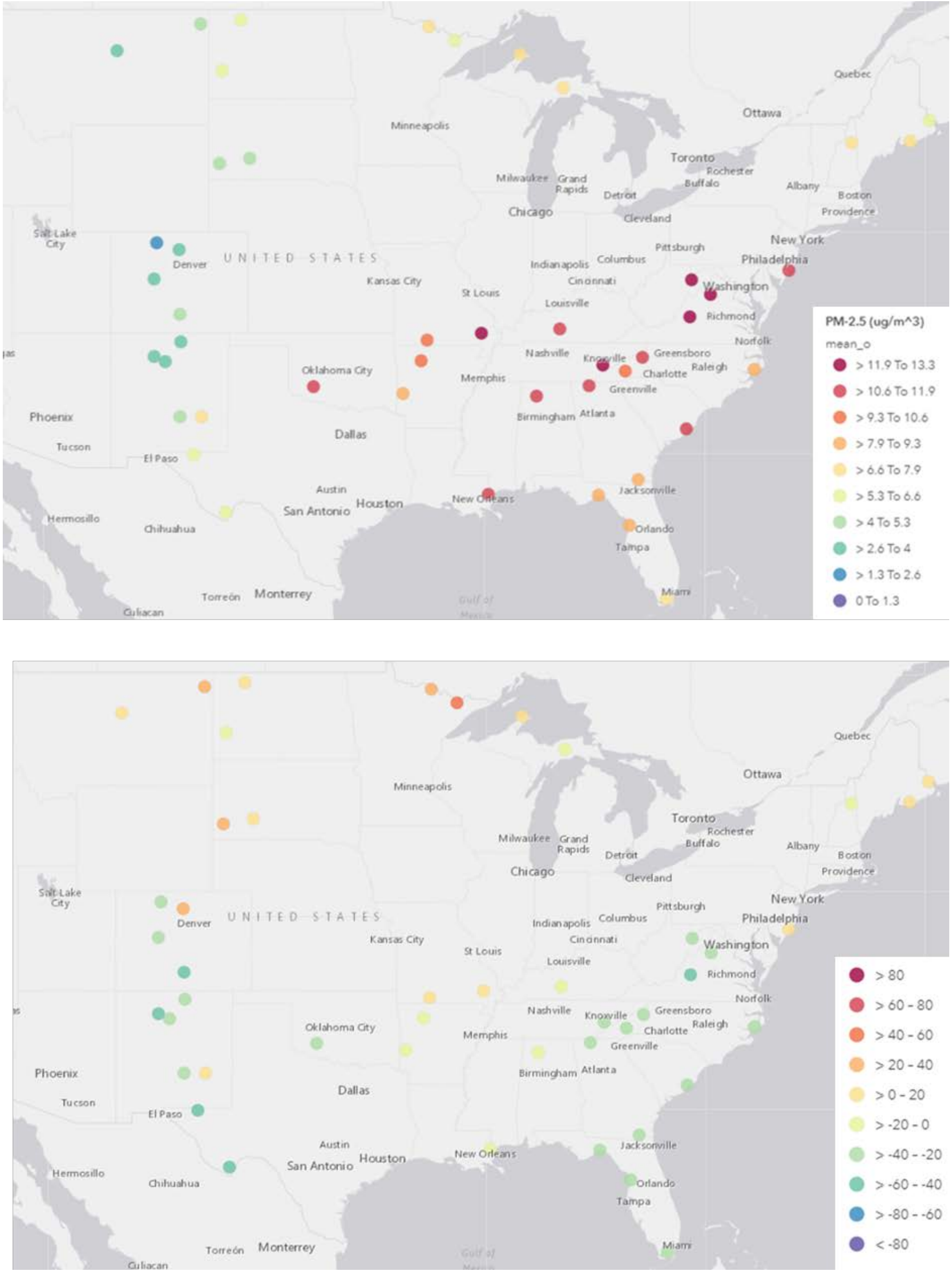


Figure 6-15: Observed Total $PM_{2.5}$ (Top) and Modeled NMB (Bottom) for Total $PM_{2.5}$ on the 20% Most-Impaired Days at IMPROVE Monitor Locations

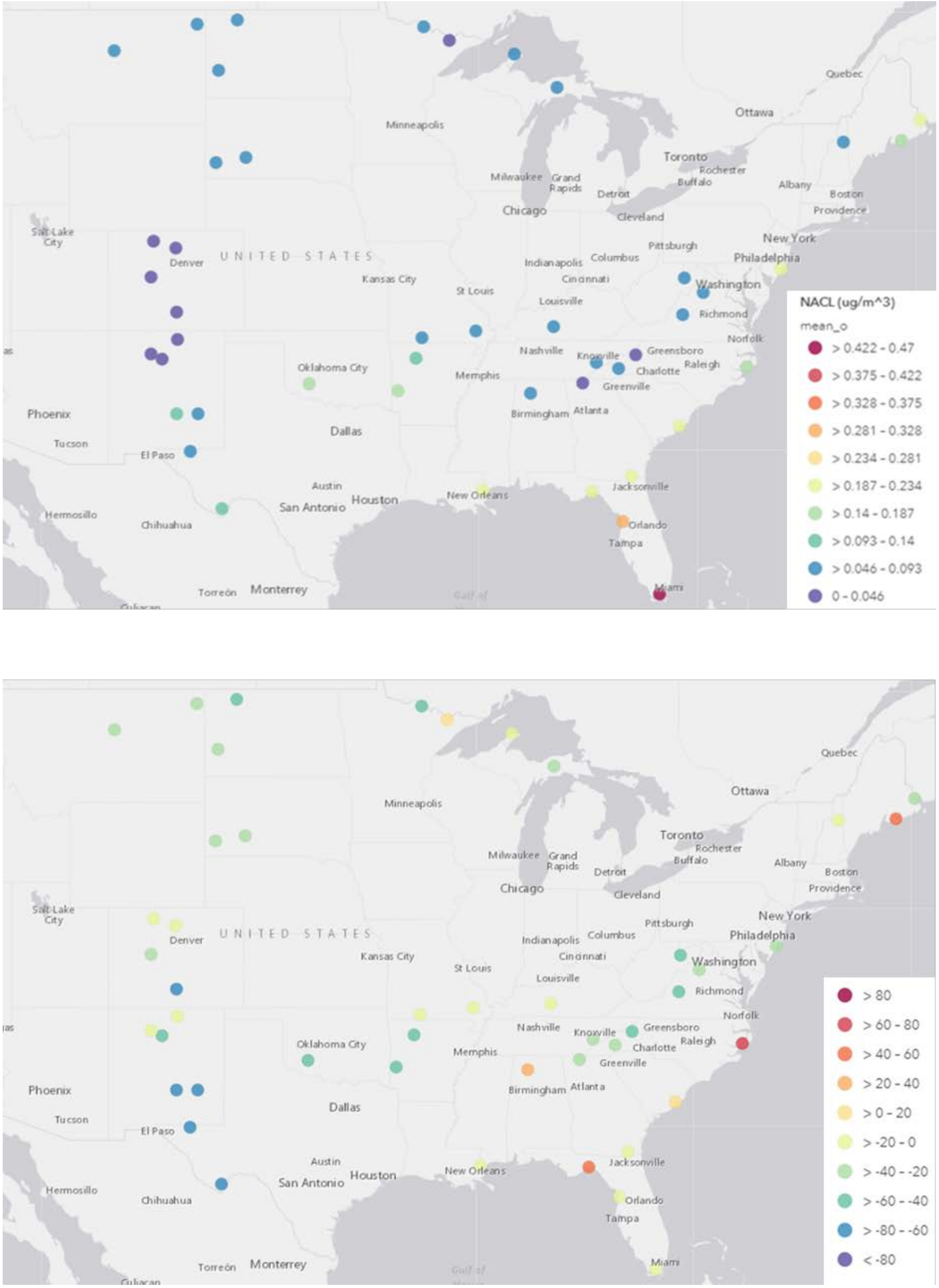


Figure 6-16: Observed Sea Salt (Top) and Modeled NMB (Bottom) for Sea Salt on the 20% Most-Impaired Days at IMPROVE Monitor Locations

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.

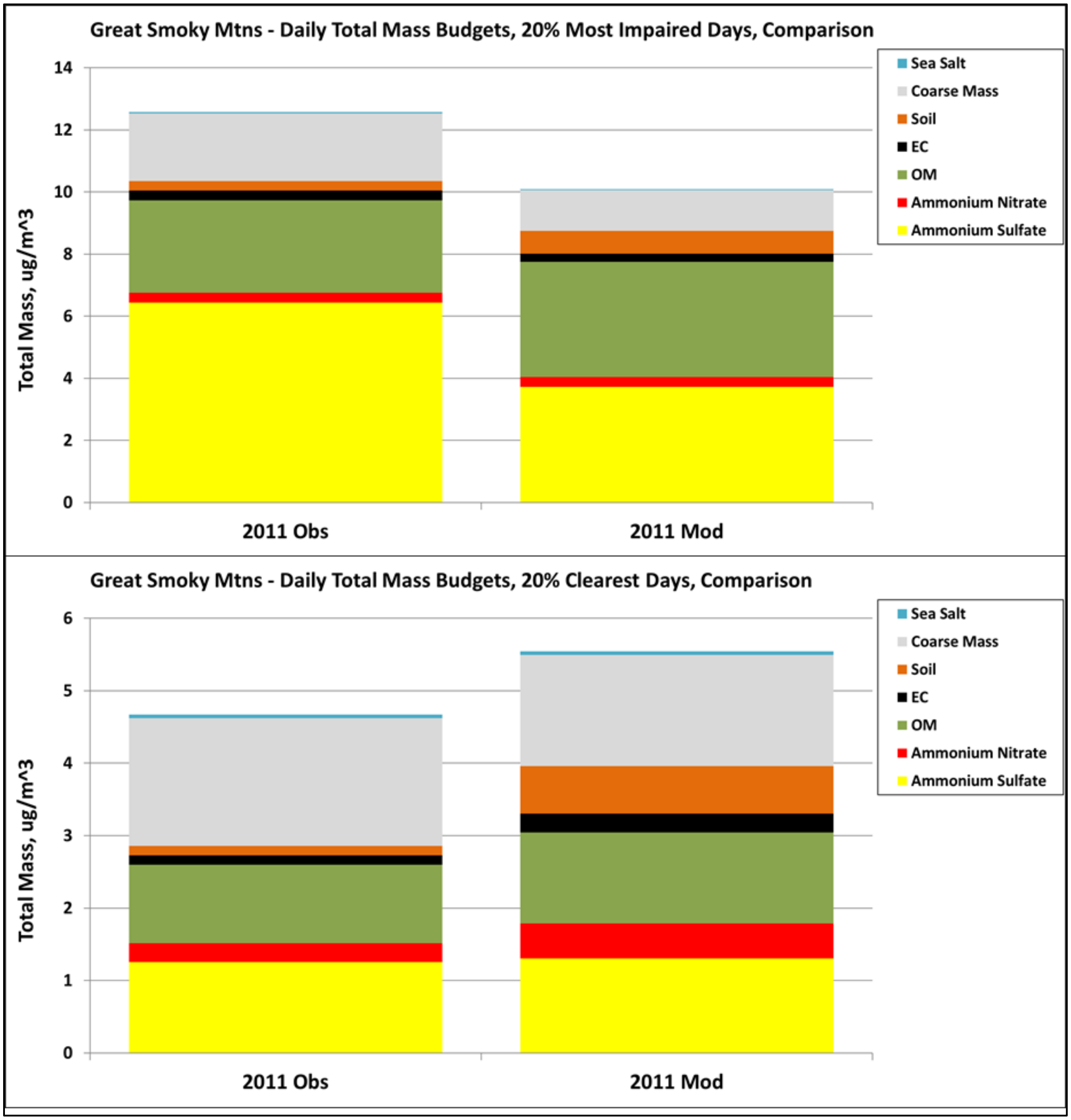
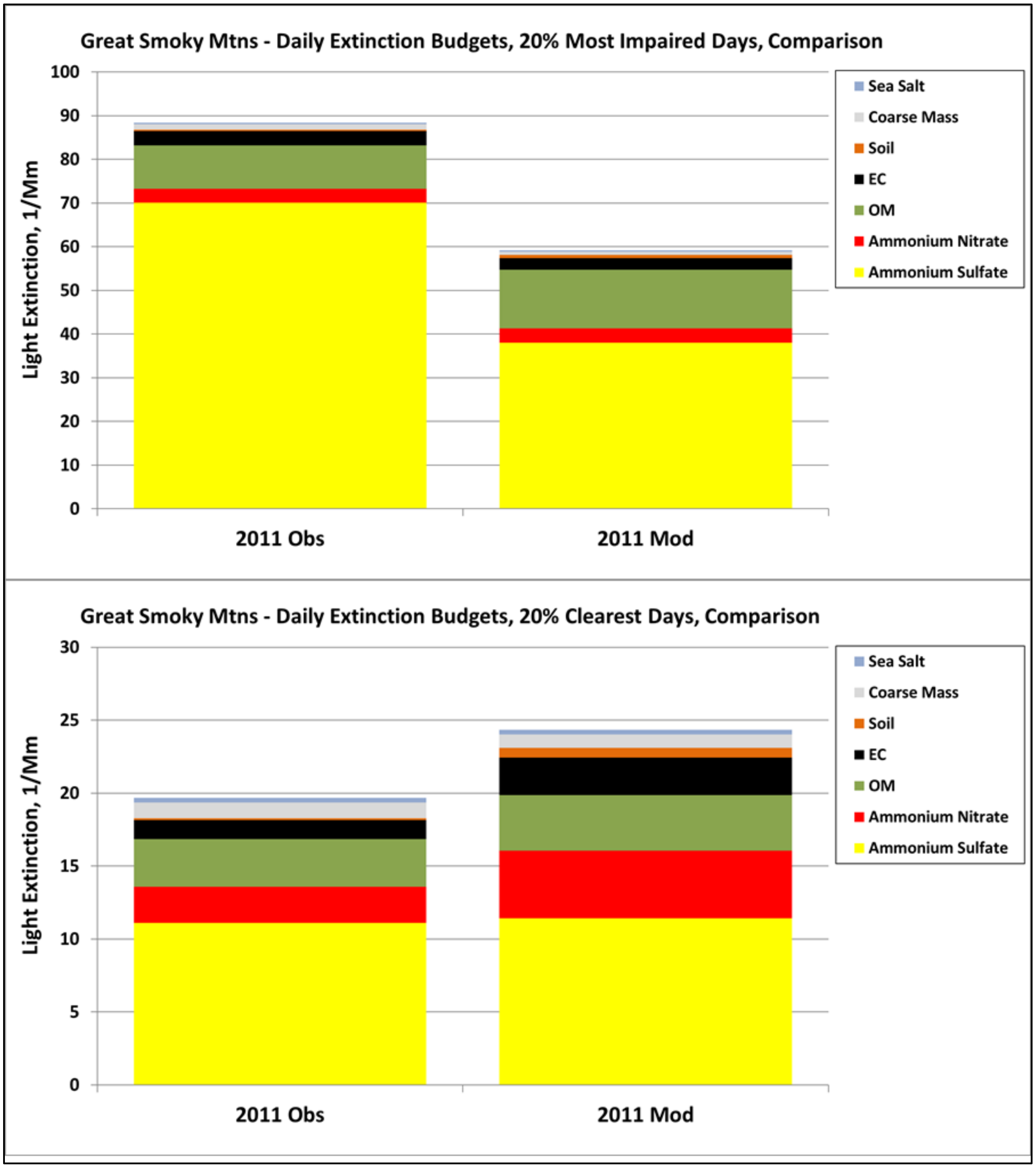


Figure 6-17: Stacked Bar Charts for Average $PM_{2.5}$ Concentrations on the 20% Most Impaired Days (top) and 20% Clearest Days (bottom) at Great Smoky Mountains National Park



Great Smoky Mtns - Daily Extinction Budgets, 20% Most Impaired Days, Comparison

Great Smoky Mtns - Daily Extinction Budgets, 20% Clearest Days, Comparison

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

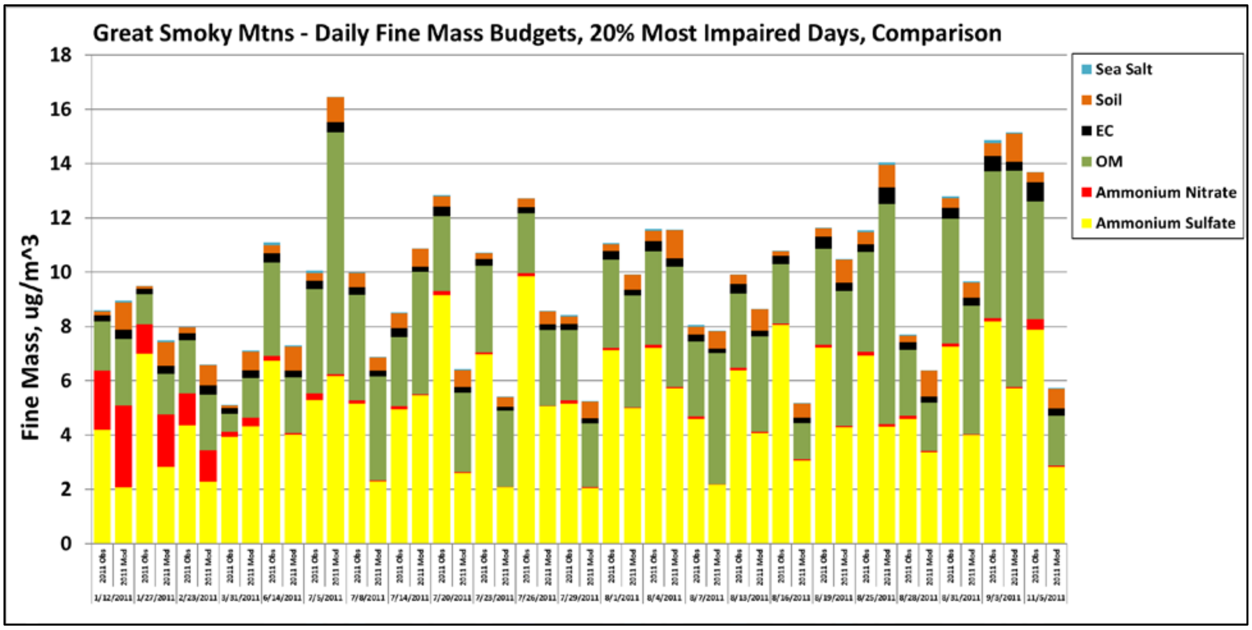


Figure 6-19: Stacked Bar Charts for Daily $PM_{2.5}$ Concentrations at Great Smoky Mountains National Park on the 20% Most Impaired Days: Observation (left) and Modeled (Right)

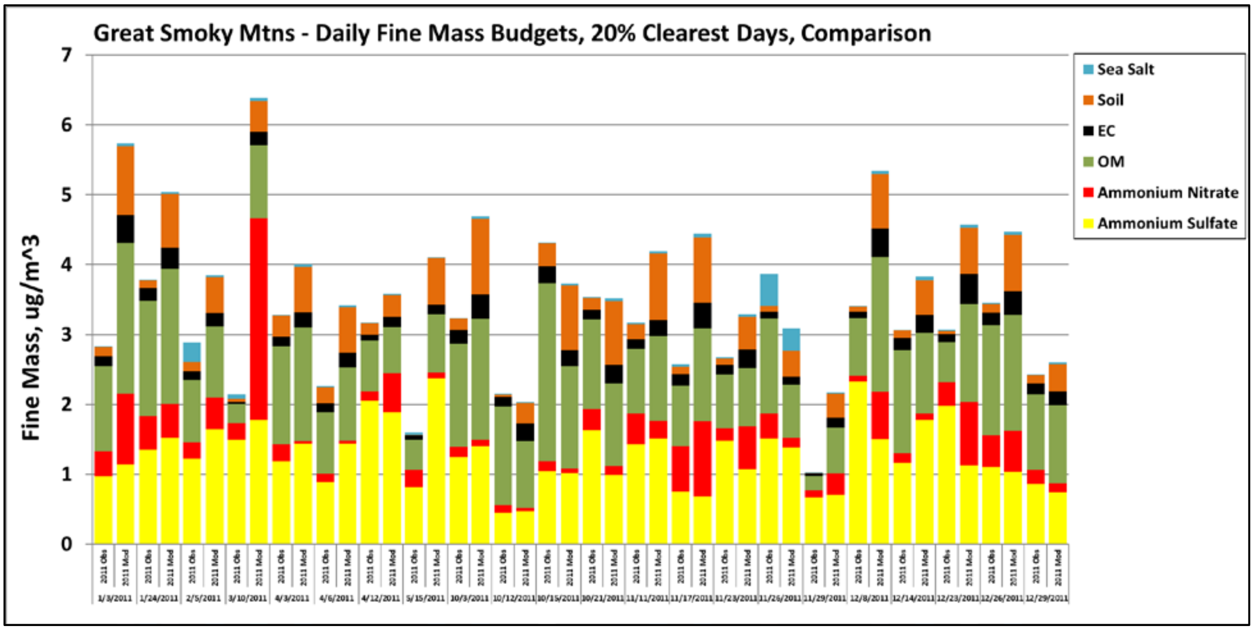


Figure 6-20: Stacked Bar Charts for Daily $PM_{2.5}$ Concentrations at Great Smoky Mountains National Park on the 20% Clearest Days: Observation (left) and Modeled (Right)

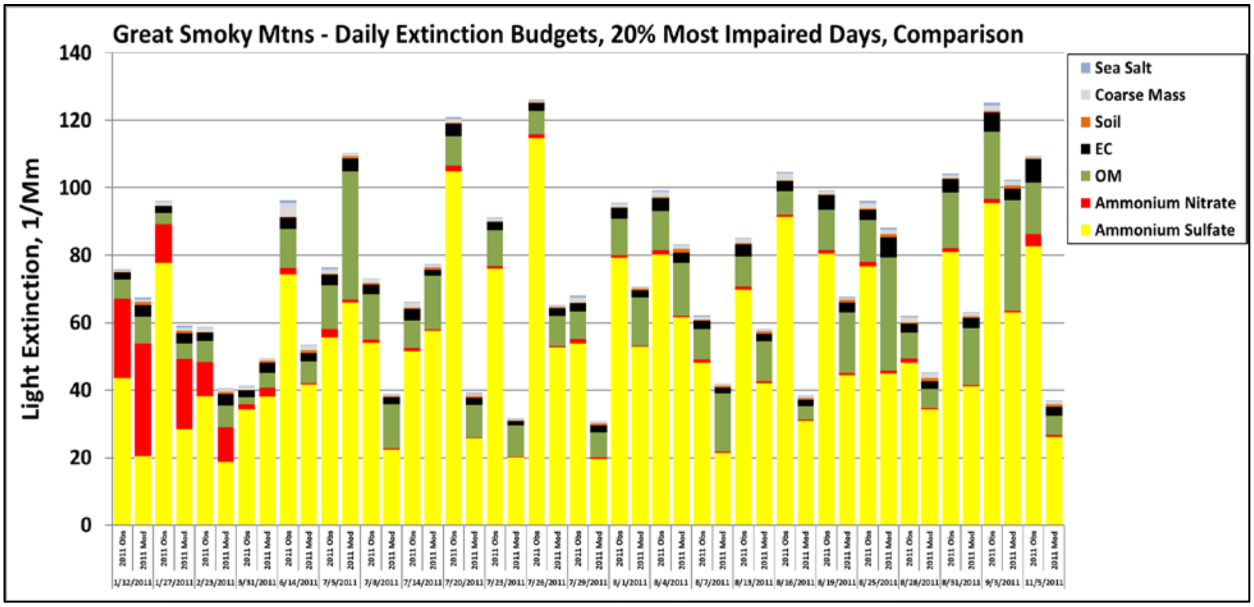


Figure 6-21: Stacked Bar Charts for Light Extinction at Great Smoky Mountains National Park on the 20% Most-Impaired Days: Observation (left) and Modeled (Right)

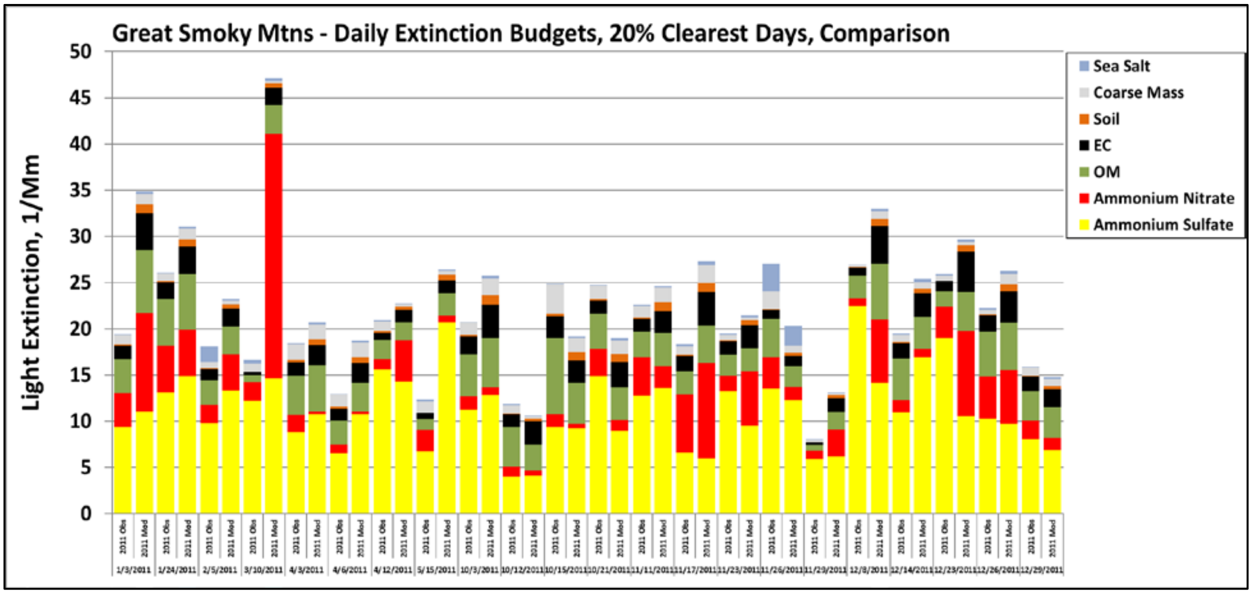


Figure 6-22: Stacked Bar Charts for Light Extinction at Great Smoky Mountains National Park on the 20% Clearest Days: Observation (left) and Modeled (Right)

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.

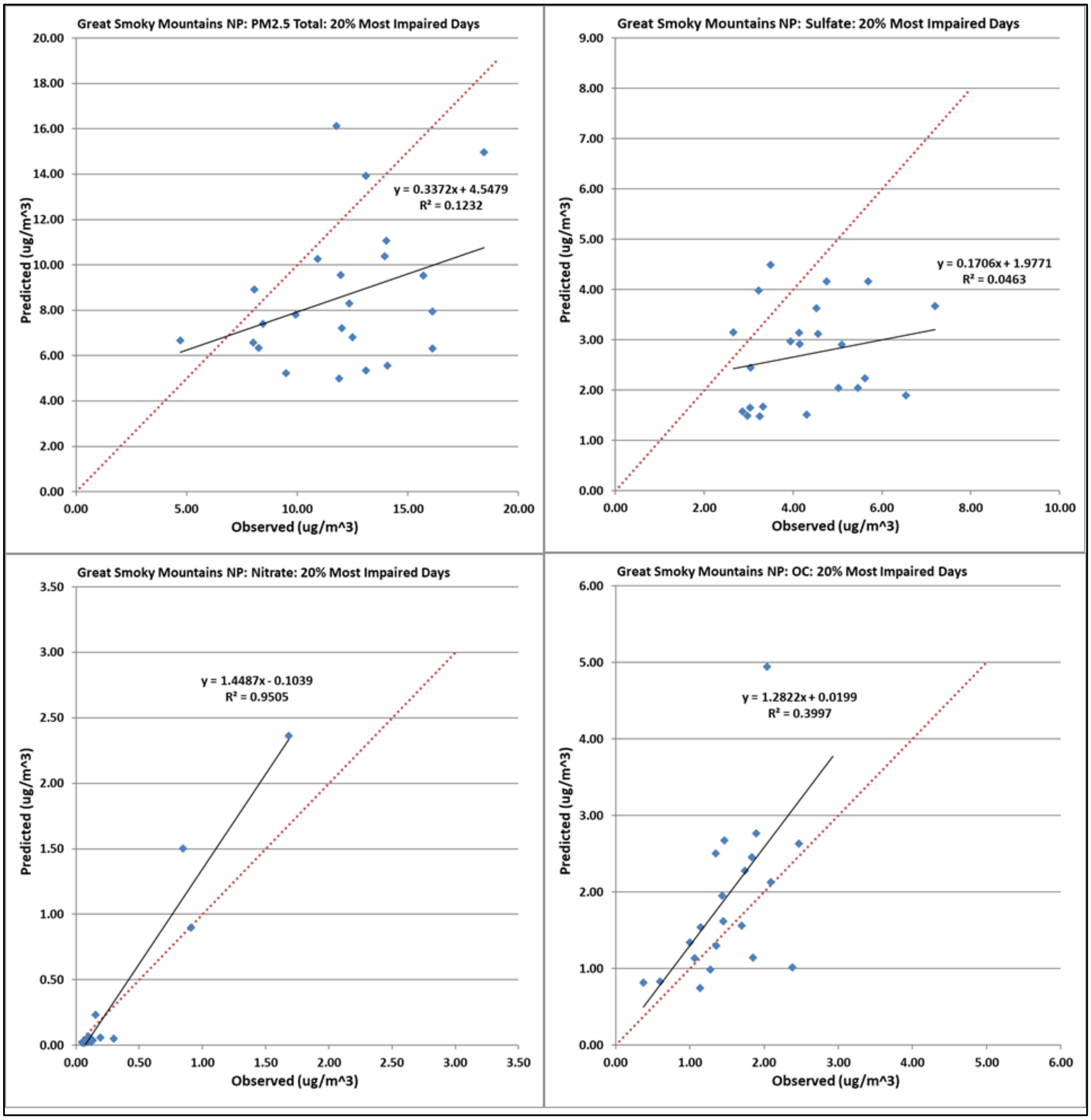


Figure 6-23: Scatter Plot for Daily PM$_{2.5}$ (top left), Sulfate (top right), Nitrate (bottom left), and Organic Carbon (bottom right) Concentrations at Great Smoky Mountains National Park on the 20% Most Impaired Days

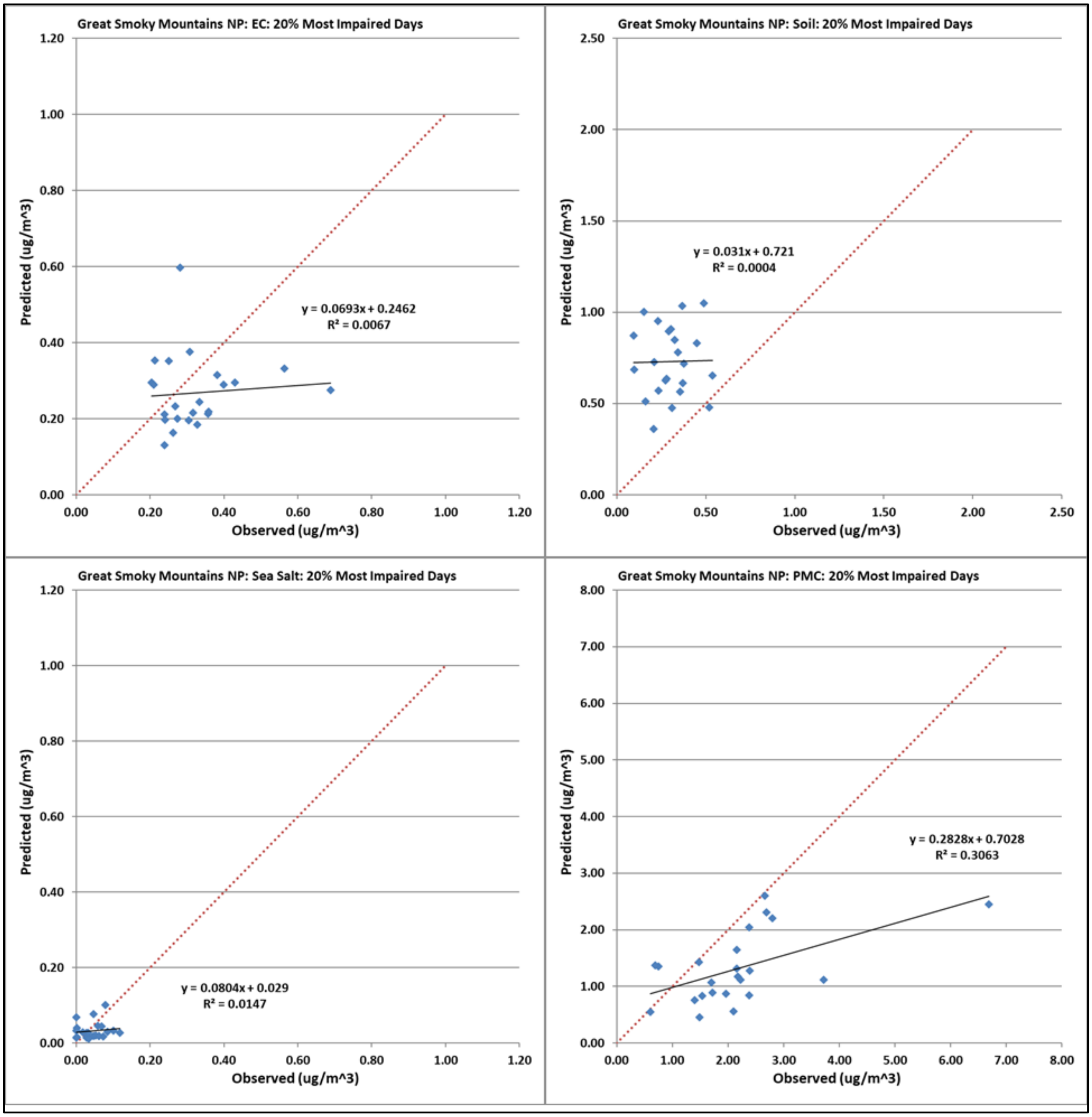


Figure 6-24: Scatter Plot for Daily Elemental Carbon (top left), Crustal (top right), Sea Salt (bottom left), and Coarse Mass (bottom right, labeled as PMC) Concentrations at Great Smoky Mountains National Park on the 20% Most Impaired Days

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.

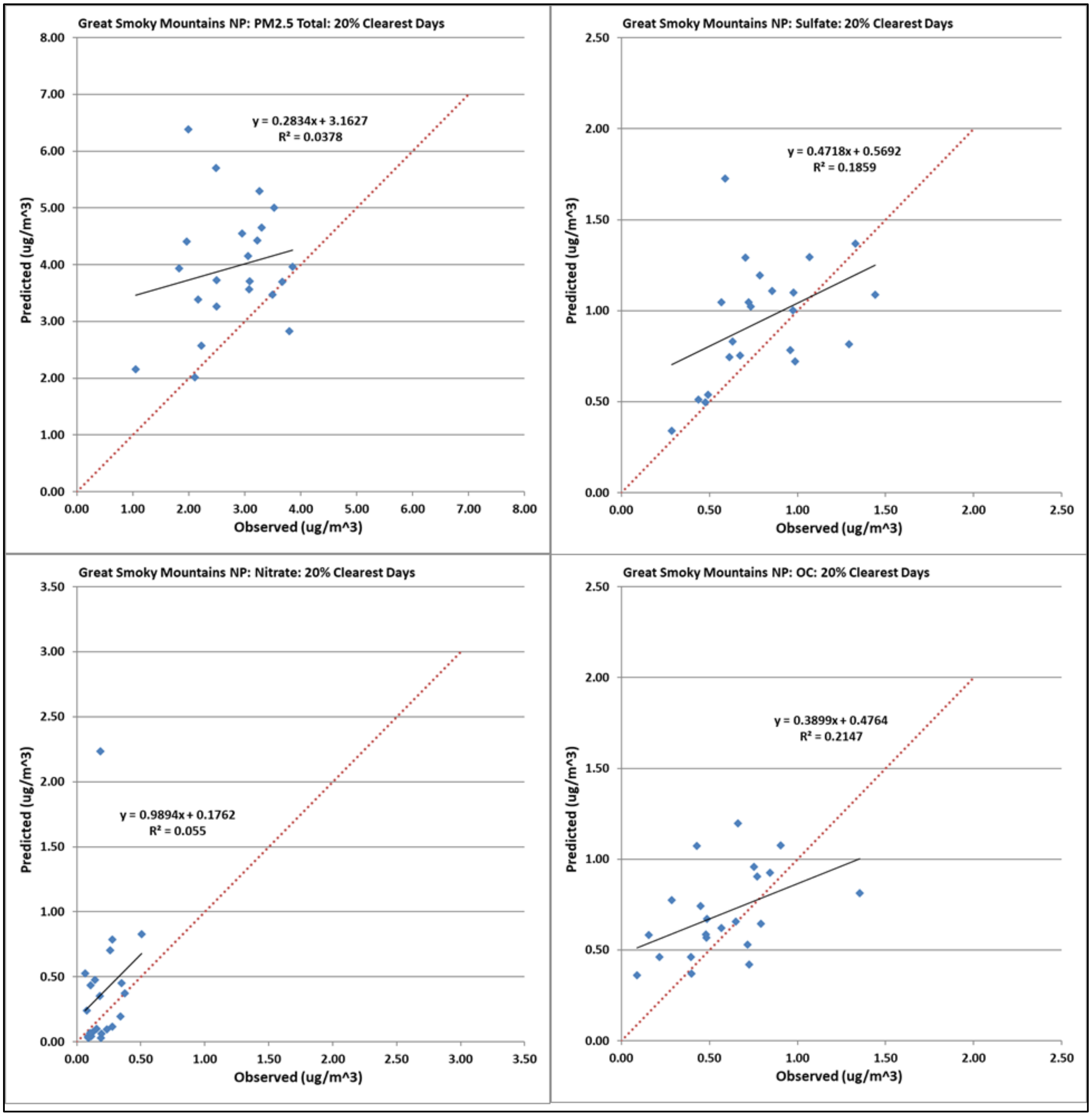


Figure 6-25: Scatter Plot for Daily $PM_{2.5}$ (top left), Sulfate (top right), Nitrate (bottom left), and Organic Carbon (bottom right) Concentrations at Great Smoky Mountains National Park on the 20% Clearest Days.

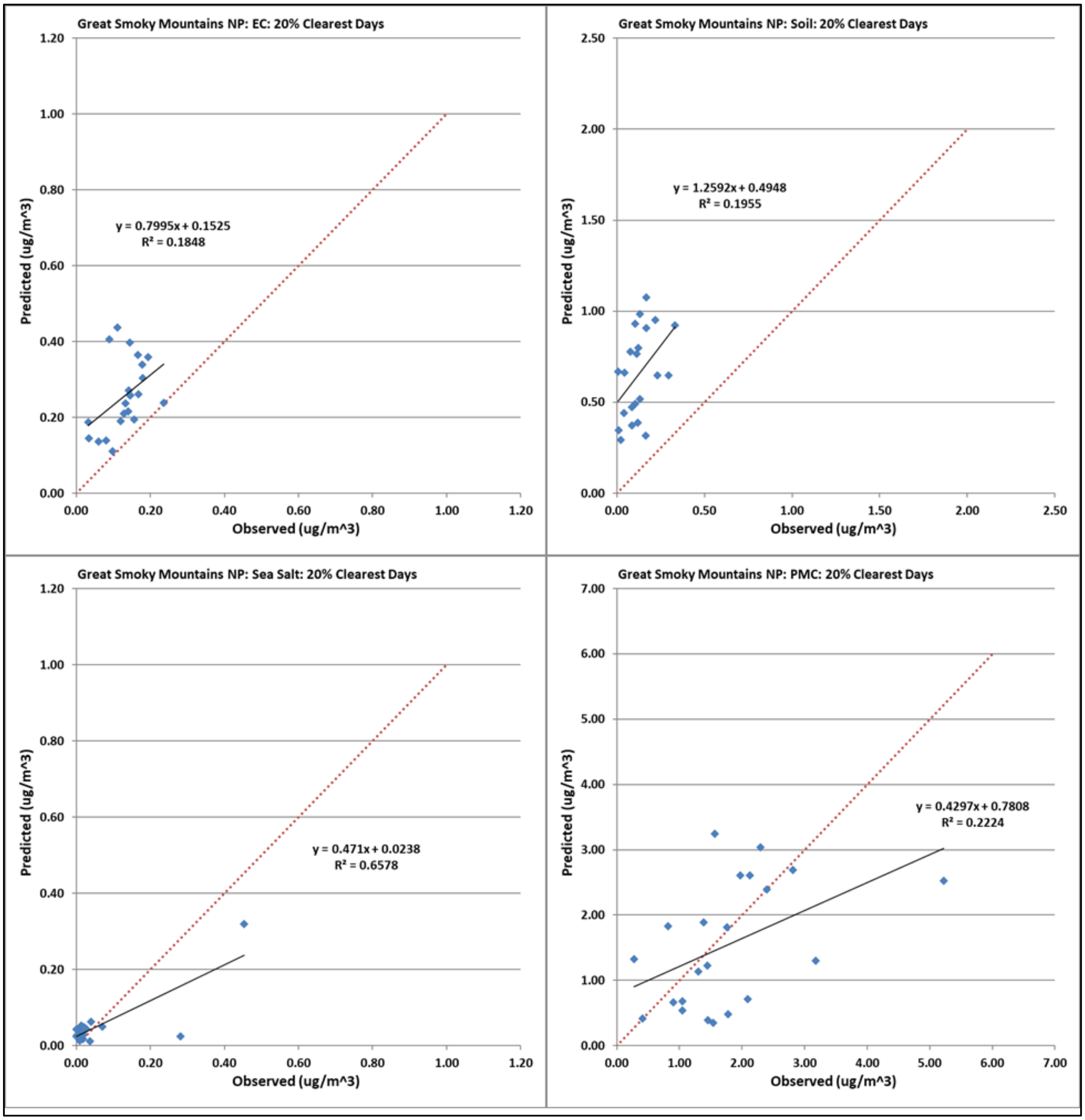


Figure 6-26: Scatter Plot for Daily Elemental Carbon (top left), Crustal (top right), Sea Salt (bottom left), and Coarse Mass (bottom right, labeled as PMC) Concentrations at Great Smoky Mountains National Park on the 20% Clearest Days

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.

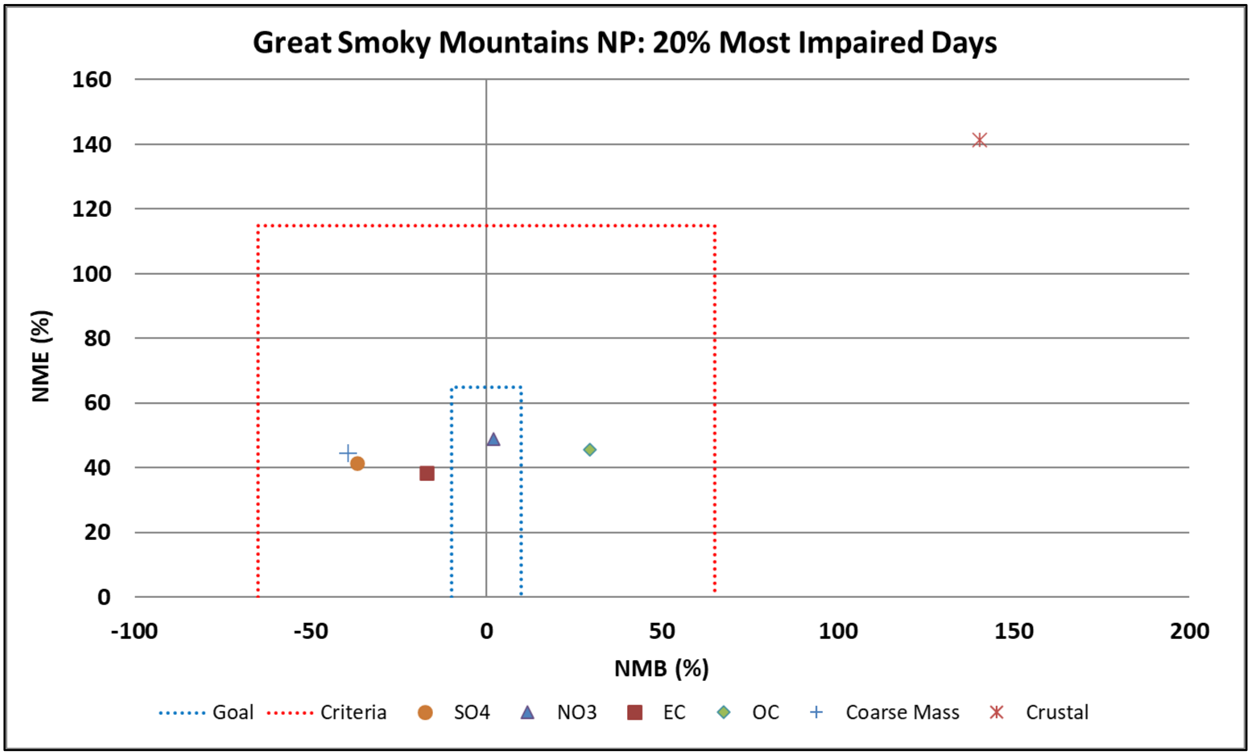


Figure 6-27: Soccer Plot for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Most Impaired Days at Great Smoky Mountains National Park

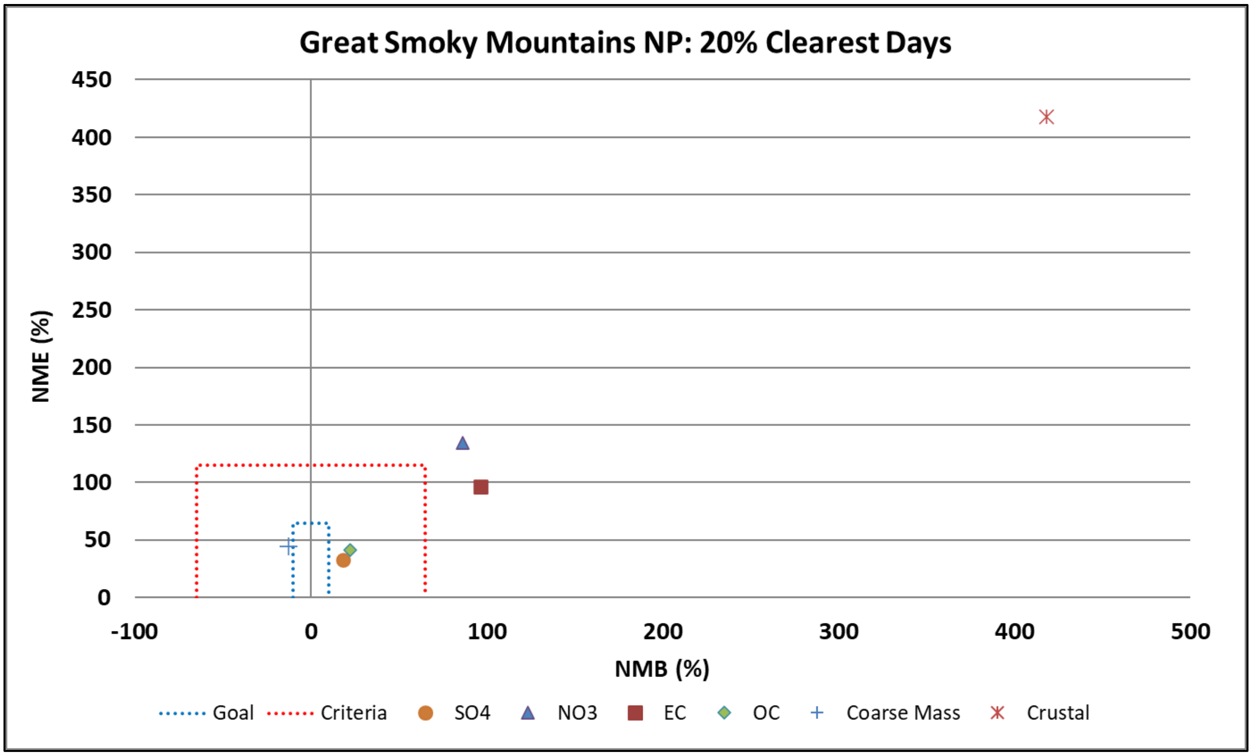
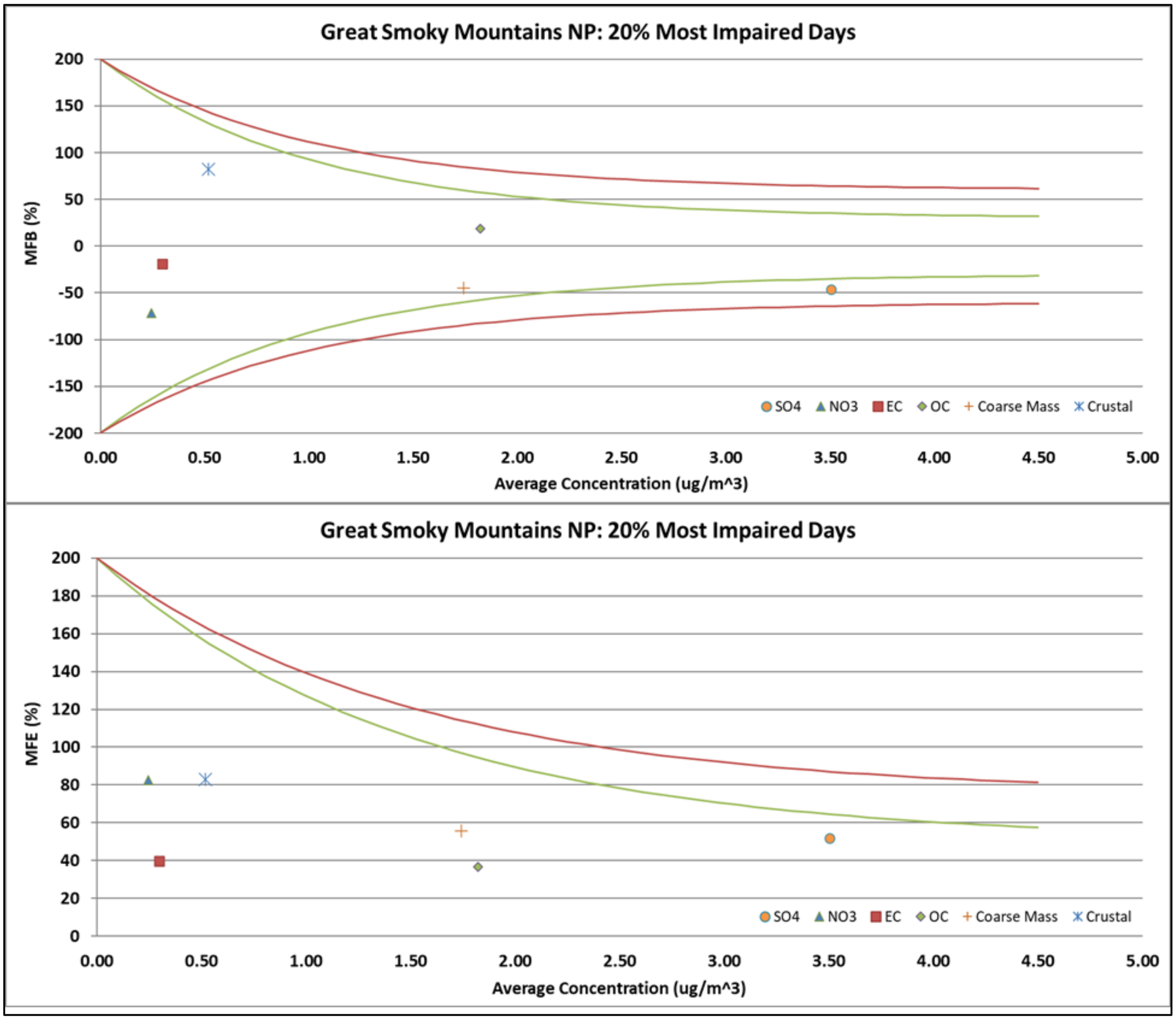


Figure 6-28: Soccer Plot for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Clearest Days at Great Smoky Mountains National Park

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).


Great Smoky Mountains NP: 20% Most Impaired Days

Great Smoky Mountains NP: 20% Most Impaired Days

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

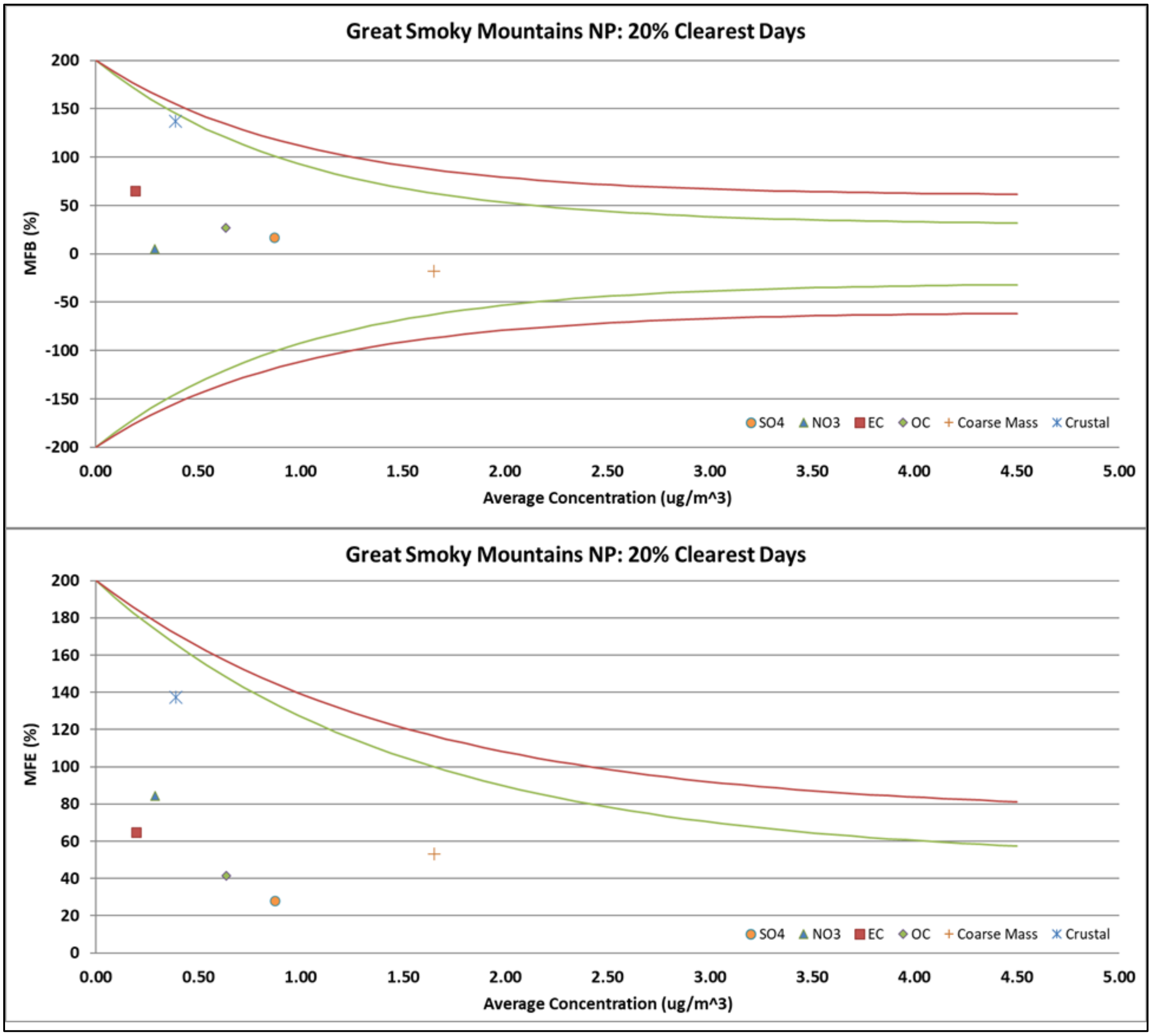


Figure 6-30: Bugle Plots of MFB (top) and MFE (bottom) for Sulfate, Nitrate, Elemental Carbon, Organic Carbon, Coarse Mass, and Crustal Concentrations on the 20% Clearest Days at Great Smoky Mountains National Park

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

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[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.

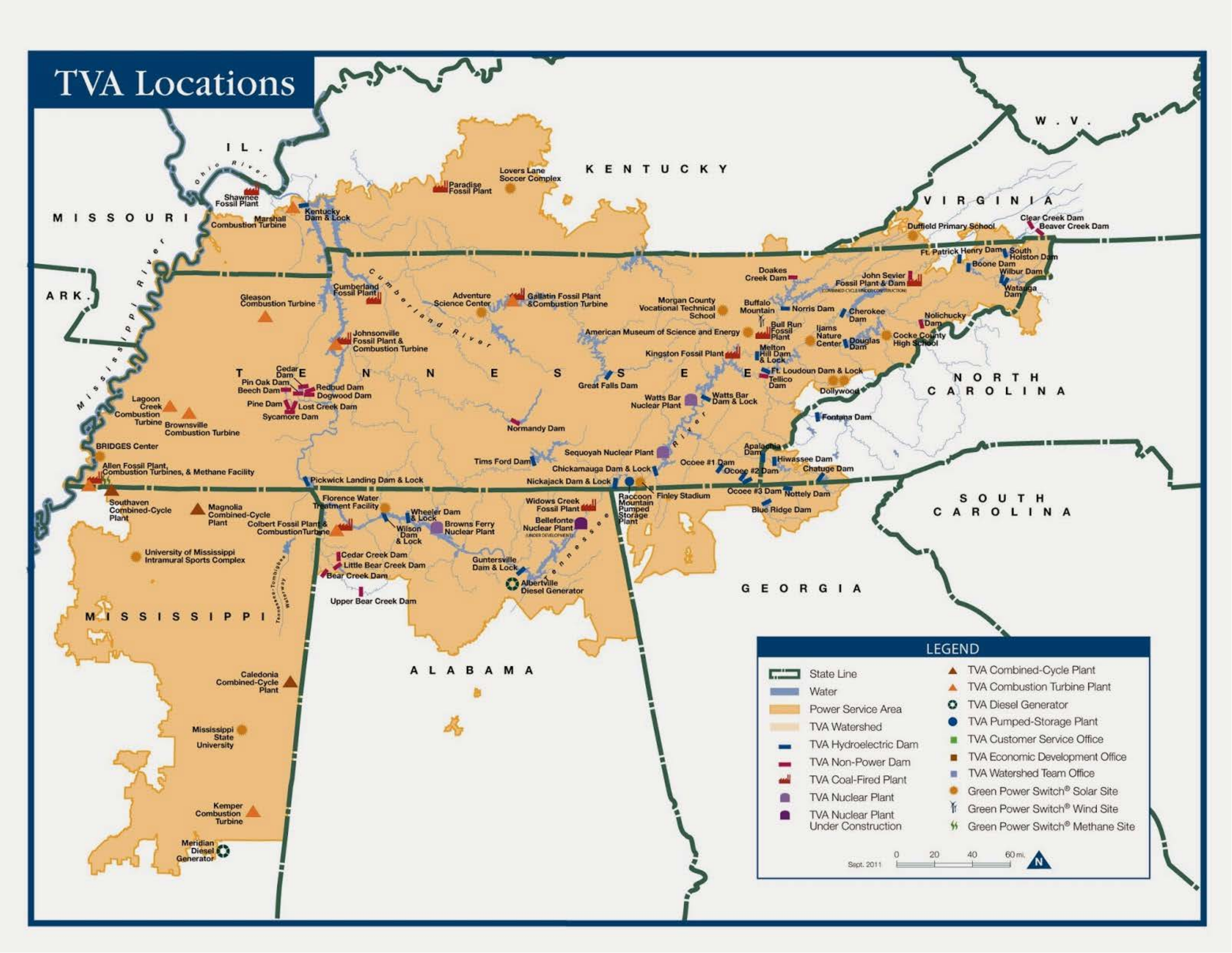
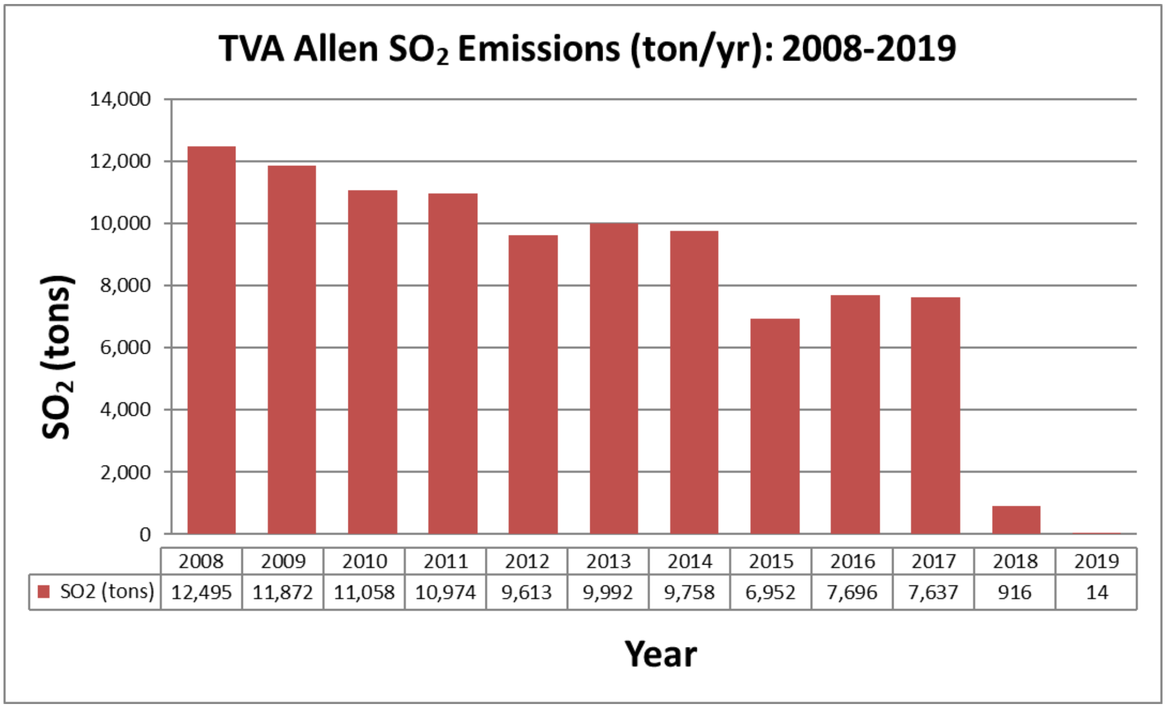


Figure 7-1: TVA Region

Table 7-1: Summary of TVA Coal-fired Power Plants

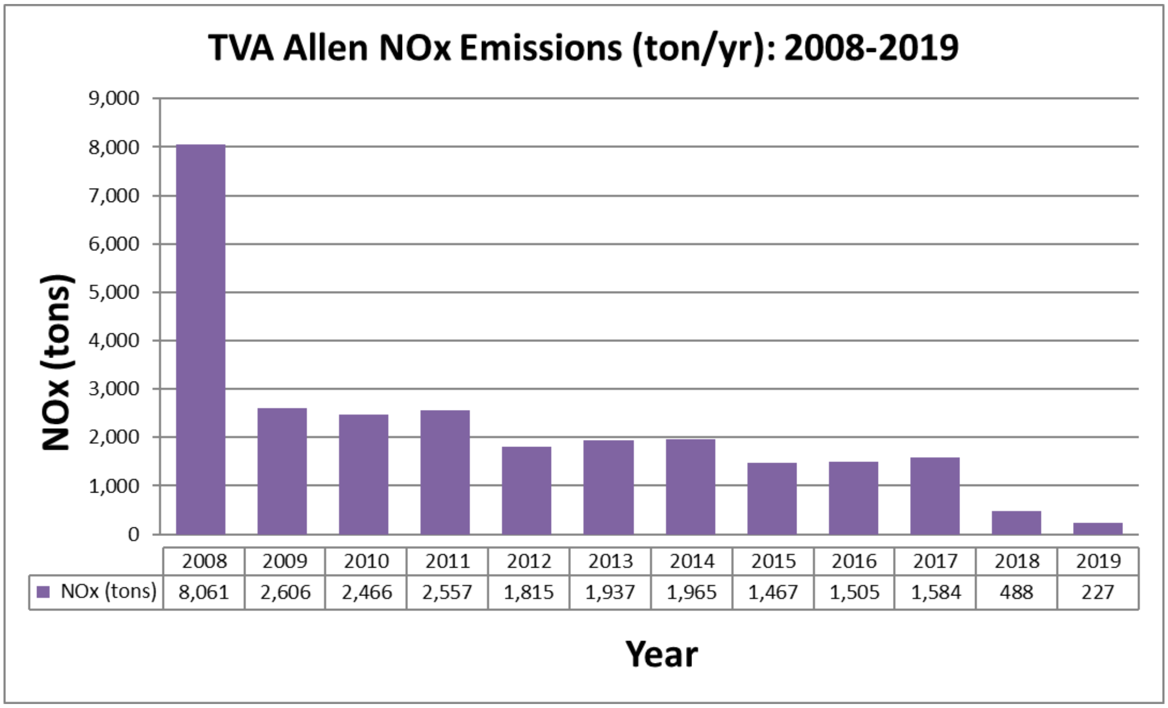
Facility	Emission Unit	Current SO_2 Emission Control	Current NO_x Emission Control	Status
TVA Allen	1	N/A	N/A	Retired March 31, 2018
	2	N/A	N/A	Retired March 31, 2018
	3	N/A	N/A	Retired March 31, 2018
TVA Bull Run	1	Wet Scrubber	SCR	Unit will retire before end of 2023
TVA Cumberland	1	Wet Scrubber	SCR	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.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟥 SO2 (tons)	12,495	11,872	11,058	10,974	9,613	9,992	9,758	6,952	7,696	7,637	916	14

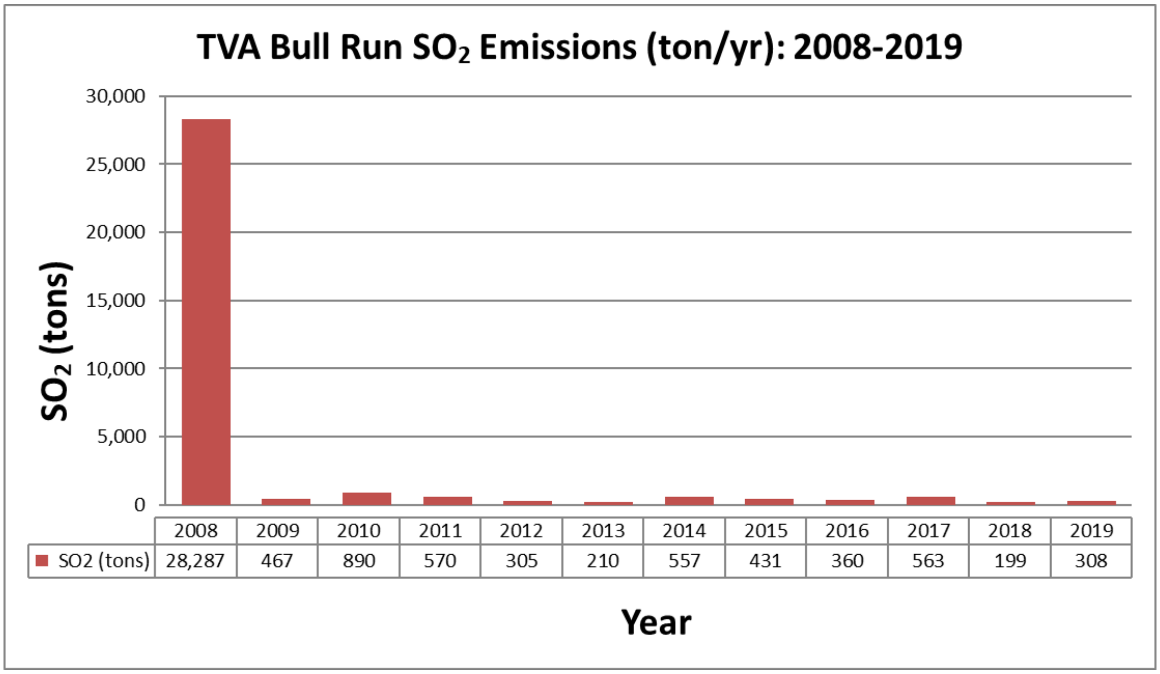
Figure 7-2: TVA Allen SO_2 Emissions (ton/yr): 2008-2019



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟪 NOx (tons)	8,061	2,606	2,466	2,557	1,815	1,937	1,965	1,467	1,505	1,584	488	227

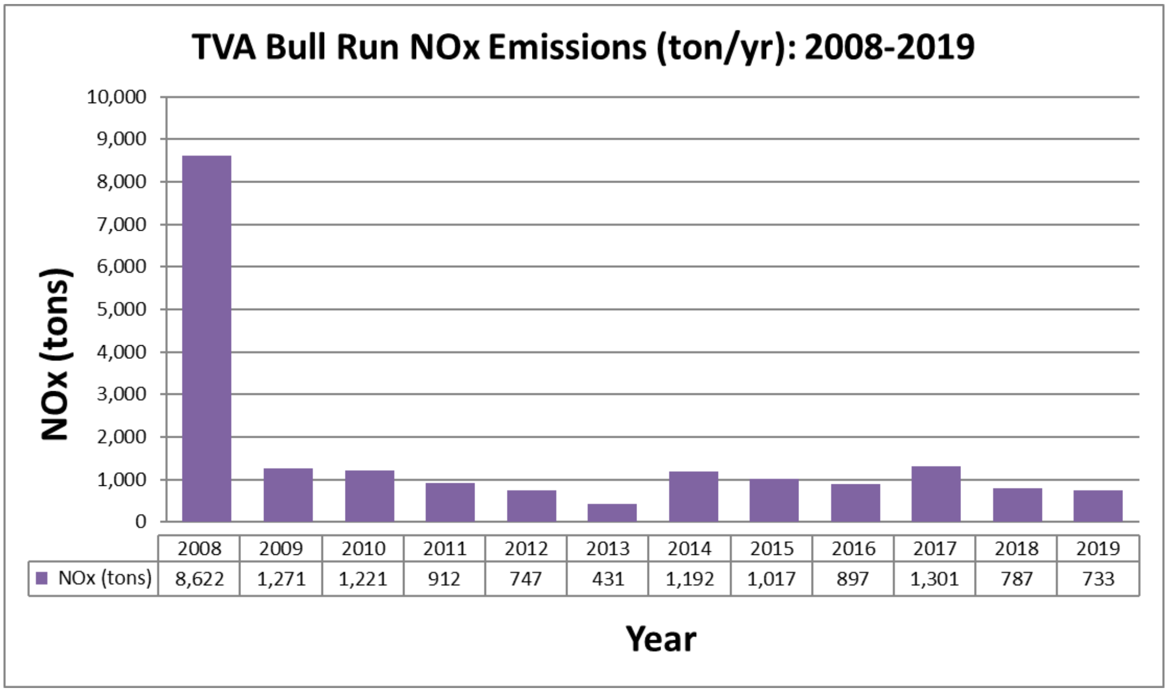
Figure 7-3: TVA Allen NO_x Emissions (ton/yr): 2008-2019

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.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟥 SO2 (tons)	28,287	467	890	570	305	210	557	431	360	563	199	308

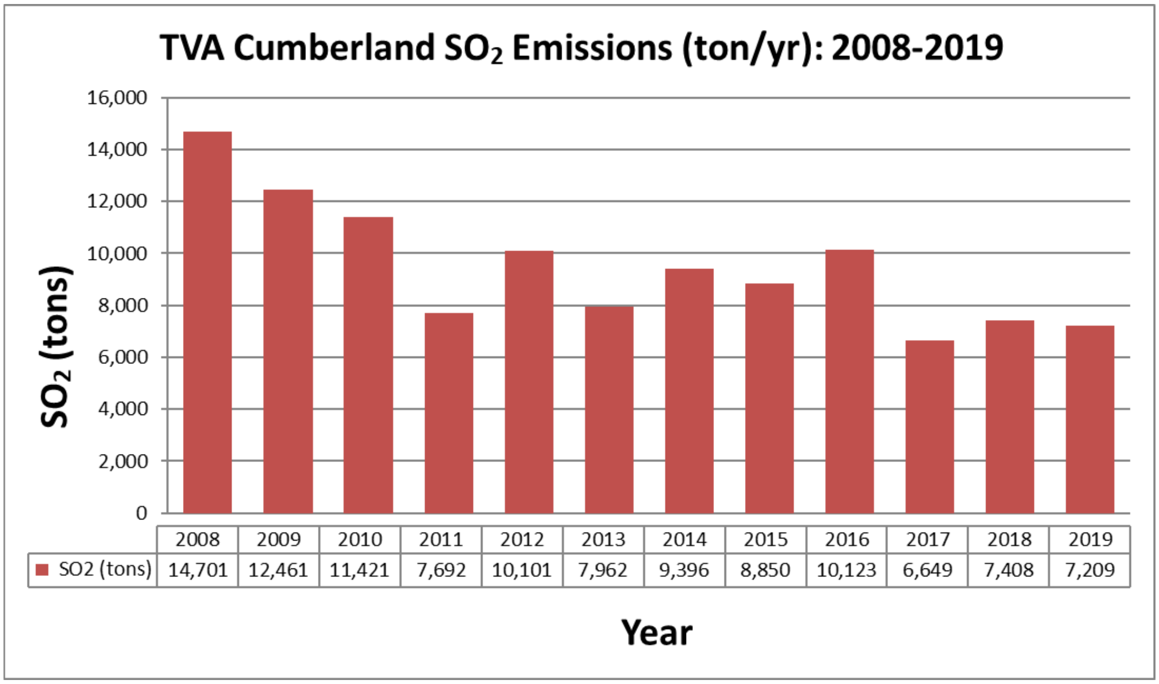
Figure 7-4: TVA Bull Run SO_2 Emissions (ton/yr): 2008-2019



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟪 NOx (tons)	8,622	1,271	1,221	912	747	431	1,192	1,017	897	1,301	787	733

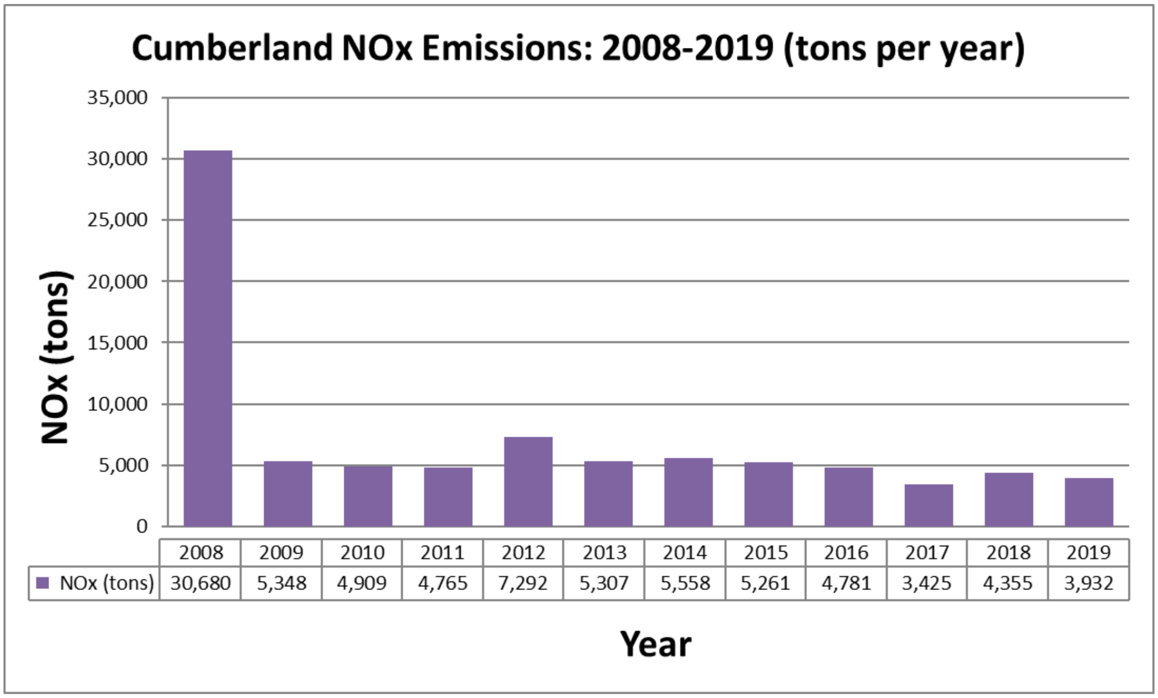
Figure 7-5: TVA Bull Run NO_x Emissions (ton/yr): 2008-2019

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.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟥 SO2 (tons)	14,701	12,461	11,421	7,692	10,101	7,962	9,396	8,850	10,123	6,649	7,408	7,209

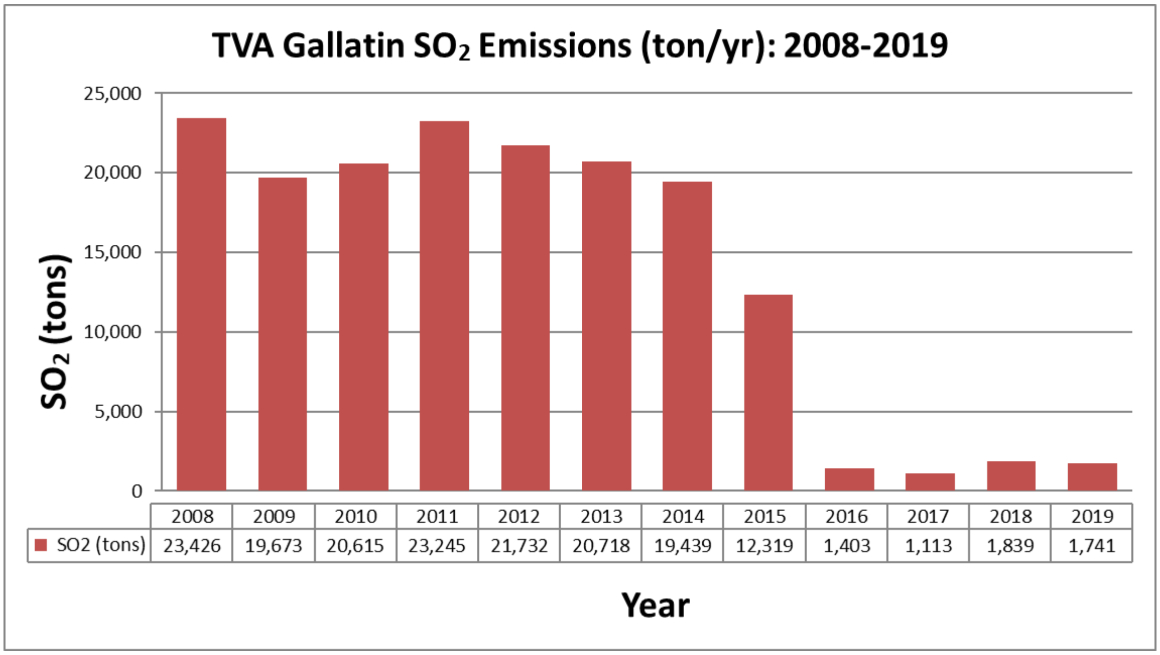
Figure 7-6: TVA Cumberland SO_2 Emissions (ton/yr): 2008-2019



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟪 NOx (tons)	30,680	5,348	4,909	4,765	7,292	5,307	5,558	5,261	4,781	3,425	4,355	3,932

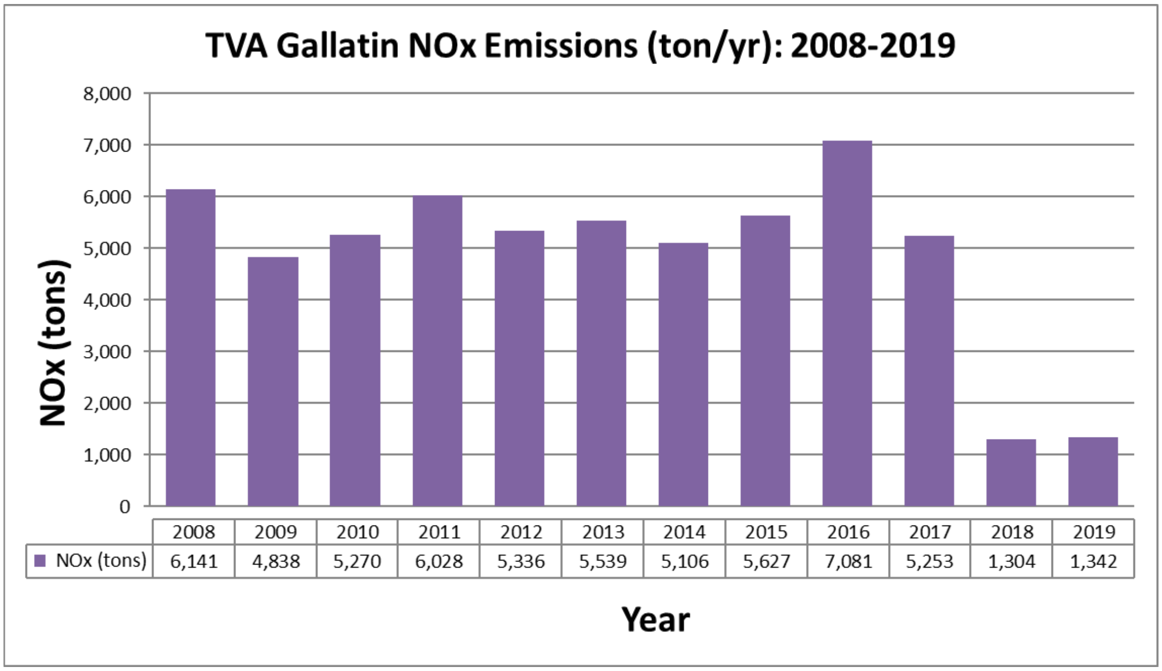
Figure 7-7: TVA Cumberland NO_x Emissions (ton/yr): 2008-2019

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.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
■ SO2 (tons)	23,426	19,673	20,615	23,245	21,732	20,718	19,439	12,319	1,403	1,113	1,839	1,741

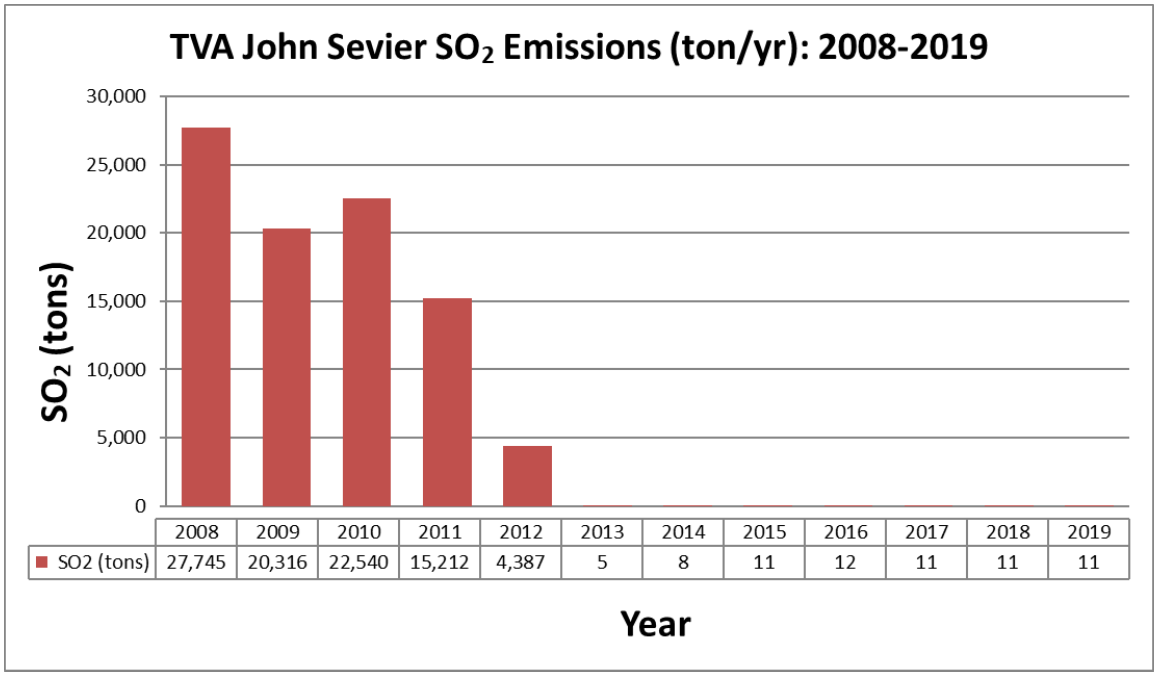
Figure 7-8: TVA Gallatin SO_2 Emissions (ton/yr): 2008-2019



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
■ NOx (tons)	6,141	4,838	5,270	6,028	5,336	5,539	5,106	5,627	7,081	5,253	1,304	1,342

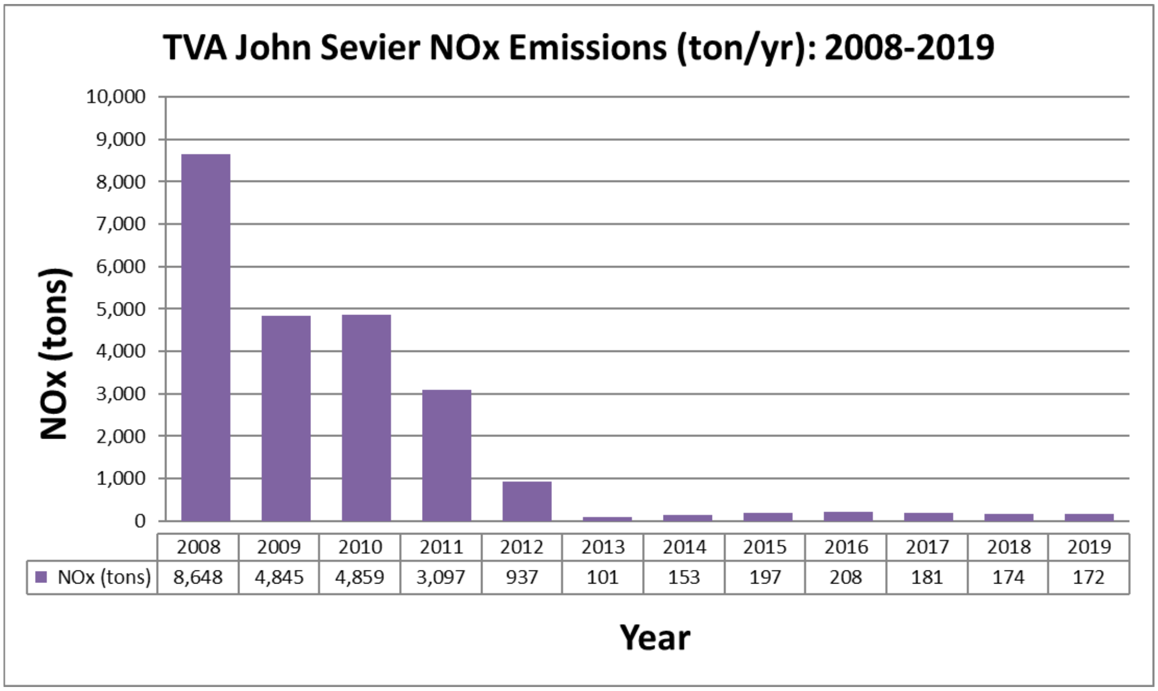
Figure 7-9: TVA Gallatin NO_x Emissions (ton/yr): 2008-2019

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.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟥 SO2 (tons)	27,745	20,316	22,540	15,212	4,387	5	8	11	12	11	11	11

Figure 7-10: TVA John Sevier SO_2 Emissions (ton/yr): 2008-2019



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
🟪 NOx (tons)	8,648	4,845	4,859	3,097	937	101	153	197	208	181	174	172

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.

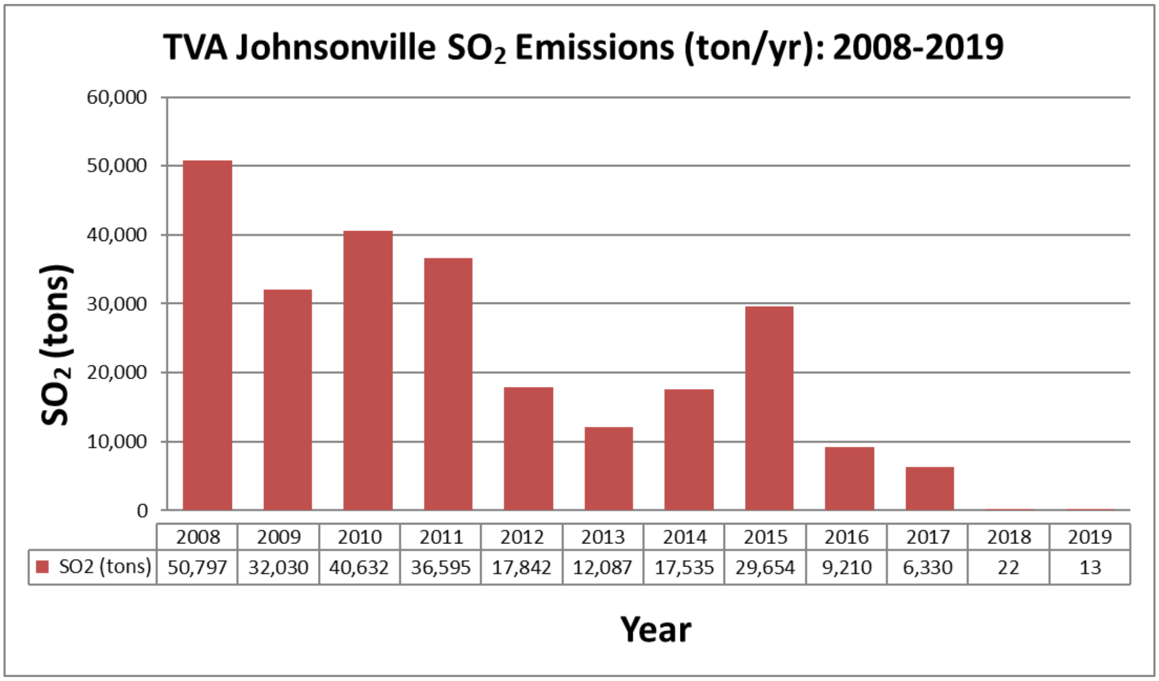


Figure 7-12: TVA Johnsonville SO_2 Emissions (ton/yr): 2008-2019

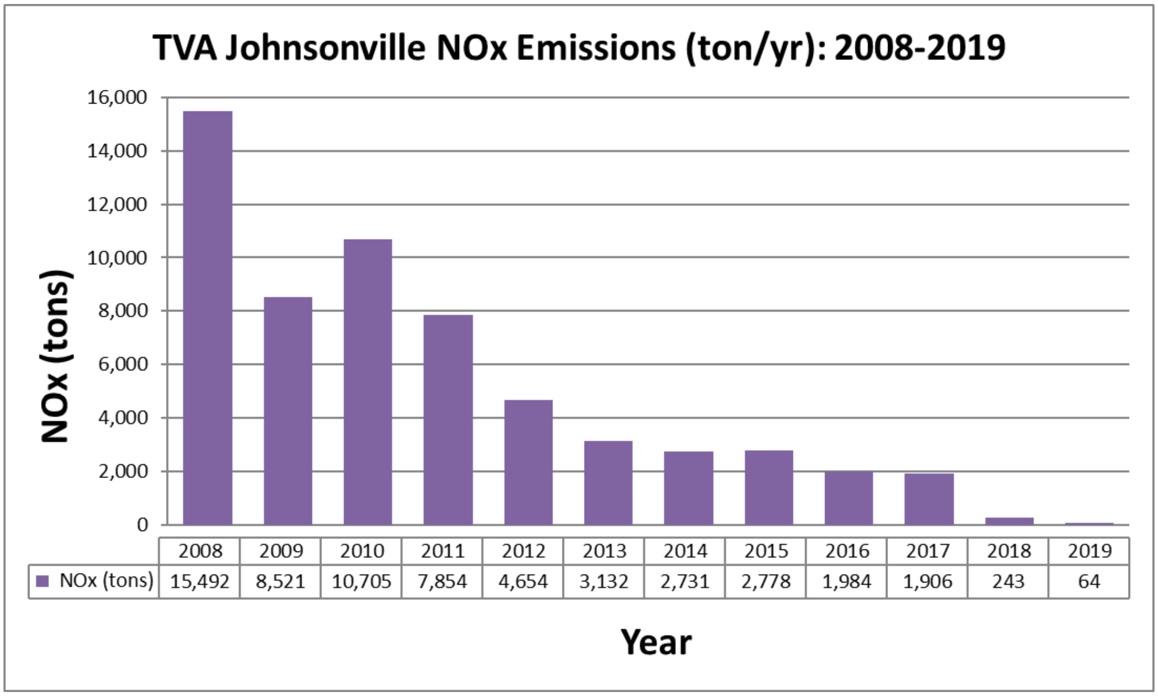


Figure 7-13: TVA Johnsonville NO_x Emissions (ton/yr): 2008-2019

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.

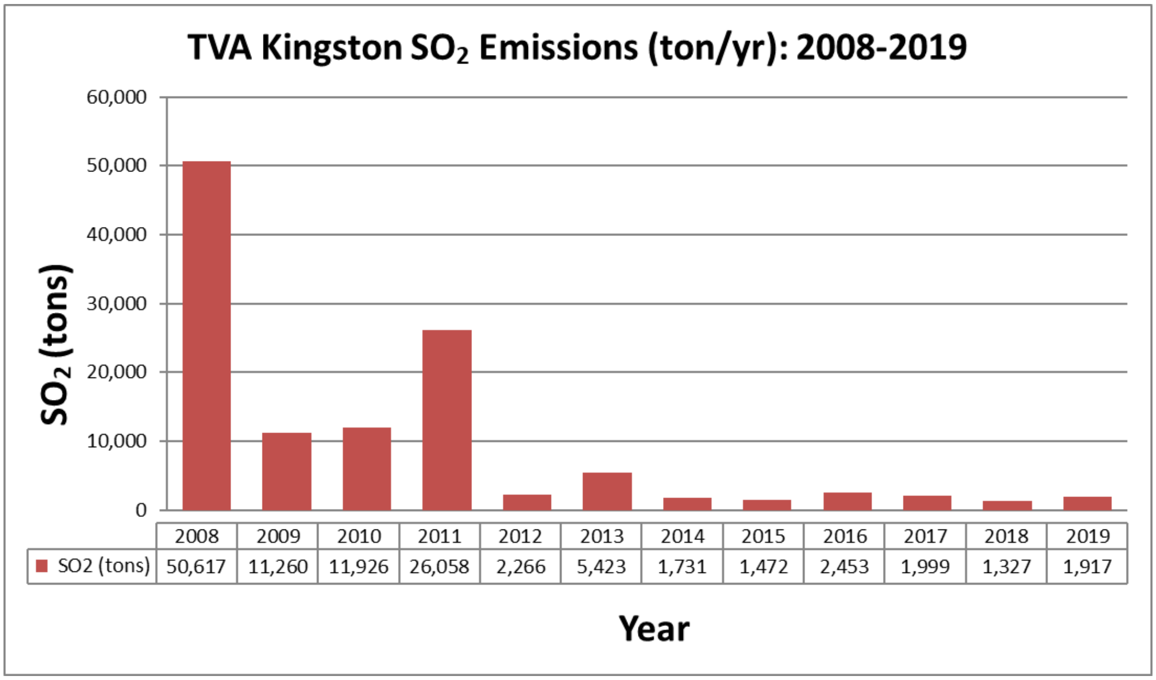


Figure 7-14: TVA Kingston SO_2 Emissions (ton/yr): 2008-2019

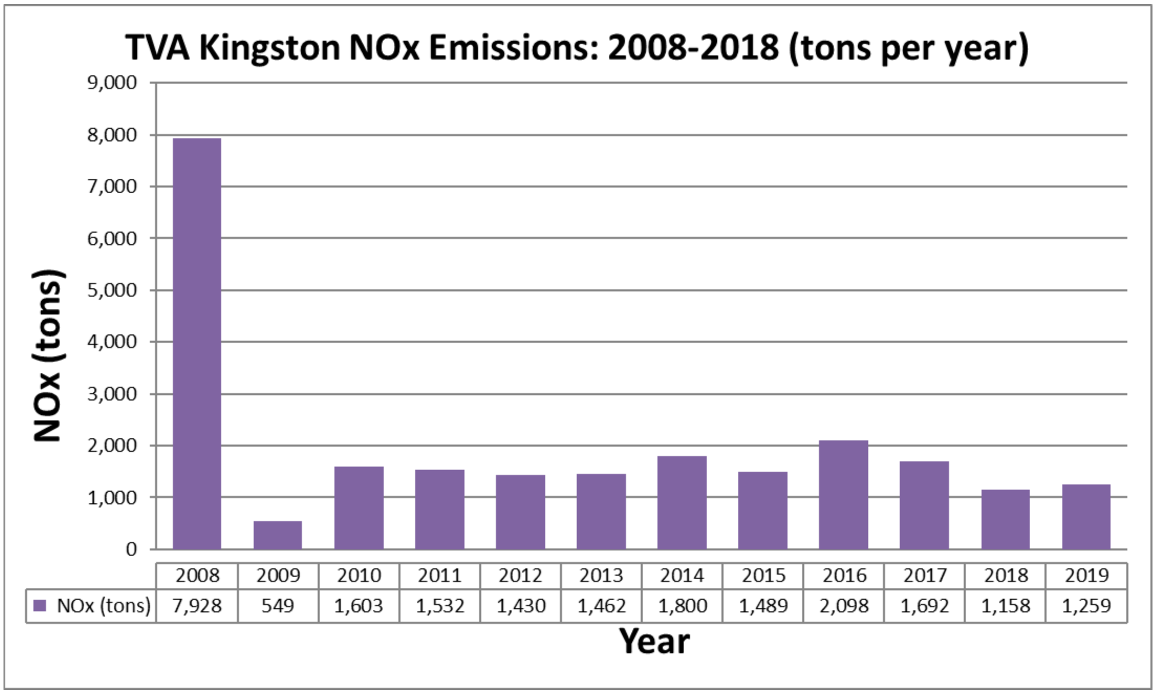
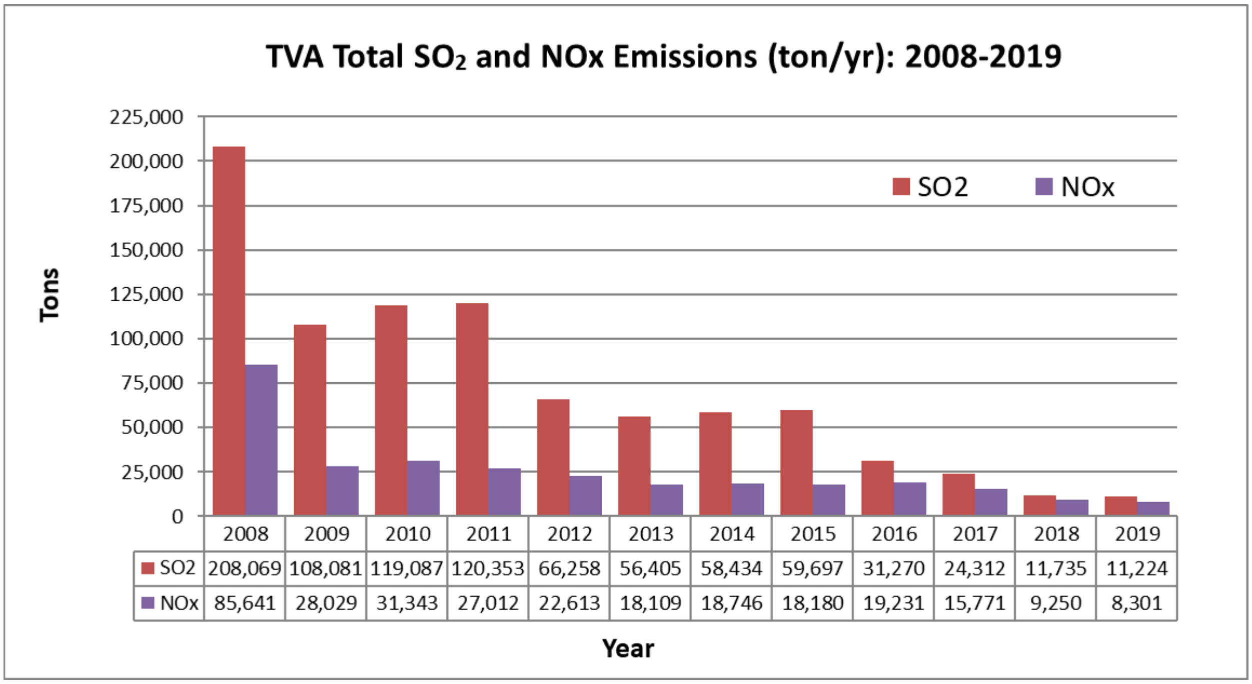


Figure 7-15: TVA Kingston NO_x Emissions (ton/yr): 2008-2019

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).



	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

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 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 NO_X/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%. 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

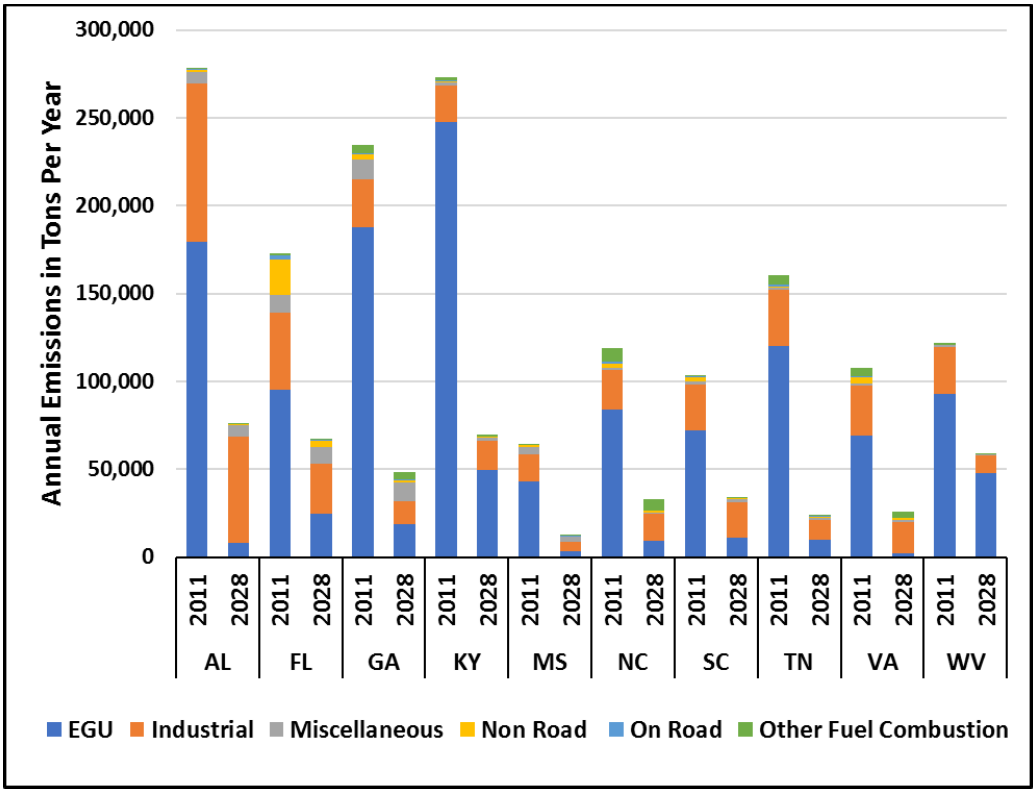

Figure 7-17: SO_2 Emissions for 2011 and 2028 for VISTAS States

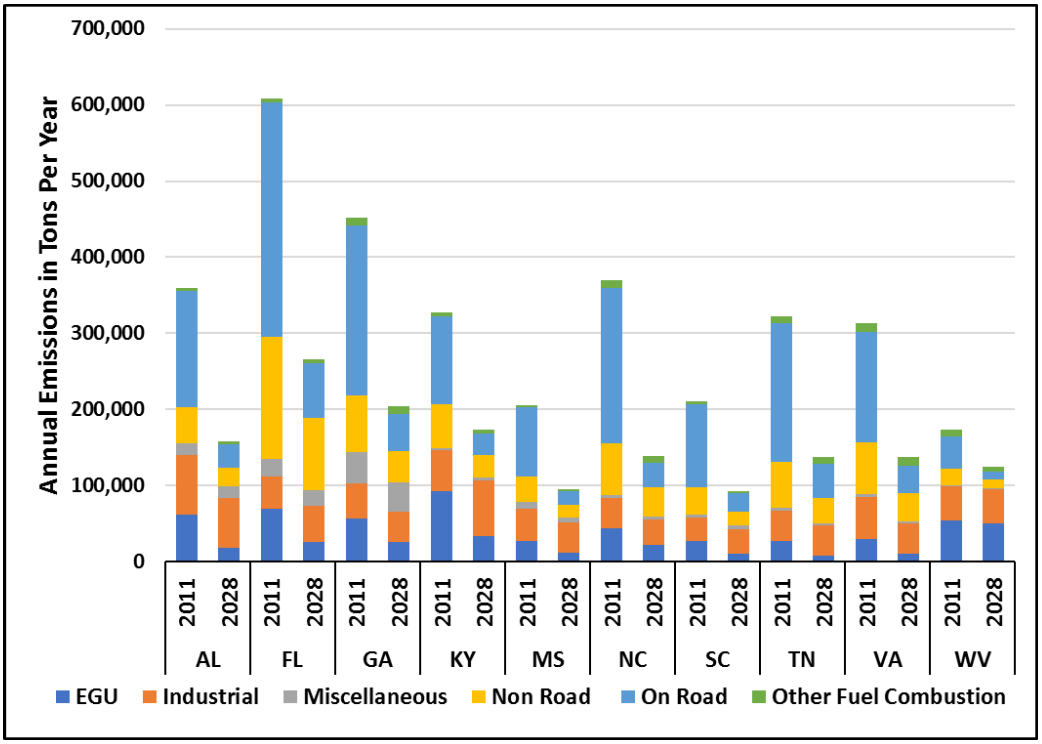

Figure 7-18: NO_X Emissions for 2011 and 2028 for VISTAS States

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.

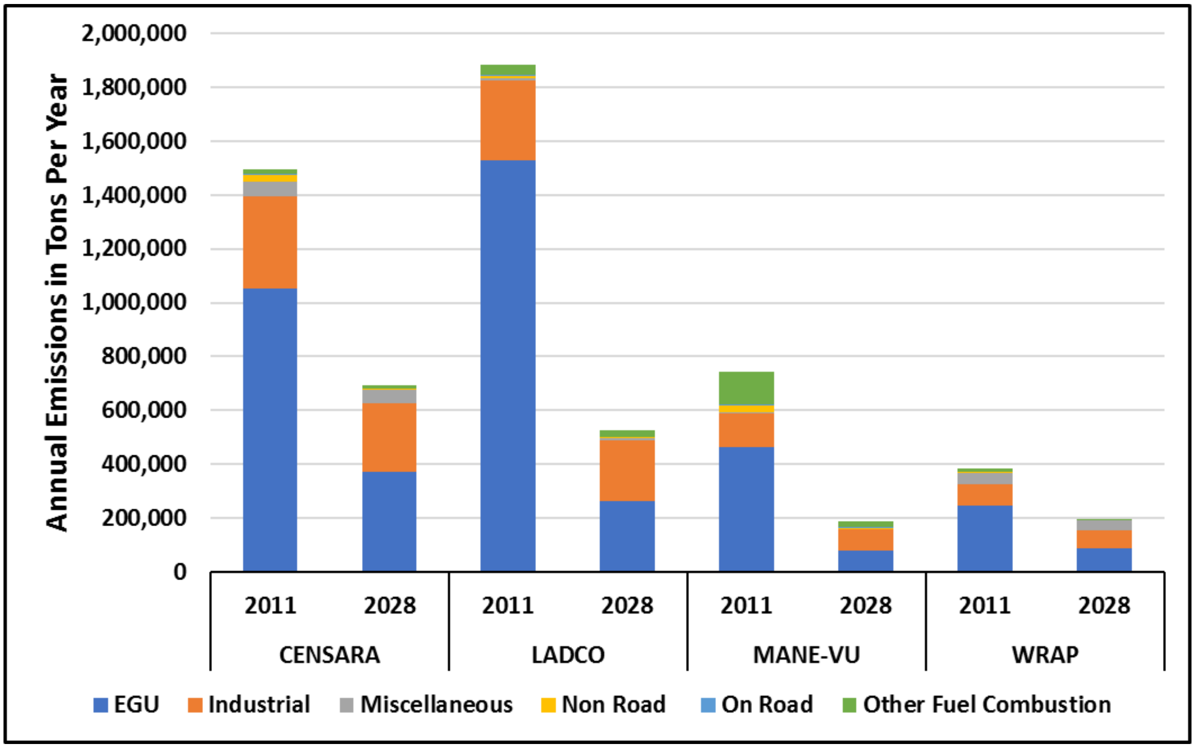

Figure 7-19: SO_2 Emissions for 2011 and 2028 for Other RPOs

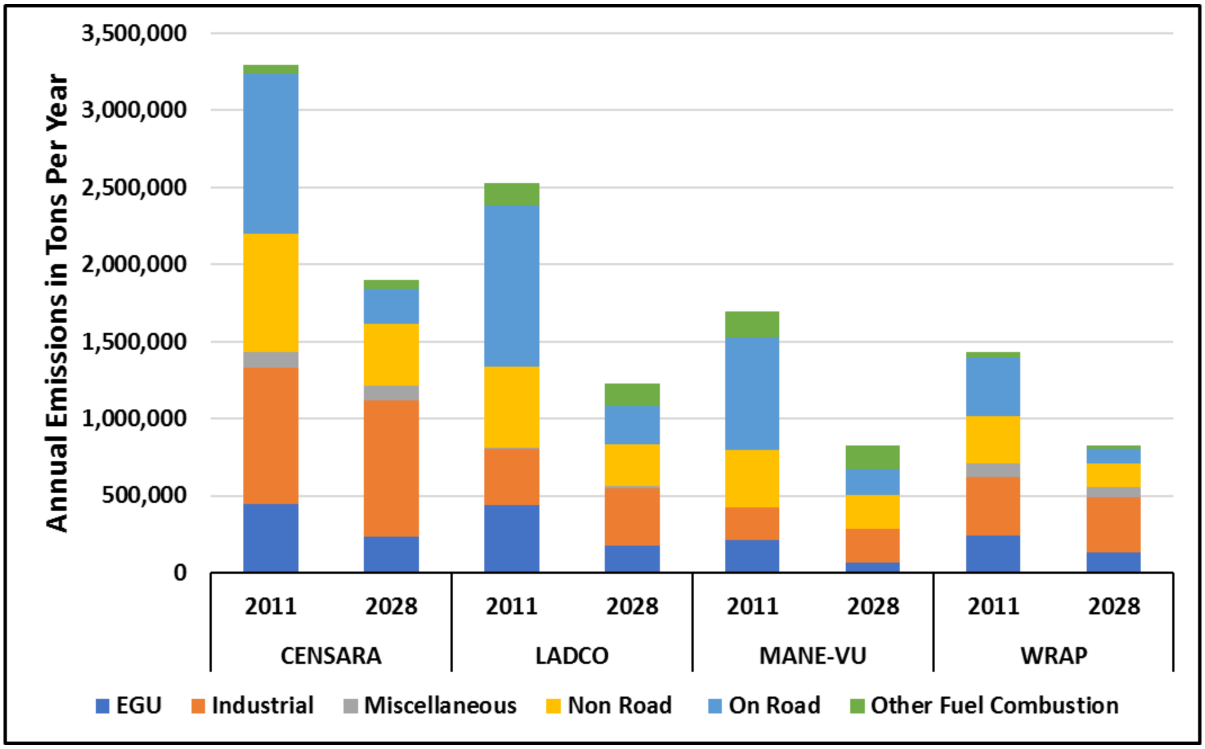

Figure 7-20: NOx Emissions for 2011 and 2028 for Other RPOs

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

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[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.

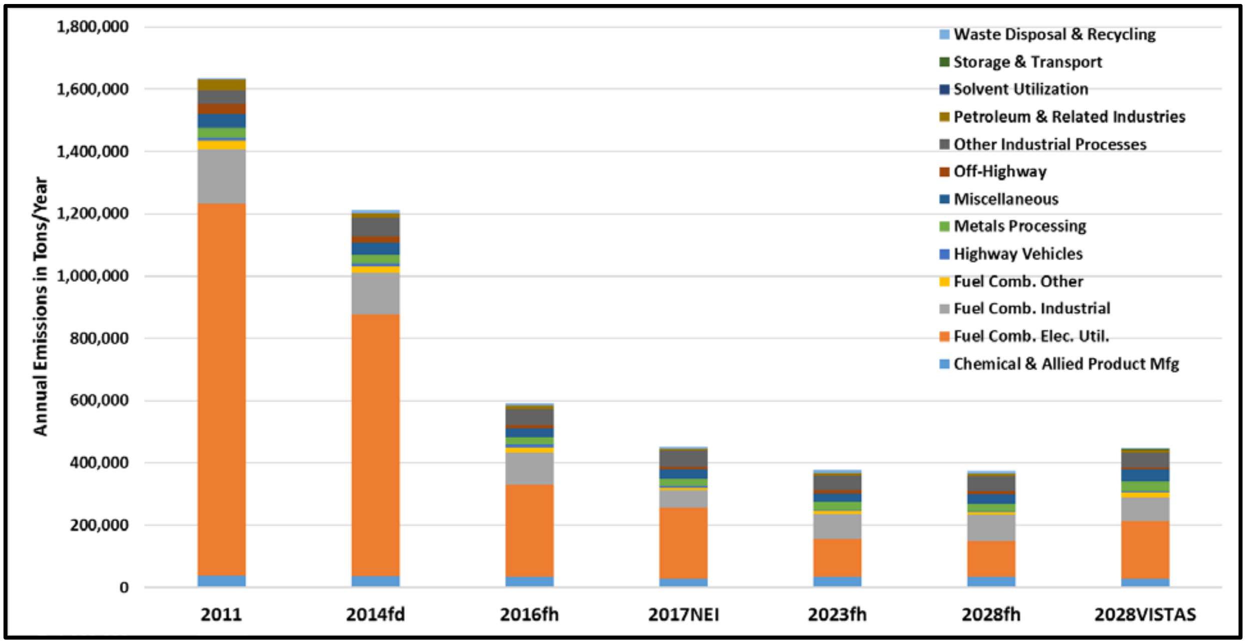

Figure 7-21: SO_2 Emissions from VISTAS States

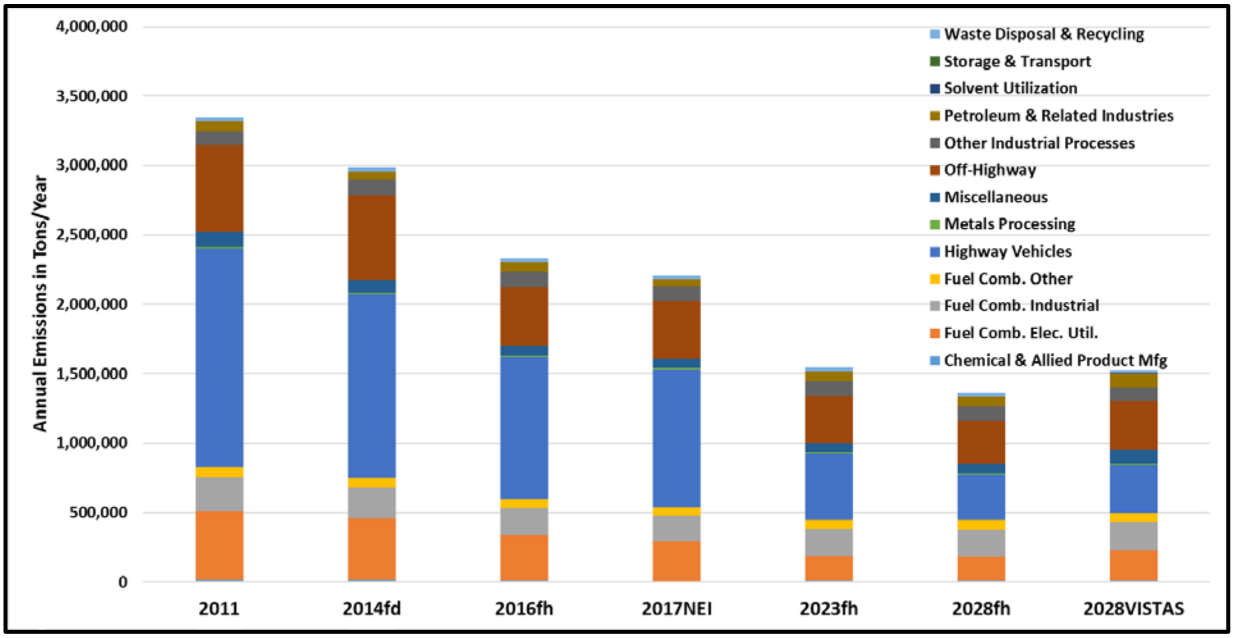

Figure 7-22: NO_X Emissions from VISTAS States

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.

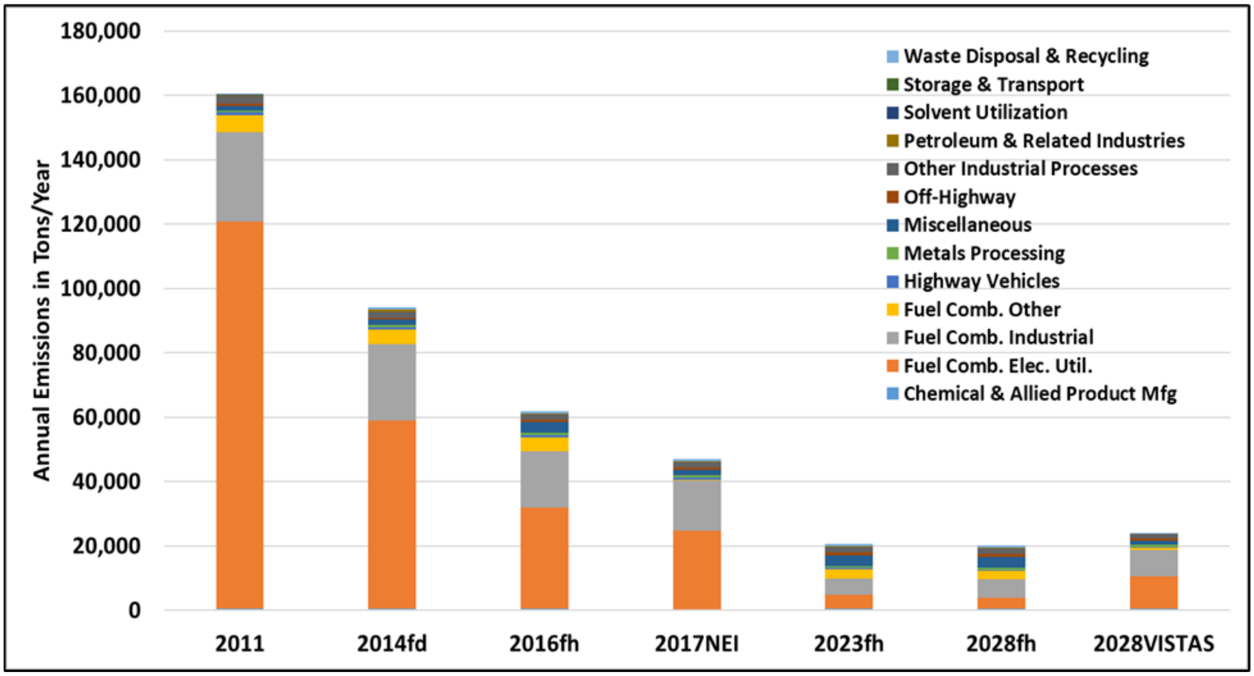

Figure 7-23: Tennessee SO_2 Emissions

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.

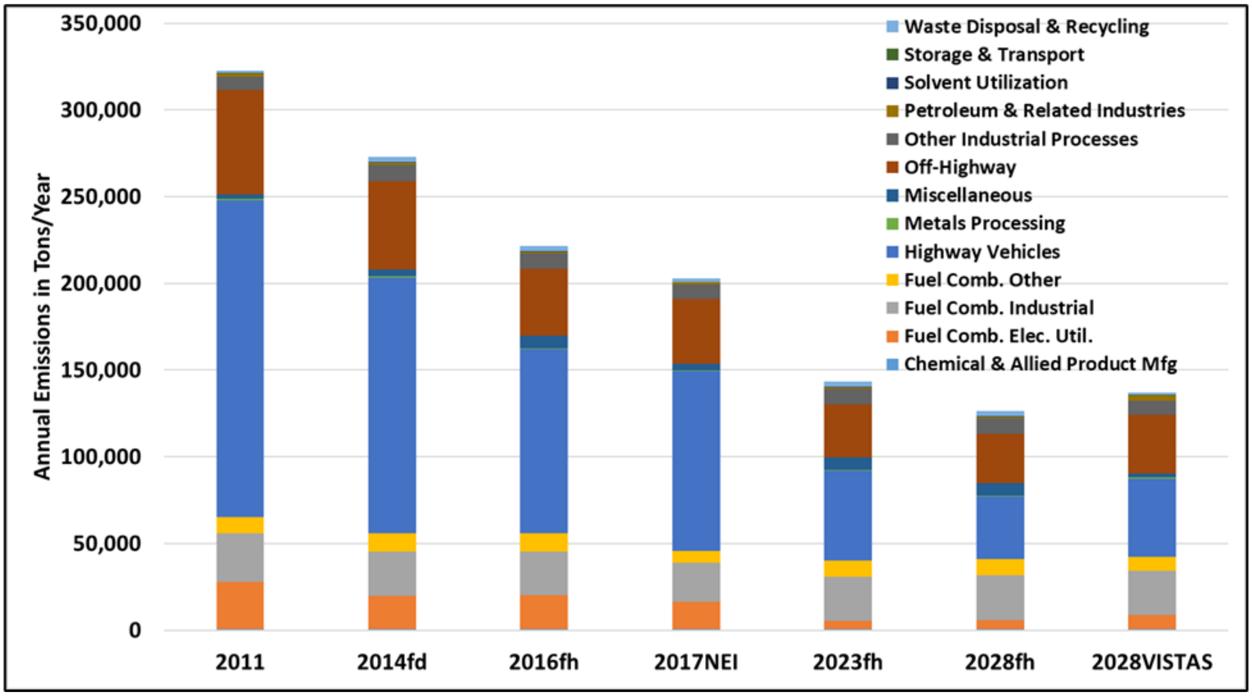

Figure 7-24: Tennessee NO_X Emissions

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, $PM_{2.5}$,

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[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

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[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.

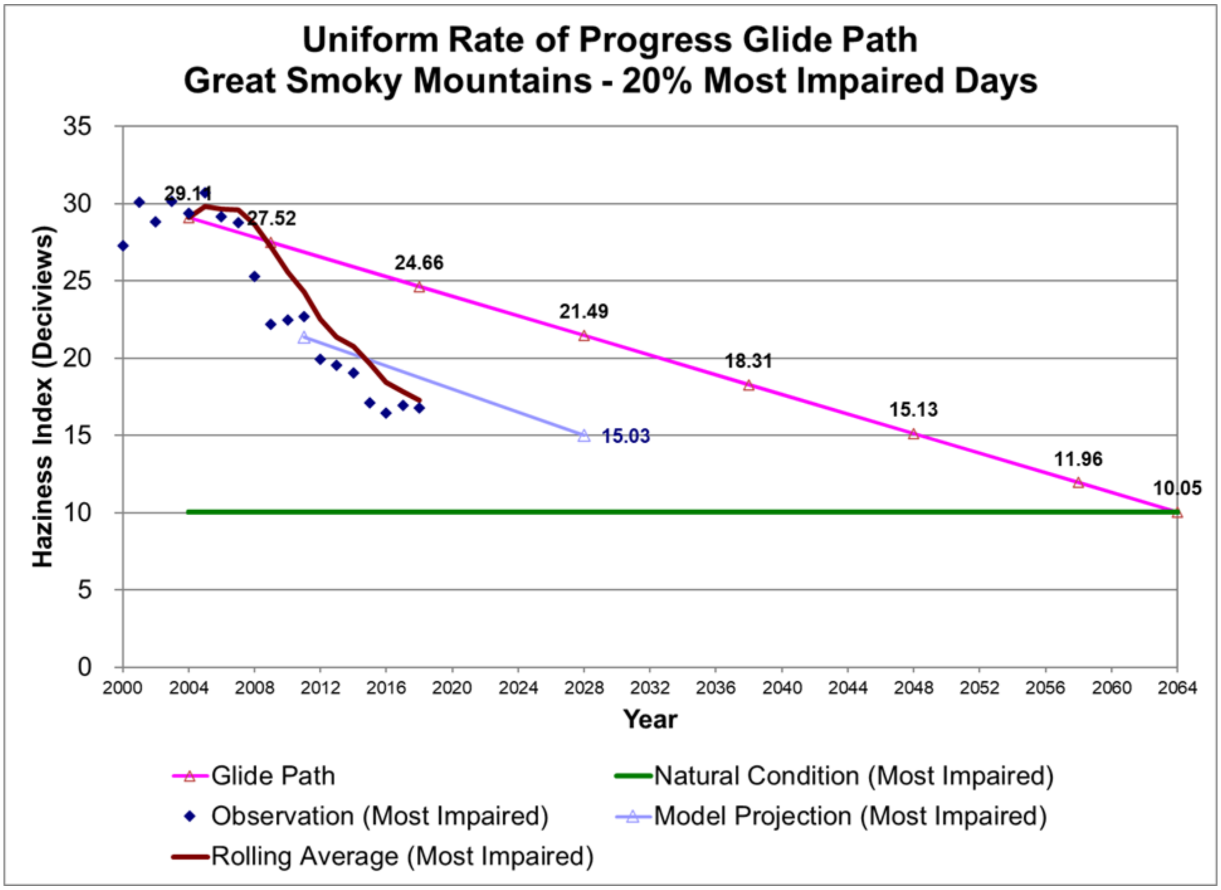

Figure 7-25: Great Smoky Mountains National Park URP on the 20% Most Impaired Days

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.

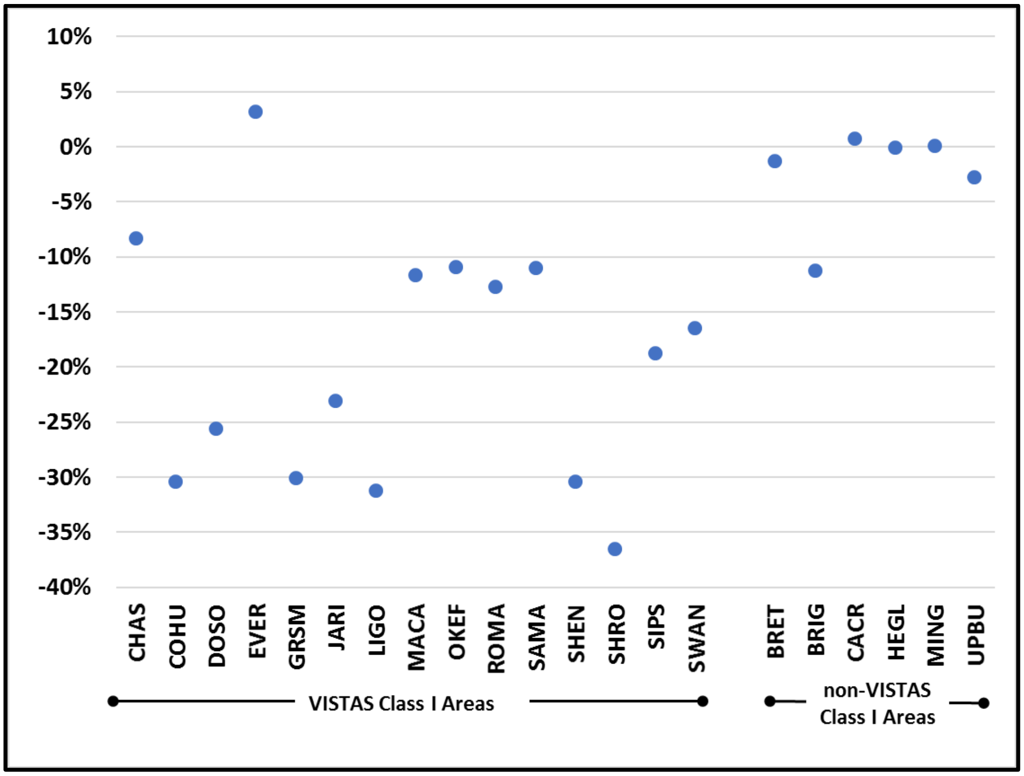

Figure 7-26: Percent of URP in 2028

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.

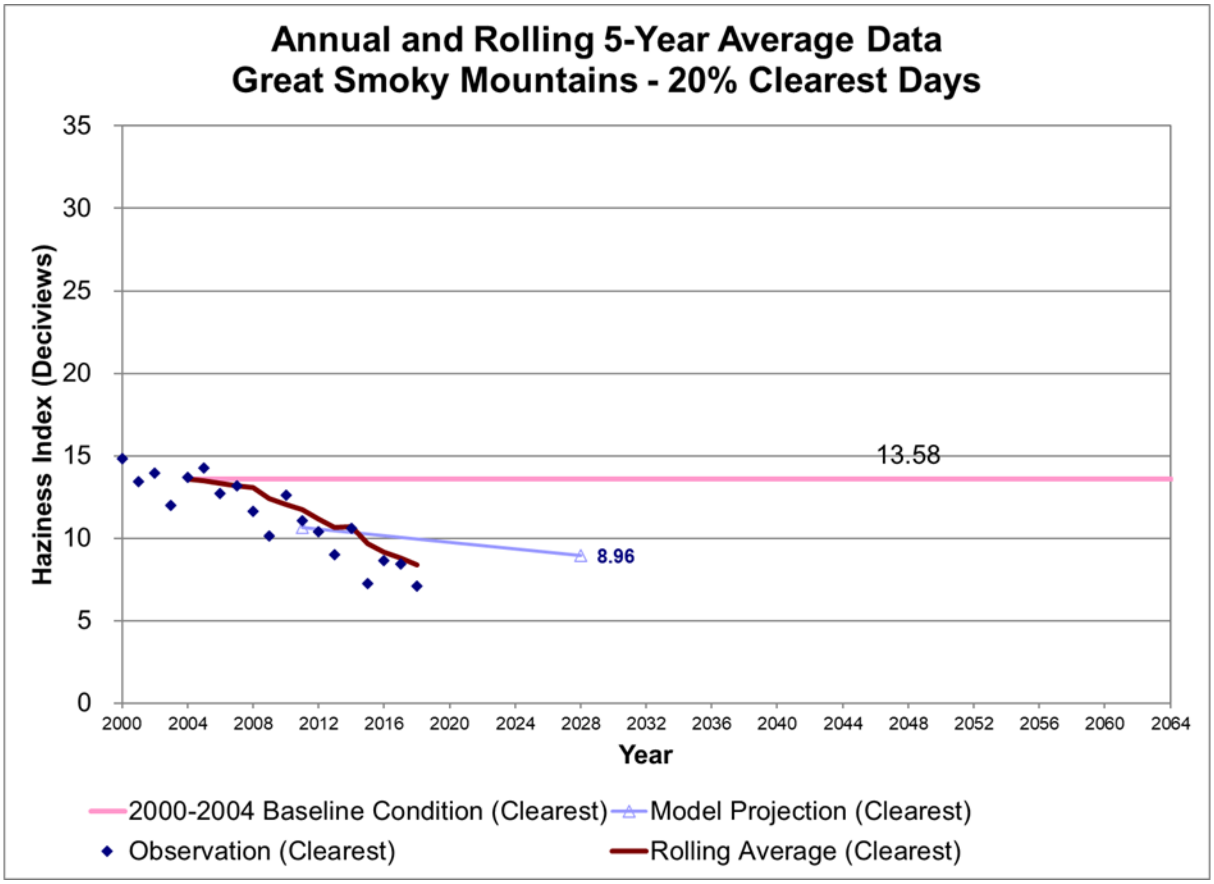

Figure 7-28: 20% Clearest Days Rate of Progress for Great Smoky Mountains National Park

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.

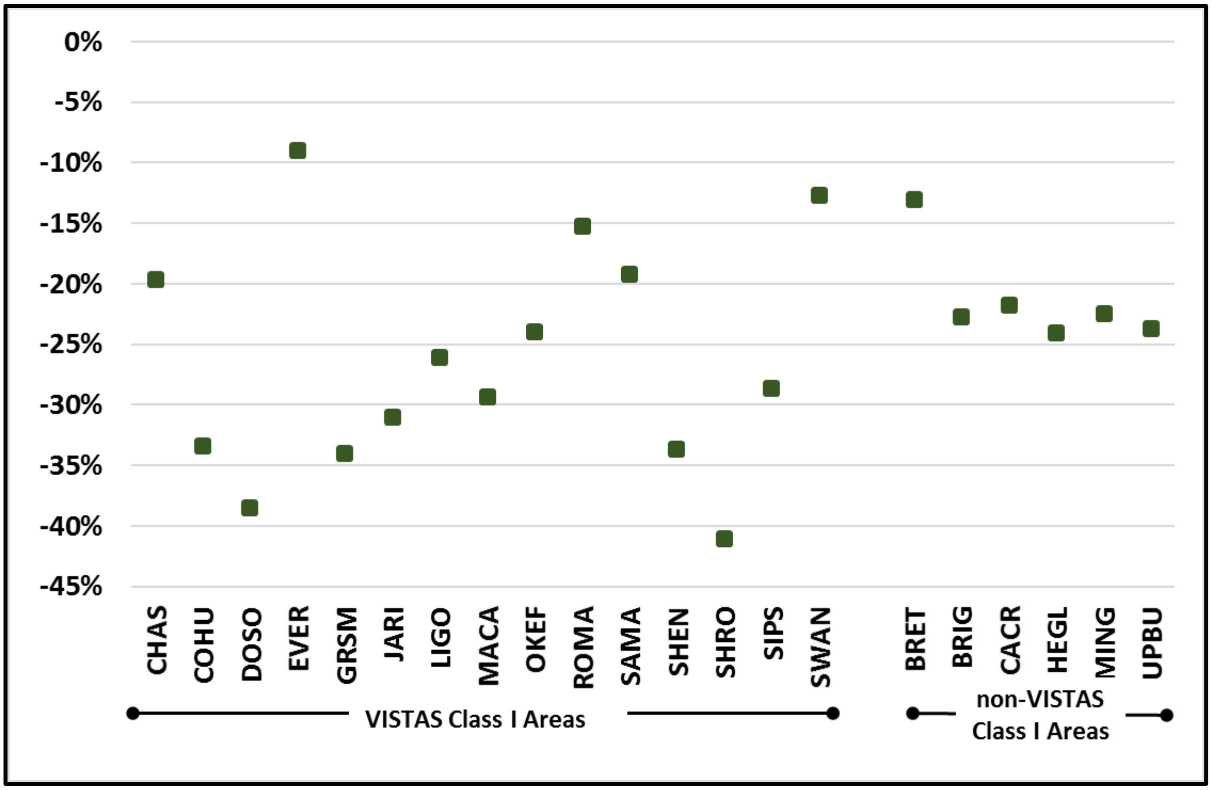

Figure 7-29: Percent Visibility Improvement on 20% Clearest Days

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

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[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.

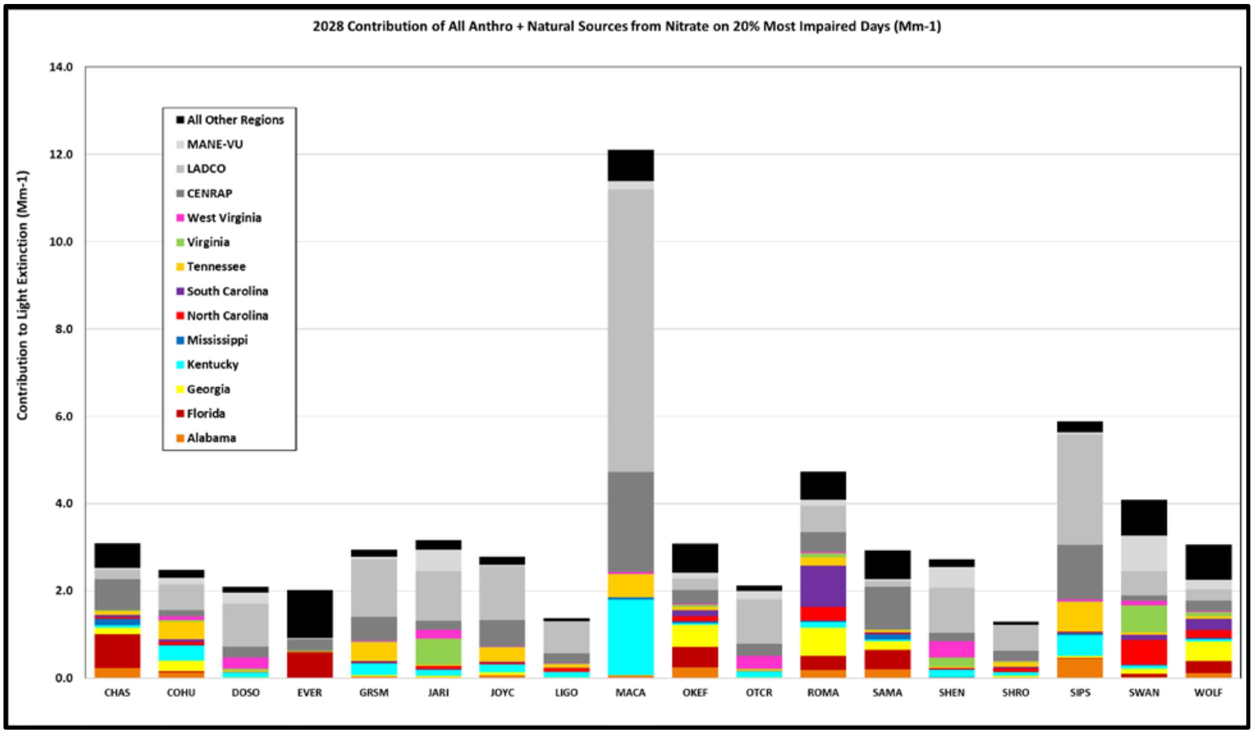

Figure 7-30: 2028 Nitrate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas

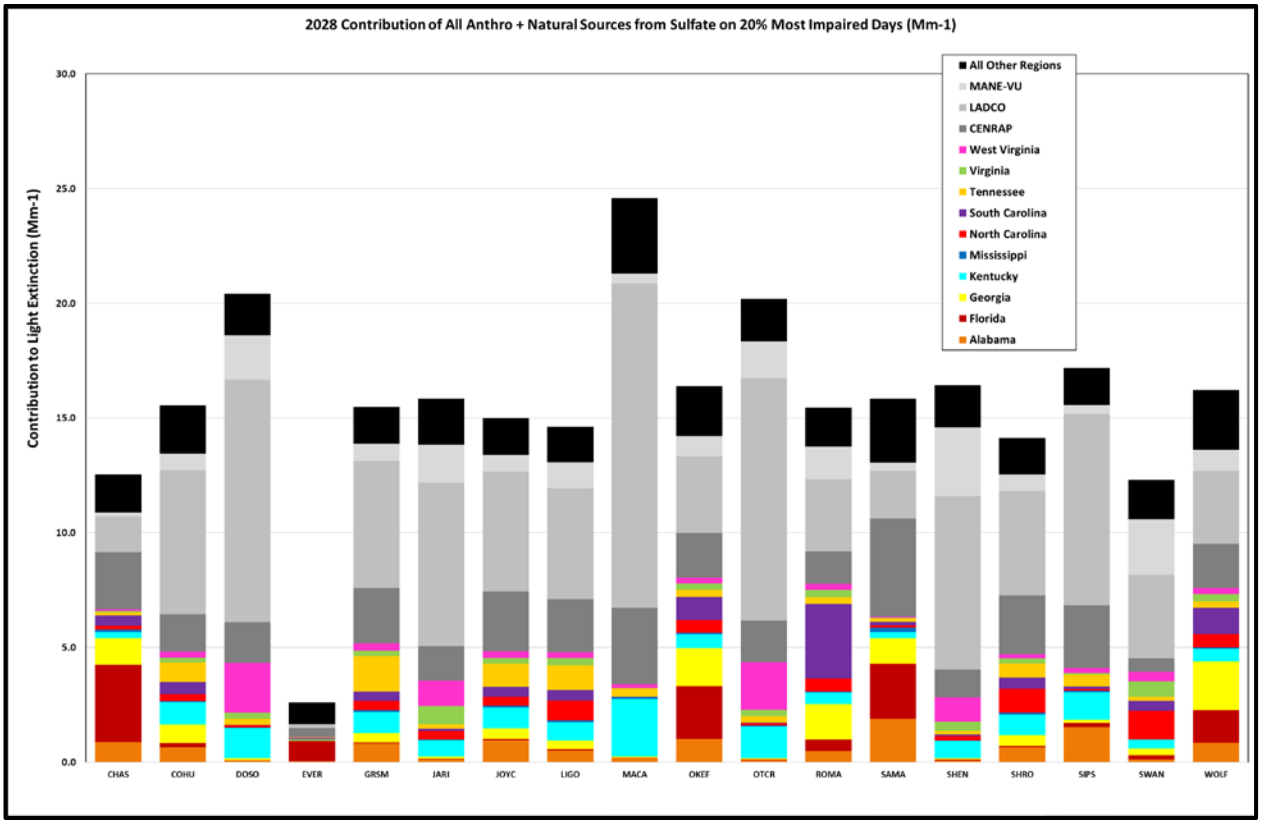

Figure 7-31: 2028 Sulfate Visibility Impairment, 20% Most Impaired Days, VISTAS Class I Areas

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.

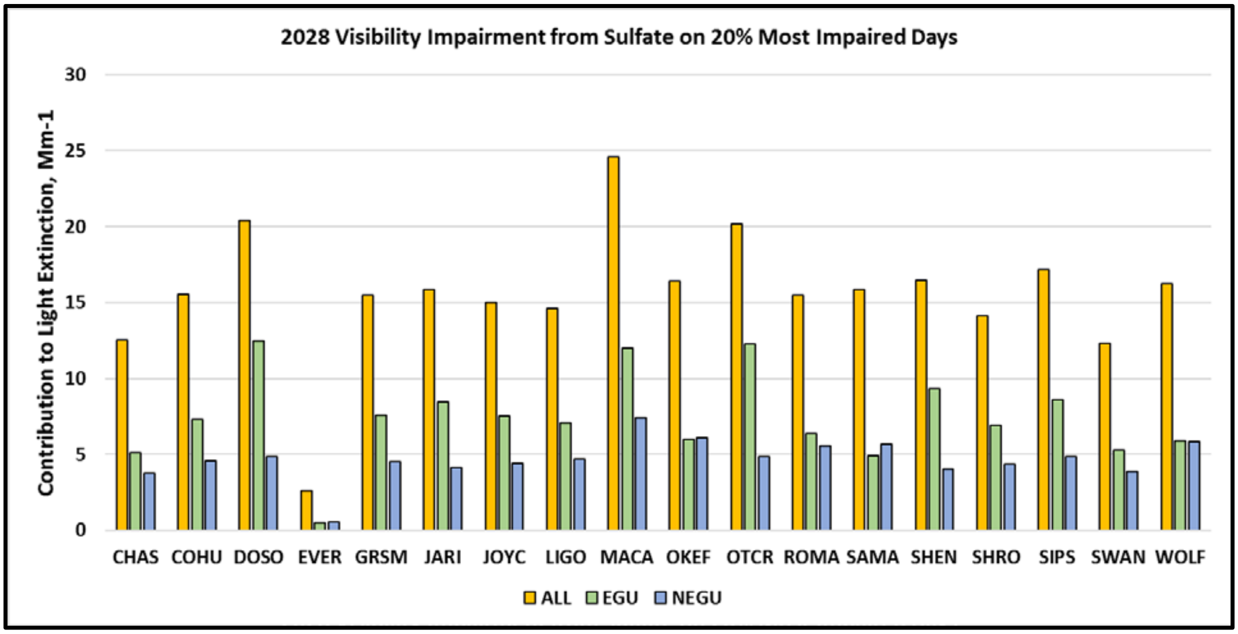

Figure 7-32: 2028 Visibility Impairment from Sulfate on 20% Most Impaired Days, VISTAS Class I Areas

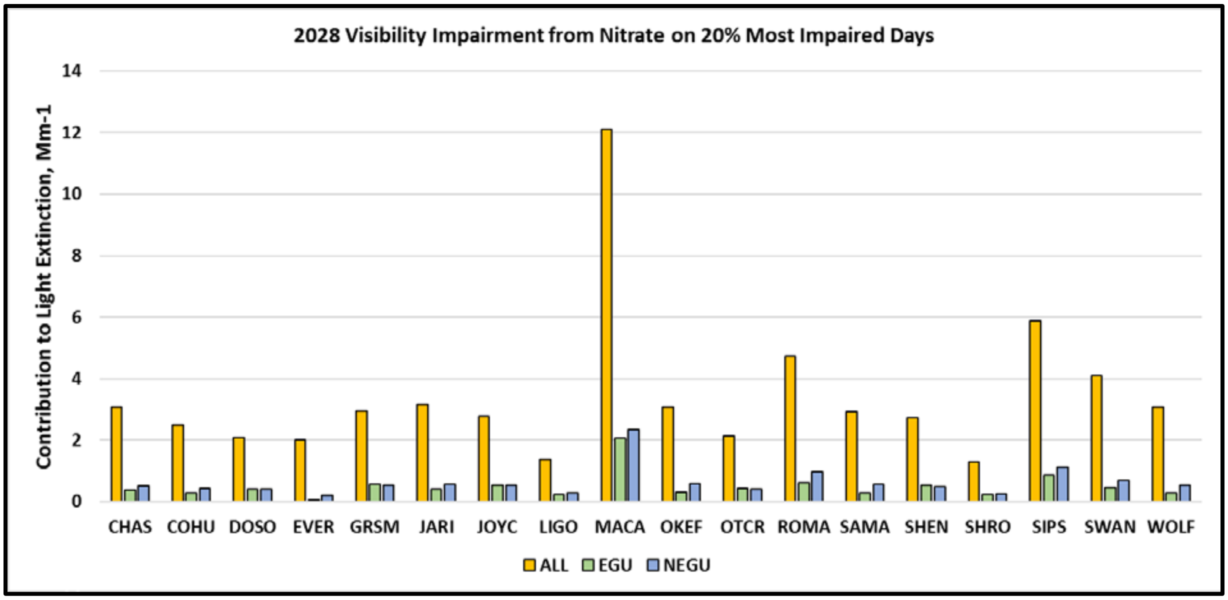

Figure 7-33: 2028 Visibility Impairment from Nitrate on 20% Most Impaired Days, VISTAS Class I Areas

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.

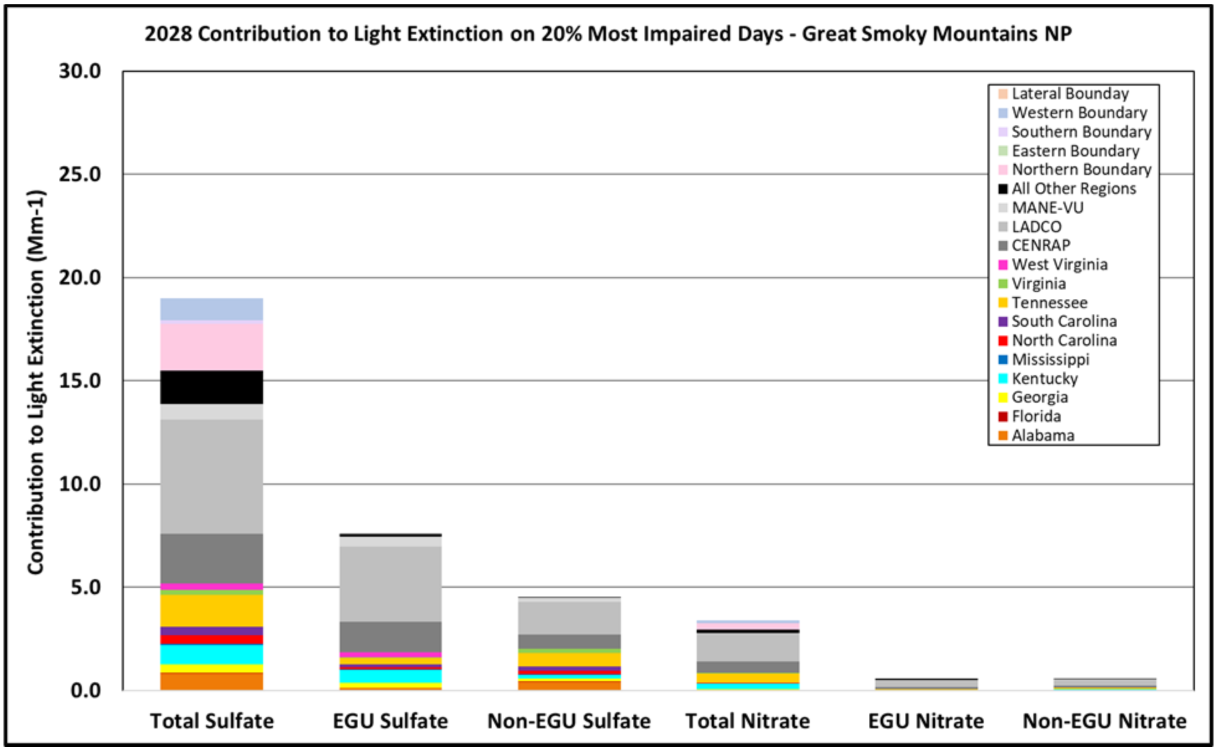

Figure 7-34: 2028 Contribution to Light Extinction on the 20% Most Impaired Days at Great Smoky Mountains National Park

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.

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

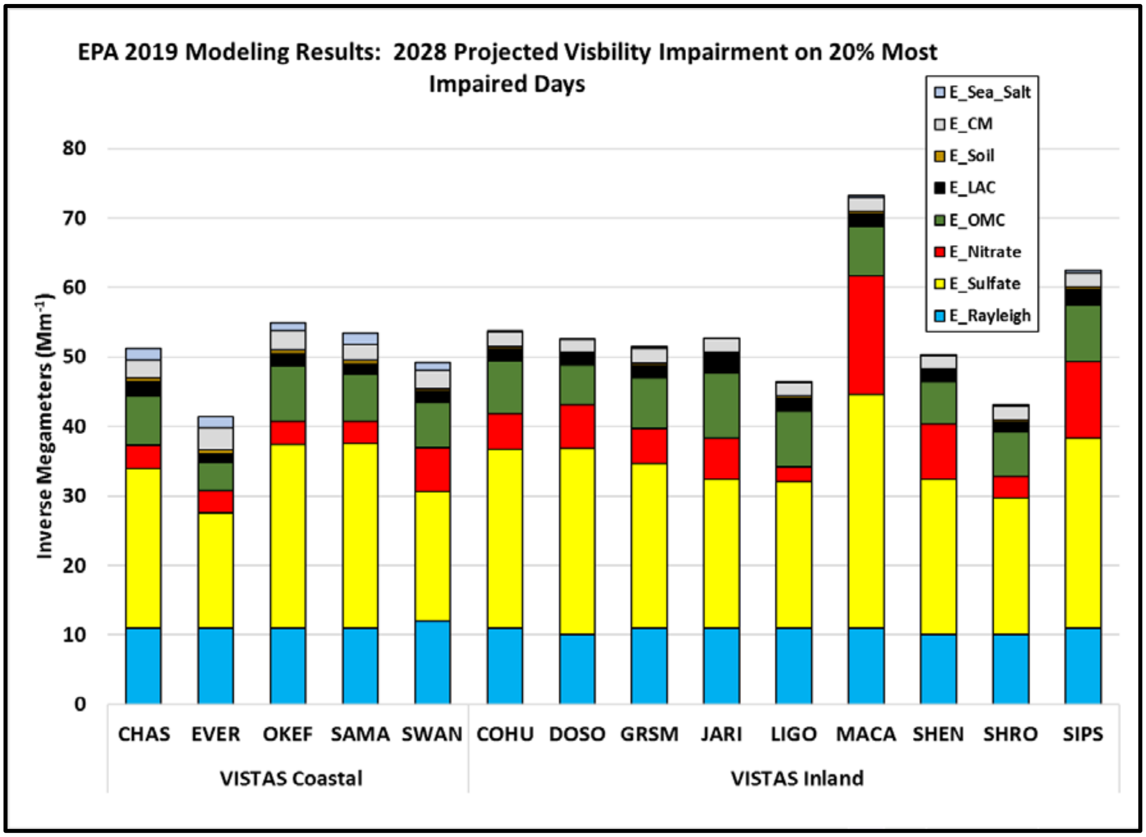

Figure 7-35: 2028 Projected Visibility Impairment by Pollutant Species, EPA 2019 Modeling Results

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 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
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

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
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.

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[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

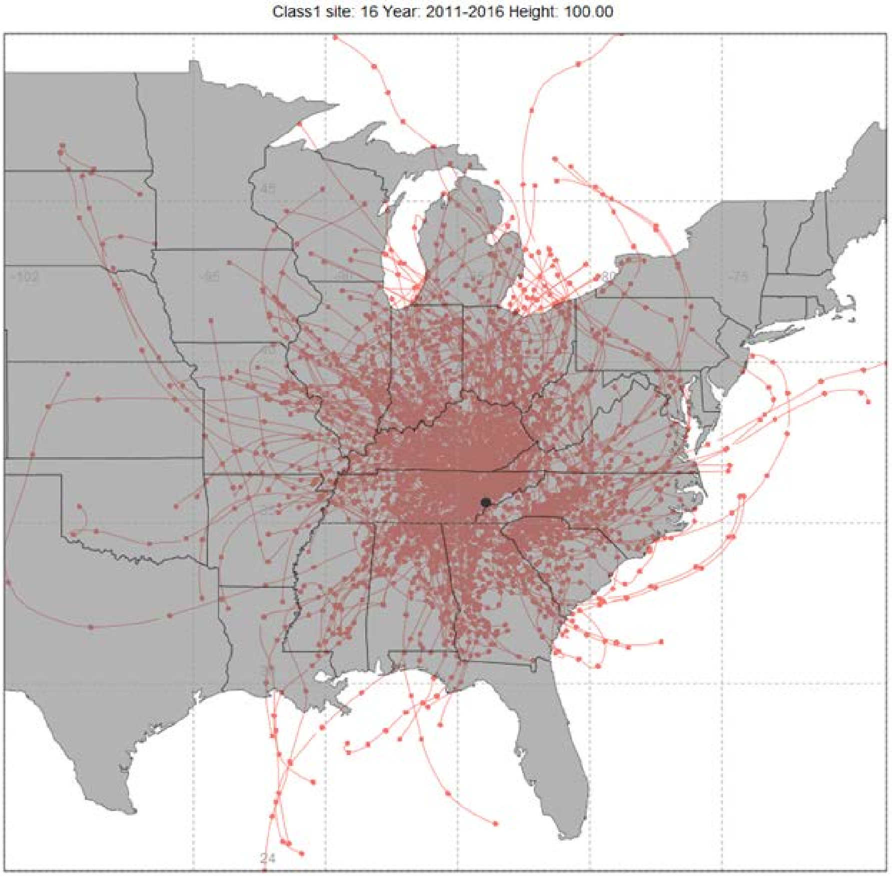

Figure 7-36: 100-Meter Back Trajectories for the 20% Most Impaired Visibility Days (2011-2016), from Great Smoky Mountains National Park

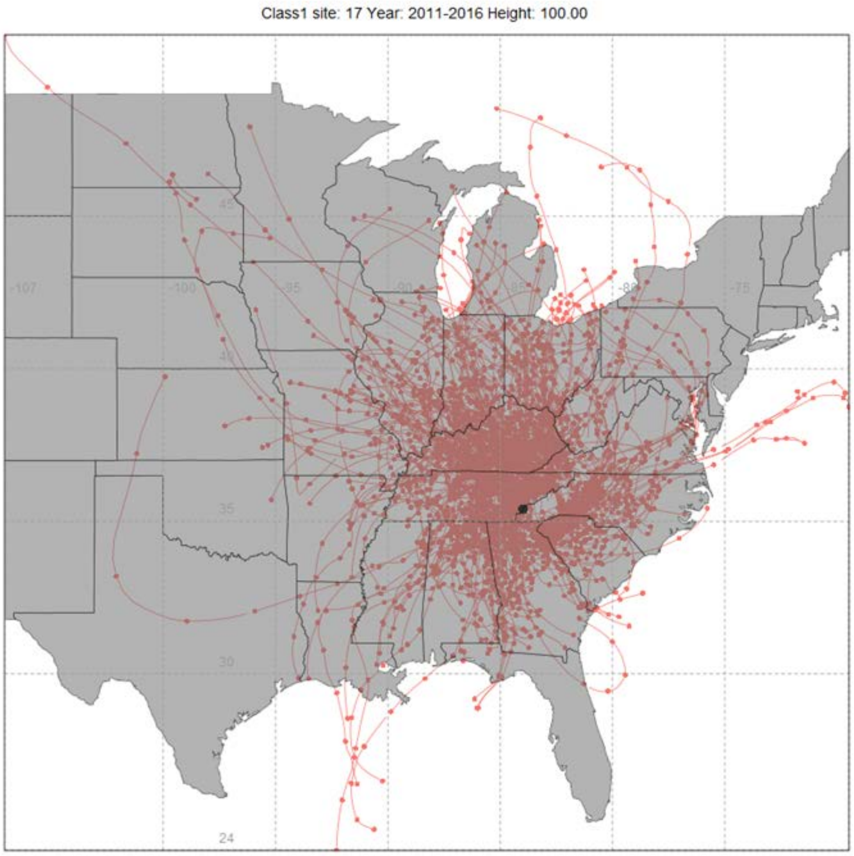

Figure 7-37: 100-Meter Back Trajectories for the 20% Most Impaired Visibility Days (2011-2016), from Joyce Kilmer-Slickrock Wilderness Area

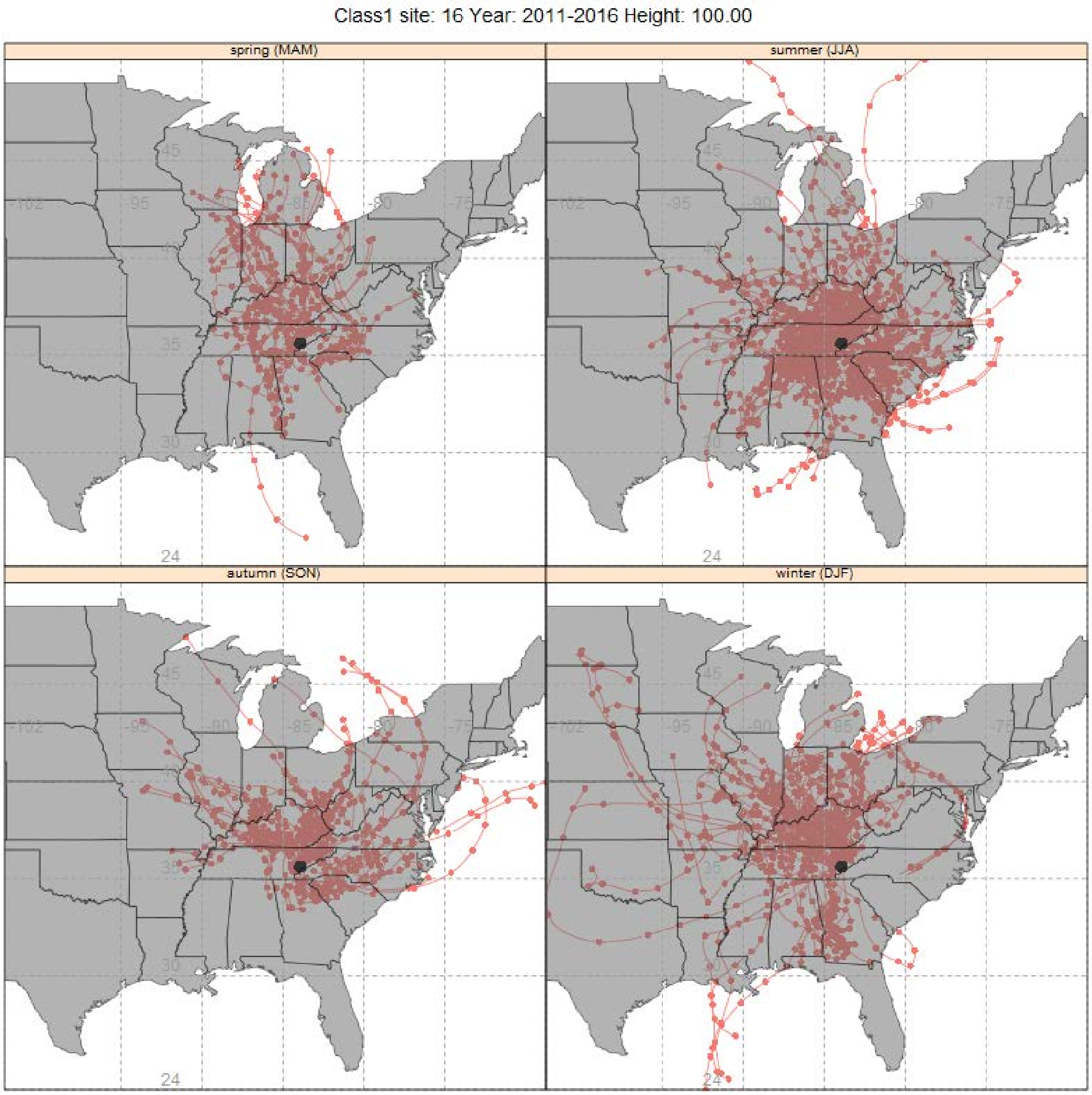

Figure 7-38: 100-Meter Back Trajectories by Season for the 20% Most Impaired Visibility Days (2011-2016) from Great Smoky Mountains National Park

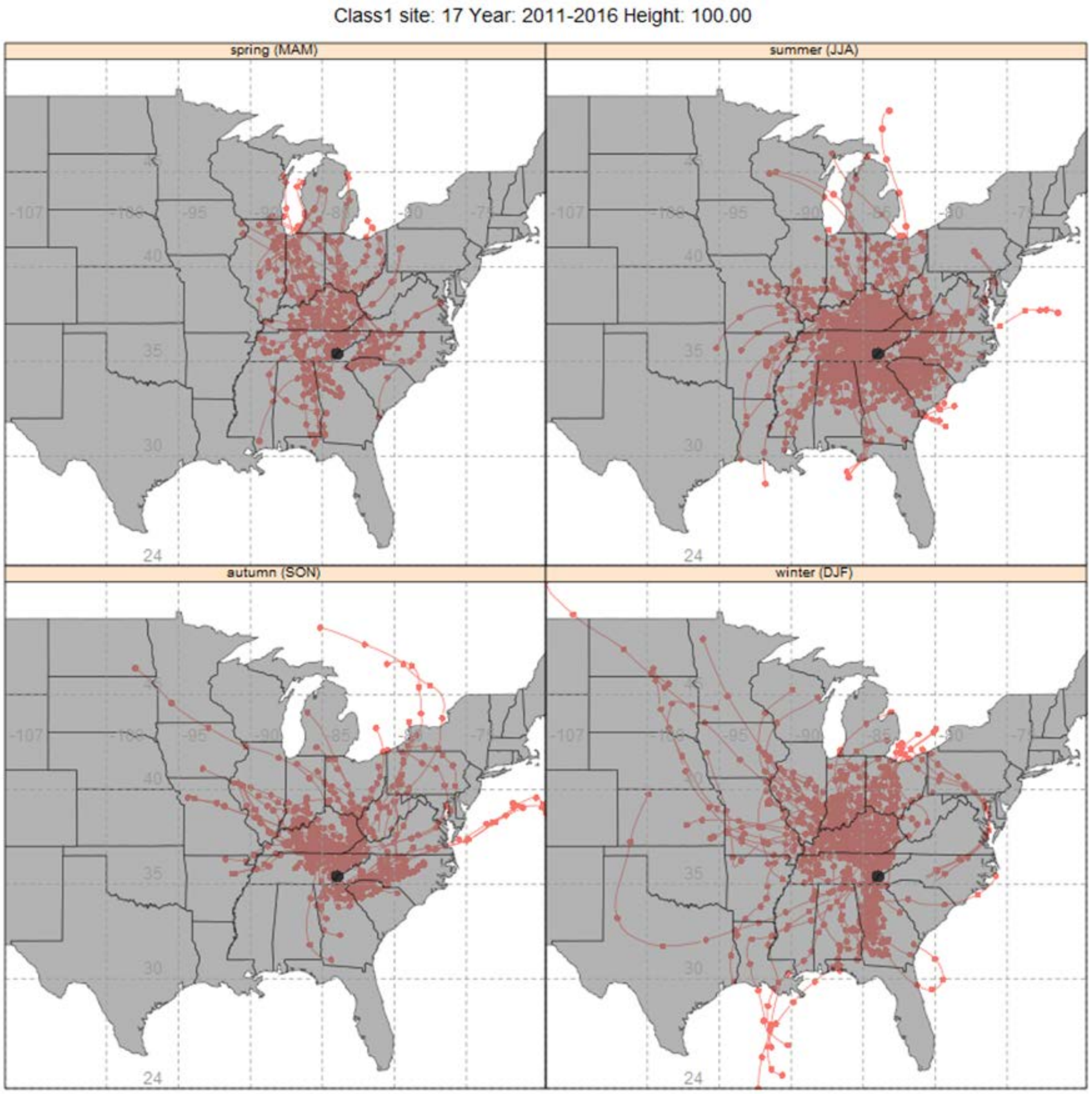

Figure 7-39: 100-Meter Back Trajectories by Season for the 20% Most Impaired Visibility Days (2011-2016) from Joyce Kilmer-Slickrock Wilderness Area

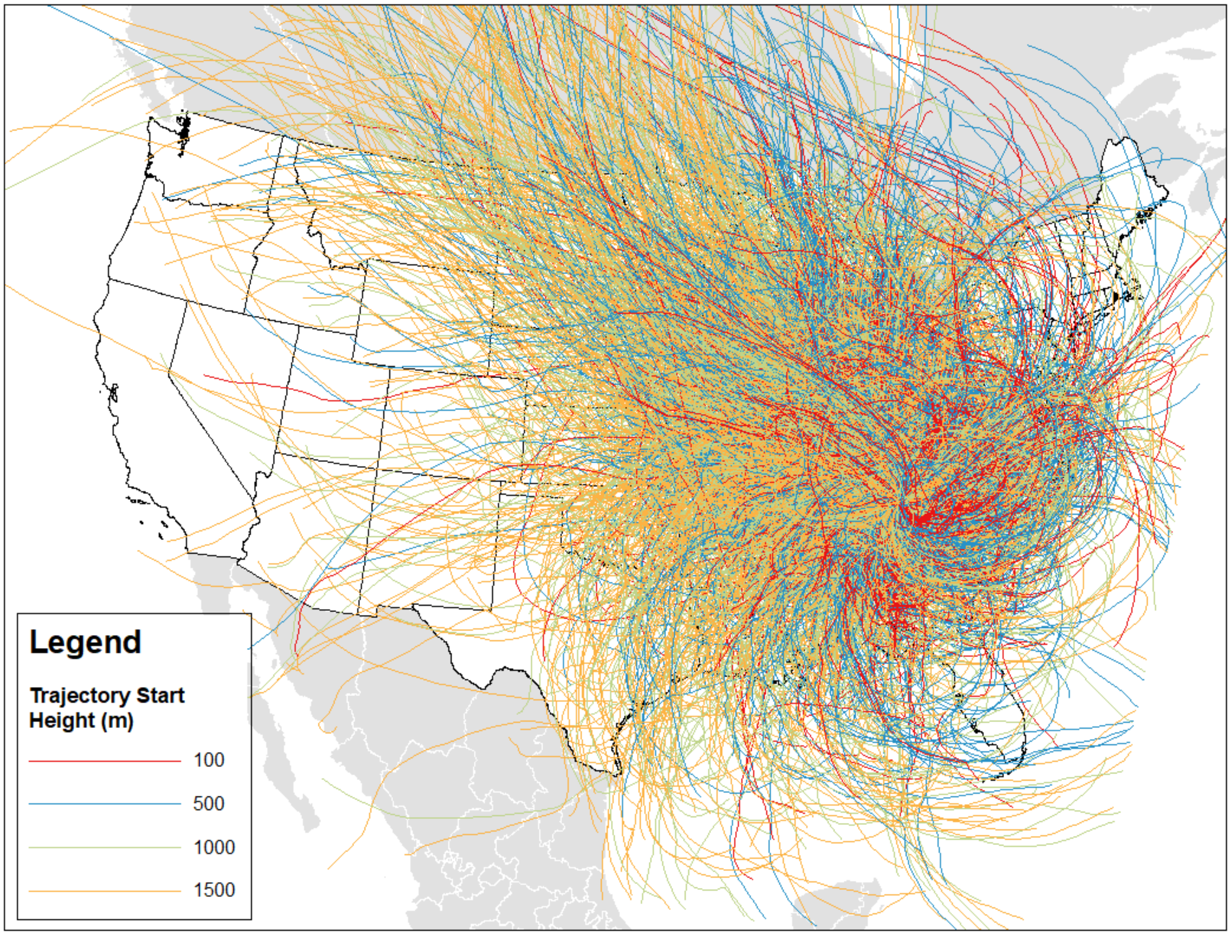

Figure 7-40: 100-Meter, 500-Meter, 1000-Meter, and 1500-Meter Back Trajectories for the 20% Most Impaired Days (2011-2016) from Great Smoky Mountains National Park

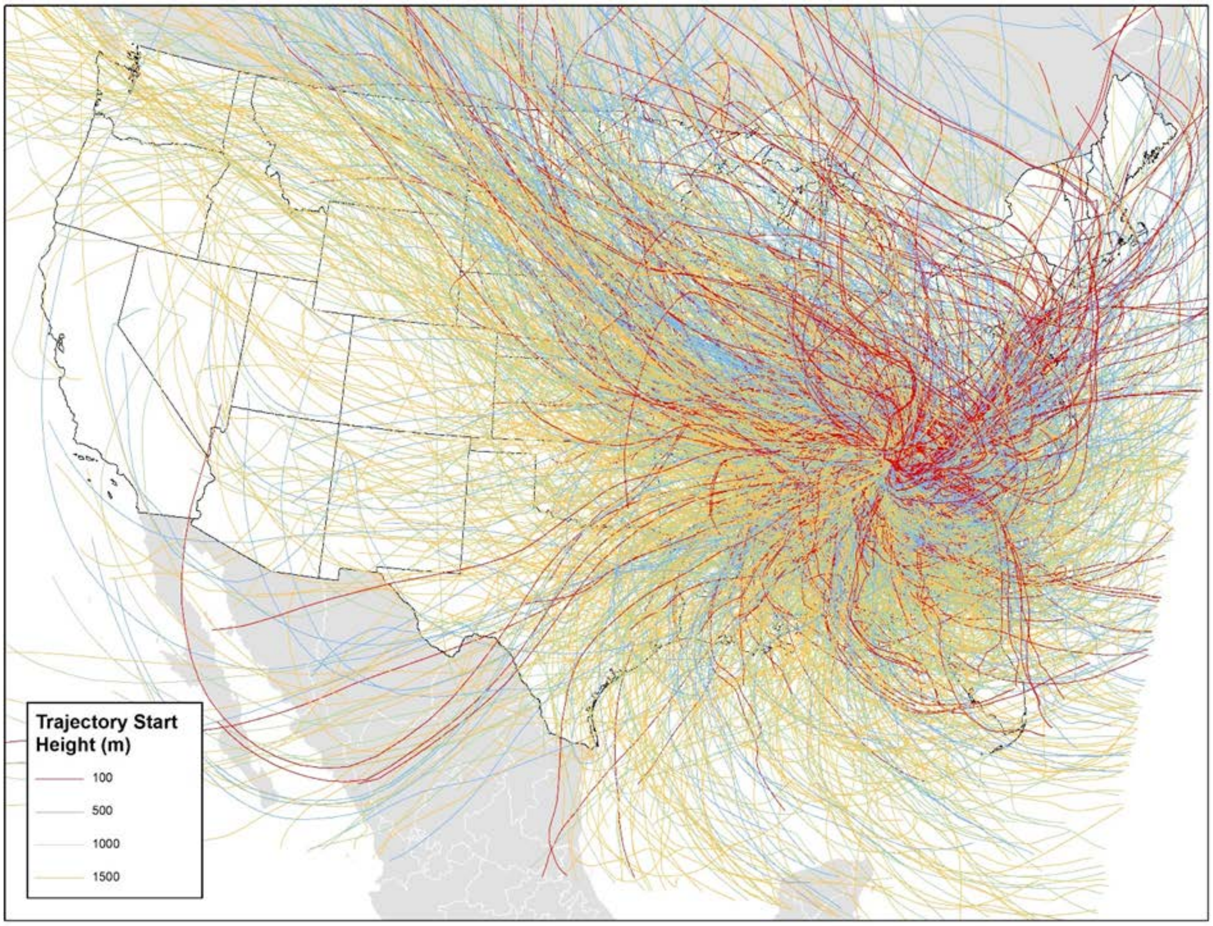

Figure 7-41: 100-Meter, 500-Meter, 1000-Meter, and 1500-Meter Back Trajectories for the 20% Most Impaired Days (2011-2016) from Joyce Kilmer-Slickrock Wilderness Area

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.

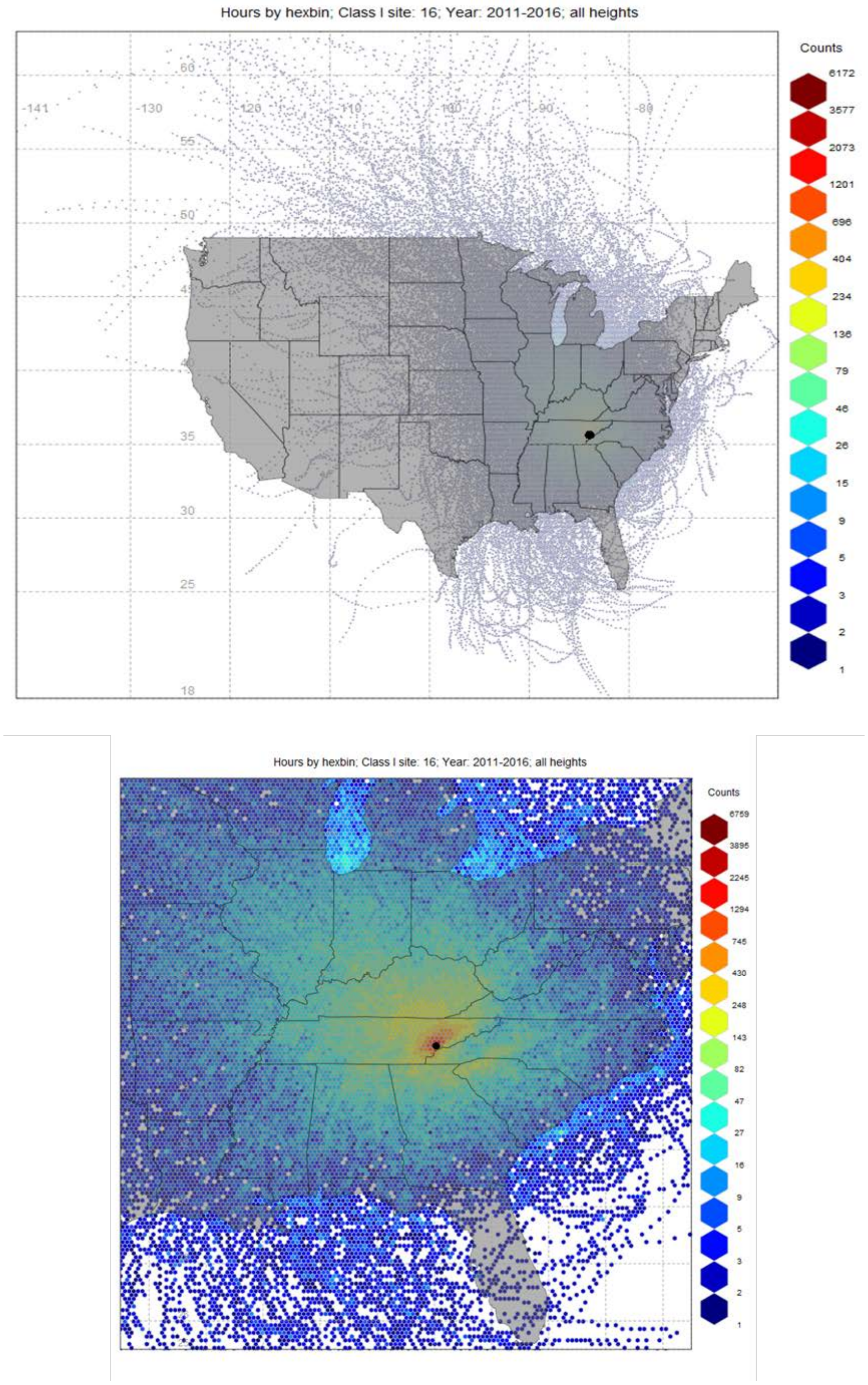

Figure 7-42: Residence Time (Counts per 12km Modeling Grid Cell) for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)

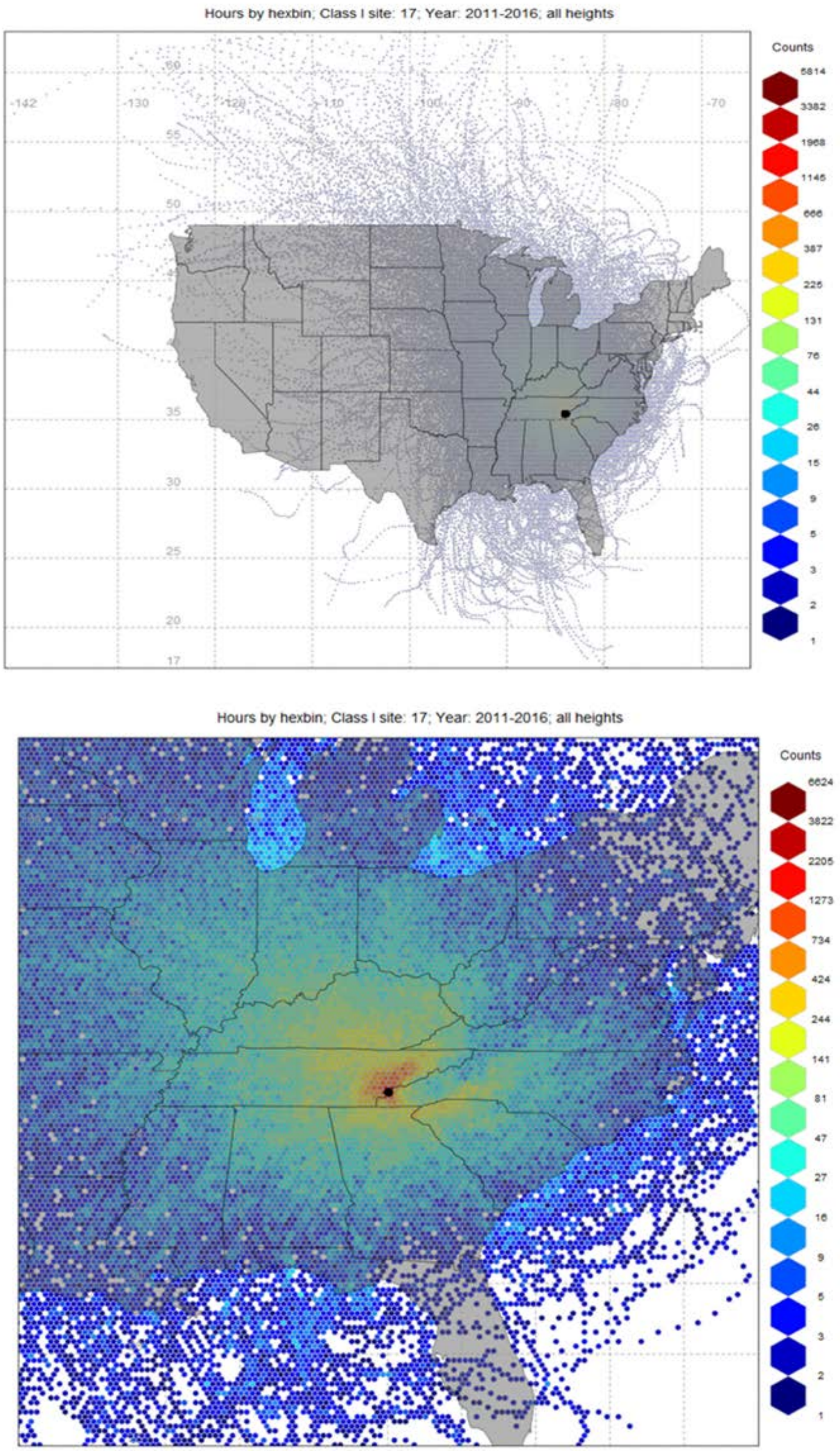

Figure 7-43: Residence Time (Counts per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area – Full View (top) and Class I Zoom (bottom)

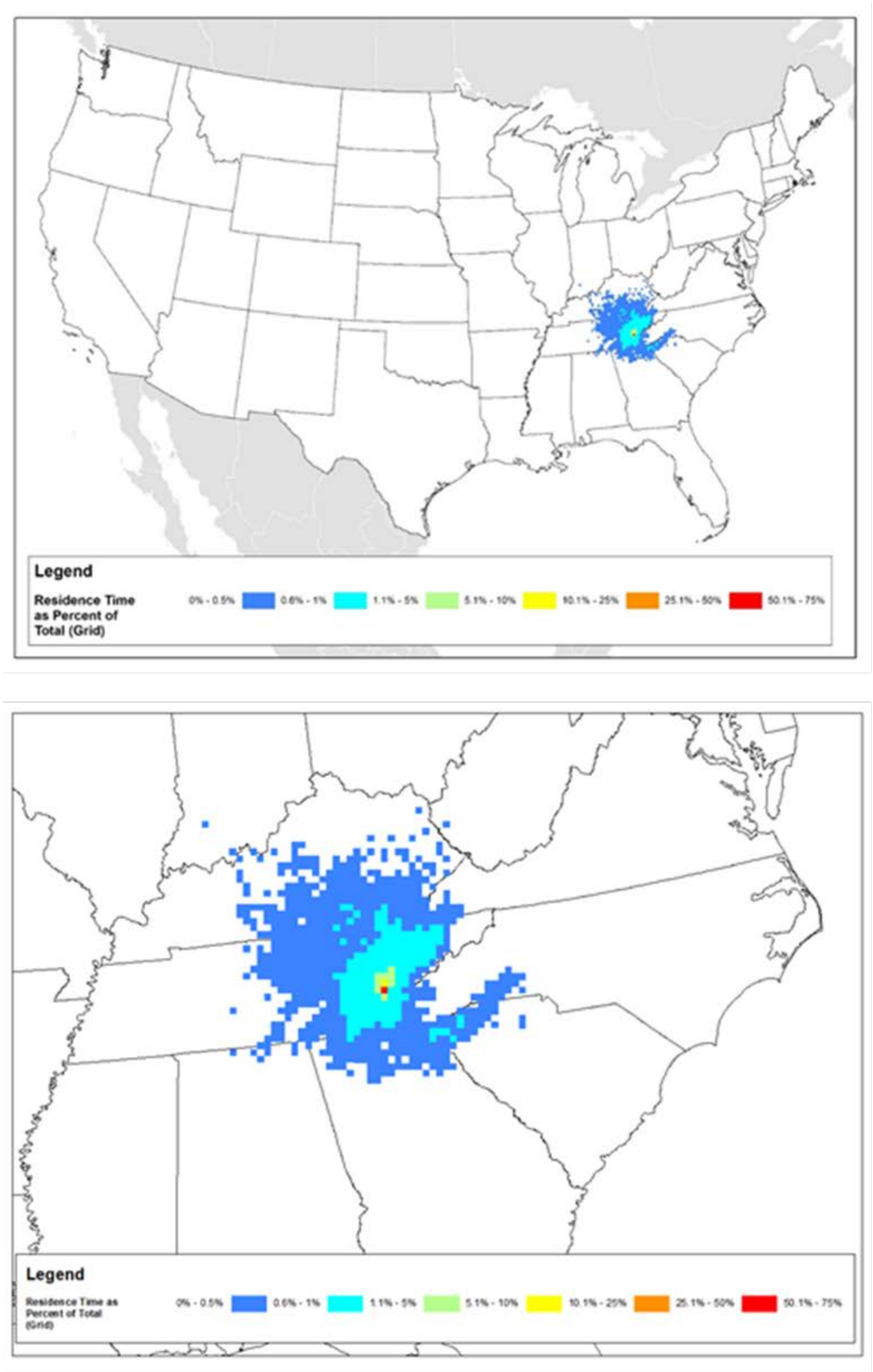

Figure 7-44: Residence Time (% of Total Counts per 12km Modeling Grid Cell for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)

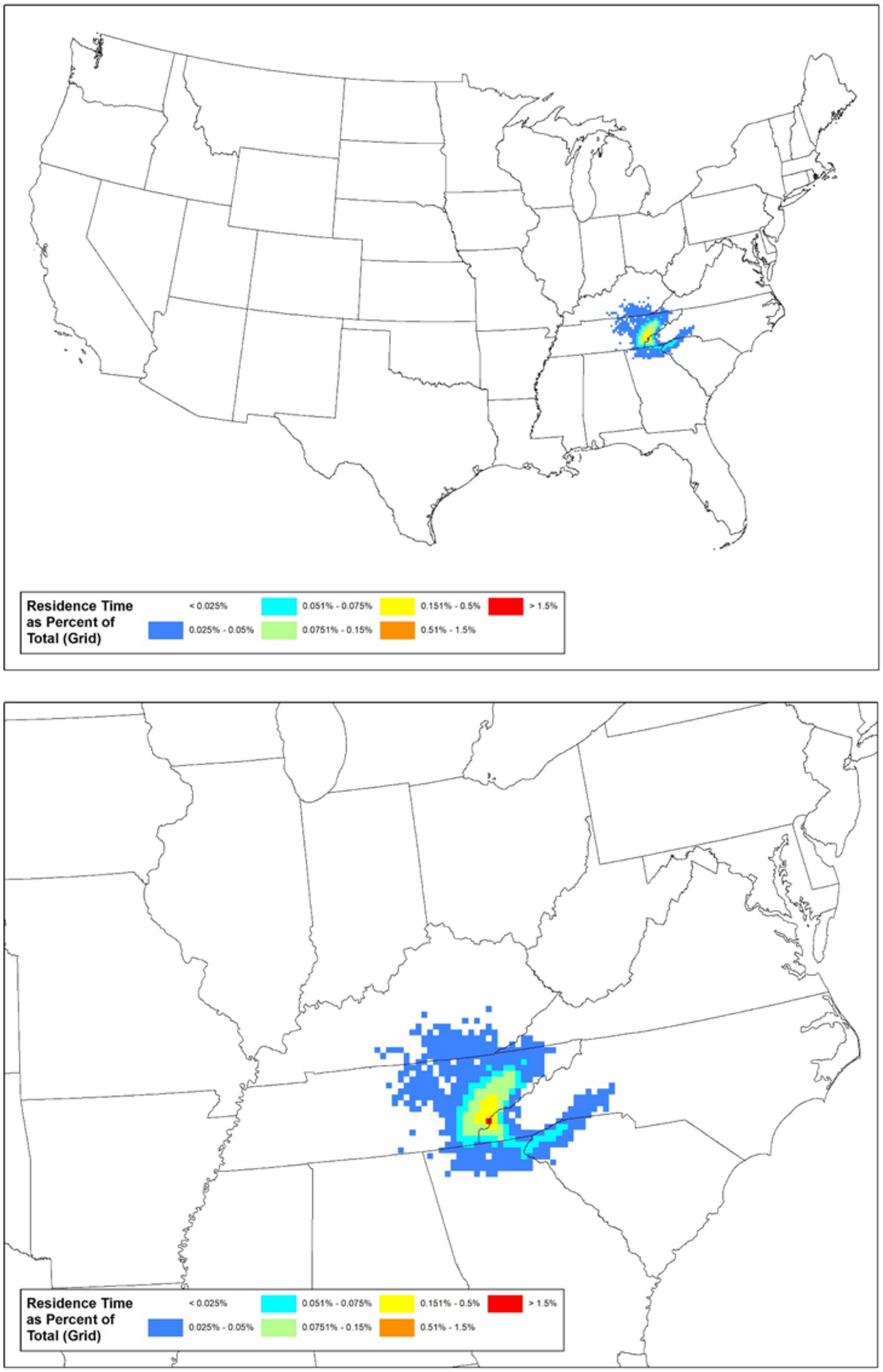

Figure 7-45: Residence Time (% of Total Counts per 12km Modeling Grid Cell for Joyce Kilmer-Slickrock Wilderness Area – Full View (top) and Class I Zoom (bottom)

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

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[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.

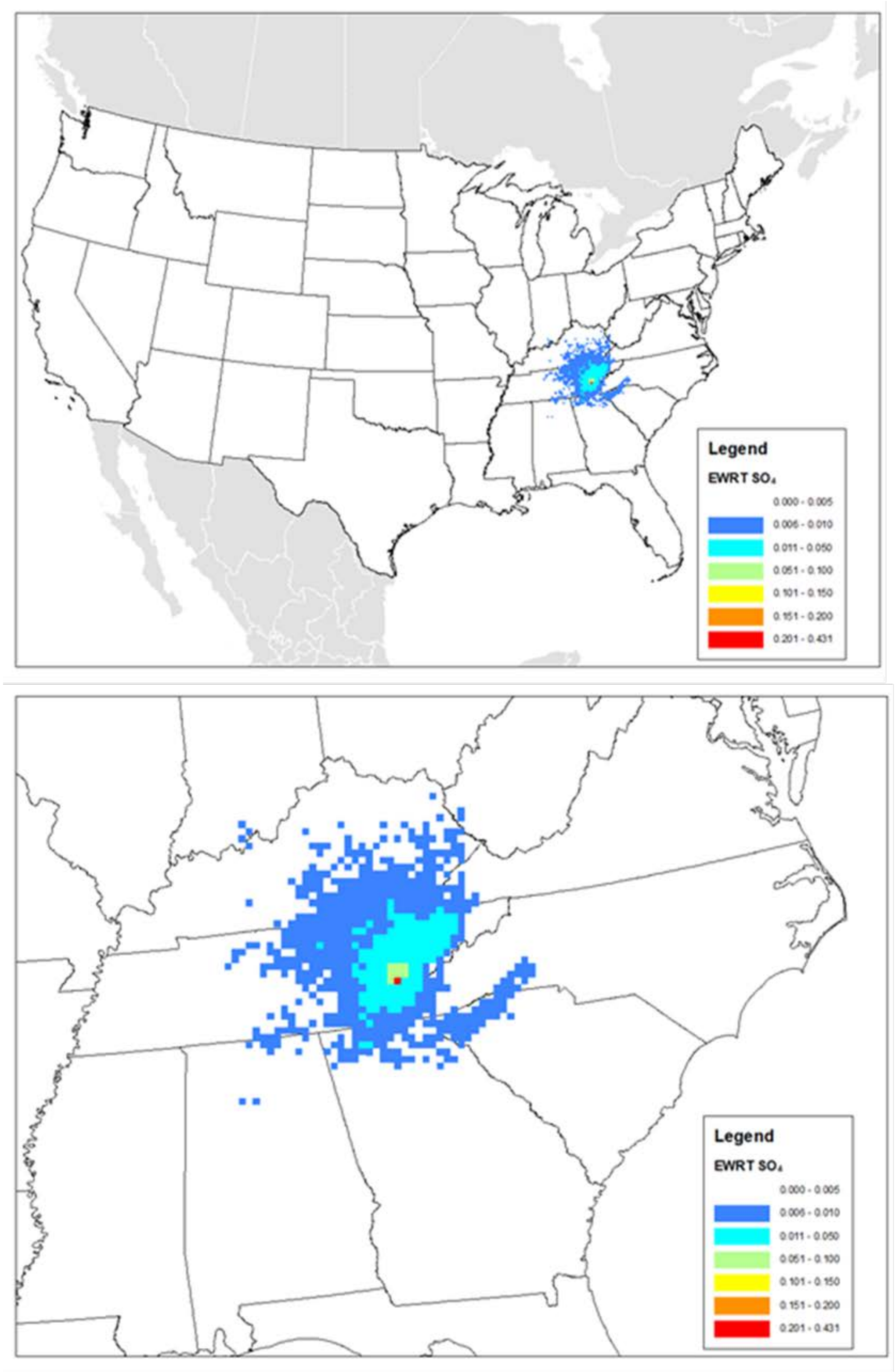

Figure 7-46: Sulfate Extinction Weighted Residence Time (Sulfate EWRT per 12km Modeling Grid Cell) for Great Smoky Mountains National Park - Full View (top) and Class I Zoom (bottom)

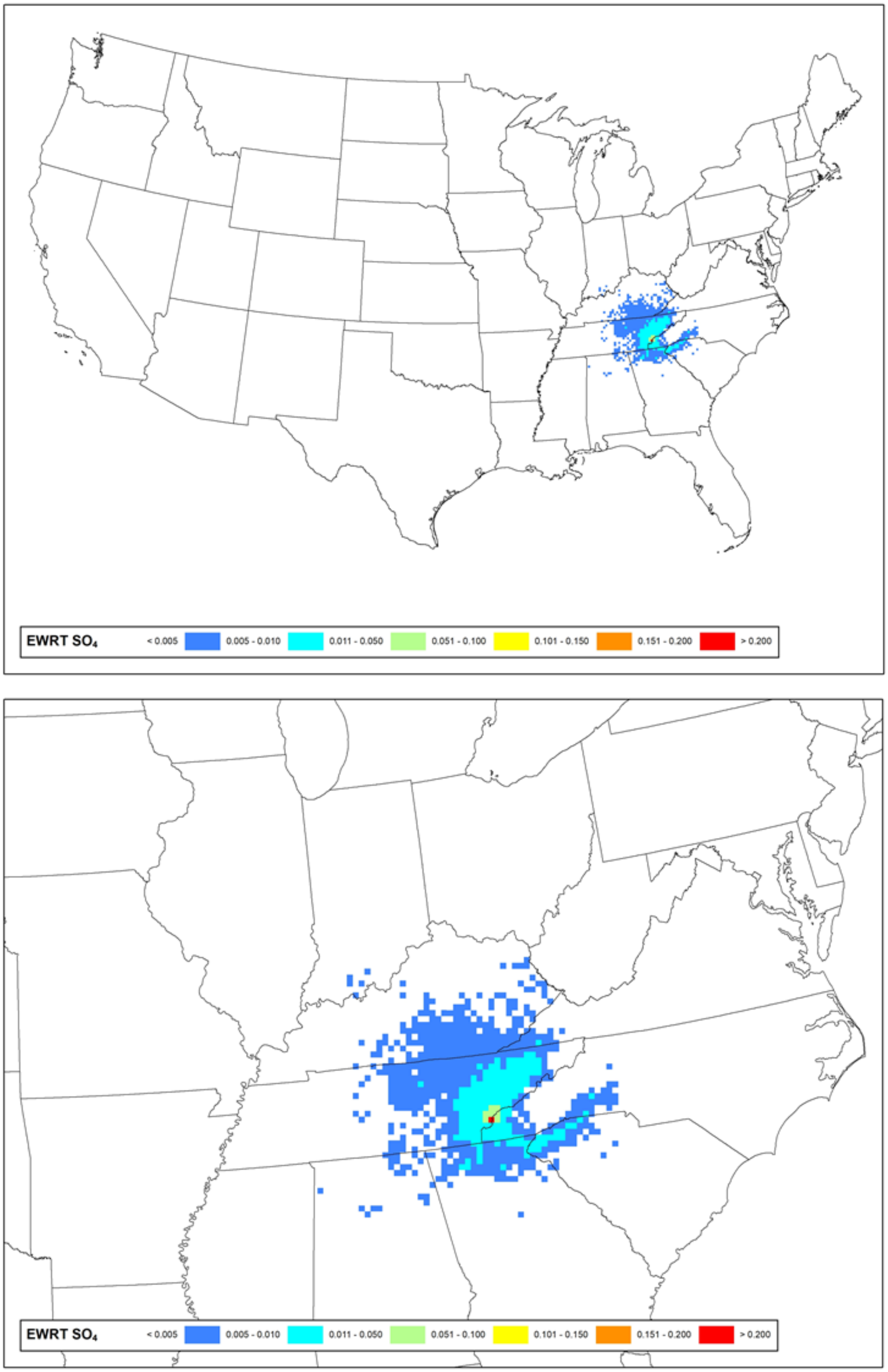

Figure 7-47: Sulfate Extinction Weighted Residence Time (Sulfate EWRT per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area - Full View (top) and Class I Zoom (bottom)

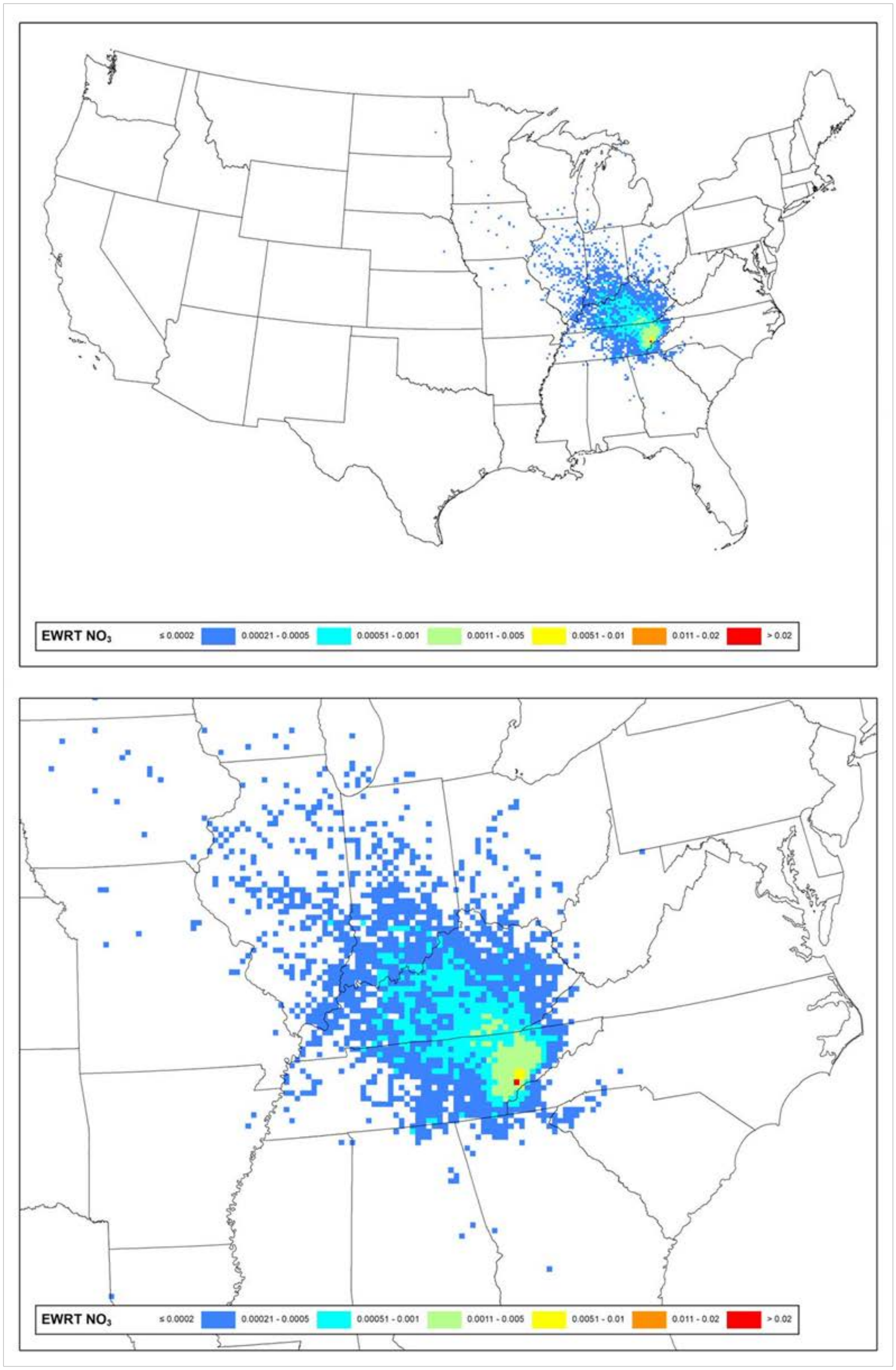

Figure 7-48: Nitrate Extinction Weighted Residence Time (Nitrate EWRT per 12-km Modeling Grid Cell) for Great Smoky Mountains National Park - Full View (top) and Class I Zoom (bottom)

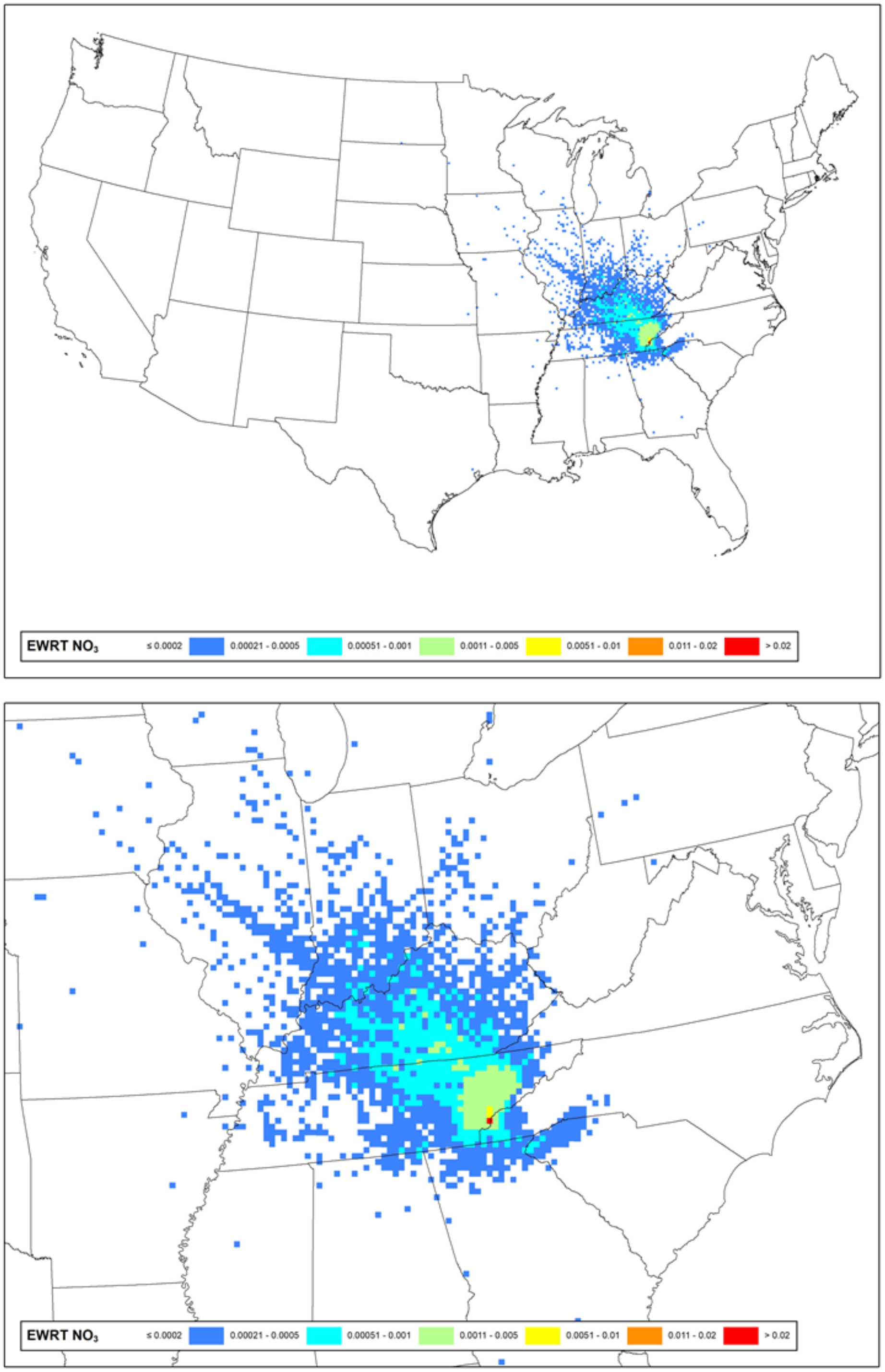

Figure 7-49: Nitrate Extinction Weighted Residence Time (Nitrate EWRT per 12-km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area - Full View (top) and Class I Zoom (bottom)

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.

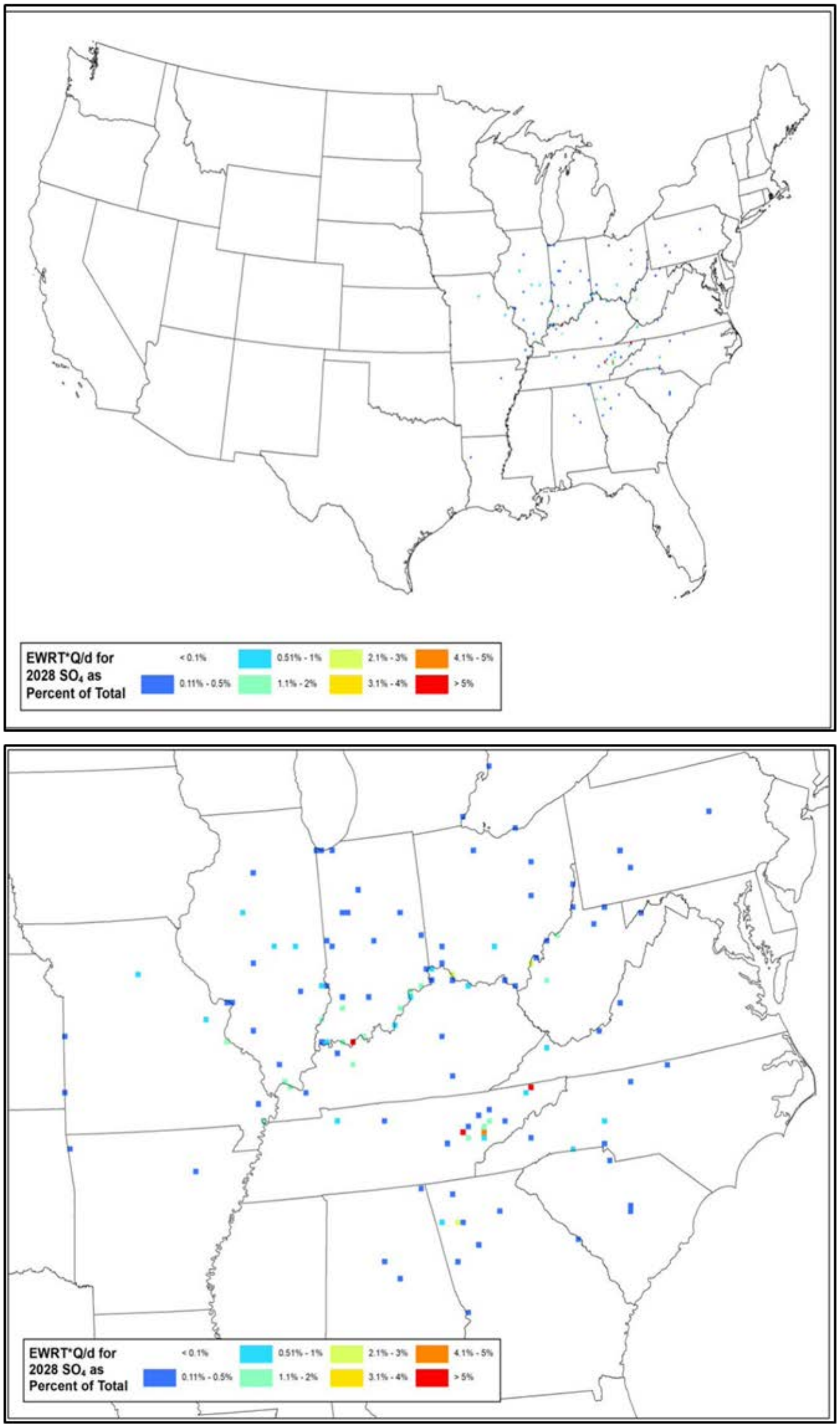

Figure 7-50: Sulfate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)

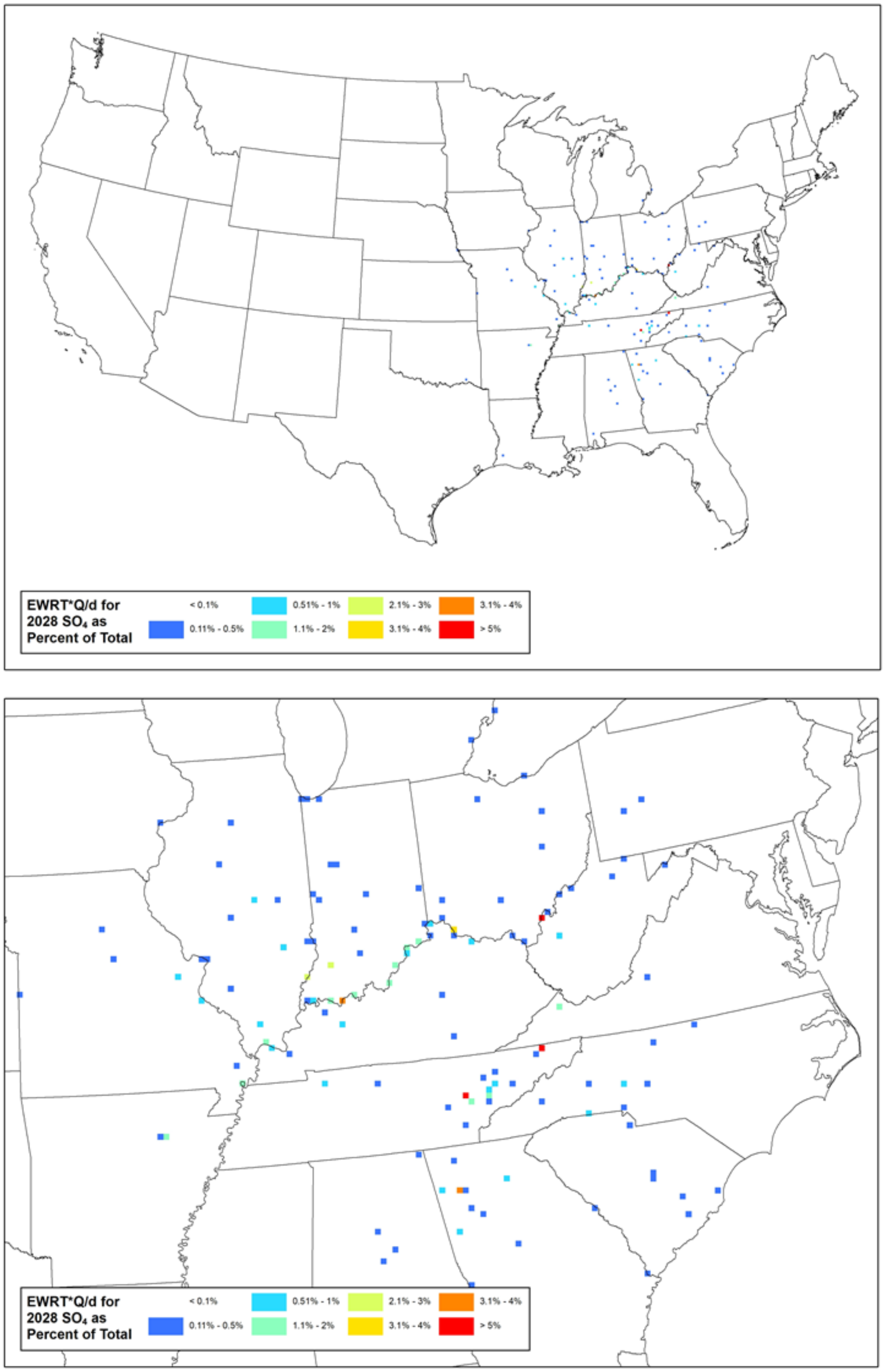

Figure 7-51: Sulfate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area– Full View (top) and Class I Zoom (bottom)

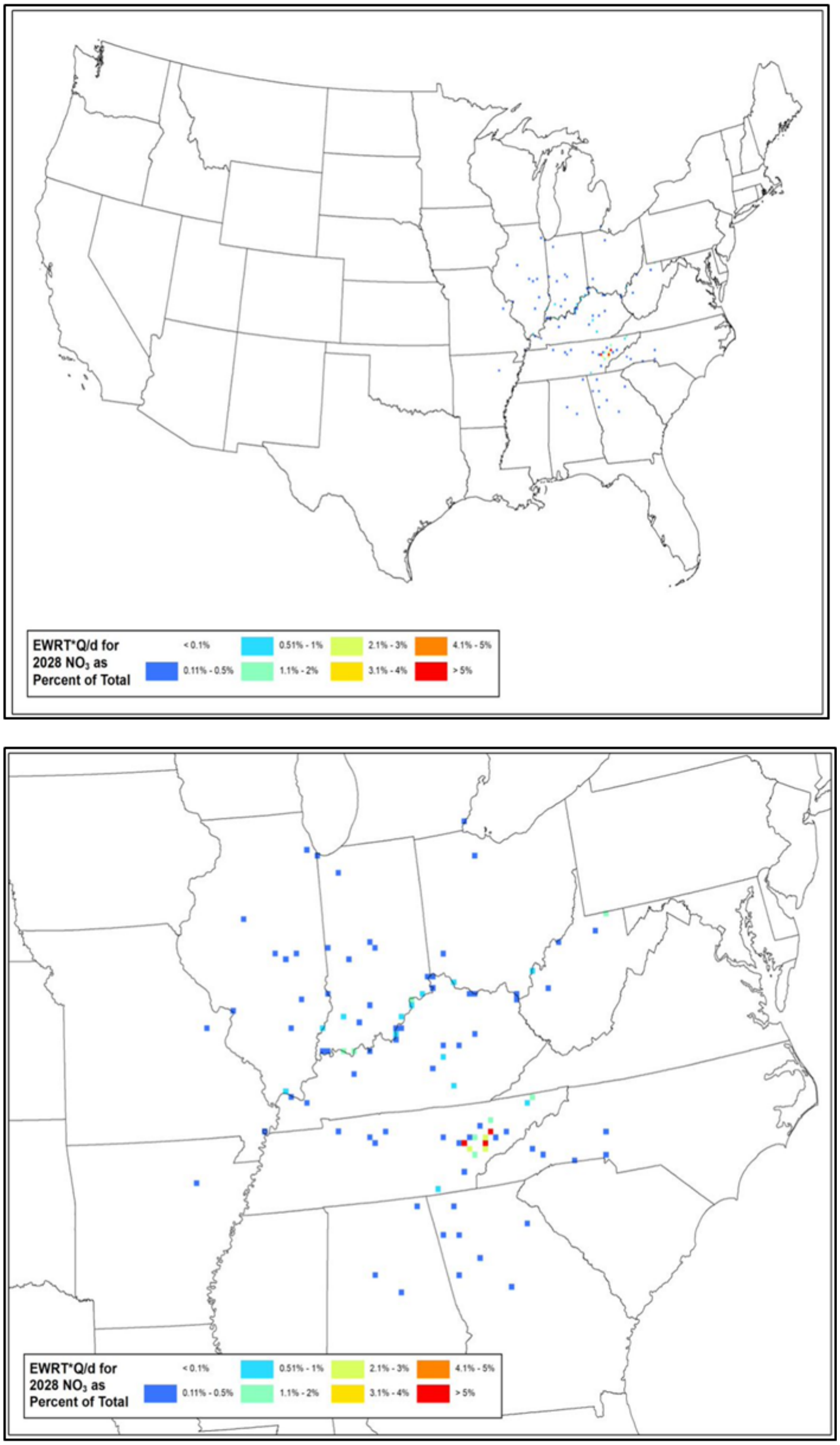

Figure 7-52: Nitrate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Great Smoky Mountains National Park – Full View (top) and Class I Zoom (bottom)

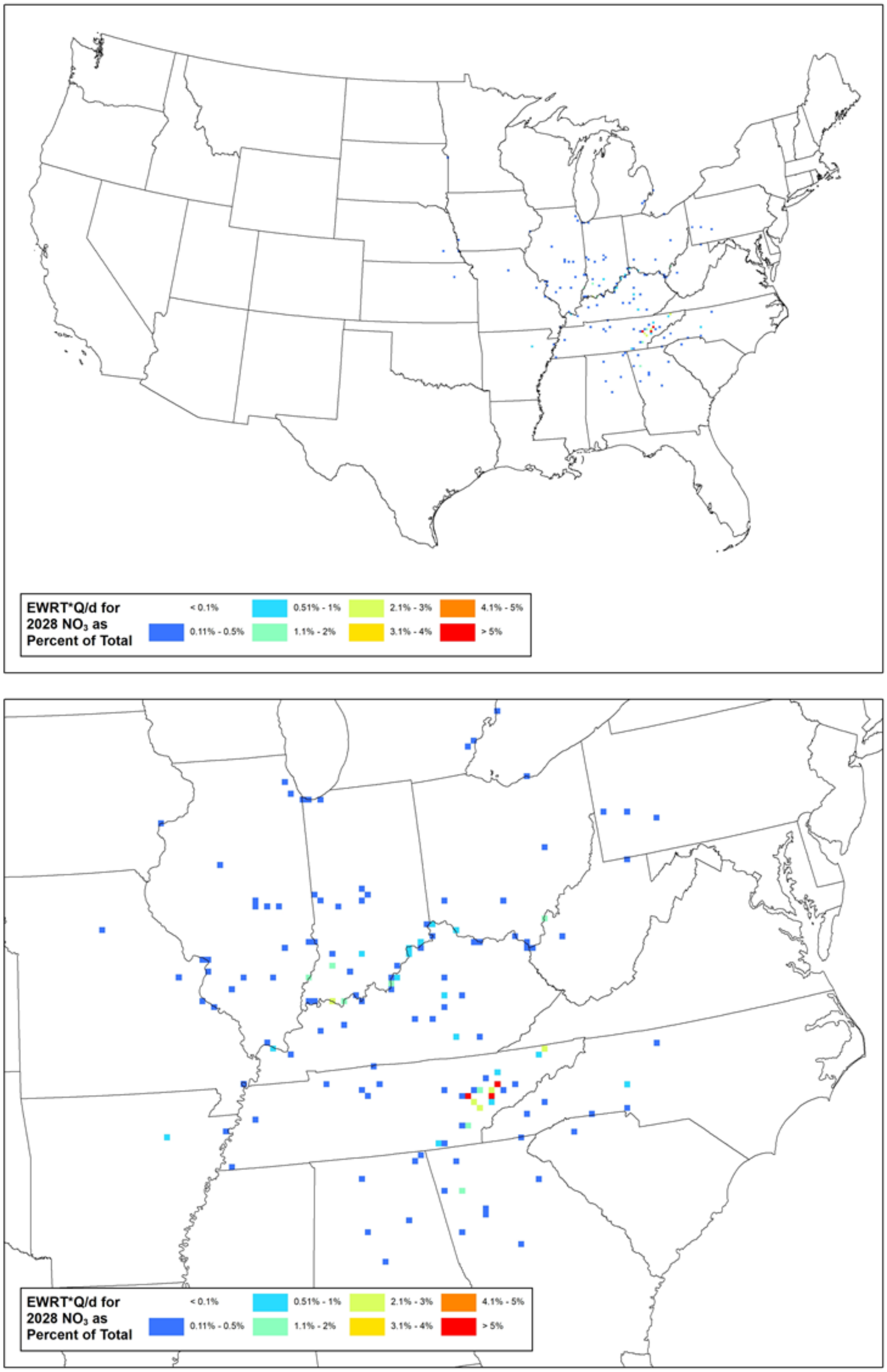

Figure 7-53: Nitrate Emissions/Distance Extinction Weighted Residence Time (% of Total Q/d*EWRT per 12km Modeling Grid Cell) for Joyce Kilmer-Slickrock Wilderness Area– Full View (top) and Class I Zoom (bottom)

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%

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[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.

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 othersh 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.

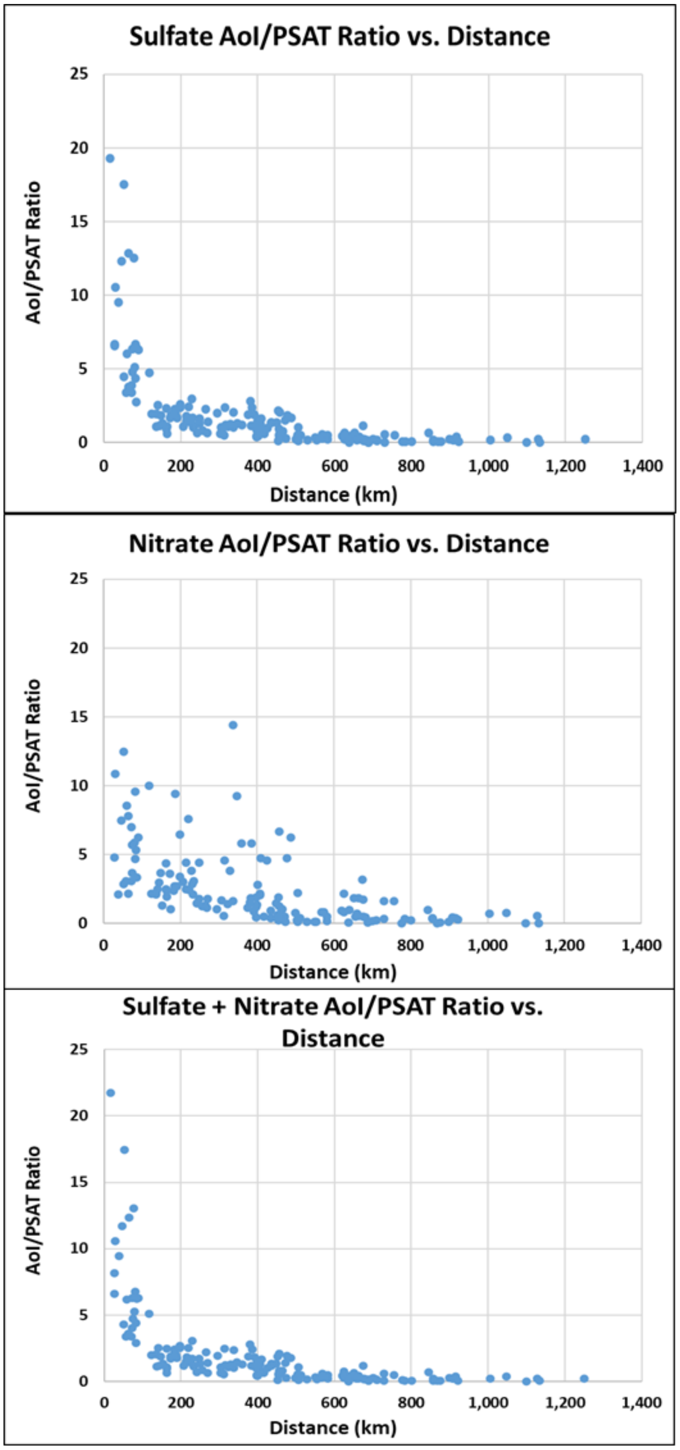

Figure 7-54: Ratio of AoI/PSAT % Contributions for Sulfate as a Function of Distance from the Facility to the Class I Area

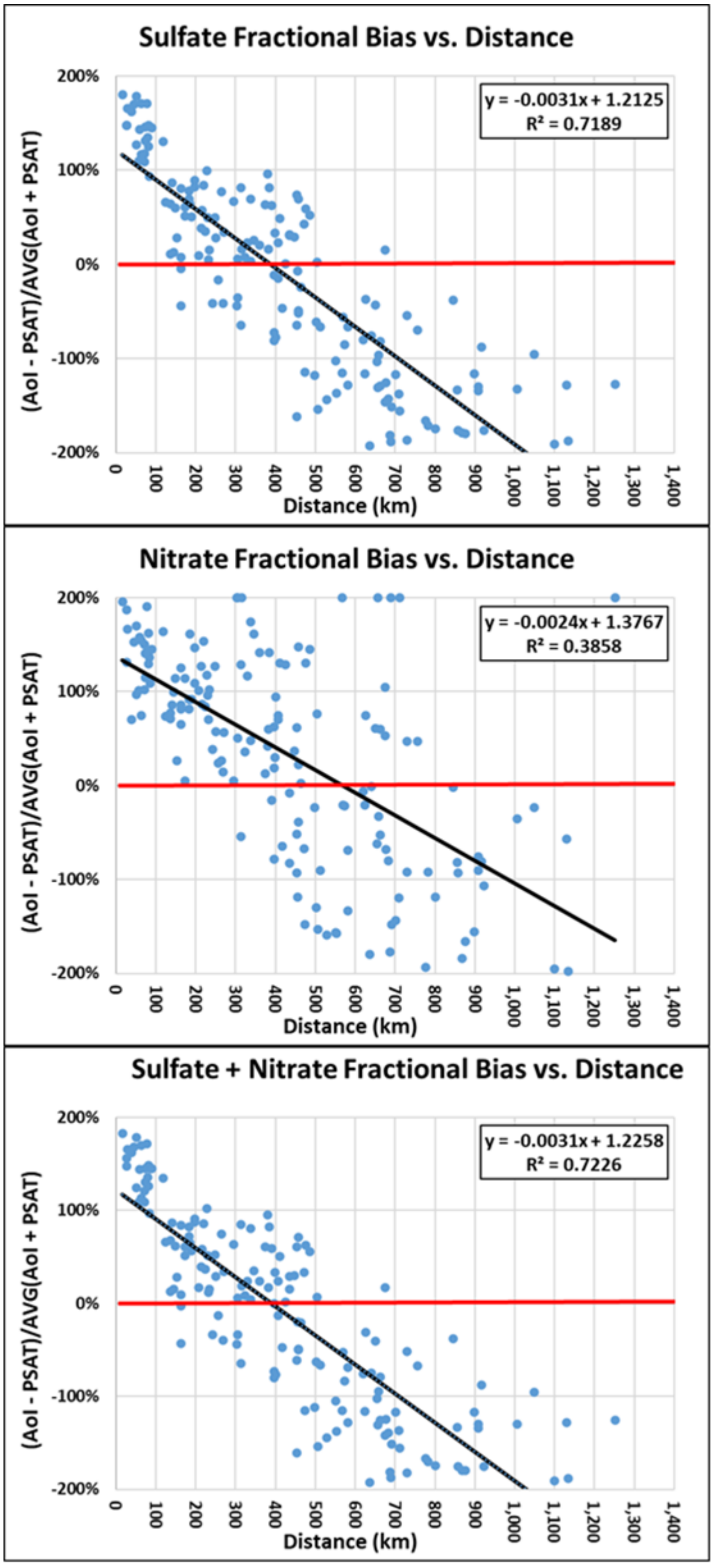

Figure 7-55: Fractional Bias for Sulfate as a Function of Distance from the Facility to the Class I Area

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 0, 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,

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[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 G1.

- 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, Memphis Intl. Airport is expected to grow resulting in the 2028 NO_X value being higher than 2017, 2018, and 2019 values. 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.

- 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. 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 than 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.

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[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. 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 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)

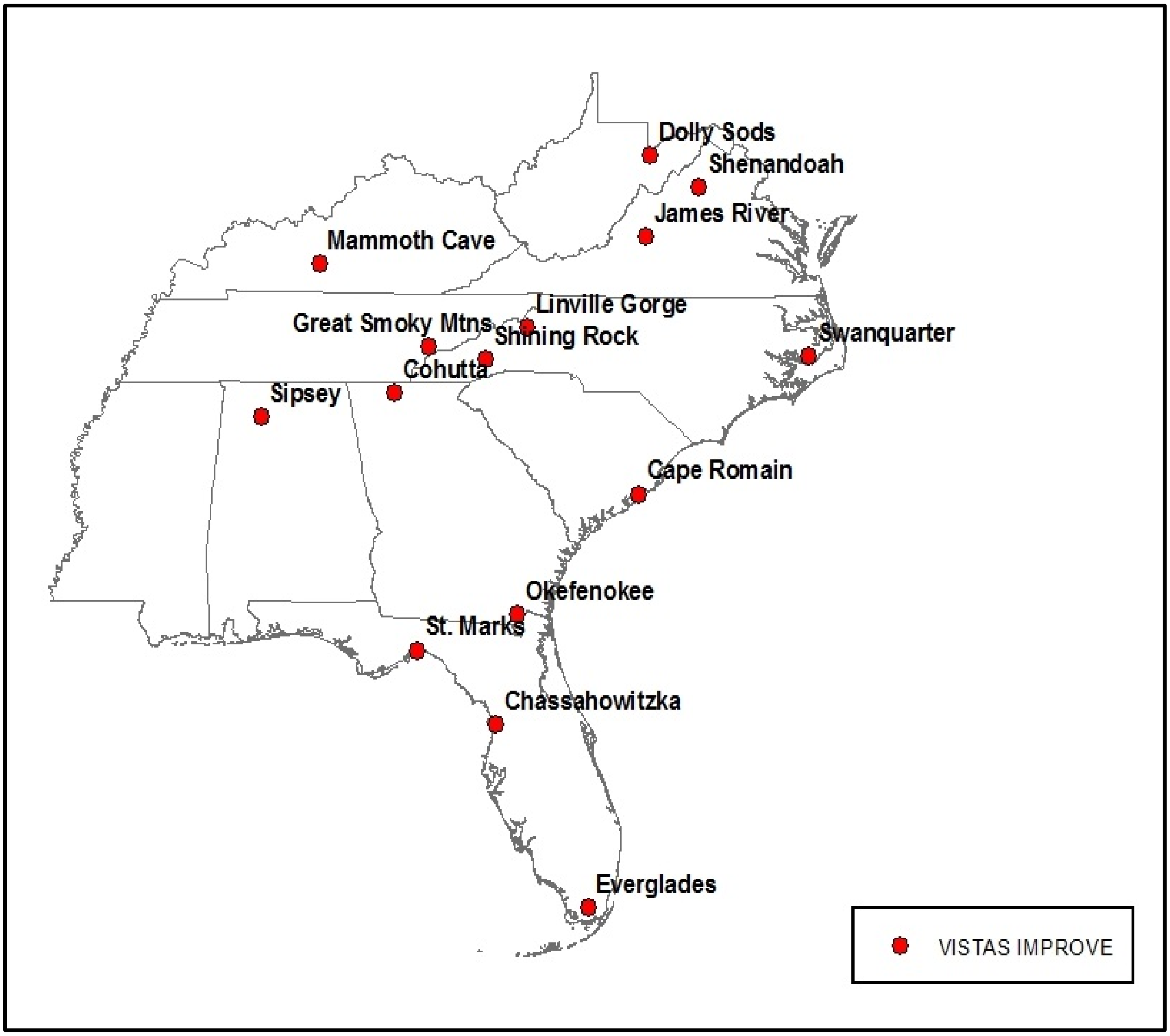

Figure 9-1: VISTAS States IMPROVE Monitoring Network

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	None

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	None
		Joyce Kilmer –Slickrock	1.07%		
Indiana Michigan Power	IN	Great Smoky Mountains	1.25%	VISTAS, June 22, 2020	None
		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
		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
		Great Smoky Mountains	1.03%		

The following summarizes the response received for each facility.

<u>Georgia Power Company – Plant Bowen, GA:</u>

- No response yet

<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. 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.

<u>Gibson, IN:</u>

- The State of Indiana did not provide a response directly to Tennessee or VISTAS. However, in section 7.4 of Indiana Department of Environmental Management's (IDEMs) draft Regional Haze SIP (September 2021), IDEM makes the following statement:

  > 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 SO2 emissions have been reduced in just Indiana alone. Emission trends for both NOx and SO2 have shown dramatic decreases in emissions and as a result, IDEM is not requiring four-factor analyses for its EGUs.

<u>Indiana Michigan Power, IN:</u>

- The State of Indiana did not provide a response directly to Tennessee or VISTAS. However, IDEM makes a statement in its Draft Regional Haze SIP that they are not requiring four-factor analyses for its EGUs (see above).

<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>

- A reasonable progress analysis provided by the state of Ohio asserts that due to the presence of an FGD and SCR system of at least 90% effectiveness, this facility is considered to be effectively controlled. Boilers B003 and B004 have federally enforceable SO_2 emissions limits of 7.41 lb/MMBtu. Both boilers are required to be continuously controlled by FGD systems with an effective control efficiency of 95%. Ohio has requested a four-factor analysis from the facility.

<u>Duke Energy Ohio, Wm. H. Zimmer Station, OH:</u>

- According to the state of Ohio, Zimmer Power Station has announced a planned shutdown in 2027. The intention of the state of Ohio is to make this commitment sufficiently federally enforceable to avoid the need for a four-factor analysis. At the time of writing this SIP, TDEC-APC is not aware that a federally enforceable requirement has been finalized.

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.[63] 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, 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

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[63] "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

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.

- <u>Technical Analysis – Inventories, Modeling, and Evaluation:</u> 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.[64]

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." "[65]

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; 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

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[64] *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (December 1998).

[65] *Federal Register,* Vol. 82, No. 10, Tuesday, January 17, 2017, Page 5195.

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: Regional haze SIPs (including the reasonable progress goals that are set for each Class I area) should only include emission reductions that are permanent, quantifiable, and enforceable. Therefore, 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 made permanent and enforceable 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 permanent and 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.

Date	Description
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.

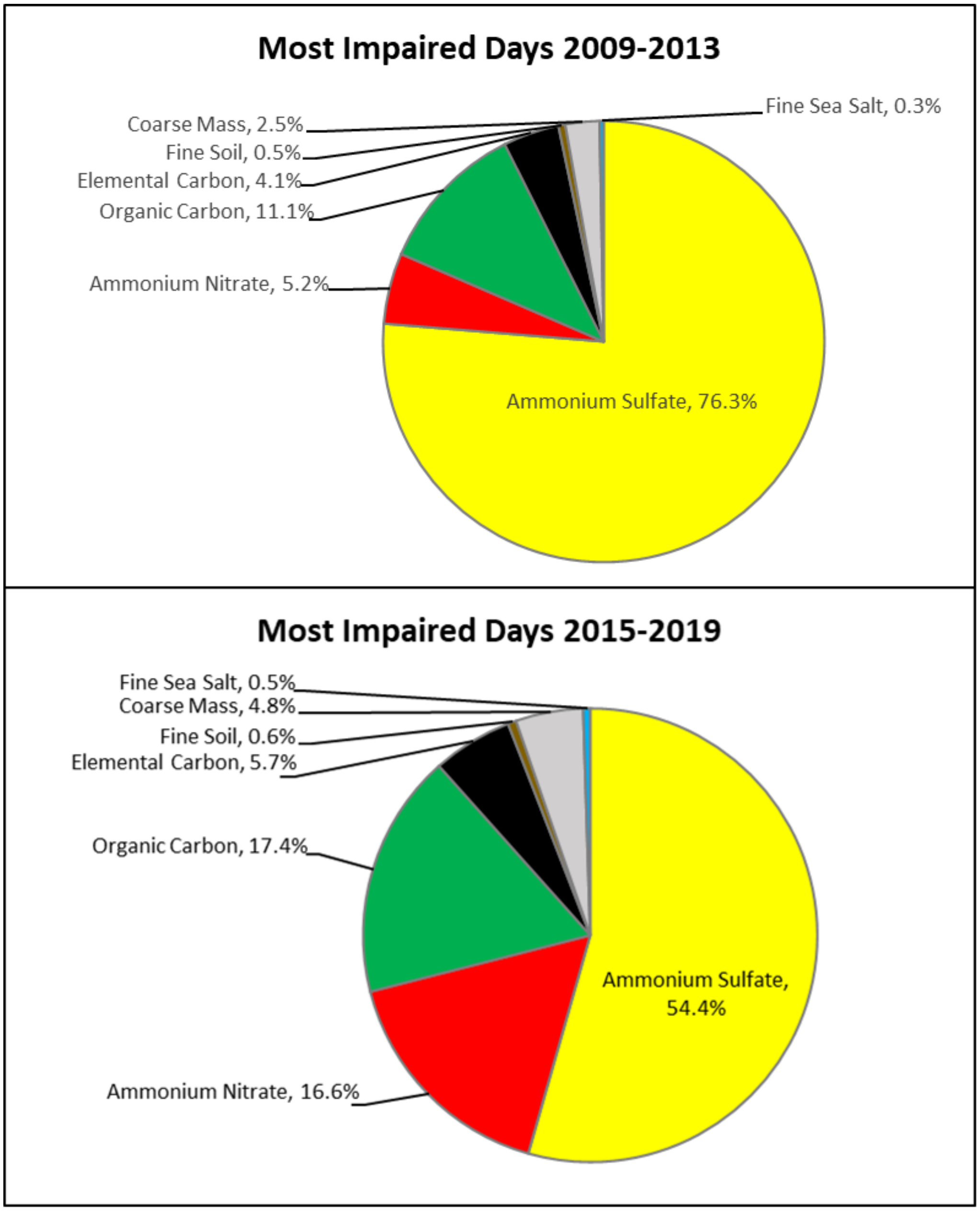

Figure 10-1: Comparison of Five-Year Average (2009-2013 vs. 2015-2019) Particle Contributions to Light Extinction for 20% Most Impaired Days at Great Smoky Mountains National Park

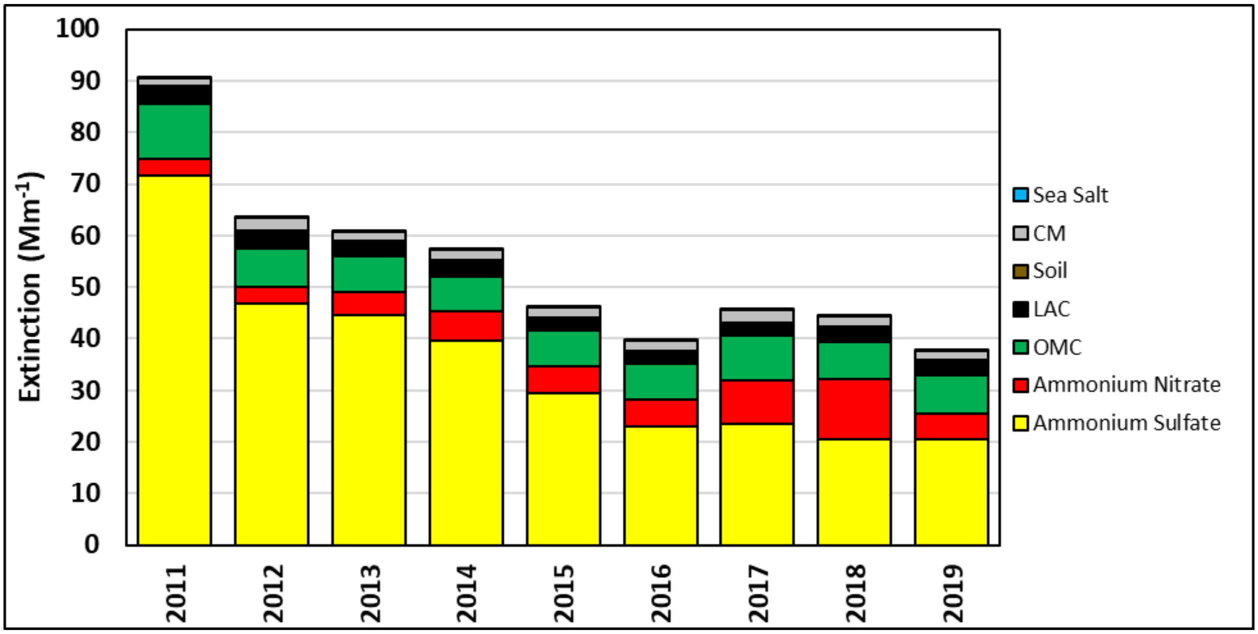

Figure 10-2: Particle Contributions to Light Extinction for 20% Most Impaired Days at Great Smoky Mountains National Park for 2011-2019

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.

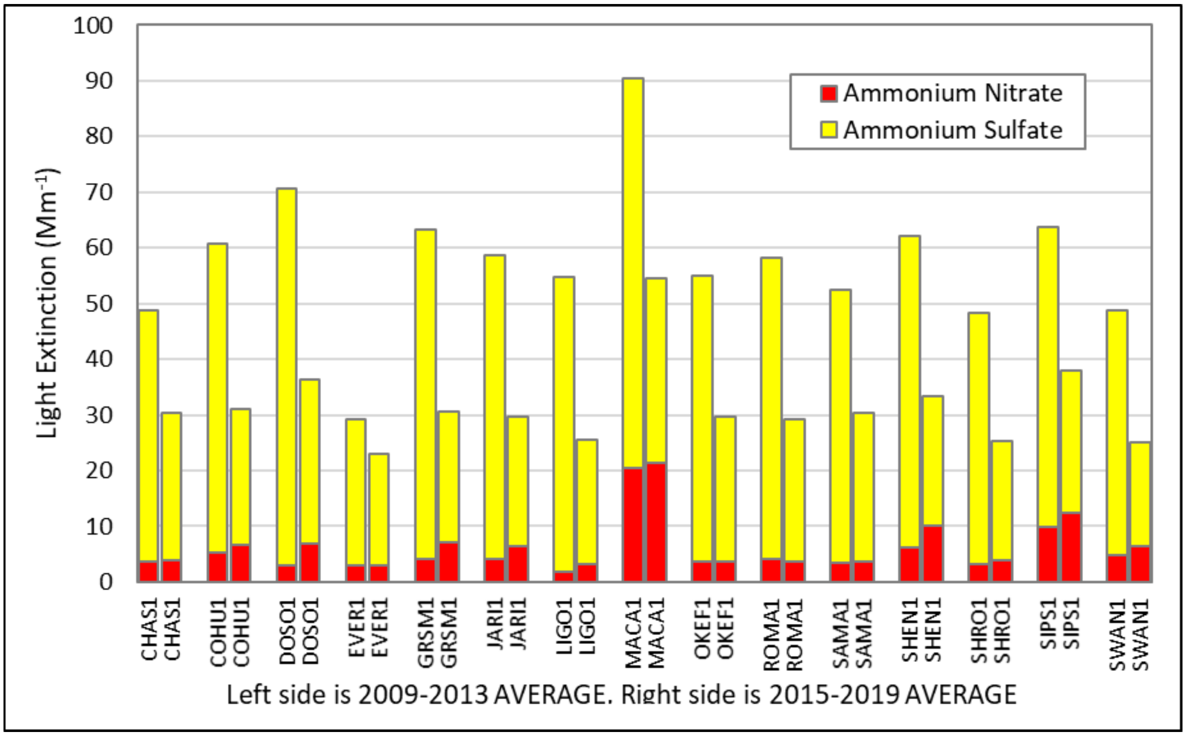

Figure 10-3: Comparison of Ammonium Sulfate and Ammonium Nitrate Five-Year Average (2009 – 2013 vs. 2015 – 2019) Contributions to Visibility Impairment for 20% Most Impaired Days

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.

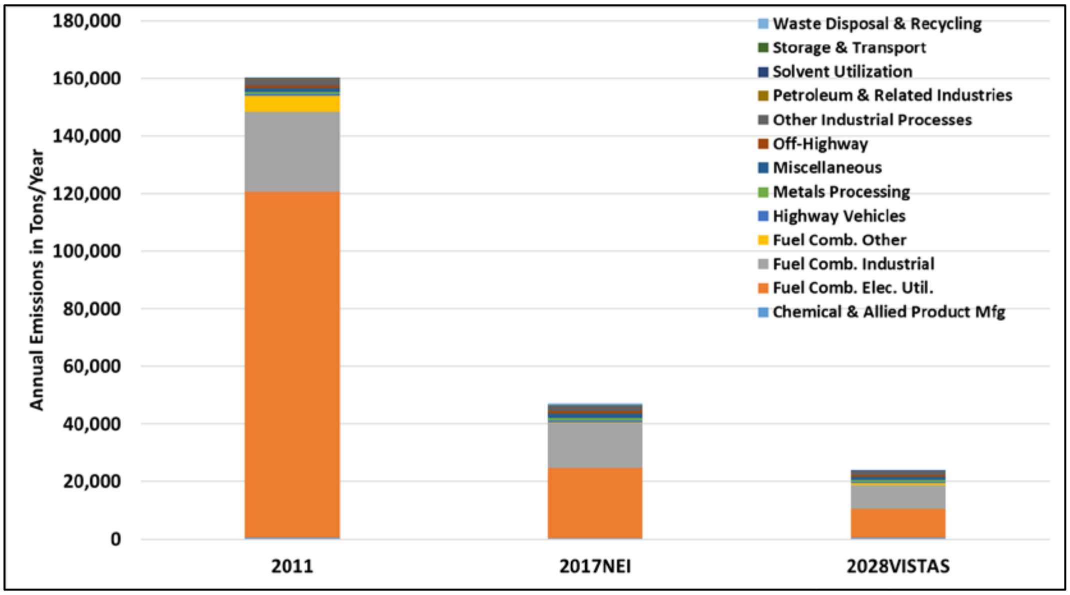

Figure 10-4: Tennessee SO_2 Emissions Trends by Sector

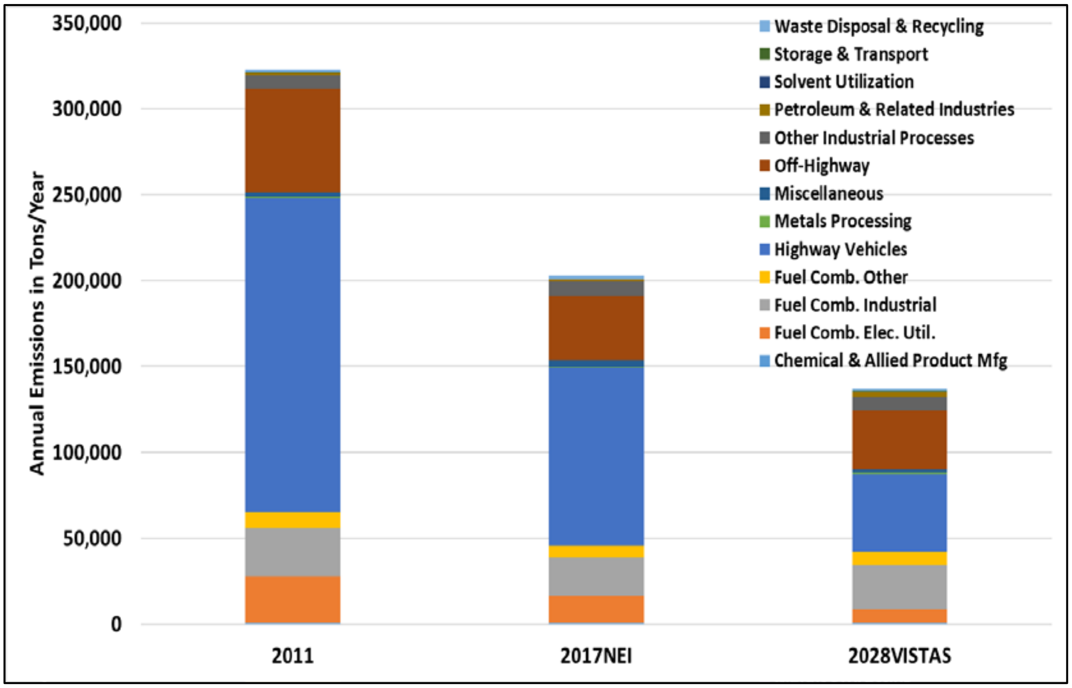

Figure 10-5: Tennessee NO_x Emissions Trends by Sector

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.

Summary and Conclusions

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.

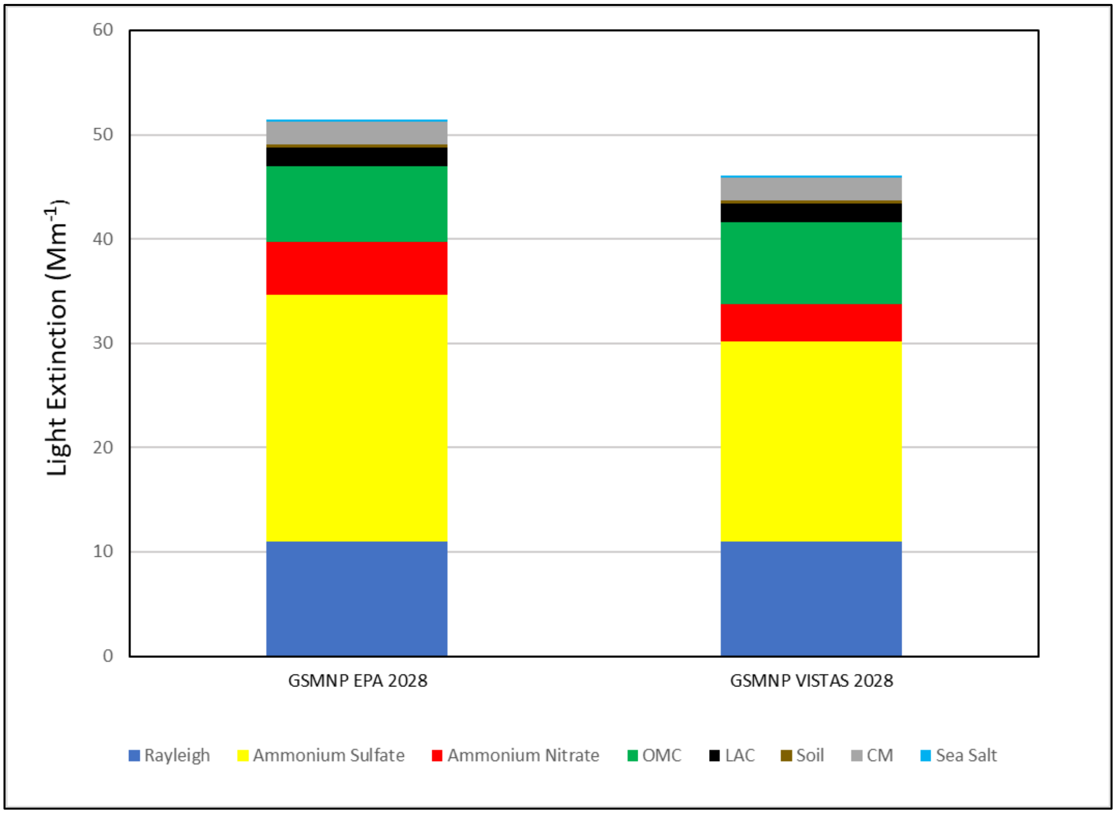

Figure 10-6: Projected 2028 Speciated Visibility Impairment for 20% Most Impaired Days at Great Smoky Mountains National Park (GSMNP)

- 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:

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

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.[66] 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:

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[66] 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. 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. Additionally, TVA is planning on retiring all of the units at TVA Kingston by 2033. Therefore, the TDEC-APC does not think it is necessary to conduct a reasonable progress analysis for TVA Kingston. Additionally, the TDEC-APC has consulted with EPA Region 4 and has concluded that enforceable SIP limits are not required. 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[67] 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

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[67] 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 Smoke 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. [68]

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[68] 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.)

TVA Gallatin

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

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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. *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*." (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, **unforeseen weather-related delays, strikes and labor shortages, escalation increases in equipment costs, increases in labor costs**, 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

TDEC-APC Response

TVA Cumberland

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

	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%

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 prior precedent. TVA is retrofitting an existing scrubber and not installing a new scrubber. As we indicated in our four-factor analysis, the 30-year scrubber life appears to represent the life of a new unit, not a retrofitted unit. We also noted TVA's pending retirement of Cumberland's units between 2026 and 2033, so a 30-year life is not appropriate.

As discussed elsewhere, Tennessee declined to consider NO_X emissions for reasonable progress during the second planning period.

TVA Kingston

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 South Carolina 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.

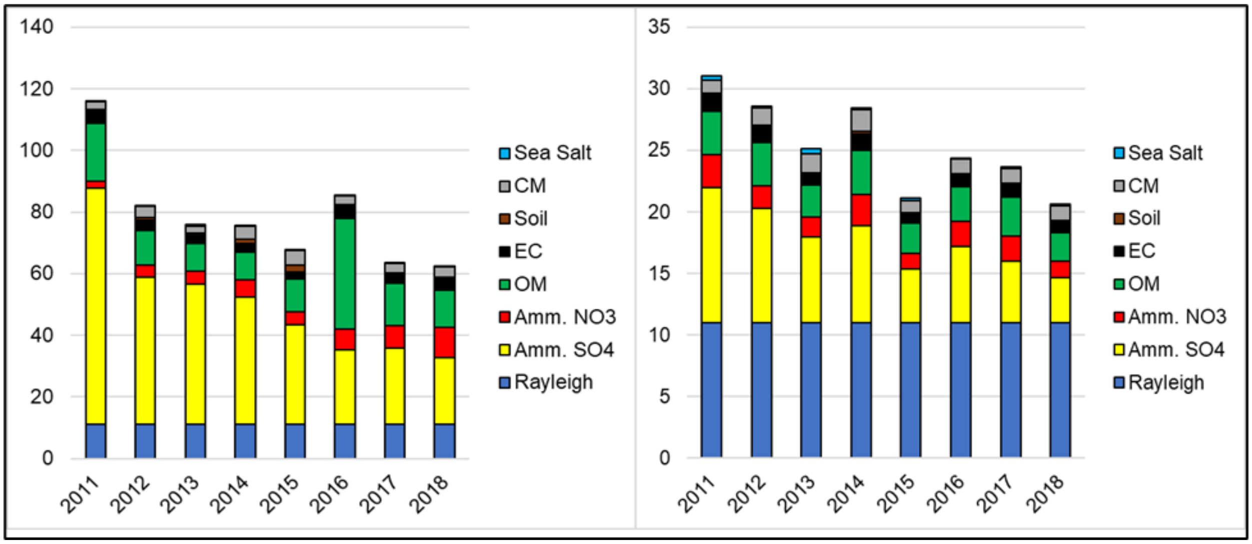

Figure 13-1: Annual Average Light Extinction for the 20% Worst Visibility Days (left) and the 20% Clearest Visibility Days (right) at Great Smoky Mountains National Park

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 Florida 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.

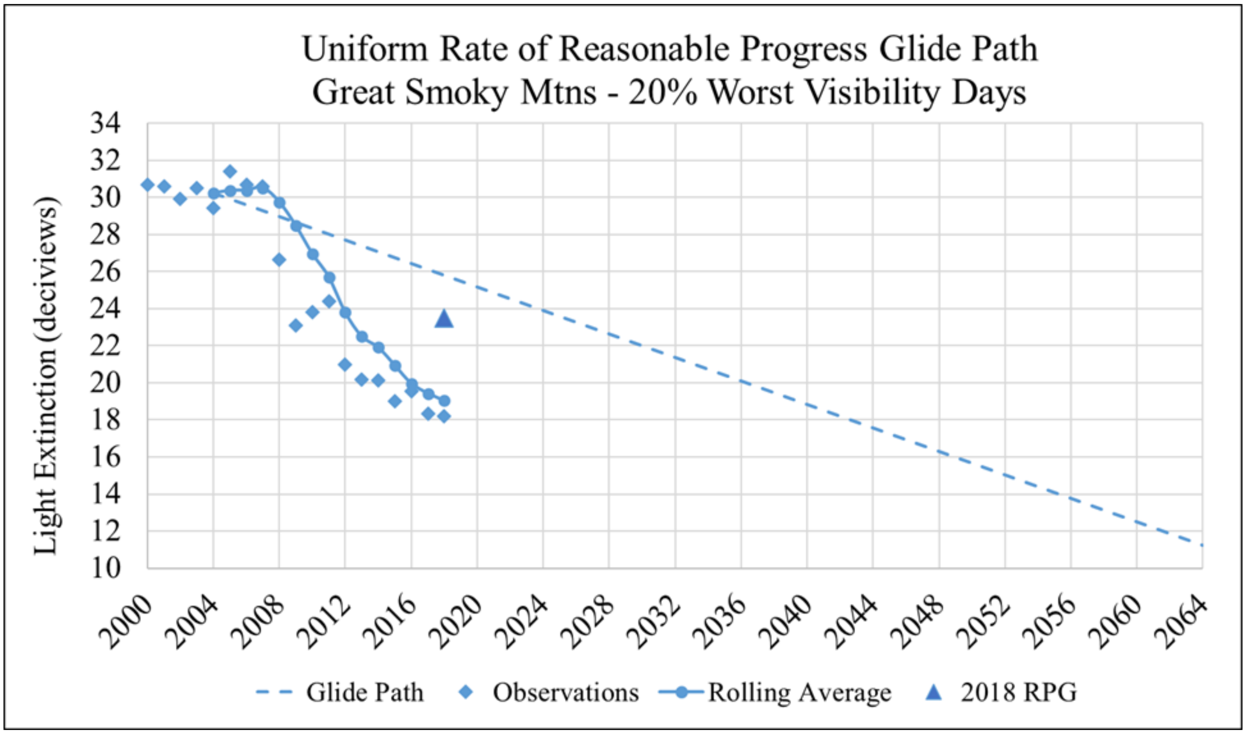

Figure 13-2: Great Smoky Mountains National Park Visibility Impairment on the 20% Worst Visibility Days, Glide Path, and 2018 RPG

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.

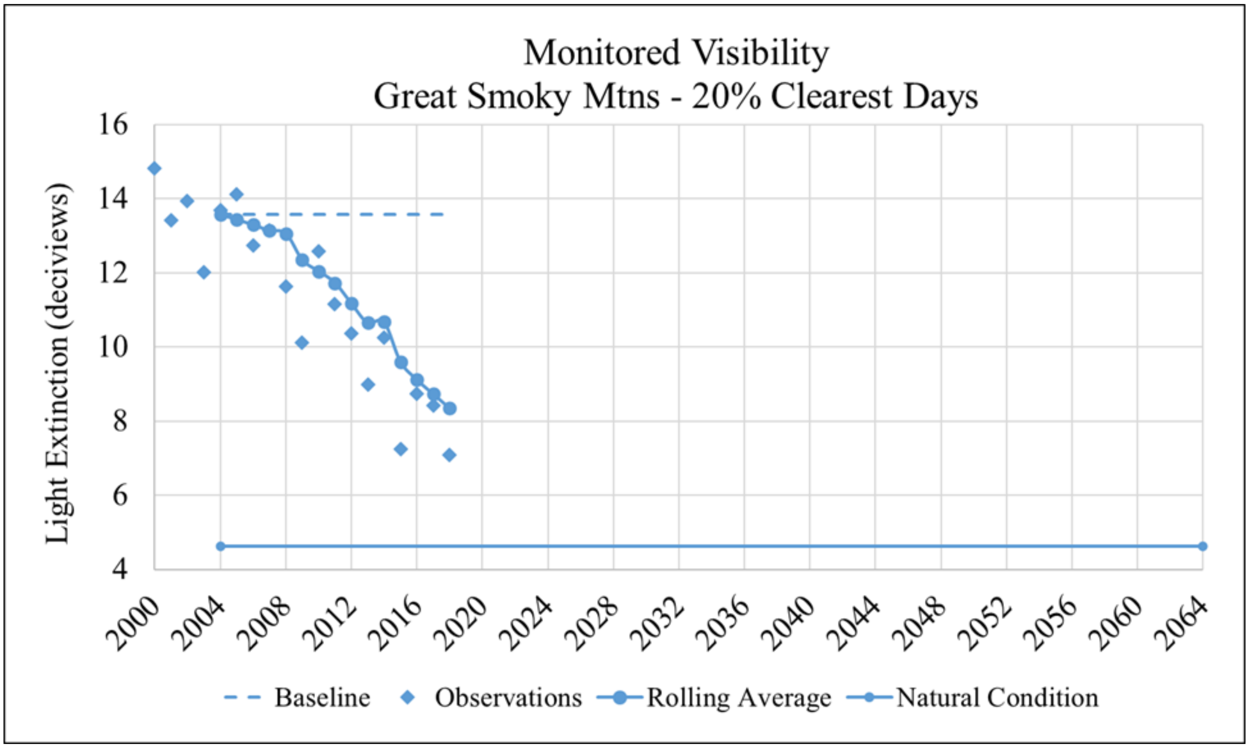

Figure 13-3: Great Smoky Mountains National Park Visibility Impairment on the 20% Clearest Days and Natural Conditions

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.

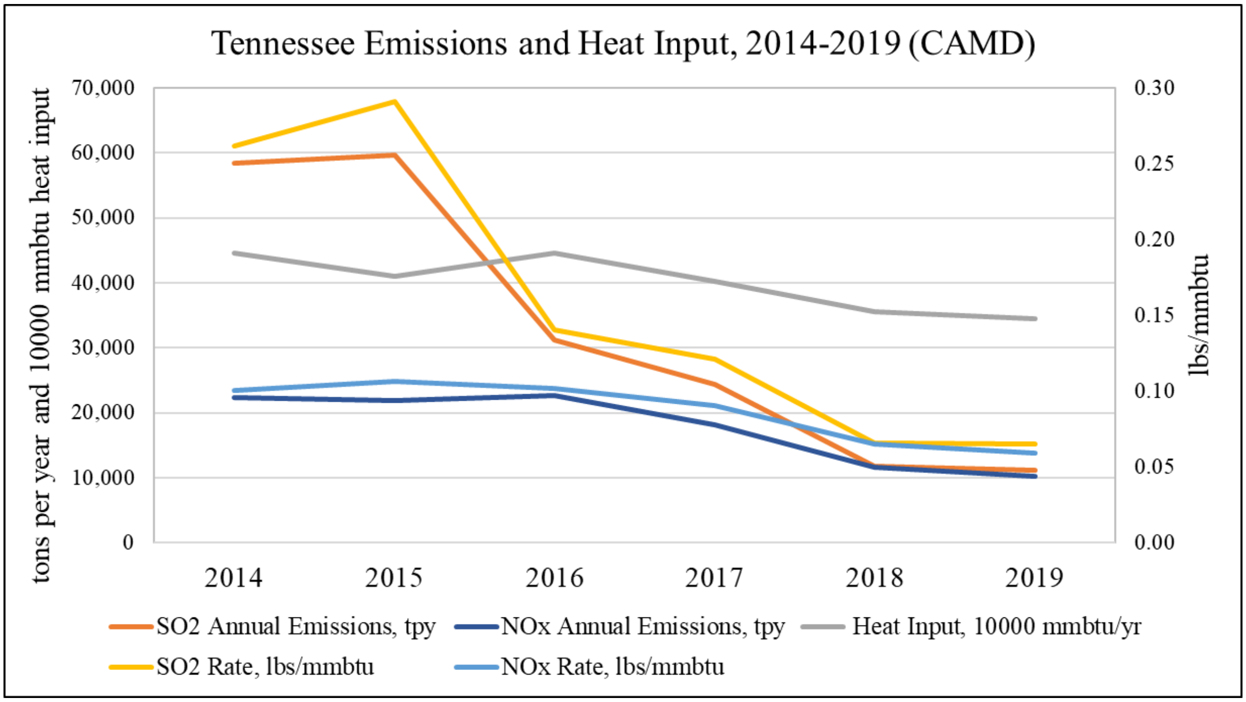

Figure 13-4: Tennessee CAMD Emissions and Heat Input Data *(Source: EPA CAMD Database)*

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.

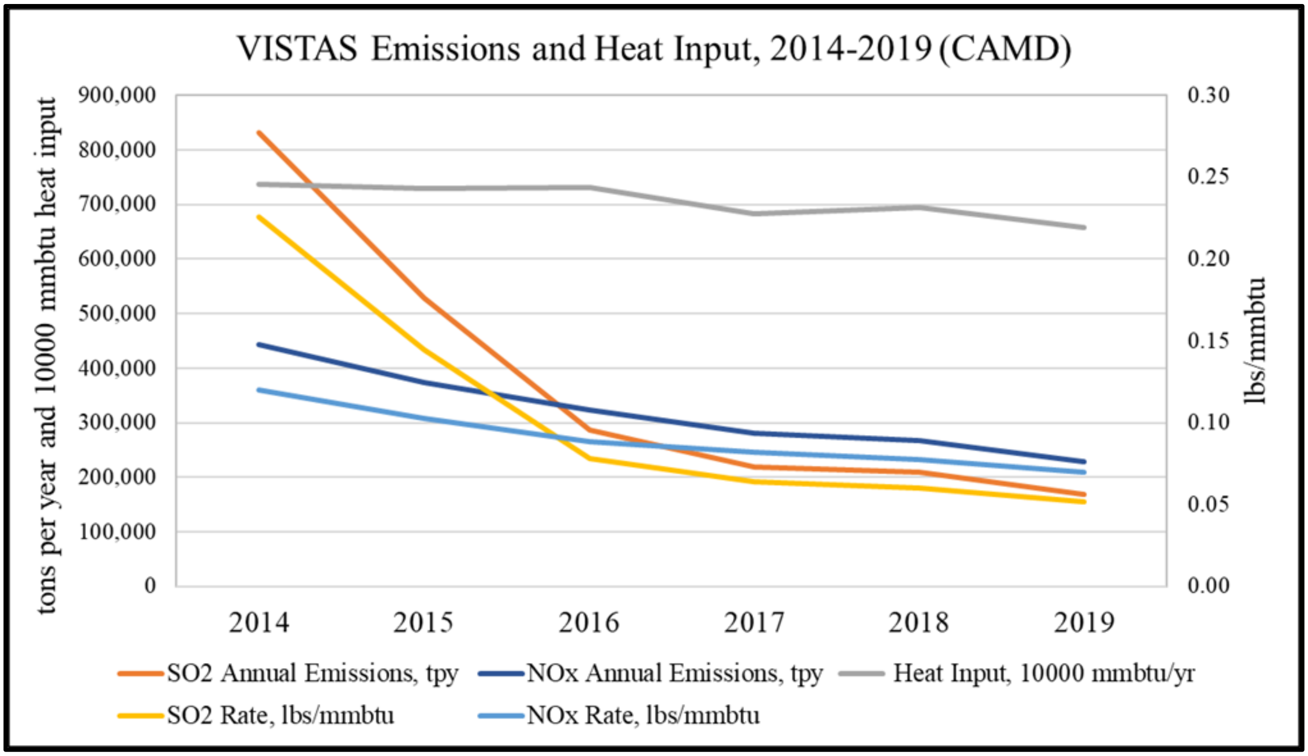

Figure 13-5: VISTAS CAMD Emissions and Heat Input Data *(source: EPA CAMD Database)*

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.

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Regional Haze
State Implementation Plan

Mark A. Reynolds, Environmental Consultant

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).

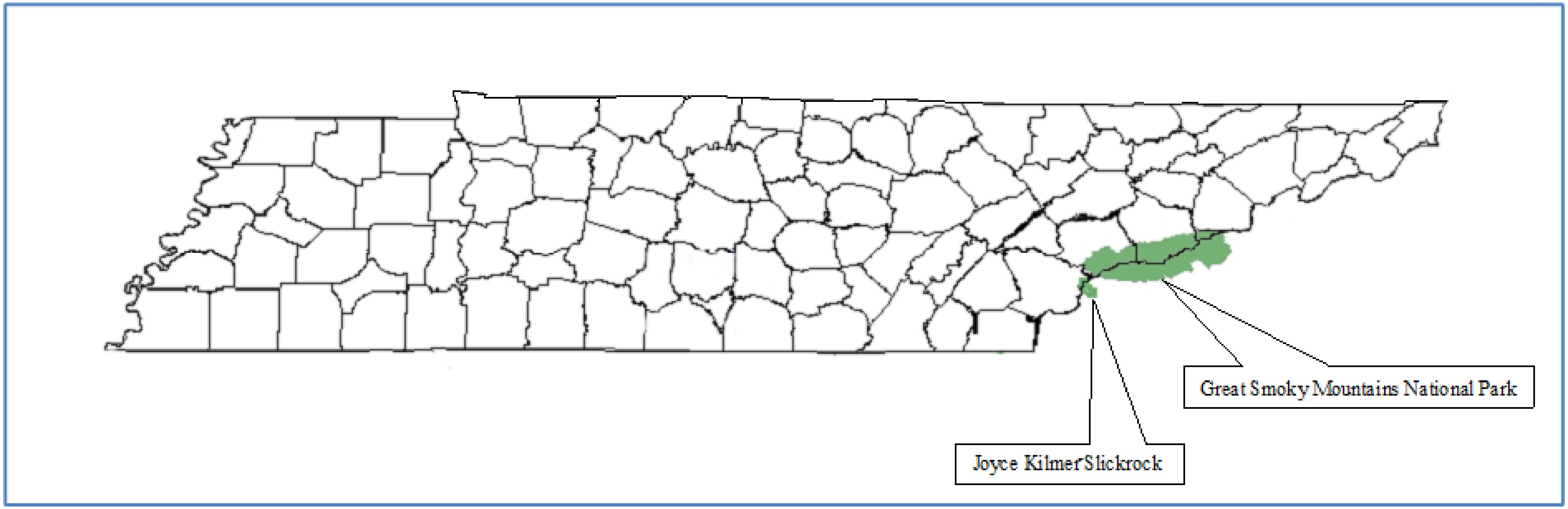
- Regional haze is caused by sources and activities emitting fine particles and their precursors, often transported over large regions.

Regional Haze SIP

- Particles affect visibility through the scattering and absorption of light.
- 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 Visibility Improvement State and Tribal Association of the Southeast (VISTAS) region.
- Contractors: ERG and Alpine


Dolly Sods
Otter Creek
Shenandoah
Mammoth Cave
James River Face
Great Smoky Mountains
Linville Gorge
Joyce Kilmer-Slickrock
Shining Rock
Swanquarter
Cohutta
Sipsey Wilderness
Cape Romain
Wolf Island
Okefenokee
St. Marks
Chassahowitzka
Everglades
N
W
E
S

Regional Haze SIP

- Visual range is the greatest distance at which a dark object can be viewed against the sky.
- The measure used by the regional haze rule is the deciview (dv), calculated directly from light extinction using a logarithmic scale
- Inverse megameter (Mm^{-1})

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

Regional Haze SIP

- Rule requires states to calculate the baseline (2000-2004), current, and natural visibility conditions for each Class 1 Federal area located within the state

- 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

Regional Haze SIP

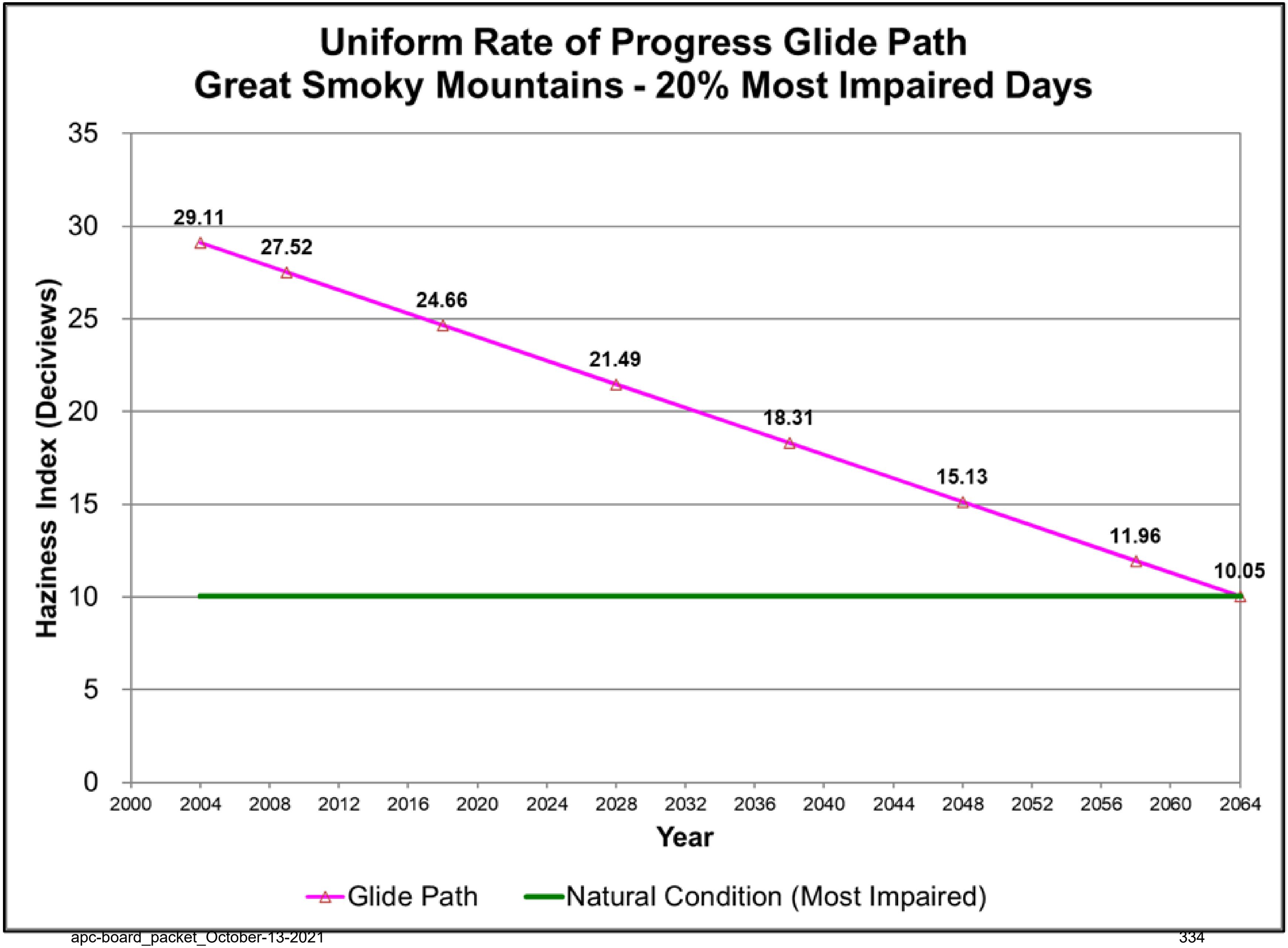
- The rule directs states to graphically show what would be a “uniform rate of progress” (URP), also known as the “glide path”, toward natural conditions for each Class I area within the State

- Most Class I areas have IMPROVE monitors. Interagency Monitoring of Protected Visual Environments (IMPROVE)

IMPROVE monitoring data

- Most impaired days means the 20% of monitored days in a calendar year with the highest amounts of anthropogenic visibility impairment

- Clearest days means the 20% of monitored days in a calendar year with the lowest values of the deciview index


Uniform Rate of Progress Glide Path
Great Smoky Mountains - 20% Most Impaired Days
Haziness Index (Deciviews)
35
30
25
20
15
10
5
0
29.11
27.52
24.66
21.49
18.31
15.13
11.96
10.05
2000
2004
2008
2012
2016
2020
2024
2028
2032
2036
2040
2044
2048
2052
2056
2060
2064
Year
Glide Path
Natural Condition (Most Impaired)

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

BART

- During the 1st implementation period, the rule required states to determine best available retrofit technology (BART) for certain facilities
  - Alcoa
  - DuPont-Old Hickory
  - Eastman Chemical Company
  - TVA Cumberland

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

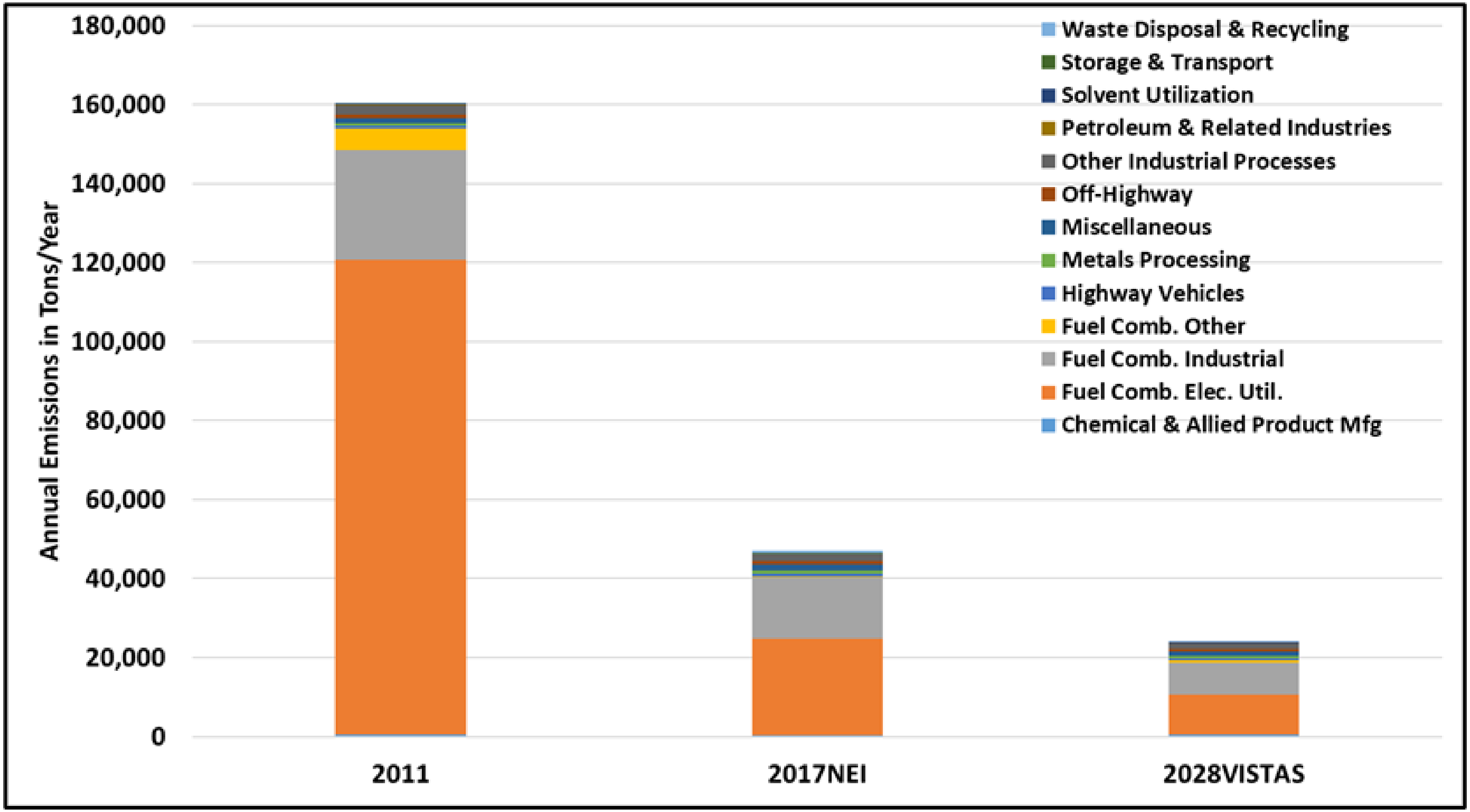
- TVA Cumberland
  - No additional controls required

- TVA Kingston
  - Revised 2028 emission projections so below 1.00%
  - Retirement by 2035
  - Not required to perform reasonable progress analysis

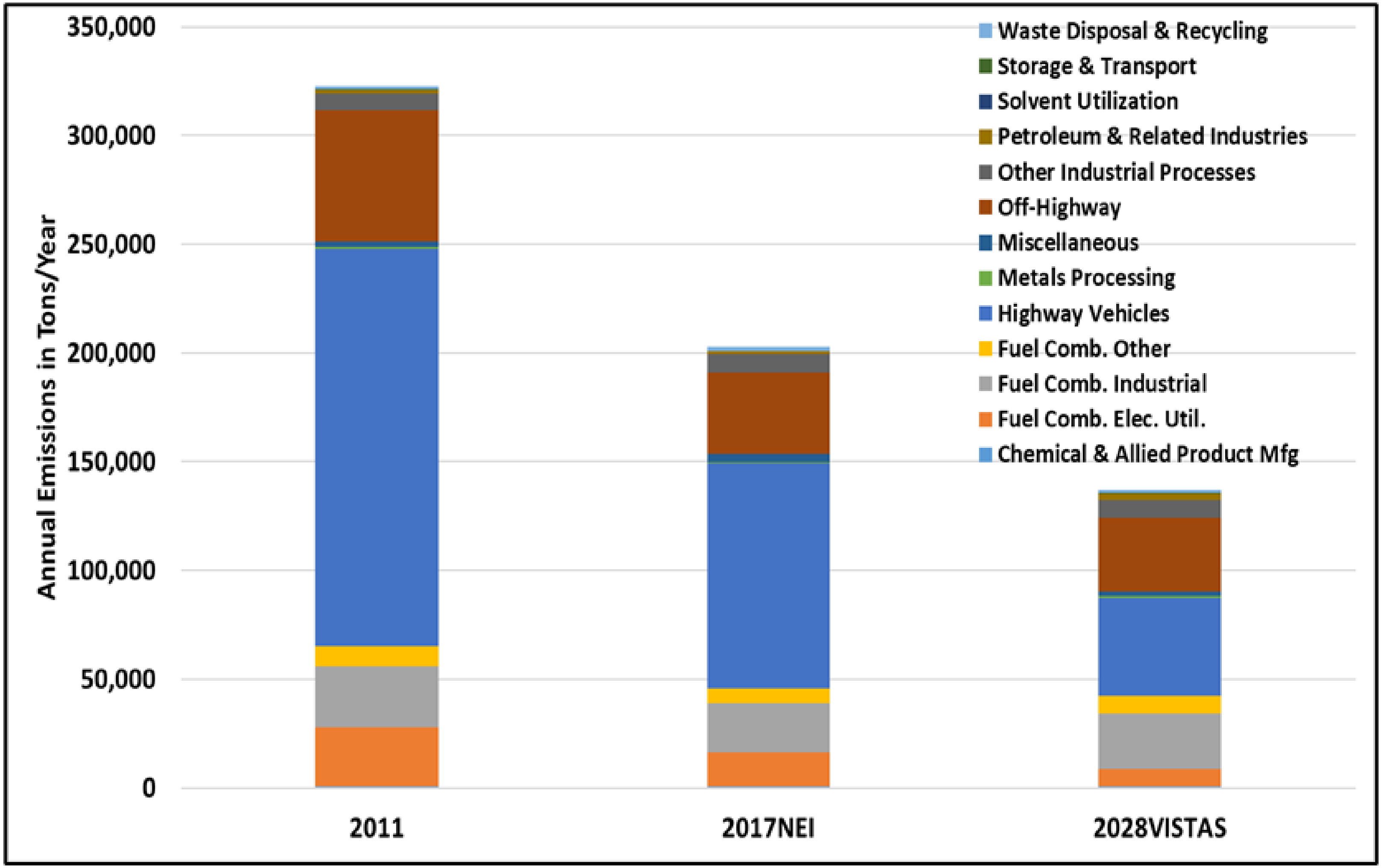
Facilities selected by TDEC for Reasonable Progress Analysis (>1.00% sulfate at GSMNP or JOYC)

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

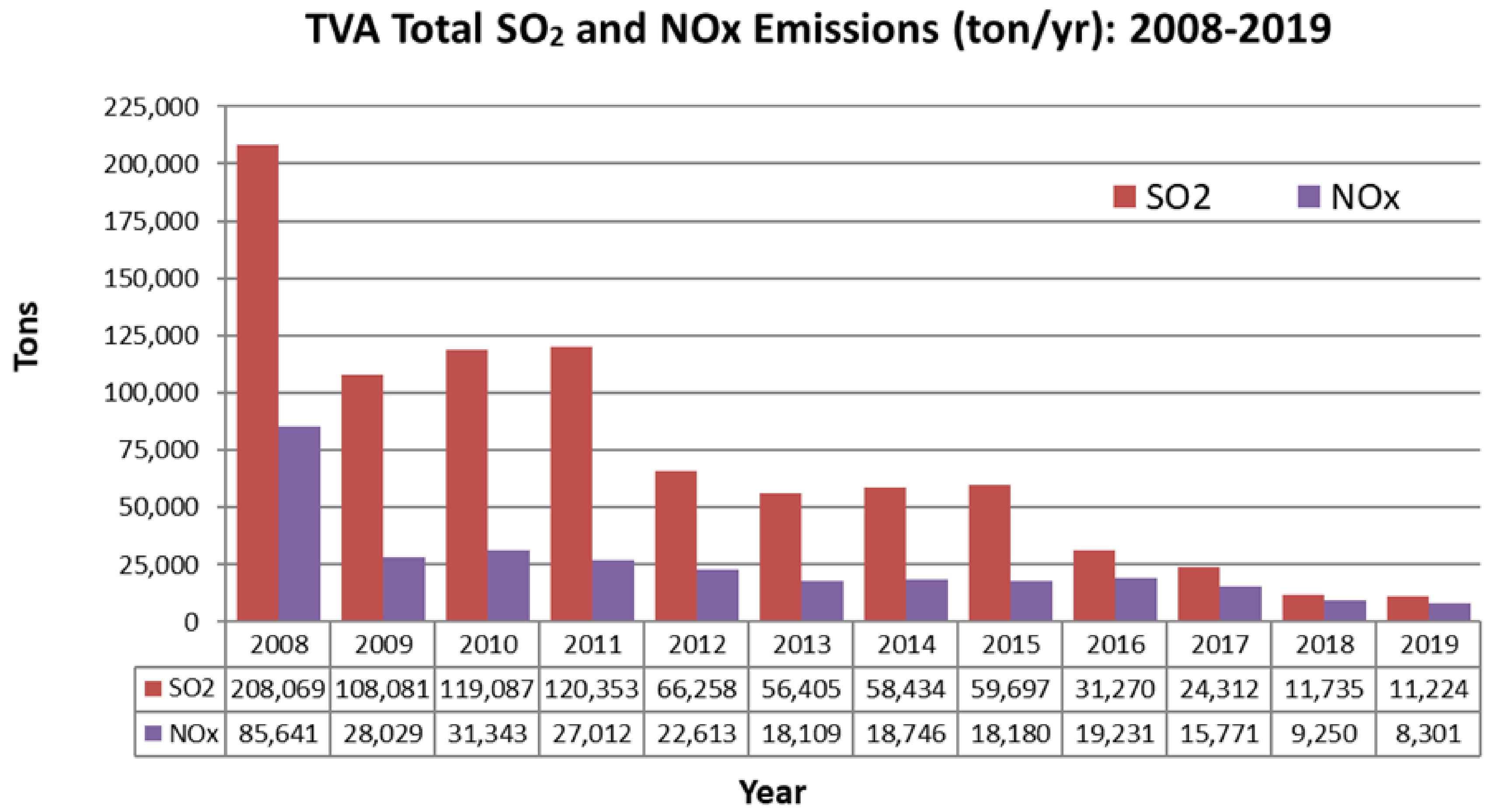
Tennessee SO_2 Emissions (2011-2028)



Tennessee NO_x Emissions (2011-2028)



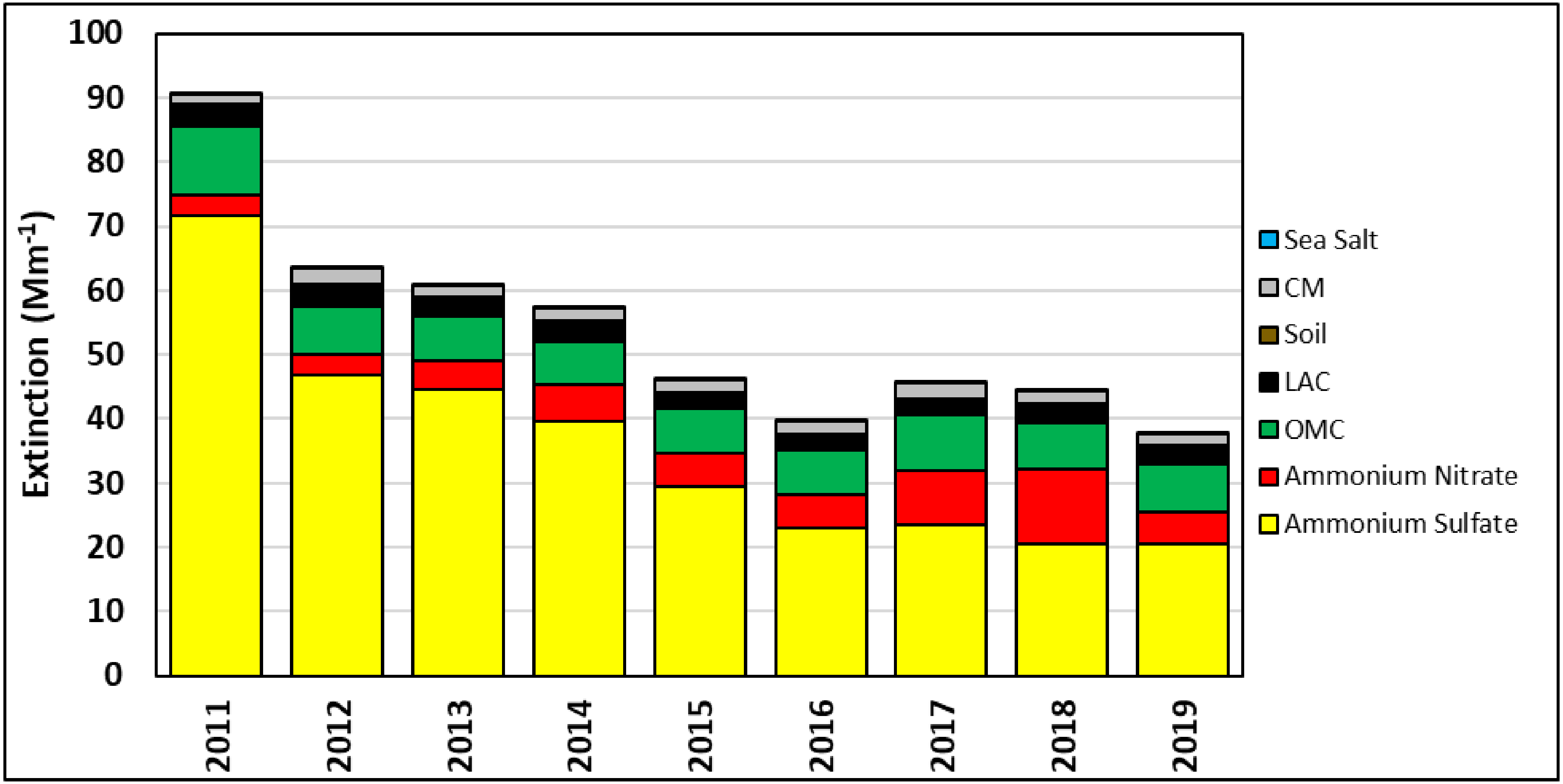
TVA Emissions from coal and natural gas plants in Tennessee (2008-2019)

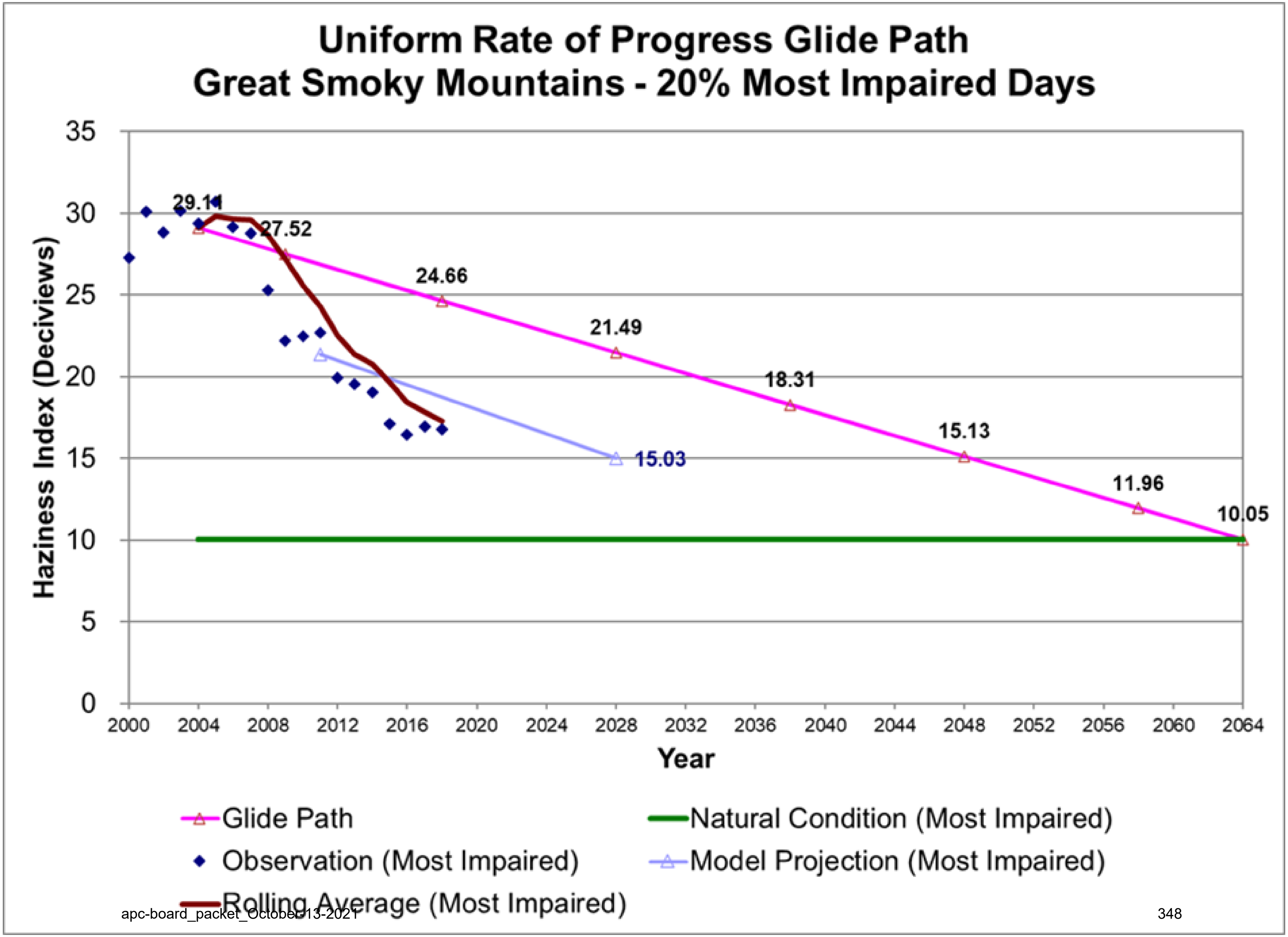


TVA Total SO_2 and NOx Emissions (ton/yr): 2008-2019

	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

Particle Contributions to Light Extinction for 20% Most Impaired Days at Great Smoky Mountains National Park





Uniform Rate of Progress Glide Path
Great Smoky Mountains - 20% Most Impaired Days

Tennessee Reasonable Progress Goals (RPG) for 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]

Tennessee Reasonable Progress Goals (RPG) for 20% Clearest Days

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]

Proposed 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 2021
Public Notice (45-day comment period)	October 2021
Public Hearing	December 2021
Board Approval	January 2022
Submit final SIP to EPA	January 2022

Questions

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TN Department of Environment & Conservation

NESHAP Rules Incorporation by Reference

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NESHAP Rules

- Federal NESHAP Rules
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- 40 CFR Part 61
- 40 CFR Part 63
- TDEC proposes to incorporate federal rules by reference into state rules

NESHAP Rules

- EPA delegated authority to TDEC for Title V program and NESHAP rules in 1990's
- "Automatic Delegation" for NESHAP rules

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NESHAP Rules

- The approved NESHAP delegation mechanism for the State Tennessee is a process commonly described as “automatic delegation” in which formal delegation of federal rules occurs without the need for completing specific State rulemaking actions for taking delegation and is automatically completed on the promulgation date of each NESHAP regulation

NESHAP Rules

- Currently, most Part 61 rules (in Chapter 11) and only four Part 63 rules (in Chapters 18, 31, & 38) are in state rules
- Mostly word-for-word basis
- Difficult to keep up-to-date if federal rule is amended
- Two Part 63 rules are adopted by reference in Chapter 0400-30-38

NESHAP Rules

- Currently, the requirements of a NESHAP that are not reproduced through the current regulations must be placed in a permit before they can be enforced
- By adopting federal NESHAP rules by reference, the Board will be able to keep the state regulations in line with the federal regulations and will be able to enforce the federal regulations directly

NESHAP Rules

- TDEC proposes to repeal current NESHAP rules that are in state rules, except Gasoline Dispensing Facilities (GDF) rule in Chapter 18
- TDEC proposes to adopt by reference all Part 61 and Part 63 rules, except GDF
- Adopt July 1, 2020, version of CFR

NESHAP Rules

- Gasoline Dispensing Facilities (GDF) rule in Chapter 18
- This is a blend of federal NESHAP rule and state rules for former ozone nonattainment and Early Action Compact counties
- Requires Stage 1 vapor recovery depending on county & size of GDF

Proposed Timeline

Event	Date
Pre-Draft of Rule sent to EPA	August 2021
Received comments from EPA	September 2021
Governor's Office approval	September 2021
Public Notice (45-day comment period)	October 2021
Public Hearing	December 2021
APC Board Approval	January 2022
Rule becomes State effective	May 2022
Submit final rule to EPA	May 2022

Questions

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Chapter Number	**Chapter Title**
0400-30-38	Emission Standards for Hazardous Air Pollutants
Rule Number	**Rule Title**
0400-30-38-.01	~~Stationary Reciprocating Internal Combustion Engines~~ Federal Standards Incorporated by Reference
0400-30-38-.02	~~Paint Stripping, Autobody Refinishing, and Miscellaneous Surface Coating Operations~~ Reserved

Chapter Number	**Chapter Title**
1200-03-02	Definitions
Rule Number	**Rule Title**
1200-03-02-.01	General Definitions

Chapter Number	**Chapter Title**
1200-03-04	Open Burning
Rule Number	**Rule Title**
1200-03-04-.04	Exceptions to Prohibition

Chapter Number	**Chapter Title**
1200-03-05	Visible Emission Regulations
Rule Number	**Rule Title**
1200-03-05-.05	Standard for Certain Existing Sources

Chapter Number	**Chapter Title**
1200-03-09	Construction and Operating Permits
Rule Number	**Rule Title**
1200-03-09-.01	Construction Permits
1200-03-09-.02	Operating Permits
1200-03-09-.04	Exemptions

Chapter Number	**Chapter Title**
1200-03-11	~~Hazardous Air Contaminants~~ Repealed
Rule Number	**Rule Title**
~~1200-03-11-.01~~	~~General Provisions~~
~~1200-03-11-.02~~	~~Asbestos~~
~~1200-03-11-.03~~	~~Beryllium~~
~~1200-03-11-.04~~	~~Mercury~~
~~1200-03-11-.05~~	~~Vinyl Chloride~~
~~1200-03-11-.06~~	~~Equipment Leaks (Fugitive Emission Sources)~~
~~1200-03-11-.07~~	~~Equipment Leaks (Fugitive Emission Sources) of Benzene~~
~~1200-03-11-.08~~	~~Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities~~
~~1200-03-11-.09~~	~~Inorganic Arsenic Emissions from Glass Manufacturing Plants~~
~~1200-03-11-.10~~	~~Inorganic Arsenic Emissions From Primary Copper Smelters~~
~~1200-03-11-.11~~	~~Inorganic Arsenic Emissions from Arsenic Trioxide and Metallic Arsenic Production Facilities~~
~~1200-03-11-.12~~	~~Reserved~~
~~1200-03-11-.13~~	~~Reserved~~
~~1200-03-11-.14~~	~~Reserved~~
~~1200-03-11-.15~~	~~Reserved~~
~~1200-03-11-.16~~	~~Reserved~~
~~1200-03-11-.17~~	~~National Emission Standards for Radon Emissions from Department of Energy Facilities~~

Chapter Number	**Chapter Title**
1200-03-16	New Source Performance Standards
Rule Number	**Rule Title**
1200-03-16-.01	General Provisions

Chapter Number	**Chapter Title**
1200-03-20	Limits on Emissions Due to Malfunctions, Startups, and Shutdowns
Rule Number	**Rule Title**
1200-03-20-.03	Notice Required When Malfunction Occurs

Chapter Number	**Chapter Title**
1200-03-21	General Alternate Emission Standards
Rule Number	**Rule Title**
1200-03-21-.01	General Alternate Emission Standard

Chapter Number	**Chapter Title**
1200-03-26	Administrative Fees Schedule
Rule Number	**Rule Title**
1200-03-26-.02	Construction and Annual Emission Fees

Chapter Number	**Chapter Title**
1200-03-31	Case By Case Determinations of Hazardous Air Pollutant Control Requirements
Rule Number	**Rule Title**
1200-03-31-.01	~~General Provisions [Reserved]~~ Reserved
1200-03-31-.02	Definitions
1200-03-31-.03	Intent of the Board for Case by Case Determinations of Hazardous Air Pollutant Control Requirements
1200-03-31-.04	Standards for Existing Sources
1200-03-31-.05	Standards for New Sources
1200-03-31-.06	Opportunity for Early Reductions Schedule
1200-03-31-.07	Residual Risk and Revisions to MACT
1200-03-31-.08	Reserved
1200-03-31-.09	Reserved
1200-03-31-.10	Reserved
1200-03-31-.11	Reserved
1200-03-31-.12	Reserved
1200-03-31-.13	~~Perchloroethylene Air Emission Standards for Dry Cleaning Facilities~~ Reserved

Place substance of rules and other info here. Please be sure to include a detailed explanation of the changes being made to the listed rule(s). Statutory authority must be given for each rule change. For information on formatting rules go to https://sos.tn.gov/products/division-publications/rulemaking-guidelines.

Chapter 0400-30-38
Emission Standards for Hazardous Air Pollutants

Amendments

The Table of Contents of Chapter 0400-30-38 Emission Standards for Hazardous Air Pollutants is amended by deleting it in its entirety and substituting instead the following:

Table of Contents

0400-30-38-.01 ~~Stationary Reciprocating Internal Combustion Engines~~ Federal Standards for Hazardous Air Pollutants
0400-30-38-.02 ~~Paint Stripping, Auto Body Refinishing, and Miscellaneous Surface Coating Operations~~ Reserved

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Rule 0400-30-38-.01 Stationary Reciprocating Internal Combustion Engines is amended by deleting it in its entirety and substituting instead the follow:

0400-30-38-.01 ~~Stationary Reciprocating Internal Combustion Engines~~ Federal Standards for Hazardous Air Pollutants

(1) ~~Emergency stationary reciprocating internal combustion engines subject to the provisions of this rule may qualify for a permit-by-rule as specified in Rule 1200-03-09-.07.~~ The provisions of the subparts and appendices of 40 CFR 63 listed in subparagraph (b) of this paragraph are hereby incorporated by reference as published in the July 1, 2020 edition of the Code of Federal Regulations (CFR), except as provided in subparagraph (a) of this paragraph. In certain cases, a different version of the federal regulation is incorporated by reference; those will be specified in subparagraph (b) of this paragraph.

  (a) Any reference contained in 40 CFR 63 to the:

    1. Administrator shall instead be a reference to the Technical Secretary.

    2. Applicable EPA regional office for the State of Tennessee shall instead be a reference to the EPA Region IV office.

  (b) List of federal regulations under 40 CFR Part 63:

    1. 40 CFR Part 63 Subpart A: General provisions;

    2. 40 CFR Part 63 Subpart B: Requirements for Control Technology Determinations for Major Sources in Accordance With Clean Air Act Sections, Sections 112(g) and 112(j);

    3. 40 CFR Part 63 Subpart D: Regulations Governing Compliance Extensions for Early Reductions of Hazardous Air Pollutants;

    4. 40 CFR Part 63 Subpart F: National Emission Standards for Organic Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry;

    5. 40 CFR Part 63 Subpart G: National Emission Standards for Organic Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry for Process Vents, Storage Vessels, Transfer Operations, and Wastewater;

    6. 40 CFR Part 63 Subpart H: National Emission Standards for Organic Hazardous Air Pollutants for Equipment Leaks;

7. 40 CFR Part 63 Subpart I: National Emission Standards for Organic Hazardous Air Pollutants for Certain Processes Subject to the Negotiated Regulation for Equipment Leaks;

8. 40 CFR Part 63 Subpart J: National Emission Standards for Hazardous Air Pollutants for Polyvinyl Chloride and Copolymers Production;

9. Reserved;

10. 40 CFR Part 63 Subpart L: National Emission Standards for Coke Oven Batteries;

11. 40 CFR Part 63 Subpart M: National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities;

12. 40 CFR Part 63 Subpart N: National Emission Standards for Chromium Emissions From Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks;

13. 40 CFR Part 63 Subpart O: Ethylene Oxide Emissions Standards for Sterilization Facilities;

14. Reserved;

15. 40 CFR Part 63 Subpart Q: National Emission Standards for Hazardous Air Pollutants for Industrial Process Cooling Towers;

16. 40 CFR Part 63 Subpart R: National Emission Standards for Gasoline Distribution Facilities (Bulk Gasoline Terminals and Pipeline Breakout Stations);

17. 40 CFR Part 63 Subpart S: National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry;

18. 40 CFR Part 63 Subpart T: National Emission Standards for Halogenated Solvent Cleaning;

19. 40 CFR Part 63 Subpart U: National Emission Standards for Hazardous Air Pollutant Emissions: Group I Polymers and Resins;

20. Reserved;

21. 40 CFR Part 63 Subpart W: National Emission Standards for Hazardous Air Pollutants for Epoxy Resins Production and Non-Nylon Polyamides Production;

22. 40 CFR Part 63 Subpart X: National Emission Standards For Hazardous Air Pollutants From Secondary Lead Smelting;

23. 40 CFR Part 63 Subpart Y: National Emission Standards for Marine Tank Vessel Loading Operations;

24. Reserved;

25. 40 CFR Part 63 Subpart AA: National Emission Standards for Hazardous Air Pollutants from Phosphoric Acid Manufacturing Plants;

26. 40 CFR Part 63 Subpart BB: National Emission Standards for Hazardous Air Pollutants from Phosphate Fertilizers Production Plants;

27. 40 CFR Part 63 Subpart CC: National Emission Standards for Hazardous Air Pollutants From Petroleum Refineries;

28. 40 CFR Part 63 Subpart DD: National Emission Standards for Hazardous Air Pollutants from Off-Site Waste and Recovery Operations;

29. 40 CFR Part 63 Subpart EE: National Emission Standards for Magnetic Tape Manufacturing Operations;

30. Reserved;

31. 40 CFR Part 63 Subpart GG: National Emission Standards for Aerospace Manufacturing and Rework Facilities;

32. 40 CFR Part 63 Subpart HH: National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities;

33. 40 CFR Part 63 Subpart II: National Emission Standards for Shipbuilding and Ship Repair (Surface Coating);

34. 40 CFR Part 63 Subpart JJ: National Emission Standards for Wood Furniture Manufacturing Operations;

35. 40 CFR Part 63 Subpart KK: National Emission Standards for the Printing and Publishing Industry;

36. 40 CFR Part 63 Subpart LL: National Emission Standards for Hazardous Air Pollutants for Primary Aluminum Reduction Plants;

37. 40 CFR Part 63 Subpart MM: National Emission Standards for Hazardous Air Pollutants for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills;

38. 40 CFR Part 63 Subpart NN: National Emission Standards for Hazardous Air Pollutants for Wool Fiberglass Manufacturing at Area Sources;

39. 40 CFR Part 63 Subpart OO: National Emission Standards for Tanks—Level 1;

40. 40 CFR Part 63 Subpart PP: National Emission Standards for Containers;

41. 40 CFR Part 63 Subpart QQ: National Emission Standards for Surface Impoundments;

42. 40 CFR Part 63 Subpart RR: National Emission Standards for Individual Drain Systems;

43. 40 CFR Part 63 Subpart SS: National Emission Standards for Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process;

44. 40 CFR Part 63 Subpart TT: National Emission Standards for Equipment Leaks—Control Level 1;

45. 40 CFR Part 63 Subpart UU: National Emission Standards for Equipment Leaks—Control Level 2 Standards;

46. 40 CFR Part 63 Subpart VV: National Emission Standards for Oil-Water Separators and Organic-Water Separators;

47. 40 CFR Part 63 Subpart WW: National Emission Standards for Storage Vessels (Tanks)—Control Level 2;

48. 40 CFR Part 63 Subpart XX: National Emission Standards for Ethylene Manufacturing Process Units: Heat Exchange Systems and Waste Operations;

49. 40 CFR Part 63 Subpart YY: National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards;

50. Reserved;

51. Reserved;

52. Reserved;

53. 40 CFR Part 63 Subpart CCC: National Emission Standards for Hazardous Air Pollutants for Steel Pickling—HCl Process Facilities and Hydrochloric Acid Regeneration Plants;

54. 40 CFR Part 63 Subpart DDD: National Emission Standards for Hazardous Air Pollutants for Mineral Wool Production;

55. 40 CFR Part 63 Subpart EEE: National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors;

56. Reserved;

57. 40 CFR Part 63 Subpart GGG: National Emission Standards for Pharmaceuticals Production;

58. 40 CFR Part 63 Subpart HHH: National Emission Standards for Hazardous Air Pollutants From Natural Gas Transmission and Storage Facilities;

59. 40 CFR Part 63 Subpart III: National Emission Standards for Hazardous Air Pollutants for Flexible Polyurethane Foam Production;

60. 40 CFR Part 63 Subpart JJJ: National Emission Standards for Hazardous Air Pollutant Emissions: Group IV Polymers and Resins;

61. Reserved;

62. 40 CFR Part 63 Subpart LLL: National Emission Standards for Hazardous Air Pollutants From the Portland Cement Manufacturing Industry;

63. 40 CFR Part 63 Subpart MMM: National Emission Standards for Hazardous Air Pollutants for Pesticide Active Ingredient Production;

64. 40 CFR Part 63 Subpart NNN: National Emission Standards for Hazardous Air Pollutants for Wool Fiberglass Manufacturing;

65. 40 CFR Part 63 Subpart OOO: National Emission Standards for Hazardous Air Pollutant Emissions: Manufacture of Amino/Phenolic Resins;

66. 40 CFR Part 63 Subpart PPP: National Emission Standards for Hazardous Air Pollutant Emissions for Polyether Polyols Production;

67. 40 CFR Part 63 Subpart QQQ: National Emission Standards for Hazardous Air Pollutants for Primary Copper Smelting;

68. 40 CFR Part 63 Subpart RRR: National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production;

69. Reserved;

70. 40 CFR Part 63 Subpart TTT: National Emission Standards for Hazardous Air Pollutants for Primary Lead Smelting;

71. 40 CFR Part 63 Subpart UUU: National Emission Standards for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units;

72. 40 CFR Part 63 Subpart VVV: National Emission Standards for Hazardous Air Pollutants:

Publicly Owned Treatment Works;

73. Reserved;

74. 40 CFR Part 63 Subpart XXX: National Emission Standards for Hazardous Air Pollutants for Ferroalloys Production: Ferromanganese and Silicomanganese;

75. Reserved;

76. Reserved;

77. 40 CFR Part 63 Subpart AAAA: National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills;

78. Reserved;

79. 40 CFR Part 63 Subpart CCCC: National Emission Standards for Hazardous Air Pollutants: Manufacturing of Nutritional Yeast;

80. 40 CFR Part 63 Subpart DDDD: National Emission Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products;

81. 40 CFR Part 63 Subpart EEEE: National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline);

82. 40 CFR Part 63 Subpart FFFF: National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing;

83. 40 CFR Part 63 Subpart GGGG: National Emission Standards for Hazardous Air Pollutants: Solvent Extraction for Vegetable Oil Production;

84. 40 CFR Part 63 Subpart HHHH: National Emission Standards for Hazardous Air Pollutants for Wet-Formed Fiberglass Mat Production;

85. 40 CFR Part 63 Subpart IIII: National Emission Standards for Hazardous Air Pollutants: Surface Coating of Automobiles and Light-Duty Trucks;

86. 40 CFR Part 63 Subpart JJJJ: National Emission Standards for Hazardous Air Pollutants: Paper and Other Web Coating;

87. 40 CFR Part 63 Subpart KKKK: National Emission Standards for Hazardous Air Pollutants: Surface Coating of Metal Cans;

88. Reserved;

89. 40 CFR Part 63 Subpart MMMM: National Emission Standards for Hazardous Air Pollutants for Surface Coating of Miscellaneous Metal Parts and Products;

90. 40 CFR Part 63 Subpart NNNN: National Emission Standards for Hazardous Air Pollutants: Surface Coating of Large Appliances;

91. 40 CFR Part 63 Subpart OOOO: National Emission Standards for Hazardous Air Pollutants: Printing, Coating, and Dyeing of Fabrics and Other Textiles;

92. 40 CFR Part 63 Subpart PPPP: National Emission Standards for Hazardous Air Pollutants for Surface Coating of Plastic Parts and Products;

93. 40 CFR Part 63 Subpart QQQQ: National Emission Standards for Hazardous Air Pollutants: Surface Coating of Wood Building Products;

94. 40 CFR Part 63 Subpart RRRR: National Emission Standards for Hazardous Air

Pollutants: Surface Coating of Metal Furniture;

95. 40 CFR Part 63 Subpart SSSS: National Emission Standards for Hazardous Air Pollutants: Surface Coating of Metal Coil;

96. 40 CFR Part 63 Subpart TTTT: National Emission Standards for Hazardous Air Pollutants for Leather Finishing Operations;

97. 40 CFR Part 63 Subpart UUUU: National Emission Standards for Hazardous Air Pollutants for Cellulose Products Manufacturing;

98. 40 CFR Part 63 Subpart VVVV: National Emission Standards for Hazardous Air Pollutants for Boat Manufacturing;

99. 40 CFR Part 63 Subpart WWWW: National Emissions Standards for Hazardous Air Pollutants: Reinforced Plastic Composites Production;

100. 40 CFR Part 63 Subpart XXXX: National Emissions Standards for Hazardous Air Pollutants: Rubber Tire Manufacturing;

101. 40 CFR Part 63 Subpart YYYY: National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines;

102. 40 CFR Part 63 Subpart ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines;

103. 40 CFR Part 63 Subpart AAAAA: National Emission Standards for Hazardous Air Pollutants for Lime Manufacturing Plants;

104. 40 CFR Part 63 Subpart BBBBB: National Emission Standards for Hazardous Air Pollutants for Semiconductor Manufacturing;

105. 40 CFR Part 63 Subpart CCCCC: National Emission Standards for Hazardous Air Pollutants for Coke Ovens: Pushing, Quenching, and Battery Stacks;

106. 40 CFR Part 63 Subpart DDDDD: National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters;

107. 40 CFR Part 63 Subpart EEEEE: National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries;

108. 40 CFR Part 63 Subpart FFFFF: National Emission Standards for Hazardous Air Pollutants for Integrated Iron and Steel Manufacturing Facilities;

109. 40 CFR Part 63 Subpart GGGGG: National Emission Standards for Hazardous Air Pollutants: Site Remediation;

110. 40 CFR Part 63 Subpart HHHHH: National Emission Standards for Hazardous Air Pollutants: Miscellaneous Coating Manufacturing;

111. 40 CFR Part 63 Subpart IIIII: National Emission Standards for Hazardous Air Pollutants: Mercury Emissions From Mercury Cell Chlor-Alkali Plants;

112. 40 CFR Part 63 Subpart JJJJJ: National Emission Standards for Hazardous Air Pollutants for Brick and Structural Clay Products Manufacturing;

113. 40 CFR Part 63 Subpart KKKKK: National Emission Standards for Hazardous Air Pollutants for Clay Ceramics Manufacturing;

114. 40 CFR Part 63 Subpart LLLLL: National Emission Standards for Hazardous Air

Pollutants: Asphalt Processing and Asphalt Roofing Manufacturing;

115. 40 CFR Part 63 Subpart MMMMM: National Emission Standards for Hazardous Air Pollutants: Flexible Polyurethane Foam Fabrication Operations;

116. 40 CFR Part 63 Subpart NNNNN: National Emission Standards for Hazardous Air Pollutants: Hydrochloric Acid Production;

117. Reserved;

118. 40 CFR Part 63 Subpart PPPPP: National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands;

119. 40 CFR Part 63 Subpart QQQQQ: National Emission Standards for Hazardous Air Pollutants for Friction Materials Manufacturing Facilities;

120. 40 CFR Part 63 Subpart RRRRR: National Emission Standards for Hazardous Air Pollutants: Taconite Iron Ore Processing;

121. 40 CFR Part 63 Subpart SSSSS: National Emission Standards for Hazardous Air Pollutants for Refractory Products Manufacturing;

122. 40 CFR Part 63 Subpart TTTTT: National Emissions Standards for Hazardous Air Pollutants for Primary Magnesium Refining;

123. 40 CFR Part 63 Subpart UUUUU: National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units;

124. Reserved;

125. 40 CFR Part 63 Subpart WWWWW: National Emission Standards for Hospital Ethylene Oxide Sterilizers;

126. Reserved;

127. 40 CFR Part 63 Subpart YYYYY: National Emission Standards for Hazardous Air Pollutants for Area Sources: Electric Arc Furnace Steelmaking Facilities;

128. 40 CFR Part 63 Subpart ZZZZZ: National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries Area Sources;

129. Reserved;

130. 40 CFR Part 63 Subpart BBBBBB: National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Distribution Bulk Terminals, Bulk Plants, and Pipeline Facilities;

131. Reserved;

132. 40 CFR Part 63 Subpart DDDDDD: National Emission Standards for Hazardous Air Pollutants for Polyvinyl Chloride and Copolymers Production Area Sources;

133. 40 CFR Part 63 Subpart EEEEEE: National Emission Standards for Hazardous Air Pollutants for Primary Copper Smelting Area Sources;

134. 40 CFR Part 63 Subpart FFFFFF: National Emission Standards for Hazardous Air Pollutants for Secondary Copper Smelting Area Sources;

135. 40 CFR Part 63 Subpart GGGGGG: National Emission Standards for Hazardous Air Pollutants for Primary Nonferrous Metals Area Sources—Zinc, Cadmium, and Beryllium;

136. 40 CFR Part 63 Subpart HHHHHH: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources;

137. Reserved;

138. 40 CFR Part 63 Subpart JJJJJJ: National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources;

139. Reserved;

140. 40 CFR Part 63 Subpart LLLLLL: National Emission Standards for Hazardous Air Pollutants for Acrylic and Modacrylic Fibers Production Area Sources;

141. 40 CFR Part 63 Subpart MMMMMM: National Emission Standards for Hazardous Air Pollutants for Carbon Black Production Area Sources;

142. 40 CFR Part 63 Subpart NNNNNN: National Emission Standards for Hazardous Air Pollutants for Chemical Manufacturing Area Sources: Chromium Compounds;

143. 40 CFR Part 63 Subpart OOOOOO: National Emission Standards for Hazardous Air Pollutants for Flexible Polyurethane Foam Production and Fabrication Area Sources;

144. 40 CFR Part 63 Subpart PPPPPP: National Emission Standards for Hazardous Air Pollutants for Lead Acid Battery Manufacturing Area Sources;

145. 40 CFR Part 63 Subpart QQQQQQ: National Emission Standards for Hazardous Air Pollutants for Wood Preserving Area Sources;

146. 40 CFR Part 63 Subpart RRRRRR: National Emission Standards for Hazardous Air Pollutants for Clay Ceramics Manufacturing Area Sources;

147. 40 CFR Part 63 Subpart SSSSSS: National Emission Standards for Hazardous Air Pollutants for Glass Manufacturing Area Sources

148. 40 CFR Part 63 Subpart TTTTTT: National Emission Standards for Hazardous Air Pollutants for Secondary Nonferrous Metals Processing Area Sources;

149. Reserved;

150. 40 CFR Part 63 Subpart VVVVVV: National Emission Standards for Hazardous Air Pollutants for Chemical Manufacturing Area Sources;

151. 40 CFR Part 63 Subpart WWWWWW: National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Plating and Polishing Operations;

152. 40 CFR Part 63 Subpart XXXXXX: National Emission Standards for Hazardous Air Pollutants Area Source Standards for Nine Metal Fabrication and Finishing Source Categories;

153. 40 CFR Part 63 Subpart YYYYYY: National Emission Standards for Hazardous Air Pollutants for Area Sources: Ferroalloys Production Facilities;

154. 40 CFR Part 63 Subpart ZZZZZZ: National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Aluminum, Copper, and Other Nonferrous Foundries;

155. 40 CFR Part 63 Subpart AAAAAAA: National Emission Standards for Hazardous Air Pollutants for Area Sources: Asphalt Processing and Asphalt Roofing Manufacturing;

156. 40 CFR Part 63 Subpart BBBBBBB: National Emission Standards for Hazardous Air

Pollutants for Area Sources: Chemical Preparations Industry;

157. 40 CFR Part 63 Subpart CCCCCCC: National Emission Standards for Hazardous Air Pollutants for Area Sources: Paints and Allied Products Manufacturing;

158. 40 CFR Part 63 Subpart DDDDDDD: National Emission Standards for Hazardous Air Pollutants for Area Sources: Prepared Feeds Manufacturing;

159. 40 CFR Part 63 Subpart EEEEEEE: National Emission Standards for Hazardous Air Pollutants: Gold Mine Ore Processing and Production Area Source Category;

160. Reserved;

161. Reserved;

162. 40 CFR Part 63 Subpart HHHHHHH: National Emission Standards for Hazardous Air Pollutant Emissions for Polyvinyl Chloride and Copolymers Production;

163. Appendix A to Part 63: Test Methods;

164. Appendix B to Part 63: Sources Defined for Early Reduction Provisions;

165. Appendix C to Part 63: Determination of the Fraction Biodegraded (Fbio) in a Biological Treatment Unit;

166. Appendix D to Part 63: Alternative Validation Procedure for EPA Waste and Wastewater Methods; and

167. Appendix E to Part 63: Monitoring Procedure for Nonthoroughly Mixed Open Biological Treatment Systems at Kraft Pulp Mills Under Unsafe Sampling Conditions.

(2) ~~The provisions of 40 CFR 63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines) are hereby adopted by reference as published in the July 1, 2017, edition of the Code of Federal Regulations (CFR), except as provided in subparagraph (a) of this paragraph~~ The provisions of the subparts and appendices of 40 CFR Part 61 listed in subparagraph (b) of this paragraph are hereby incorporated by reference as published in the July 1, 2020, edition of the Code of Federal Regulations (CFR), except as provided in subparagraph (a) of this paragraph. In certain cases, a different version of the federal regulation is incorporated by reference; those will be specified in subparagraph (b) of this paragraph.

(a) Any reference contained in ~~40 CFR 63 Subpart ZZZZ~~ 40 CFR Part 61 to the:

1. Administrator shall instead be a reference to the Technical Secretary; and

2. Applicable EPA regional office for the State of Tennessee shall instead be a reference to the EPA Region IV office.

(b) List of Federal Regulations under 40 CFR Part 61:

1. 40 CFR Part 61 Subpart A: General provisions;

2. 40 CFR Part 61 Subpart B: National Emission Standards for Radon Emissions From Underground Uranium Mines;

3. 40 CFR Part 61 Subpart C: National Emission Standard for Beryllium;

4. 40 CFR Part 61 Subpart D: National Emission Standard for Beryllium Rocket Motor Firing;

5. 40 CFR Part 61 Subpart E: National Emission Standard for Mercury;

6. 40 CFR Part 61 Subpart F: National Emission Standard for Vinyl Chloride;

7. Reserved;

8. 40 CFR Part 61 Subpart H: National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities;

9. 40 CFR Part 61 Subpart I: National Emission Standards for Radionuclide Emissions From Federal Facilities Other Than Nuclear Regulatory Commission Licensees and Not Covered by Subpart H;

10. 40 CFR Part 61 Subpart J: National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene;

11. 40 CFR Part 61 Subpart K: National Emission Standards for Radionuclide Emissions From Elemental Phosphorus Plants;

12. 40 CFR Part 61 Subpart L: National Emission Standard for Benzene Emissions from Coke By-Product Recovery Plants;

13. 40 CFR Part 61 Subpart M: National Emission Standard for Asbestos;

14. 40 CFR Part 61 Subpart N: National Emission Standard for Inorganic Arsenic Emissions From Glass Manufacturing Plants;

15. 40 CFR Part 61 Subpart O: National Emission Standard for Inorganic Arsenic Emissions From Primary Copper Smelters;

16. 40 CFR Part 61 Subpart P: National Emission Standard for Inorganic Arsenic Emissions From Arsenic Trioxide and Metallic Arsenic Production Facilities;

17. 40 CFR Part 61 Subpart Q: National Emission Standards for Radon Emissions From Department of Energy Facilities;

18. 40 CFR Part 61 Subpart R: National Emission Standards for Radon Emissions From Phosphogypsum Stacks;

19. Reserved;

20. 40 CFR Part 61 Subpart T: National Emission Standards for Radon Emissions From the Disposal of Uranium Mill Tailings;

21. Reserved;

22. 40 CFR Part 61 Subpart V: National Emission Standard for Equipment Leaks (Fugitive Emission Sources);

23. 40 CFR Part 61 Subpart W: National Emission Standards for Radon Emissions From Operating Mill Tailings;

24. Reserved;

25. 40 CFR Part 61 Subpart Y: National Emission Standard for Benzene Emissions From Benzene Storage Vessels;

26. Reserved;

27. Reserved;

28. 40 CFR Part 61 Subpart BB: National Emission Standard for Benzene Emissions From Benzene Transfer Operations;

29. Reserved;

30. Reserved;

31. Reserved;

32. 40 CFR Part 61 Subpart FF: National Emission Standard for Benzene Waste Operations;

33. Appendix A to Part 61: National Emission Standards for Hazardous Air Pollutants, Compliance Status Information;

34. Appendix B to Part 61: Test Methods;

35. Appendix C to Part 61: Quality Assurance Procedures;

36. Appendix D to Part 61: Methods for Estimating Radionuclide Emissions; and

37. Appendix E to Part 61: Compliance Procedures Methods for Determining Compliance With Subpart I.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Rule 0400-30-38-.02 Paint Stripping, Auto Body Refinishing, and Miscellaneous Surface Coating Operations is amended by deleting it in its entirety and substituting instead the follow:

0400-30-38-.02 ~~Paint Stripping, Auto Body Refinishing, and Miscellaneous Surface Coating Operations~~ Reserved

~~(1) Auto body refinishing operations, which includes paint stripping and surface coating of motor vehicles and mobile equipment, subject to the provisions of this rule may qualify for a permit-by-rule as specified in Rule 1200-03-09-.07. However, no emission source subject to a rule in Chapter 1200-03-18 Volatile Organic Compounds shall qualify for permit-by-rule.~~

~~(2) The provisions of 40 CFR 63 Subpart HHHHHH (National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources) are hereby adopted by reference as published in the July 1, 2017, edition of the Code of Federal Regulations (CFR), except as provided in subparagraph (a) of this paragraph.~~

~~(a) Any reference contained in 40 CFR 63 Subpart HHHHHH to the:~~

~~1. Administrator shall instead be a reference to the Technical Secretary; and~~

~~2. Applicable EPA regional office for the State of Tennessee shall instead be a reference to the EPA Region IV office.~~

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-02
Definitions

Amendments

Subparagraph (g) of paragraph (1) of Rule 1200-03-02-.01 General Definitions is amended by deleting it in its entirety and substituting instead the following:

(g) "Best available control technology (BACT)" means an emission limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under these rules which would be emitted from any proposed new or modified air contaminant source which the Technical Secretary, on a case-by-case bases, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under Chapters ~~1200-03-11~~ 0400-30-38 and 1200-03-16 of these rules. If the Technical Secretary determines that technological or economic limitations on the application of measurement methodology to a particular class of sources would make the imposition of an emission standard infeasible, a design, equipment, work practice, or operational standard, or combination thereof, may be prescribed instead to require the application of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation, and shall provide for compliance by means which achieve equivalent results.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-04
Open Burning

Amendments

Part 3 of subparagraph (c) of paragraph (1) of Rule 1200-03-04-.04 Exceptions to Prohibition is amended by deleting it in its entirety and substituting instead the following:

3. All regulated asbestos containing materials have been removed in accordance with ~~Rule 1200-3-11-.02~~ part (2)(b)13 of Rule 0400-30-38-.01; and

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-05
Visible Emission Regulations

Amendments

Subparagraph (b) of Paragraph (2) of Rule 1200-03-05-.05 Standard for Certain Existing Sources is amended by deleting it in its entirety and substituting instead the following:

(b) The air contaminate source is not regulated under the rules contained in Chapter ~~1200-03-11~~ 0400-30-38, Chapter 1200-03-16, and Chapters 1200-03-25 and ~~Paragraph~~ paragraph (4) of 1200-03-09-.01~~(4)~~.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-09
Construction and Operating Permits

Amendments

Subparagraph (d) of paragraph (2) of Rule 1200-03-09-.01 Construction Permits is amended by deleting it in its entirety and substituting instead the following:

(d) “Best available control technology (BACT)” means an emission limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under these rules which would be emitted from any proposed new or modified air contaminant source which the Technical Secretary, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under Chapters ~~1200-03-11~~ 0400-30-38 and 1200-03-16 of these rules. If the Technical Secretary determines that technological or economic limitations on the application of measurement methodology to a particular class of sources would make the imposition of an emission standard infeasible, a design, equipment, work practice, or operational standard, or combination thereof, may be prescribed instead to require the application of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation, and shall provide for compliance by means which achieve equivalent results. This definition does not apply to major sources and major modifications, as defined in subparagraph (4)(b) of this rule, which are subject to the provisions of paragraph (4) of this rule.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Subpart (i) of part 1 of subparagraph (d) of paragraph (4) of Rule 1200-03-09-.01 Construction Permits is amended by deleting it in its entirety and substituting instead the following:

(i) The source or modification would be a major stationary source or major modification only if fugitive emissions, to the extent quantifiable, are considered in calculating the potential to emit of the stationary source or modification and such source does not belong to any of the categories listed under subpart (b)1~~.~~(i), or any other stationary source category which, as of the (effective date of this rule) is being regulated under Chapters ~~1200-03-11~~ 0400-30-38 and 1200-03-16.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Subitem XXVII of item (IV) of subpart (iv) of part 1 of subparagraph (b) of paragraph (5) of Rule 1200-03-09-.01 Construction Permits is amended by deleting it in its entirety and substituting instead the following:

XXVII. Any other stationary source category which, as of August 7, 1980, is being regulated under Chapter 1200-03-16, New Source Performance Standards or Chapter ~~1200-03-11~~ 0400-30-38, ~~Hazardous Air Contaminants~~ Emission Standards for Hazardous Air Pollutants, or Chapter 1200-03-31, Standards For Hazardous Air Contaminants For Source Categories.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Subitem II of item (I) of subpart (xi) of part 1 of subparagraph (b) of paragraph (5) of Rule 1200-03-09-.01 Construction Permits is amended by deleting it in its entirety and substituting instead the following:

II. The National Emission Standards for Hazardous Air Pollutants (NESHAP) contained in Chapter ~~1200-03-11~~ 0400-30-38 and Chapter 1200-03-31 or;

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Item (XXVII) of subpart (ii) of part 4 of subparagraph (b) of paragraph (8) of Rule 1200-03-09-.01 Construction Permits is amended by deleting it in its entirety and substituting instead the following:

(XXVII) Any other stationary source category which, as of August 7, 1980, is being regulated under Chapter 1200-03-16, New Source Performance Standards, or Chapter ~~1200-03-11~~ 0400-30-38, ~~Hazardous Air Contaminants~~ Emission Standards for Hazardous Air Pollutants. or Chapter 1200-03-31, Standards For Hazardous Air Contaminants For Source Categories, or 40 CFR Part 60 and 61 (July 1, 1993).

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

The first sentence of subparagraph (b) of paragraph (11) of Rule 1200-03-09-.02 Operating Permits is amended by deleting "Chapter 1200-03-11" and replacing it with "Chapter 0400-30-38" so that as amended the first sentence of the subparagraph shall read as follows:

Definitions - The following terms are defined as they uniquely apply to this paragraph. All other terms shall have the meaning given to them in Chapter 1200-03-02, ~~Chapter 1200-03-11~~ Chapter 0400-30-38, Chapter 1200-03-30 Chapter 1200-03-31, Chapter 1200-03-32 and Chapter 1200-03-20.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Subpart (iii) of part 1 of subparagraph (c) of paragraph (11) of Rule 1200-03-09-.02 Operating Permits is amended by deleting it in its entirety and substituting instead the following:

(iii) Any source, including an area source, subject to a standard or other requirement under section 112 of the Federal Act, ~~chapter 1200-03-11~~ Chapter 0400-30-38, or ~~chapter~~ Chapter 1200-03-31 except that a source is not required to obtain a permit solely because it is subject to regulations or requirements under section 112(r) of the Federal Act or Chapter 1200-03-32;

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Subpart (i) of part 2 of subparagraph (c) of paragraph (11) of Rule 1200-03-09-.02 Operating Permits is amended by deleting it in its entirety and substituting instead the following:

(i) All non-major sources including those subject to Section 112 of the Federal Act or ~~chapter 1200-03-11~~ Chapter 0400-30-38 or Chapter 1200-03-31 and section 111 of the Federal Act or ~~chapter~~ Chapter 1200-03-16. If the Administrator promulgates future regulations which prohibit the exemption of a non-major source from the requirements of this paragraph ~~1200-03-09-.02(11)~~, such source will be so permitted by the Technical Secretary. Upon the Administrator's written notification to the Technical Secretary that such sources must be permitted according to the provisions of this paragraph ~~1200-03-09-.02(11)~~, the Technical Secretary shall notify the sources that the applications are due within 180 days of his written notice. The Technical Secretary shall have up to 90 days to accomplish the notification commencing upon his notification from the Administrator.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Section A of subitem IV of item (I) of subpart (ii) of part 5 of subparagraph (f) of paragraph (11) of Rule 1200-03-09-.02 Operating Permits is amended by deleting it in its entirety and substituting instead the following:

A. A federally enforceable emissions cap assumed to avoid classification as a modification under any provision of Title I of the federal Act. Further, federally enforceable emission caps assumed to avoid classification as a modification under ~~chapter 1200-03-11~~ Chapter 0400-30-38, ~~chapter~~ Chapter 1200-30-16, Chapter 1200-03-31, paragraph (4) of Rule 1200-03-09-.01~~(4)~~ or paragraph (5) of Rule 1200-03-09-.01~~(5)~~ are included in the criteria of this section~~ 1200-03-09-.02(11)(f)5.(ii)(I)IV.A~~.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-03-09-.04 Exemptions is amended by deleting it in its entirety and substituting instead the following:

(1) The permit exemptions listed in paragraph (4) of this rule do not apply if an air contaminant source is subject to a standard or requirement contained in the following, except if the air contaminant source belongs to a source category listed in paragraph (5) of Rule 1200-03-09-.07, even if the source itself is not eligible for authorization, or except where specifically stated:

Chapter ~~1200-03-11 (Hazardous air contaminants)~~ 0400-30-38 (Emission Standards for Hazardous Air Pollutants);
Chapter 1200-03-18 (Volatile organic compounds);
Chapter 1200-03-19 (Emission standards and monitoring requirements for additional control areas);
Chapter 1200-03-22 (Lead emission standards);
Chapter 1200-03-27 (Nitrogen oxides); and
Paragraph (2) of Rule 1200-03-31-.05~~(2)~~ (Case by case determinations of hazardous air pollutant requirements).

In addition, the exemption provided for the air contaminant sources in paragraph (4) of this rule does not exempt the sources from inclusion in determining if a major stationary source or major modification construction permit is required under paragraphs (4) and (5) of Rule 1200-03-09-.01.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Part 10 of subparagraph (a) of paragraph (2) of Rule 1200-03-09-.04 Exemptions is amended by deleting it in its entirety and substituting instead the following:

10. “Hazardous air pollutant” means any air contaminant regulated in Chapter ~~1200-03-11~~ 0400-30-38, or listed in ~~Chapter~~ paragraph (6) of Rule 1200-03-31-.02~~(6)~~.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Part 9 of subparagraph (d) of paragraph (4) of Rule 1200-03-09-.04 Exemptions is amended by deleting it in its entirety and substituting instead the following:

9. Any emission unit with the potential to emit radionuclides which will result in a dose to the most exposed member of the public of less than 0.1 millirem per year. Even though radionuclide air contaminant sources are regulated under Chapter ~~1200-03-11~~ 0400-30-38, this exemption is still valid except that recordkeeping and reporting requirements must be met.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Part 15 of subparagraph (a) of paragraph (5) of Rule 1200-03-09-.04 Exemptions is amended by deleting it in its entirety and substituting instead the following:

15. “Hazardous air pollutant” means any air contaminant regulated in Chapter ~~1200-03-11,~~ 0400-30-38 or listed in ~~Chapter~~ paragraph (6) of Rule 1200-03-31-.02~~(6)~~.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Part 3 of subparagraph (c) of paragraph (5) of Rule 1200-03-09-.04 Exemptions is amended by deleting it in its entirety and substituting instead the following:

3. Any emission unit or activity which is a subset of a process emission source, fuel burning installation, or incinerator, and which has a potential to emit less than 5 tons per year of a regulated air pollutant, by annual certification of compliance as required in item (11)(d)1(ii)(I) of Rule 1200-03-09-.02~~(11)(d)1.(ii)(I)~~, may, at the discretion of the Technical Secretary, be considered to meet the monitoring and related recordkeeping and reporting requirements of subpart (11)(e)1(iii) of Rule 1200-03-09-.02~~(11)(e)1.(iii)~~ and part (2)(b)1 of Rule 1200-03-10-.04~~(2)(b)1.~~, and the compliance requirements of subpart (11)(e)3(i) of Rule 1200-03-09-.02~~(11)(e)3.(i)~~ for that regulated air pollutant except where generally applicable requirements of the state implementation plan specifically impose monitoring and related record keeping and reporting requirements, or except where any applicable procedures and methods are required pursuant to ~~rule~~ Rule 1200-03-10-.04. This provision shall not relieve any emissions unit or activity from any applicable standard or requirement under Chapters ~~1200-03-11~~ 0400-30-38 and 1200-03-31, and subparagraph (1)(dd) of Rule 1200-03-02-.01~~(1)(dd)~~.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Part 28 of subparagraph (f) of paragraph (5) of Rule 1200-03-09-.04 Exemptions is amended by deleting it in its entirety and substituting instead the following:

28. Vacuum cleaning systems used exclusively for industrial, commercial, or residential housekeeping purposes, except those systems used to collect hazardous air contaminants regulated by Chapter ~~1200-03-11~~ 0400-30-38.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-11
Hazardous Air Contaminants

Repeal

Chapter 1200-03-11 Hazardous Air Contaminants is Repealed.

~~Chapter 0400-30-11~~
~~Hazardous Air Contaminants~~

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~~1200-03-11-.01 GENERAL PROVISIONS.~~

~~(1) List of Pollutants and Applicability~~

~~(a) Hazardous air contaminants are any air contaminants which may cause, or contribute to, an increase in serious irreversible or incapacitating reversible illness, and has been so designated by the Board. The Board shall, from time to time, after public hearing, designate additional hazardous air contaminants. The following are hereby designated hazardous air contaminants:~~

~~1. Asbestos~~

~~2. Beryllium~~

~~3. Mercury~~

~~4. Vinyl Chloride~~

~~5. Benzene~~

~~6. Radionuclides~~

~~7. Inorganic Arsenic~~

~~(b) The sources covered by emission standards in this chapter are still subject to all provisions in the other chapters of the Tennessee Air Pollution Control Regulations.~~

~~(c) Unless otherwise noted, references to paragraph or subdivisions of paragraphs in rules in this chapter are to paragraphs or subdivisions of paragraphs in that rule.~~

~~(2) Permit and Information Requirements~~

~~(a) Any person constructing or modifying an air contaminant source that is subject to an emission~~

~~standard in this chapter must obtain a construction permit as outlined in rule 1200-03-09-.01.~~

~~(b) Any person planning to construct or modify a source of hazardous air contaminants shall file with the Technical Secretary, following the time frame outlined in rule 1200-03-09-.01, sufficient information to allow evaluation of the air pollution potential of the source. This information shall be submitted on forms provided by the Technical Secretary and as a minimum shall include:~~

~~1. Name and address of owner or operator;~~

~~2. The location or proposed location of the source;~~

~~3. Nature, size, design, operating design capacity, and method of operation of the source;~~

~~4. Identification of the hazardous air contaminant;~~

~~5. Emission rate(s) of the hazardous air contaminant;~~

~~6. Period or periods of operation;~~

~~7. Composition of the hazardous air contaminant;~~

~~8. Temperature and moisture content of the air or gas stream in which the hazardous air contaminant is contained;~~

~~9. Characterization of the variability of hazardous air contaminant release with respect to rate, composition and physical characteristics;~~

~~10. Height, velocity, and direction of air or gas stream at the point where released to the atmosphere;~~

~~11. A description of the control equipment for each emission point.~~

~~(i) Primary control device(s) for each hazardous pollutant.~~

~~(ii) Secondary control device(s) for each hazardous pollutant.~~

~~(iii) Estimated control efficiency (percent) for each control device.~~

~~12. Identify each point of emission for each hazardous air contaminant.~~

~~13. Such other information as may be specifically requested by the Technical Secretary.~~

~~(c) The owner or operator of one or more sources of hazardous air contaminants shall, within 90 days after notification by the Technical Secretary, submit to the Technical Secretary the information specified in parts 1. through 13. of subparagraph (b) above.~~

~~(d) Any owner or operator of a source which has an initial startup after the effective date of a standard prescribed under this chapter shall furnish written notification to the Technical Secretary as follows:~~

~~1. A notification of the anticipated date of initial startup of the source not more than 60 days nor less than 30 prior to such date.~~

~~2. A notification of the actual date of initial startup of the source within 15 days after such date.~~

~~(e) Within ninety (90) days after the effective date of any emission standard in this chapter, the owner or operator of a source to which the standard applies in existence or under construction on the effective date of the standard shall submit the information specified in part 1. through 13. in subparagraph (b) above. Along with this package of information, the owner or operator shall submit a statement as to whether he can comply with the standards prescribed in this chapter~~

~~within ninety (90) days of the said effective date.~~

~~(f) Changes in the information provided under subparagraphs (b), (c), and/or (e) of this paragraph shall be provided by the source to the Technical Secretary within 30 days after such change, except that if changes will result from modification of the source, as defined in chapter 1200-03-02, then the provisions in subparagraphs (a) and (b) of this paragraph apply.~~

~~(g) The owner or operator of any air contaminant source not previously required to have a permit (operating and/or construction) by the provisions of chapter 1200-03-09 must do so within 90 days after one of the sources' emissions has been designated by the Board as a hazardous air contaminant.~~

~~(3) Definitions~~

~~(a) ''Alternative method'' means any method of sampling and analyzing for an air pollutant which is not a reference method but which has been demonstrated to the Technical Secretary's satisfaction to produce results adequate for the Technical Secretary's determination of compliance.~~

~~(b) ''Capital expenditure'' means an expenditure for a physical or operational change to a stationary source which exceeds the product of the applicable ''annual asset guideline repair allowance percentage'' specified in the latest edition of Internal Revenue Service (IRS) Publication 534 and the stationary source's basis, as defined by section 1012 of the Internal Revenue Code. However, the total expenditure for a physical or operational change to a stationary source must not be reduced by any ''excluded additions'' as defined for stationary sources constructed after December 31, 1981, in IRS Publication 534, as would be done for tax purposes. In addition, ''annual asset guideline repair allowance'' may be used even though it is excluded for tax purposes in IRS Publication 534.~~

~~(c) ''Commenced'' means, with respect to the definition of ''new source'' in subparagraph (cc) of rule 1200-03-02-.01, that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.~~

~~(d) ''Compliance schedule'' means the date or dates by which a source or category of sources is required to comply with the standards of this chapter.~~

~~(e) ''Construction'' means fabrication, erection, or installation of an affected facility.~~

~~(f) ''Equivalent method'' means any method of sampling and analyzing for an air pollutant which has been demonstrated to the Technical Secretary's satisfaction to have a consistent and quantitatively known relationship to the reference method, under specified conditions.~~

~~(g) ''Existing source'' means any stationary source which is not a new source.~~

~~(h) ''Modification'' means any physical change in, or change in the method of operation of, a stationary source which increases the amount of any hazardous air pollutant emitted by such source or which results in the emission of any hazardous air pollutant not previously emitted, except that:~~

~~1. Routine maintenance, repair, and replacement shall not be considered physical changes, and~~

~~2. The following shall not be considered a change in the method of operation:~~

~~(i) An increase in the production rate, if such increase does not exceed the operating design capacity of the stationary source;~~

~~(ii) An increase in hours of operation.~~

~~(i) ''Monitoring system'' means any system, required under the monitoring paragraphs in applicable~~

~~rules, used to sample and condition (if applicable), to analyze, and to provide a record of emissions or process parameters.~~

~~(j) ''Run'' means the net period of time during which an emission sample is collected. Unless otherwise specified, a run may be either intermittent or continuous within the limits of good engineering practice.~~

~~(k) ''Standard'' means an emission standard including a design, equipment, work practice or operational standard for a hazardous air pollutant promulgated under this chapter.~~

~~(l) ''New source'' means any stationary source, the construction or modification of which is commenced after the effective date of the rule for hazardous air pollutants which will be applicable to such source.~~

~~(m) ''Owner or operator'' means any person who owns, leases, operates, controls, or supervises a stationary source.~~

~~(n) ''Reference method'' means any method of sampling and analyzing for an air pollutant. Any references to reference methods in this chapter shall be to those reference methods set forth in Subparagraph 1200-03-16-.01(5)(g) unless otherwise stated in this chapter.~~

~~(o) ''Startup'' means the setting in operation of a stationary source for any purpose.~~

~~(p) ''Stationary source'' means any building, structure, facility, or installation which emits or may emit any air pollutant which has been designated as hazardous by the Technical Secretary.~~

~~(q) ''ASTM Method'' ASTM in this chapter refers to the American Society for Testing Materials. Copies of methods are available for purchase by writing to ASTM, 1916 Race Street, Philadelphia, PA 19103 or by writing to the Tennessee Division of Air Pollution Control, 701 Broadway, 4th Floor Customs House, Nashville, TN 37219. Be sure to specify which method is desired.~~

~~(r) ''in VOC service'' means that the piece of equipment contains or contacts a process fluid that is at least 10 percent Volatile Organic Compound (VOC) by weight.~~

~~(s) Reserved.~~

~~(4) Modification~~

~~(a) Except as provided under subparagraph (d) of this paragraph, any physical or operational change to a stationary source which results in an increase in the rate of emission to the atmosphere of a hazardous pollutant to which a standard applies shall be considered a modification.~~

~~(b) Upon modification, an existing source shall become a new source for each hazardous pollutant for which the rate of emission to the atmosphere increases and to which a standard applies.~~

~~(c) Emission rate shall be expressed as kg/hr for any hazardous pollutant discharged into the atmosphere for which a standard is applicable. The Technical Secretary shall use the following to determine the emission rate:~~

~~1. Emission factors as specified in the background information document (BID) for the applicable standard, or in the latest issue of ''Compilation of Air Pollutant Emission Factors,'' EPA Publication No. AP-42, or other emission factors determined by the Technical Secretary to be superior to AP-42 emission factors, in cases where use of emission factors demonstrates that the emission rate will clearly increase or clearly not increase as a result of the physical or operational change.~~

~~2. Material balances, monitoring data, or manual emission tests in cases where use of emission factors, as referenced in subparagraph (c)(1) of this paragraph, does not demonstrate to the Technical Secretary's satisfaction that the emission rate will clearly increase or clearly not increase as a result of the physical or operational change, or~~

~~where it is demonstrated to the Technical Secretary's satisfaction that there are reasonable grounds to dispute the result obtained by the Technical Secretary using emission factors. When the emission rate is based on results from manual emission tests or monitoring data, the procedures specified in the *Federal Register*, Vol. 40, December 16, 1975, beginning on page 58420, shall be used to determine whether an increase in emission rate has occurred. Tests shall be conducted under such conditions as the Technical Secretary shall specify to the owner or operator. At least three test runs must be conducted before and at least three after the physical or operational change. All operating parameters which may affect emissions must be held constant to the maximum degree feasible for all test runs.~~

~~(d) The following shall not, by themselves, be considered modifications under this chapter:~~

~~1. Maintenance, repair, and replacement which the Technical Secretary determines to be routine for a source category.~~

~~2. An increase in production rate of a stationary source, if that increase can be accomplished without a capital expenditure on the stationary source.~~

~~3. An increase in the hours of operation.~~

~~4. Any conversion to coal by reason of any order under section 2(a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (or any superseding legislation) or by reason of a natural gas curtailment plan pursuant to an applicable federal statute.~~

~~5. The relocation or change in ownership of a stationary source.~~

~~(5) Monitoring Requirements~~

~~(a) Unless otherwise specified, this paragraph applies to each monitoring system required under each rule which requires monitoring.~~

~~(b) Each owner or operator shall maintain and operate each monitoring system as specified in the applicable rule and in a manner consistent with good air pollution control practice for minimizing emissions. Any unavoidable breakdown or malfunction of the monitoring system should be repaired or adjusted as soon as practicable after its occurrence. The Technical Secretary's determination of whether acceptable operating and maintenance procedures are being used will be based on information which may include, but not be limited to, review of operating and maintenance procedures, manufacturer recommendations and specifications, and inspection of the monitoring system.~~

~~(c) When required by the applicable rule, and at any other time the Technical Secretary may require, the owner or operator of a source being monitored shall conduct a performance evaluation of the monitoring system and furnish the Technical Secretary with a copy of a written report of the results within 60 days of the evaluation. Such a performance evaluation shall be conducted according to the applicable specifications and procedures described in the applicable rule. The owner or operator of the source shall furnish the Technical Secretary with written notification of the date of the performance evaluation at least 30 days before the evaluation is to begin.~~

~~(d) When the effluents from a single source, or from two or more sources subject to the same emission standards, are combined before being released to the atmosphere, the owner or operator shall install a monitoring system on each effluent or on the combined effluent. If two or more sources are not subject to the same emission standards, the owner or operator shall install a separate monitoring system on each effluent, unless otherwise specified. If the applicable standard is a mass emission standard and the effluent from one source is released to the atmosphere through more than one point, the owner or operator shall install a monitoring system at each emission point unless the installation of fewer systems is approved by the Technical Secretary.~~

~~(e) The owner or operator of each monitoring system shall reduce the monitoring data as specified in each applicable rule. Monitoring data recorded during periods of unavoidable monitoring system~~

~~breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in any data average.~~

~~(f) The owner or operator shall maintain records of monitoring data, monitoring system calibration checks, and the occurrence and duration of any period during which the monitoring system is malfunctioning or inoperative. These records shall be maintained at the source for a minimum of 2 years and made available, upon request, for inspection by the Technical Secretary.~~

~~(g) 1. Monitoring shall be conducted as set forth in this paragraph and the applicable rule unless the Technical Secretary:~~

~~(i) Specifies or approves the use of the specified monitoring requirements and procedures with minor changes in methodology; or~~

~~(ii) Approves the use of alternatives to any monitoring requirements or procedures.~~

~~2. If the Technical Secretary finds reasonable grounds to dispute the results obtained by an alternative monitoring method, the Technical Secretary may require the monitoring requirements and procedures specified in this chapter.~~

~~Authority: T.C.A. §§ 4-5-201, et seq.; 4-5-202; 68-25-105; and 68-201-101, et seq.~~

~~1200-03-11-.02 ASBESTOS.~~

~~The provisions of this rule are applicable to those sources specified in 1200-03-11-.02(2)(a) through (l), 1200-03-11-.02(5) and 1200-03-11-.02(6).~~

~~(1) Definitions.~~

~~All terms that are used in this rule and are not defined below are given the same meaning as provided in Chapter 1200-03-02 DEFINITIONS.~~

~~(a) "Active waste disposal site" means any disposal site other than an inactive site.~~

~~(b) "Adequately wet" means sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wet.~~

~~(c) "Asbestos" means the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.~~

~~(d) "Asbestos-containing material" (ACM) means asbestos or any asbestos containing material, which contains more than 1 percent asbestos as determined using Polarized Light Microscopy according to the method specified in Appendix A, Subpart F, 40 CFR, Part 763, Section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR.~~

~~(e) "Asbestos-containing waste materials" means mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this rule. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.~~

~~(f) "Asbestos mill" means any facility engaged in converting, or in any intermediate step in converting, asbestos ore into commercial asbestos. Outside storage of asbestos material is not considered a part of the asbestos mill.~~

~~(g) "Asbestos tailings" means any solid waste that contains asbestos and is a product of asbestos mining or milling operations.~~

~~(h) "Asbestos waste from control devices" means any waste material that contains asbestos and is collected by a pollution control device.~~

~~(i) "Category I nonfriable ACM" means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products, containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR.~~

~~(j) "Category II nonfriable ACM" means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos, as determined using polarized light microscopy according to the methods specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.~~

~~(k) "Commercial asbestos" means any material containing asbestos that is extracted from ore and has value because of its asbestos content.~~

~~(l) "Cutting" means to penetrate with a sharp-edged instrument and includes sawing but does not include shearing, slicing, or punching.~~

~~(m) "Demolition" means the wrecking or taking out of any load-supporting structural member of a facility together with any related handling operations or the intentional burning of any facility.~~

~~(n) "Emergency renovation operation" means a renovation operation that was not planned but results from a sudden, unexpected event that, if not immediately attended to, presents a safety or public health hazard, is necessary to protect equipment from damage, or is necessary to avoid imposing an unreasonable financial burden. This term includes operations necessitated by nonroutine failures of equipment.~~

~~(o) "Fabricating" means any processing (e.g., cutting, sawing, drilling) of a manufactured product that contains commercial asbestos, with the exception of processing at temporary sites (field fabricating) for the construction or restoration of facilities. In the case of friction products, fabricating includes bonding, debonding, grinding, sawing, drilling, or other similar operations performed as part of fabricating.~~

~~(p) "Facility" means any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of this definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this rule is not excluded, regardless of its current use or function.~~

~~(q) "Facility component" means any part of a facility including equipment.~~

~~(r) "Friable asbestos material" means any material containing more than 1 percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.~~

~~(s) "Fugitive source" means any source of emissions not controlled by an air pollution control device.~~

~~(t) "Glove bag" means a sealed compartment with attached inner gloves used for the handling of asbestos-containing materials. Properly installed and used, glove bags provide a small work area enclosure typically used for small-scale asbestos stripping operations. Information on glove-bag installation, equipment and supplies, and work practices is contained in the Occupational Safety and Health Administration's (OSHA's) final rule on occupational exposure to asbestos (Appendix~~

~~G to 29 CFR 1926.58, as contained in the 7-1-91 Edition of the CFR).~~

~~(u) "Grinding" means to reduce to powder or small fragments and includes mechanical chipping or drilling.~~

~~(v) "Inactive waste disposal site" means any disposal site or portion of it where additional asbestos-containing waste material has not been deposited within the past year.~~

~~(w) "In poor condition" means the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.~~

~~(x) "Installation" means any building or structure or any group of buildings or structures at a single demolition or renovation site that are under the control of the same owner or operator (or owner or operator under common control).~~

~~(y) "Leak-tight" means that solids or liquids cannot escape or spill out. It also means dust-tight.~~

~~(z) "Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of asbestos are increased. Failures of equipment shall not be considered malfunctions if they are caused in any way by poor maintenance, careless operation, or any other preventable upset conditions, equipment breakdown, or process failure.~~

~~(aa) "Manufacturing" means the combining of commercial asbestos—or, in the case of woven friction products, the combining of textiles containing commercial asbestos—with any other material(s), including commercial asbestos, and the processing of this combination into a product. Chlorine production is considered a part of manufacturing.~~

~~(bb) "Natural barrier" means a natural object that effectively precludes or deters access. Natural barriers include physical obstacles such as cliffs, lakes or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.~~

~~(cc) "Nonfriable asbestos material" means any material containing more than 1 percent asbestos by area as determined by the method specified in Appendix A, Subpart F, 40 CFR Part 763 section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.~~

~~(dd) "Nonscheduled renovation operation" means a renovation operation necessitated by the routine failure of equipment, which is expected to occur within a given period based on past operating experience, but for which an exact date cannot be predicted.~~

~~(ee) "Owner or operator of a demolition or renovation activity" means any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.~~

~~(ff) "Outside air" means the air outside buildings and structures, including, but not limited to, the air under a bridge or in an open air ferry dock.~~

~~(gg) "Particulate asbestos material" means finely divided particles of asbestos or material containing asbestos.~~

~~(hh) "Planned renovation operations" means a renovation operation, or a number of such operations, in which some RACM will be removed or stripped within a given period of time and that can be predicted. Individual nonscheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.~~

~~(ii) "Regulated asbestos containing material (RACM)" means~~

~~1. Friable asbestos material,~~

~~2. Category I nonfriable ACM that has become friable,~~

~~3. Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or~~

~~4. Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operations regulated by this rule.~~

~~(jj) "Remove" means to take out RACM or facility components that contain or are covered with RACM from any facility.~~

~~(kk) "Renovation" means altering a facility or one or more facility components in any way, including the stripping or removal of RACM from a facility component. Operations in which load-supporting structural members are wrecked or taken out are demolitions.~~

~~(ll) "Resilient floor covering" means asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR.~~

~~(mm) "Roadways" means surfaces on which vehicles travel. This term includes public and private highways, roads, streets, parking areas, and driveways.~~

~~(nn) "Strip" means to take off RACM from any part of a facility or facility components.~~

~~(oo) "Structural member" means any load supporting member of a facility, such as beams and load supporting walls; or any nonload supporting member, such as ceilings and nonload-supporting walls.~~

~~(pp) "Visible emissions" means any emissions, which are visually detectable without the aid of instruments, coming from RACM or asbestos-containing waste material, or from any asbestos milling, manufacturing, or fabricating operation. This does not include condensed, uncombined water vapor.~~

~~(qq) "Waste generator" means any owner or operator of a source covered by this rule whose act or process produces asbestos-containing waste material.~~

~~(rr) "Waste shipment record" means the shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.~~

~~(ss) "Working day" means Monday through Friday and includes holidays that fall on any of the days Monday through Friday.~~

~~(2) Standard for various sources of asbestos.~~

~~(a) Standard for asbestos mills.~~

~~1. Each owner or operator of an asbestos mill shall either discharge no visible emissions to the outside air from that asbestos mill, including fugitive sources, or use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~2. Each owner or operator of an asbestos mill shall meet the following requirements:~~

~~(i) Monitor each potential source of asbestos emissions from any part of the mill facility, including air cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day, during daylight hours, for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.~~

~~(ii) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunction, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this rule, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:~~

~~(I) Maintenance schedule.~~

~~(II) Recordkeeping plan.~~

~~(iii) Maintain records of the results of visible emissions monitoring and control device inspections using the forms shown in Figures 1 and 2 and include the following:~~

~~(I) Date and time of each inspection.~~

~~(II) Presence or absence of visible emissions.~~

~~(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.~~

~~(IV) Presence of dust deposits on clean side of fabric filters.~~

~~(V) Brief description of corrective actions taken, including date and time.~~

~~(VI) Daily hours of operation for each control device.~~

~~(iv) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this paragraph.~~

~~(v) Retain a copy of all monitoring and inspection records for at least 2 years.~~

~~(vi) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.~~

~~(b) Standard for roadways. No person may construct or maintain a roadway with asbestos tailings or asbestos-containing waste material on that roadway, unless, for asbestos tailings,~~

~~1. It is a temporary roadway on an area of asbestos ore deposits (asbestos mine); or~~

~~2. It is a temporary roadway at an active asbestos mill site and is encapsulated with a resinous or bituminous binder. The encapsulated road surface must be maintained at a minimum frequency of once per year to prevent dust emissions; or~~

~~3. It is encapsulated in asphalt concrete meeting the specifications contained in Section 401 of Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-85, 1985, or their equivalent.~~

~~(c) Standard for manufacturing.~~

~~1. Applicability. This standard applies to the following manufacturing operations using commercial asbestos:~~

~~(i) The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yarn, roving lap, or other textile materials.~~

~~(ii) The manufacture of cement products.~~

~~(iii) The manufacturing of fireproofing and insulating materials.~~

~~(iv) The manufacture of friction products.~~

~~(v) The manufacture of paper, millboard, and felt.~~

~~(vi) The manufacture of floor tile.~~

~~(vii) The manufacture of paints, coatings, caulks, adhesives, and sealants.~~

~~(viii) The manufacture of plastics and rubber materials.~~

~~(ix) The manufacture of chlorine utilizing asbestos diaphragm technology.~~

~~(x) The manufacture of shotgun shell wads.~~

~~(xi) The manufacture of asphalt concrete.~~

~~2. Standard. Each owner or operator of the manufacturing operations to which this Subparagraph (2)(c) applies shall either:~~

~~(i) Discharge no visible emissions to the outside air from these operations or from any building or structure in which they are conducted or from any other fugitive sources; or~~

~~(ii) Use the methods specified by 1200-03-11-.02(3) to clean emissions from these operations containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~(iii) Monitor each potential source of asbestos emissions from any part of the manufacturing facility, including air cleaning devices, process equipment, and buildings housing material processing and handling equipment, at least once each day during daylight hours for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.~~

~~(iv) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this rule, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:~~

~~(I) Maintenance schedule.~~

~~(II) Recordkeeping plan~~

~~(v) Maintain records of the results of visible emission monitoring and air cleaning device inspections using a format similar to that shown in Figures 1 and 2 and include the following:~~

~~(I) Date and time of each inspection.~~

~~(II) Presence or absence of visible emissions.~~

~~(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.~~

~~(IV) Presence of dust deposits on clean side of fabric filters.~~

~~(V) Brief description of corrective actions taken, including date and time.~~

~~(VI) Daily hours of operation for each control device.~~

~~(vi) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this subparagraph (2)(c).~~

~~(vii) Retain a copy of all monitoring and inspection records for at least 2 years.~~

~~(viii) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.~~

~~(d) Standard for demolition and renovation.~~

~~1. Applicability. To determine which requirements of parts 1., 2., and 3. of this subparagraph apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of parts 2. and 3. of this subparagraph apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:~~

~~(i) Requirements of Parts 2. and 3. of this subparagraph apply, except as provided in Subpart 1.(iii) of this subparagraph, if the amount of RACM is~~

~~(I) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or~~

~~(II) At least 1 cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously.~~

~~(ii) In a facility being demolished, only the notification requirements of subparts 2.(i), (ii), (iii)(I) and (IV), and (iv)(I) through (VII) and (iv)(IX) and (XVI) of this subparagraph apply, if the amount of RACM is~~

~~(I) Less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, and~~

~~(II) Less than one cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously, or there is no asbestos.~~

~~(iii) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of subparts 2.(i), 2.(ii),2.(iii)(III), 2.(iv) (except 2.(iv)(VIII)), 2.(v), and 3.(iv) through 3.(ix) of this subparagraph apply.~~

~~(iv) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of parts 2. and 3. of this subparagraph apply if the combined amount of RACM stripped, removed, dislodged, cut, drilled, or similarly disturbed is~~

~~(I) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or~~

~~(II) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.~~

~~(III) To determine whether subpart 1.(iv) of this subparagraph applies to planned renovation operations involving individual nonscheduled operations, predict the combined additive amount of RACM to be removed or stripped during a calendar year of January 1 through December 31.~~

~~(IV) To determine whether subpart 1.(iv) of this subparagraph applies to emergency renovation operations, estimate the combined amount of RACM to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.~~

~~(v) Owners or operators of demolition and renovation operations are exempt from the requirements of subparagraphs 1200-03-11-.01(2)(a), 1200-03-11-.01(2)(b), and 1200-03-11-.01(2)(d).~~

~~2. Notification requirements. Each owner or operator of a demolition or renovation activity to which this subparagraph applies shall:~~

~~(i) Provide the Technical Secretary with written notice of intention to demolish or renovate. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.~~

~~(ii) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.~~

~~(iii) Postmark or deliver the notice as follows:~~

~~(I) At least 10 working days before asbestos stripping or removal work or any other activity begins (such as site preparation that would break up, dislodge or similarly disturb asbestos material), if the operation is described in subparts 1(i) and (iv) (except 1(iv)(III) and 1(iv)(IV)) of this subparagraph. If the operation is as described in subpart 1.(ii) of this subparagraph, notification is required 10 working days before demolition begins.~~

~~(II) At least 10 working days before the end of the calendar year preceding the year for which notice is being given for renovations described in item 1.(iv)(III) of this subparagraph.~~

~~(III) As early as possible before, but not later than, the following working day if the operation is a demolition ordered according to subpart 1.(iii) of this subparagraph or, if the operation is a renovation described in item 1.(iv)(IV) of this subparagraph.~~

~~(IV) For asbestos stripping or removal work in a demolition or renovation operation, described in subparts 1.(i) and (iv) (except 1.(iv)(III) and 1.(iv)(IV)) of this subparagraph, and for a demolition described in subparts 1.(ii) of this subparagraph, that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Technical Secretary as follows:~~

~~I. When the asbestos stripping or removal operation or demolition operation covered by this rule will begin after the date contained in the notice,~~

~~A. Notify Technical Secretary of the new start date by telephone as soon as possible before the original start date, and~~

~~B. Provide Technical Secretary a written notice of the new~~

~~start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.~~

~~II. When the asbestos stripping or removal operation or demolition operation covered by this subparagraph will begin on a date earlier than the original start date,~~

~~A. Provide the Technical Secretary a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.~~

~~B. For demolitions covered by subpart 1.(ii) of this subparagraph, provide the Technical Secretary with written notice of a new start date at least 10 working days before commencement of demolition. Delivery of updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.~~

~~III. In no event shall an operation covered by this subparagraph begin on a date other than the date contained in the written notice of the new start date.~~

~~(iv) Include the following in the notice:~~

~~(I) An indication of whether the notice is the original or a revised notification.~~

~~(II) Name, address, and telephone number of both the facility owner and operator and the asbestos removal contractor owner or operator.~~

~~(III) Type of operation: demolition or renovation.~~

~~(IV) Indicate whether or not asbestos is present in the building.~~

~~(V) Location and address (including building number or name and floor or room number, if appropriate), street address, city, county, and state, of the facility being demolished or renovated. Description of the facility or affected part of the facility including the size (square meters [square feet] and number of floors), age, and present and prior use of the facility.~~

~~(VI) Procedure, including analytical methods, employed to detect the presence of RACM and Category I and Category II nonfriable ACM.~~

~~(VII) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet) if off the facility components. Also, estimate the approximate amount of Category I and Category II nonfriable ACM in the affected part of the facility that will not be removed during renovation or before demolition.~~

~~(VIII) Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in item 1.(iv)(III) of this subparagraph. Also report the day(s) of the week and work hours the project will take place.~~

~~(IX) Scheduled starting and completion dates of demolition or renovation.~~

~~(X) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.~~

~~(XI) Description of work practices and engineering controls to be used to comply with the requirements of this rule, including asbestos removal and waste-handling emission control procedures.~~

~~(XII) Name, address, phone number and contact of the firm who will transport the asbestos material to the waste disposal site. If a second transporter is involved, also list this firm.~~

~~(XIII) Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.~~

~~(XIV) For facilities described in subpart 1.(iii) of this subparagraph, the name, title, and authority of the State or local government representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order shall be attached to the notification.~~

~~(XV) For emergency renovations described in item 1.(iv)(IV) of this subparagraph, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, or would cause equipment damage or an unreasonable financial burden.~~

~~(XVI) Description of procedures to be followed in the event that unexpected RACM is found or Category II nonfriable ACM becomes crumbled, pulverized, or reduced to powder.~~

~~(XVII) A certification that only a person trained as required by subpart 3.(viii) of this subparagraph will supervise the stripping and removal described by this notification.~~

~~(XVIII) The signature of the Owner/Operator and the date certifying that the notification information is correct.~~

~~(v) The information required in subpart 2.(iv) of this subparagraph must be reported using the form shown in Figure 3.~~

~~3. Procedures for asbestos emission control. Each owner or operator of a demolition or renovation activity to whom this subparagraph applies, according to subpart 1. of this subparagraph, shall comply with the following procedures:~~

~~(i) Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. RACM need not be removed before demolition if:~~

~~(I) It is Category I nonfriable ACM that is not in poor condition and is not friable.~~

~~(II) It is on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition; or~~

~~(III) It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the~~

~~exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and must be adequately wet at all times until disposed of.~~

~~(IV) They are Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.~~

~~(ii) When a facility component that contains, is covered with, or is coated with RACM is being taken out of the facility as a unit or in sections:~~

~~(I) Adequately wet all RACM exposed during cutting or disjoining operations; and~~

~~(II) Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.~~

~~(iii) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation.~~

~~(I) In renovation operations, wetting is not required if:~~

~~I. The owner or operator has obtained prior written approval from the Technical Secretary after his consultation with the EPA Regional Administrator, based on a written application that wetting to comply with this subparagraph would unavoidably damage equipment or present a safety hazard; and~~

~~II. The owner or operator uses one of the following emission control methods:~~

~~A. A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in 1200-03-11-.02(3).~~

~~B. A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.~~

~~C. Leak-tight wrapping to contain all RACM prior to dismantlement.~~

~~(II) In renovation operations where wetting would result in equipment damage or a safety hazard, and the methods allowed in item 3.(iii)(I) of this subparagraph cannot be used, another method may be used after obtaining written approval from the Technical Secretary after his consultation with the EPA Regional Administrator, based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in item 3.(iii)(I) of this subparagraph.~~

~~(III) A copy of the Technical Secretary's written approval shall be kept at the worksite and made available for inspection.~~

~~(iv) After a facility component covered, coated, or containing RACM has been taken out of the facility as a unit or in sections pursuant to subpart 3.(ii) of this subparagraph, it shall be stripped or contained in leak-tight wrapping, except as~~

~~described in subpart 3.(v) of this subparagraph. If stripped, either:~~

~~(I) Adequately wet the RACM during stripping; or~~

~~(II) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in 1200-03-11-.02(3).~~

~~(v) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with subpart 3.(ii), (iii), and (iv) of this subparagraph), the RACM is not required to be stripped if the following requirements are met:~~

~~(I) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.~~

~~(II) The component is encased in a leak-tight wrapping.~~

~~(III) The leak-tight wrapping is labeled according to 1200-03-11-.02(2)(k)4.(i)(I), (II), and (III) during all loading and unloading operations and during storage.~~

~~(vi) For all RACM, including material that has been removed or stripped:~~

~~(I) Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal in accordance with 1200-03-11-.02(2)(j); and~~

~~(II) Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.~~

~~(III) Transport the material to the ground via leak-tight chutes or containers if it has been removed or stripped more than 50 feet above ground level and was not removed as units or in sections.~~

~~(IV) RACM contained in leak-tight wrapping that has been removed in accordance with subpart 3.(iv) and 3.(iii)(I)II.C. of this subparagraph need not be wetted.~~

~~(vii) When the temperature at the point of wetting is below 0°C (32°F):~~

~~(I) The owner or operator need not comply with item 3.(ii)(I) and the wetting provisions of subpart 3.(iii) of this subparagraph.~~

~~(II) The owner or operator shall remove facility components containing, coated, or covered with RACM as units or in sections to the maximum extent possible.~~

~~(III) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Technical Secretary during normal business hours at the demolition or renovation site. The owner or operator shall retain the temperature records for at least 2 years.~~

~~(viii) No RACM shall be stripped, removed, or otherwise handled or disturbed at a facility regulated by this subparagraph unless at least one on-site representative, such as a foreman or management-level person or other authorized~~

~~representative, trained in the provisions of this regulation and the means of complying with them is present. Every 2 years, the trained on-site individual shall receive refresher training in the provisions of this regulation. The required training shall include as a minimum: applicability; notifications; material identification; control procedures for removals, including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and asbestos hazards and worker protection. Evidence that the required training has been completed shall be posted and made available for inspection by the Technical Secretary at the demolition or renovation site.~~

~~(ix) For facilities described in subpart 1.(iii) of this subparagraph, adequately wet the portion of the facility that contains RACM during the wrecking operation.~~

~~(x) If a facility is demolished by intentional burning, all RACM including Category I and Category II nonfriable ACM must be removed in accordance with this rule before burning.~~

~~(e) Standard for spraying. The owner or operator of an operation in which asbestos-containing materials are spray applied shall comply with the following requirements:~~

~~1. For spray-on application on buildings, structures, pipes, and conduits, do not use material containing more than 1 percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, except as provided in part 3. of this subparagraph.~~

~~2. For spray-on application of materials that contain more than 1 percent asbestos as determined using method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, on equipment and machinery, except as provided in part 3. of this subparagraph:~~

~~(i) Notify the Technical Secretary at least 20 days before beginning the spraying operation. Include the following information in the notice:~~

~~(I) Name and address of owner or operator.~~

~~(II) Location of spraying operation.~~

~~(III) Procedures to be followed to meet the requirements of this subparagraph.~~

~~(ii) Discharge no visible emissions to the outside air from spray-on application of the asbestos-containing material or use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~3. The requirements of subparts 1. and 2. of this subparagraph do not apply to the spray-on application of materials where the asbestos fibers in the materials are encapsulated with a bituminous or resinous binder during spraying and the materials are not friable after drying.~~

~~4. Owners or operators of sources subject to this subparagraph are exempt from the requirements of paragraph 1200-03-11-.01(2)(a) and (d).~~

~~(f) (Reserved)~~

~~(g) (Reserved)~~

~~(h) Standard for fabricating.~~

~~1. Applicability. This subparagraph applies to the following fabricating operations using commercial asbestos:~~

~~(i) The fabrication of cement building products.~~

~~(ii) The fabrication of friction products, except those operations that primarily install asbestos friction materials on motor vehicles.~~

~~(iii) The fabrication of cement or silicate board for ventilation hoods: ovens; electrical panels; laboratory furniture, bulkheads, partitions, and ceilings for marine construction; and flow control devices for the molten metal industry.~~

~~2. Standard. Each owner or operator of any of the fabricating operations to which this subparagraph applies shall either:~~

~~(i) Discharge no visible emissions to the outside air from any of the operations or from any building or structure in which they are conducted or from any other fugitive sources; or~~

~~(ii) Use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~(iii) Monitor each potential source of asbestos emissions from any part of the fabricating facility, including air cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day, during daylight hours, for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.~~

~~(iv) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this rule, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:~~

~~(I) Maintenance schedule.~~

~~(II) Recordkeeping plan.~~

~~(v) Maintain records of the results of visible emission monitoring and air cleaning device inspections using the form(s) shown in Figures 1 and 2 and include the following:~~

~~(I) Date and time of each inspection.~~

~~(II) Presence or absence of visible emissions.~~

~~(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.~~

~~(IV) Presence of dust deposits on clean side of fabric filters.~~

~~(V) Brief description of corrective actions taken, including date and time.~~

~~(VI) Daily hours of operation for each control device.~~

~~(vi) Furnish upon request and make available during normal business hours for inspection by the Technical Secretary, all records required under this~~

~~subparagraph.~~

~~(vii) Retain a copy of all monitoring and inspection records for at least 2 years.~~

~~(viii) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.~~

~~(i) Standard for insulating materials.~~

~~No owner or operator of a facility may install or reinstall on a facility component any insulating materials that contain commercial asbestos if the materials are either molded and friable or wet-applied and friable after drying. The provisions of this subparagraph do not apply to spray-applied insulating materials regulated under 1200-03-11-.02(2)(e).~~

~~(j) Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.~~

~~Each owner or operator of any source covered under the provisions of 1200-03-11-.02(2)(c), 1200-03-11-.02(2)(d), 1200-03-11-.02(2)(e), and 1200-03-11-.02(2)(h) shall comply with the following provisions:~~

~~1. Discharge no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or use one of the emission control and waste treatment methods specified in subparts 1.(i) through (iv) of this subparagraph.~~

~~(i) Adequately wet asbestos-containing waste material as follows:~~

~~(I) Mix control device asbestos waste to form a slurry; adequately wet other asbestos-containing waste material; and~~

~~(II) Discharge no visible emissions to the outside air from collection, mixing, wetting, and handling operations, or use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air; and~~

~~(III) After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; or, for materials that will not fit into containers without additional breaking, put materials into leak-tight wrapping; and~~

~~(IV) Label the containers or wrapped materials specified in item 1.(i)(III) of this subparagraph using warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001(j)(2) or 1926.58(k)(2)(iii), as contained in the 7-1-91 Edition of the CFR. The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible.~~

~~(V) For asbestos-containing waste material to be transported off the facility site, label containers or wrapped materials with the name of the waste generator and the location at which the waste was generated.~~

~~(ii) Process asbestos-containing waste material into nonfriable forms as follows:~~

~~(I) Form all asbestos-containing waste material into nonfriable pellets or other shapes;~~

~~(II) Discharge no visible emissions to the outside air from collection and processing operations, including incineration, or use the method~~

~~specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~(iii) For facilities demolished where the RACM is not removed prior to demolition according to 1200-03-11-.02(2)(d)3.(i)(I), (II), (III), and (IV) or for facilities demolished according to 1200-03-11-.02(2)(d)3.(ix), adequately wet asbestos-containing waste material at all times after demolition and keep wet during handling and loading for transport to disposal site. Asbestos-containing waste materials covered by this subparagraph do not have to be sealed in leak-tight containers or wrapping but may be transported and disposed of in bulk.~~

~~(iv) Use an alternative emission control and waste treatment method that has received prior approval by the Administrator of the EPA and the Technical Secretary according to the procedure described in 1200-03-11-.02(2)(k)3.(ii).~~

~~(v) As applied to demolition and renovation, the requirements of part 1. of this subparagraph do not apply to Category I nonfriable ACM waste and Category II nonfriable ACM waste that did not become crumbled, pulverized, or reduced to powder.~~

~~2. All asbestos-containing waste material shall be deposited as soon as is practical by the waste generator at:~~

~~(i) A waste disposal site operated in accordance with the provisions of 1200-03-11-.02(5), or~~

~~(ii) An EPA-approved site that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material according to the provisions of 1200-03-11-.02(6).~~

~~(iii) The requirements of part 2. of this subparagraph do not apply to Category I nonfriable ACM that is not RACM.~~

~~3. Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of waste so that the signs are visible. The markings must conform to the requirements of 1200-03-11-.02(2)(k)4.(i)(I), (II), and, (III).~~

~~4. For all asbestos-containing waste material transported off the facility site:~~

~~(i) Maintain waste shipment records, using the form shown in Figure 4, and include the following information:~~

~~(I) The name, address, and telephone number of the waste generator.~~

~~(II) The name and address of the local or State agency responsible for administering the asbestos NESHAP program.~~

~~(III) The approximate quantity in cubic meters (cubic yards).~~

~~(IV) The name and telephone number of the disposal site operator.~~

~~(V) The name and physical site location of the disposal site and the disposal facility permit number.~~

~~(VI) The date transported.~~

~~(VII) The name, address, and telephone number of the transporter(s).~~

~~(VIII) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified,~~

~~packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.~~

~~(ii) Provide a copy of the waste shipment record, described in subpart 4.(i) of this subparagraph, to the disposal site owners or operators at the same time as the asbestos-containing waste material is delivered to the disposal site.~~

~~(iii) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated treatment or disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated treatment or disposal site meeting the requirements of this rule to determine the status of the waste shipment.~~

~~(iv) Report in writing to the local or State office responsible for administering the asbestos NESHAP program for the waste generator if a copy of the waste shipment record, signed by the owner or operator of the designated waste treatment or disposal site, is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information.~~

~~(I) A copy of the waste shipment record for which a confirmation of delivery was not received, and~~

~~(II) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.~~

~~(v) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.~~

~~5. Furnish upon request, and make available for inspection by the Technical Secretary, all records required under this subparagraph.~~

~~(k) Standard for waste disposal for asbestos mills.~~

~~Each owner or operator of any source covered under the provisions of 1200-03-11-.02(2)(a) shall:~~

~~1. Deposit all asbestos-containing waste material at a waste disposal site operated in accordance with the provisions of 1200-03-11-.02(5); and~~

~~2. Discharge no visible emissions to the outside air from the transfer of control device asbestos waste to the tailings conveyor, or use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air. Dispose of the asbestos waste from control devices in accordance with 1200-03-11-.02(2)(j)1. or part 3. of this subparagraph; and~~

~~3. Discharge no visible emissions to the outside air during the collection, processing, packaging, or on-site transporting of any asbestos-containing waste material, or use one of the disposal methods specified in subparts 3.(i) or (ii) of this subparagraph, as follows:~~

~~(i) Use a wetting agent as follows:~~

~~(I) Adequately mix all asbestos-containing waste material with a wetting agent recommended by the manufacturer of the agent to effectively wet dust and tailings, before depositing the material at a waste disposal site. Use the agent as recommended for the particular dust by the manufacturer of the agent.~~

~~(II) Discharge no visible emissions to the outside air from the wetting~~

~~operation or use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~(III) Wetting may be suspended when the ambient temperature at the waste disposal site is less than -9.5°C (15°F), as determined by an appropriate measurement method with an accuracy of ± 1°C (± 2°F). During periods when wetting operations are suspended, the temperature must be recorded at least at hourly intervals, and records must be retained for at least 2 years in a form suitable for inspection.~~

~~(ii) Use an alternative emission control and waste treatment method that has received prior written approval by the Administrator of the EPA and the Technical Secretary. To obtain approval for an alternative method, a written application must be submitted to the Technical Secretary demonstrating that the following criteria are met:~~

~~(I) The alternative method will control asbestos emissions equivalent to currently required methods.~~

~~(II) The suitability of the alternative method for the intended application.~~

~~(III) The alternative method will not violate other regulations.~~

~~(IV) The alternative method will not result in increased water pollution, land pollution, or occupational hazards.~~

~~4. When waste is transported by vehicle to a disposal site:~~

~~(i) Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of the waste so that the signs are visible. The markings must:~~

~~(I) Be displayed in such a manner and location that a person can easily read the legend.~~

~~(II) Conform to the requirements for 51 cm x 36 cm (20 in x 14 in) upright format signs specified in 29 CFR 1910.145(d)(4), as contained in the 7-1-91 Edition of the CFR, and this subparagraph; and~~

~~(III) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this subparagraph.~~

~~Legend~~

~~DANGER~~

~~ASBESTOS DUST HAZARD~~

~~CANCER AND LUNG DISEASE HAZARD~~

~~Authorized Personnel Only~~

~~Notation~~

~~1st Line: 2.5 cm (1 inch) Sans Serif, Gothic or Block~~
~~2nd and 3rd Lines: 1.9 cm (3/4 inch) Sans Serif, Gothic or Block~~
~~4th Line: 14 Point Gothic~~

~~Spacing between any two lines must be at least equal to the height of the upper of the two lines.~~

~~(ii) For off-site disposal, provide a copy of the waste shipment record, described in part 5.(i) of this subparagraph, to the disposal site owner or operator at the same time as the asbestos-containing waste material is delivered to the disposal site.~~

~~5. For all asbestos-containing waste material transported off the facility site:~~

~~(i) Maintain asbestos waste shipment records, using the form shown in Figure 4, and include the following information:~~

~~(I) The name, address, and telephone number of the waste generator.~~

~~(II) The name and address of the local or State agency responsible for administering the asbestos NESHAP program.~~

~~(III) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).~~

~~(IV) The name and telephone number of the disposal site operator.~~

~~(V) The name and physical site location of the disposal site and the disposal facility permit number.~~

~~(VI) The date transported.~~

~~(VII) The name, address, and telephone number of the transporter(s).~~

~~(VIII) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.~~

~~(ii) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated disposal site to determine the status of the waste shipment.~~

~~(iii) Report in writing to the Technical Secretary if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information:~~

~~(I) A copy of the waste shipment record for which a confirmation of delivery was not received, and~~

~~(II) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.~~

~~(iv) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.~~

~~6. Furnish upon request, and make available for inspection by the Technical Secretary, all records required under this subparagraph.~~

~~(l) Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations.~~

~~Each owner or operator of any inactive waste disposal site that was operated by sources covered under 1200-03-11-.02(2)(a), 1200-03-11-.02(2)(c), or 1200-03-11-.02(2)(h) and received deposits~~

~~of asbestos-containing waste material generated by the sources, shall:~~

~~1. Comply with one of the following:~~

~~(i) Either discharge no visible emissions to the outside air from an inactive waste disposal site subject to this subparagraph; or~~

~~(ii) Cover the asbestos-containing waste material with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos-containing waste material. In desert areas where vegetation would be difficult to maintain, at least 8 additional centimeters (3 inches) of well-graded, nonasbestos crushed rock may be placed on top of the final cover instead of vegetation and maintained to prevent emissions; or~~

~~(iii) Cover the asbestos containing waste material with at least 60 centimeters (2 feet) of compacted nonasbestos-containing material, and maintain it to prevent exposure of the asbestos-containing waste; or~~

~~(iv) For inactive waste disposal sites for asbestos tailings, a resinous or petroleum-based dust suppression agent that effectively binds dust to control surface air emissions may be used instead of the methods in subparts 1.(i), (ii), and (iii) of this subparagraph. Use the agent in the manner and frequency recommended (for the particular asbestos tailings) by the manufacturer of the dust suppression agent to achieve and maintain dust control. Obtain prior written approval of the Technical Secretary to use other equally effective dust suppression agents. For purposes of this subparagraph, any used, spent, or other waste oil is not considered a dust suppression agent.~~

~~2. Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as follows, or comply with subparts 1.(ii) or 1.(iii) of this subparagraph.~~

~~(i) Display warning signs at all entrances and at intervals of 100 m (328 feet) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material was deposited. The warning signs must:~~

~~(I) Be posted in such a manner and location that a person can easily read the legend; and~~

~~(II) Conform to the requirements for 51 cm x 36 cm (20" x 14") upright format signs specified in 29 CFR 1910.145(d) (as published in (7-1-91 Edition)) and this subparagraph; and~~

~~(III) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this subparagraph.~~

~~Legend~~	~~Notation~~
~~Asbestos Waste Disposal~~	~~2.5 cm (1 inch) Sans Serif, Gothic or Block~~
~~Do Not Create Dust~~	~~1.9 cm (3/4 inch) Sans Serif, Gothic or Block~~
~~Breathing Asbestos is Hazardous to your health~~	~~14 Point Gothic~~

~~Spacing between any two lines must be at least equal to the height of the upper of the two lines.~~

~~(ii) Fence the perimeter of the site in a manner adequate to deter access by the general public.~~

~~(iii) When requesting a determination on whether a natural barrier adequately deters public access, supply information enabling the Technical Secretary to determine whether a fence or a natural barrier adequately deters access by the general public.~~

~~3. The owner or operator may use an alternative control method that has received prior approval of the Administrator of the EPA and the Technical Secretary rather than comply with the requirements of parts 1. or 2. of this subparagraph.~~

~~4. Notify the Technical Secretary in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site under this subparagraph, and follow the procedures specified in the notification. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Technical Secretary at least 10 working days before the excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:~~

~~(i) Scheduled starting and completion dates.~~

~~(ii) Reason for disturbing the waste.~~

~~(iii) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Technical Secretary may require changes in the emission control procedures to be used.~~

~~(iv) Location of any temporary storage site and the final disposal site.~~

~~5. Within 60 days of a site becoming inactive and after the effective date of this rule, record, in accordance with State law, a notation on the deed to the facility property and on any other instrument that would normally be examined during a title search; this notation will in perpetuity notify any potential purchaser of the property that:~~

~~(i) The land has been used for the disposal of asbestos-containing waste material;~~

~~(ii) The survey plot and record of the location and quantity of asbestos-containing waste disposed of within the disposal site required in 1200-03-11-.02(5)(f) have been filed with the Technical Secretary; and~~

~~(iii) The site is subject to 40 CFR 61 Subpart M, as contained in the 7-1-91 Edition of the CFR.~~

~~(3) Air Cleaning~~

~~(a) The owner or operator who uses air cleaning, as specified in 1200-03-11-.02(2)(a)1., 1200-03-11-.02(2)(c)2.(ii), 1200-03-11-.02(2)(d)3.(iii)(I)IIA, 1200-03-11-.02(2)(d)3.(iv)(II), 1200-03-11-.02(2)(e)2.(ii), 1200-03-11-.02(2)(h)2.(ii), 1200-03-11-.02(2)(k)2., 1200-03-11-.02(2)(k)3.(i)(II), 1200-03-11-.02(2)(j)1.(i)(II), 1200-03-11-.02(2)(j)1.(ii)(II), and 1200-03-11-.02(6)(e) shall:~~

~~1. Use fabric filter collection devices, except as noted in subparagraph (b) of this paragraph, doing all of the following:~~

~~(i) Repealed.~~

~~(ii) Ensuring that the airflow permeability, as determined by ASTM Method D737-75, does not exceed 9 m3/min/m2 (30 ft3/min/ft2) for woven fabrics or 11 m3/min/m2 (35 ft3/min/ft2) for felted fabrics, except that 12 m3/min/m2 (40 ft3/min/ft2) for woven and 14 m3/min/m2 (45 ft3/min/ft2) for felted fabrics is allowed for filtering air from asbestos ore dryers; and~~

~~(iii) Ensuring that felted fabric weighs at least 475 grams per square meter (14 ounces per square yard) and is at least 1.6 millimeters (one-sixteenth inch) thick throughout; and~~

~~(iv) Avoiding the use of synthetic fabrics that contain fill yarn other than that which is spun.~~

~~2. Properly install, use, operate, and maintain all air-cleaning equipment authorized by this paragraph. Bypass devices may be used only during upset or emergency conditions and then only for so long as it takes to shut down the operation generating the particulate asbestos material.~~

~~3. For fabric filter collection devices installed after January 10, 1989, provide for easy inspection for faulty bags.~~

~~(b) There are the following exceptions to part (a)1:~~

~~1. After January 10, 1989, if the use of fabric creates a fire or explosion hazard, or the Technical Secretary determines that a fabric filter is not feasible, the Technical Secretary may authorize as a substitute the use of wet collectors designed to operate with a unit contacting energy of at least 9.95 kilopascals (40 inches water gage pressure).~~

~~2. Use a HEPA filter that is certified to be at least 99.97 percent efficient for 0.3 micron particles.~~

~~3. The Technical Secretary may authorize the use of filtering equipment other than described in parts (a)1. and (b)1. and 2. of this paragraph if the owner or operator demonstrates to the satisfaction of the Administrator of the EPA and the Technical Secretary that it is equivalent to the described equipment in filtering particulate asbestos material.~~

~~(4) Reporting.~~

~~(a) Any new source to which this paragraph applies (with the exception of sources subject to 1200-03-11-.02(2)(b), 1200-03-11-.02(2)(e), and 1200-03-11-.02(2)(i)), which has an initial startup date preceding the effective date of this revision, shall provide the following information to the Technical Secretary postmarked or delivered within 90 days of the effective date. In the case of a new source that does not have an initial startup date preceding the effective date, the information shall be provided, postmarked or delivered, within 90 days of the initial startup date. Any owner or operator of an existing source shall provide the following information to the Technical Secretary within 90 days of the effective date of this rule unless the owner or operator of the existing source has previously provided this information to the Technical Secretary. Any changes in the information provided by any existing source shall be provided to the Technical Secretary, postmarked or delivered, within 30 days after the change.~~

~~1. A description of the emission control equipment used for each process; and~~

~~2. If a fabric filter device is used to control emissions,~~

~~(i) The airflow permeability in m3/min/m2 (ft3/min/ft2) if the fabric filter device uses a woven fabric, and, if the fabric is synthetic, whether the fill yarn is spun or not spun; and~~

~~(ii) If the fabric filter device uses a felted fabric, the density in g/m2 (oz/yd2), the minimum thickness in millimeters (inches), and the airflow permeability in m3/min/m2 (ft3/min/ft2).~~

~~3. If a HEPA filter is used to control emissions, the certified efficiency.~~

~~4. For sources subject to 1200-03-11-.02(2)(k) and 1200-03-11-.02(2)(j):~~

~~(i) A brief description of each process that generates asbestos-containing waste material; and~~

~~(ii) The average volume of asbestos-containing waste material disposed of, measured in m3/day (yd3/day); and~~

~~(iii) The emission control methods used in all stages of waste disposal; and~~

~~(iv) The disposal, the name of the site operator, and the name and location of the disposal site.~~

~~5. For sources subject to 1200-03-11-.02(2)(l) and 1200-03-11-.02(5):~~

~~(i) A brief description of the site; and~~

~~(ii) The method or methods used to comply with the standard, or alternate procedures to be used.~~

~~(b) The information required by subparagraph (a) of this paragraph must accompany the information required by Appendix A to 40 CFR 61.1 (7-1-91 Edition). Active waste disposal sites subject to 1200-03-11-.02(5) shall also comply with this provision. Roadways, demolition and renovation, spraying, and insulating materials are exempted from the requirements of reporting the information required by Appendix A to 40 CFR 61.1 (7-1-91 Edition).~~

~~(5) Standard for active waste disposal sites.~~

~~Each owner or operator of an active waste disposal site that receives asbestos-containing waste material from a source covered under 1200-03-11-.02(2)(k), 1200-03-11-.02(2)(j), or 1200-03-11-.02(6) shall meet the requirements of this paragraph:~~

~~(a) Either there must be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, or the requirements of subparagraph (c) or (d) of this paragraph must be met.~~

~~(b) Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of subparagraph (c), part 1. of this paragraph must be met.~~

~~1. Warning signs must be displayed at all entrances and at intervals of 100 m (328 feet) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must:~~

~~(i) Be posted in such a manner and location that a person can easily read the legend; and~~

~~(ii) Conform to the requirements for 51 cm x 36 cm (20" x 14") upright format signs specified in 29 CFR 1910.145(d) (as published in (7-1-91 Edition)) and this subparagraph; and~~

~~(iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this subparagraph.~~

~~Legend~~	~~Notation~~
~~Asbestos Waste Disposal~~	~~2.5 cm (1 inch) Sans Serif, Station Gothic or Block~~
~~Do Not Create Dust~~	~~1.9 cm (3/4 inch) Sans Serif, Gothic or Block~~
~~Breathing Asbestos is~~	~~14 Point Gothic~~

~~Hazardous to your health~~

~~Spacing between any two lines must be at least equal to the height of the upper of the two lines.~~

~~2. The perimeter of the disposal site must be fenced in a manner adequate to deter access by the general public.~~

~~3. Upon request and supply of appropriate information, the Technical Secretary will determine whether a fence or natural barrier adequately deters access by the general public.~~

~~(c) Rather than meet the no visible emission requirement of subparagraph (a) of this paragraph, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall:~~

~~1. Be covered with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, or~~

~~2. Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control. Other equally effective dust suppression agents may be used upon prior approval by the Technical Secretary. For purposes of this paragraph, any used, spent, or other waste oil is not considered a dust~~

~~(d) Rather than meet the no visible emission requirement of subparagraph (a) of this paragraph, use an alternative emissions control method that has received prior written approval by the Administrator of the EPA and the Technical Secretary according to the procedures described in 1200-03-11-.02(2)(k)3.(ii).~~

~~(e) For all asbestos-containing waste material received, the owner or operator of the active waste disposal site shall:~~

~~1. Maintain waste shipment records, using a form similar to that shown in Figure 4 following subparagraph (6)(h) of this rule, and include the following information:~~

~~(i) The name, address, and telephone number of the waste generator.~~

~~(ii) The name, address, and telephone number of the transporter(s).~~

~~(iii) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).~~

~~(iv) The presence of improperly enclosed or uncovered waste, or any asbestos-containing waste material not sealed in leak-tight containers. Report in writing to the Technical Secretary by the following working day, the presence of a significant amount of improperly enclosed or uncovered waste. Submit a copy of the waste shipment record along with the report.~~

~~(v) The date of receipt.~~

~~2. As soon as possible and no longer than 30 days after receipt of the waste, send a copy of the signed waste shipment record to the waste generator.~~

~~3. Upon discovering a discrepancy between the quantity of waste designated on the waste shipment records and the quantity actually received, attempt to reconcile the discrepancy with the waste generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report it in writing to the Technical Secretary. Describe the discrepancy and attempts to reconcile it, and submit a copy of the waste shipment record along with the report.~~

~~4. Retain a copy of all records and reports required by this subparagraph for at least 2 years.~~

~~(f) Maintain, until closure, records of the location, depth and area, and quantity in cubic meters (cubic yards) of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area.~~

~~(g) Upon closure, comply with all the provisions of 1200-03-11-.02(2)(l).~~

~~(h) Submit to the Technical Secretary, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities.~~

~~(i) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this paragraph.~~

~~(j) Notify the Technical Secretary in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site and is covered. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Technical Secretary at least 10 working days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:~~

~~1. Scheduled starting and completion dates.~~

~~2. Reason for disturbing the waste.~~

~~3. Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Technical Secretary may require changes in the emission control procedure to be used.~~

~~4. Location of any temporary storage site and the final disposal site.~~

~~(6) Standard for operations that convert asbestos-containing waste material into nonasbestos (asbestos-free) material.~~

~~Each owner or operator of an operation that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material shall:~~

~~(a) Obtain the prior written approval of the Administrator of the EPA and the Technical Secretary to construct the facility. To obtain approval, the owner or operator shall provide the Technical Secretary with the following information:~~

~~1. Application to construct pursuant to paragraph 1200-03-11-.01(2).~~

~~2. In addition to the information requirements of paragraph 1200-03-11-.01(2).~~

~~(i) Description of waste feed handling and temporary storage.~~

~~(ii) Description of process operating conditions.~~

~~(iii) Description of the handling and temporary storage of the end product.~~

~~(iv) Description of the protocol to be followed when analyzing output materials by transmission electron microscopy.~~

~~3. Performance test protocol, including provisions for obtaining information required under subparagraph (b) of this paragraph.~~

~~4. The Administrator of the EPA or the Technical Secretary may require that a~~

~~demonstration of the process be performed prior to approval of the application to construct.~~

~~(b) Conduct a start-up performance test. Test results shall include:~~

~~1. A detailed description of the types and quantities of nonasbestos material, RACM, and asbestos-containing waste material processed, e.g., asbestos cement products, friable asbestos insulation, plaster, wood, plastic, wire, etc. Test feed is to include the full range of materials that will be encountered in actual operation of the process.~~

~~2. Results of analyses, using polarized light microscopy, that document the asbestos content of the wastes processed.~~

~~3. Results of analyses, using transmission electron microscopy, that document that the output materials are free of asbestos. Samples for analysis are to be collected as 8-hour composite samples (one 200-gram (7-ounce) sample per hour), beginning with the initial introduction of RACM or asbestos-containing waste material and continuing until the end of the performance test.~~

~~4. A description of operating parameters, such as temperature and residence time, defining the full range over which the process is expected to operate to produce nonasbestos (asbestos-free) materials. Specify the limits for each operating parameter within which the process will produce nonasbestos (asbestos-free) materials.~~

~~5. The length of the test.~~

~~(c) During the initial 90 days of operation,~~

~~1. Continuously monitor and log the operating parameters identified during start-up performance tests that are intended to ensure the production of nonasbestos (asbestos-free) output material.~~

~~2. Monitor input materials to ensure that they are consistent with the test feed materials described during start-up performance tests in subparagraph (b)1. of this paragraph.~~

~~3. Collect and analyze samples, taken as 10-day composite samples (one 200-gram (7-ounce) sample collected every 8 hours of operation) of all output material for the presence of asbestos. Composite samples may be for fewer than 10 days. Transmission electron microscopy (TEM) shall be used to analyze the output material for the presence of asbestos. During the initial 90-day period, all output materials must be stored on-site until analysis shows the material to be asbestos-free or disposed of as asbestos-containing waste material according to 1200-03-11-.02(2)(j).~~

~~(d) After the initial 90 days of operation,~~

~~1. Continuously monitor and record the operating parameters identified during start-up performance testing and any subsequent performance testing. Any output produced during a period of deviation from the range of operating conditions established to ensure the production of nonasbestos (asbestos-free) output materials shall be:~~

~~(i) Disposed of as asbestos-containing waste material according to 1200-03-11-.02(2)(j), or~~

~~(ii) Recycled as waste feed during process operation within the established range of operating conditions, or~~

~~(iii) Stored temporarily on-site in a leak-tight container until analyzed for asbestos content. Any product material that is not asbestos-free shall be either disposed of as asbestos-containing waste material or recycled as waste feed to the process.~~

~~2. Collect and analyze monthly composite samples (one 200-gram (7-ounce) sample~~

~~collected every 8 hours of operation) of the output material. Transmission electron microscopy shall be used to analyze the output material for the presence of asbestos.~~

~~(e) Discharge no visible emissions to the outside air from any part of the operation, or use the methods specified by 1200-03-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.~~

~~(f) Maintain records on-site and include the following information:~~

~~1. Results of start-up performance testing and all subsequent performance testing, including operating parameters, feed characteristics, and analyses of output materials.~~

~~2. Results of the composite analyses required during the initial 90 days of operation under 1200-03-11-.02(6)(c).~~

~~3. Results of the monthly composite analyses required under 1200-03-11-.02(6)(d).~~

~~4. Results of continuous monitoring and logs of process operating parameters required under 1200-03-11-.02(6)(c) and (d).~~

~~5. The information on waste shipments received as required in 1200-03-11-.02(5)(e).~~

~~6. For output materials where no analyses were performed to determine the presence of asbestos, record the name and location of the purchaser or disposal site to which the output materials were sold or deposited, and the date of sale or disposal.~~

~~7. Retain records required by subparagraph (f) of this paragraph for at least 2 years.~~

~~(g) Submit the following reports to the Technical Secretary:~~

~~1. A report for each analysis of product composite samples performed during the initial 90 days of operation.~~

~~2. A quarterly report, including the following information concerning activities during each consecutive 3-month period:~~

~~(i) Results of analyses of monthly product composite samples.~~

~~(ii) A description of any deviation from the operating parameters established during performance testing, the duration of the deviation, and steps taken to correct the deviation.~~

~~(iii) Disposition of any product produced during a period of deviation, including whether it was recycled, disposed of as asbestos-containing waste material, or stored temporarily on-site until analyzed for asbestos content.~~

~~(iv) The information on waste disposal activities as required in 1200-03-11-.02(5)(f).~~

~~(h) Nonasbestos (asbestos-free) output material is not subject to any of the provisions of this rule. Output materials in which asbestos is detected, or output materials produced when the operating parameters deviated from those established during the start-up performance testing, unless shown by TEM analysis to be asbestos-free, shall be considered to be asbestos-containing waste and shall be handled and disposed of according to 1200-03-11-.02(2)(j) and 1200-03-11-.02(5) or reprocessed while all of the established operating parameters are being met.~~

~~FIGURE 1~~

~~RECORD OF VISIBLE EMISSION MONITORING~~

~~Date of Inspection~~	~~(Time of) Inspection~~	~~Air Cleaning Device or~~	~~Visible Emissions~~	~~Daily Operating Hours~~	~~Inspectors Initials~~

~~(mo/day/yr)~~	~~Also Indicate (a.m./p.m.)~~	~~Fugitive Source Designation or Number~~	~~Observed (Yes/No) Corrective Action Taken~~		

~~FIGURE 2~~

~~AIR CLEANING DEVICE INSPECTION CHECKLIST~~

~~1. Air cleaning device designation or number~~				
~~2. Dates of inspection~~				
~~3. Times of inspection~~				
~~4. Is air cleaning device operating properly~~				
~~5. Tears, holes or abrasions in fabric filter? (Yes / No)~~				
~~6. Dust on clean side of fabric filter? (Yes / No)~~				
~~7. Other signs of malfunctions or potential malfunctions?~~				
~~8. Describe other malfunctions or sings of potential malfunctions~~				
~~9. Describe corrective action(s) taken~~				
~~10. Date and time corrective action taken~~				
~~11. Inspected by:~~ ~~(Print/Type Name) Title Signature~~ ~~Date~~ ~~(Print/Type Name) Title Signature~~				

~~FIGURE 3~~
~~TENNESSEE DIVISION OF AIR POLLUTION CONTROL~~
~~NOTIFICATION OF ASBESTOS DEMOLITION OR RENOVATION~~

~~OPERATOR PROJECT #~~	~~POSTMARK~~	~~DATE RECEIVED~~	~~NOTIFICATION #~~

~~I. Type of Notification (O-Orig. R-Revised C-Cancelled)~~

~~II. Facility Information (Identify Owner, Removal Contractor, Operator)~~

~~Owner Name:~~

~~Address:~~

~~City: State: Zip:~~

~~Contact: Telephone:~~

~~Removal Contractor:~~

~~Address:~~

~~City: State: Zip:~~

~~Contact: Telephone:~~

~~Other Operator (If Different From Owner):~~

~~Address:~~

~~City: State: Zip:~~

~~Contact: Telephone:~~

~~III. Type of Operation (D-Demo. O-Ordered Demo. R-Renov. E-Emer. Renov.)~~

~~IV. Is Asbestos Present ? (Yes/No)~~

~~V. Facility Description (Include Building Name, Number and Floor or Room Number)~~

~~Bldg. Name:~~

~~Address:~~

~~City: State: Zip:~~

~~Site Location:~~

~~Building Size: Total Sq. Ft. # of Floors: Age in Years:~~

~~Present Use: Prior Use:~~

~~VI. Procedure and Analytical Method Used to Detect the Presence of Asbestos Material~~

~~VII. Approximate Amount of Asbestos Material In Work Area Including~~ ~~1. Regulated ACM to be Removed~~ ~~2. Category I ACM Not Removed~~ ~~3. Category II ACM Not Removed~~	~~RACM Not To Be Removed~~	~~Nonfriable Asbestos Material~~				~~Units of Measurement~~
		~~Not to be removed~~		~~To be removed~~		
		~~Cat I~~	~~Cat II~~	~~Cat I~~	~~Cat II~~	~~Unit~~
~~Pipes~~						~~LnFt Ln m~~
~~Surface Area~~						~~SqFt Sq m~~
~~Vol RACM off Facility Components~~						~~CuFt Cu m~~

~~Unit~~

~~Pipes~~

~~Surface Area~~

~~Vol RACM Off Facility Components~~

~~VIII. Scheduled Dates Asbestos Removal Start: Complete:~~

~~Scheduled Dates of Preparation Start: Complete:~~

~~Days of Week:(circle) All Sun Mon Tue Wed Thu Fri Sat Hours of Day:~~

~~IX. Scheduled Dates Demo/Renovation Start: Complete:~~

~~Continued on Page Two~~

~~NOTIFICATION OF DEMOLITION OR RENOVATION (continued)~~

~~X. Description of Planned Demolition or Renovation Work, Method(s) to be Used:~~

~~XI. Description of Work Practices and Engineering Controls to be used to Prevent Emissions of Asbestos at the Demolition and Renovation Site:~~

~~XII. Waste Transporter #1~~

~~Name:~~

~~Address:~~

~~City: State: Zip:~~

~~Contact Person: Telephone:~~

~~Waste Transporter #2~~

~~Name:~~

~~Address:~~

~~City: State: Zip:~~

~~Contact Person: Telephone:~~

~~XIII. Waste Disposal Site~~

~~Name:~~

~~Location:~~

~~City: State: Zip:~~

~~Telephone:~~

~~XIV. If Demolition Ordered by a Government Agency, Please Identify Below:~~

~~Name: Title:~~

~~Authority:~~

~~Date of Order (MM/DD/YY): Date Ordered to Begin (MM/DD/YY):~~

~~XV. For Emergency Renovations~~

~~Date and Hour of Emergency (MM/DD/YY):~~

~~Description of the Sudden, Unexpected Event:~~

~~Explanation of How the Event Caused Unsafe Conditions or Would Cause Equipment Damage or an Unreasonable Financial Burden:~~

~~XVI. Description of Procedures to be Followed in the Event Asbestos is Found or Previously Nonfriable Asbestos Material Becomes Crumbled, Pulverized, or Reduced to Powder.~~

~~XVII. I Certify That an Individual Trained in the Provisions of This Regulation(40 CFR Part 61, Subpart M) Will be On-Site During the Demolition or Renovation and Evidence That Required Training has Been Accomplished by This Person Will be Available for Inspection During Normal Business Hours.~~

~~(REQUIRED AFTER NOVEMBER 20, 1991)~~

~~-------------------------------- ------------~~

~~(Signature of Owner/Operator) (Date)~~

~~XVIII. I Certify That the Above Information is Correct.~~

~~-------------------------------- ------------~~

~~Signature of Owner/Operator) Date)~~

~~Submit Completed Form by U.S. Postal Service / Commercial Delivery Service or Hand Deliver to: Tennessee Air Pollution Control, 9th Floor L&C Annex, 401 Church St., Nashville, TN 37243-1531~~

~~FIGURE 4~~

~~WASTE SHIPMENT RECORD~~

~~GENERATOR~~

~~1. Work site name and mailing address~~	~~Owner's name~~	~~Owner's telephone no.~~
~~2. Operator's name and address~~		~~Operator's telephone no.~~

~~3. Waste disposal site (WDS) name, mailing address, physical site location and disposal facility permit and number.~~	~~WDS phone no.~~ ~~Permit No.~~

~~4. Name, and address of responsible agency~~

~~5. Description of materials~~	~~6. Containers~~ ~~No. Type~~	~~7. Total quantity~~ ~~m3 (yd3)~~

~~8. Special handling instructions and additional information~~

~~9. OPERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.~~

~~Printed/typed name & title~~ ~~Signature~~ ~~Month Day Year~~

~~TRANSPORTER~~

~~10. Transporter 1 (Acknowledgment of receipt of materials)~~

~~Printed/typed name & title~~ ~~Signature~~ ~~Month Day Year~~

~~Address and telephone no.~~

~~11. Transporter 2 (Acknowledgment of receipt of materials)~~

~~Printed/typed name & title~~ ~~Signature~~ ~~Month Day Year~~

~~Address and telephone no.~~

~~DISPOSAL SITE~~

~~12. Discrepancy indication space~~

~~13. Waste disposal site owner or operator: Certification of receipt of asbestos materials covered by this manifest except as noted in item~~

~~Printed/typed name & title~~	~~Signature~~	~~Month Day Year~~

~~Waste Generator Section (Items 1-9)~~

~~1. Enter the name of the facility at which asbestos waste is generated and the address where the facility is located. In the appropriate spaces, also enter the name of the owner of the facility and the owner's phone number.~~

~~2. If a demolition or renovation, enter the name and address of the company and authorized agent responsible for performing the asbestos removal. In the appropriate spaces, also enter the phone number of the operator.~~

~~3. Enter the name, address, and physical site location of the waste disposal site (WDS) that will be receiving the asbestos materials. In the appropriate spaces, also enter the phone number of the WDS. Enter "on-site" if the waste will be disposed of on the generator's property. Enter disposal facility permit number.~~

~~4. Provide the name and address of the local, State, or EPA Regional agency responsible for administering the asbestos NESHAP program.~~

~~5. Indicate the types of asbestos waste materials generated. If from a demolition or renovation, indicate the amount of asbestos that is~~

~~Friable Asbestos Material~~
~~Nonfriable Asbestos Material~~

~~6. Enter the number of containers used to transport the asbestos materials listed in item 4. Also enter one of the following container codes used in transporting each type of asbestos material (specify any other type of container used if not listed below):~~

~~DM - Metal drums, barrels~~
~~DP - Plastic drums, barrels~~
~~BA - 6 mil plastic bags or wrapping~~

~~7. Enter the quantities of each type of asbestos material removed in units of cubic meters (cubic yards).~~

~~8. Use this space to indicate special transportation, treatment, storage or disposal of Bill of Lading information. If an alternate waste disposal site is designated, note it here. Emergency response telephone numbers or similar information may be included here.~~

~~9. The authorized agent of the waste generator must read and then sign and date this certification. The date is the date of receipt by transporter.~~

~~NOTE: The waste generator must retain a copy of this form.~~

~~Transporter Section (Items 10 & 11)~~

~~10. & 11. Enter name, address, and telephone number of each transporter used, if applicable. Print or type the full name and title of person accepting responsibility and acknowledging receipt of materials as listed on this waste shipment record for transport. Enter date of receipt and signature.~~

~~NOTE: The transporter must retain a copy of this form.~~

~~Disposal Site Section (Items 12 & 13)~~

~~12. The authorized representative of the WDS must note in this space any discrepancy between waste described on this manifest and waste actually received as well as any improperly enclosed or contained waste. Any rejected materials should be listed and destination of those materials provided. A site that converts asbestos-containing waste material to nonasbestos material is considered a WDS.~~

~~13. The signature (by hand) of the authorized WDS agent indicates acceptance and agreement with statements on this manifest except as noted in Item 12. The date is the date of signature and receipt of shipment.~~

~~NOTE: The WDS must retain a completed copy of this form. The WDS must also send a completed copy to the operator listed in item 2.~~

~~Authority: T.C.A. §§ 4-5-201, et seq.; 4-5-202, et. seq.; 68-201-101, et seq.; and 68-201-105.~~

~~1200-03-11-.03 BERYLLIUM.~~

~~(1) Applicability. The provisions of this rule are applicable to the following stationary sources.~~

~~(a) Extraction plants, ceramic plants, foundries, incinerators, and propellant plants which process beryllium ore, beryllium, beryllium oxide, beryllium alloys, or beryllium containing waste.~~

~~(b) Machine shops which process beryllium, beryllium oxides, or any alloy when such alloy contains more than five (5) percent beryllium by weight.~~

~~(2) Definitions. Terms used in this Rule not defined herein shall have the meaning given to them in chapter 1200-03-02.~~

~~(a) ‘‘Beryllium’’ means the element beryllium. Where weights or concentrations are specified, such weights or concentrations apply to beryllium only, excluding the weight or concentration of any associated elements.~~

~~(b) ‘‘Extraction plant’’ means a facility chemically processing beryllium ore to beryllium metal, alloy, or oxide, or performing any of the intermediate steps in these processes.~~

~~(c) ‘‘Beryllium ore’’ means any naturally occurring material mined or gathered for its beryllium content.~~

~~(d) ‘‘Machine shop’’ means a facility performing cutting, grinding, turning, honing, milling, deburring, lapping, electrochemical machining, etching, or other similar operations.~~

~~(e) ‘‘Ceramic Plant’’ means a manufacturing plant producing ceramic items.~~

~~(f) ‘‘Foundry’’ means a facility engaged in the melting or casting of beryllium metal or alloy.~~

~~(g) ‘‘Beryllium containing waste’’ means material contaminated with beryllium and/or beryllium compounds used or generated during any process or operation performed by a source subject to this rule.~~

~~(h) ‘‘Incinerator’’ means any furnace used in the process of burning waste for the primary purpose of reducing the volume of the waste by removing combustible matter.~~

~~(i) ‘‘Propellant’’ means a fuel and oxidizer physically or chemically combined which undergoes combustion to provide rocket propulsion.~~

~~(j) ‘‘Beryllium alloy’’ means any metal to which beryllium has been added in order to increase its beryllium content and which contains more than 0.1 percent beryllium by weight.~~

~~(k) ‘‘Propellant plant’’ means any facility engaged in the mixing, casting, or machining of propellants.~~

~~(l) ‘‘Rocket motor test site’’ means any building, structure, facility, or installation where the static test firing of a beryllium rocket motor and/or the disposal of beryllium propellant is conducted.~~

~~(m) ‘‘Beryllium propellant’’ means any propellant incorporating beryllium.~~

~~(3) Emission Standard for Beryllium~~

~~(a) Emissions to the atmosphere from stationary sources subject to the provisions of this Rule shall not exceed ten (10) grams of beryllium over a twenty-four (24) hour period.~~

~~(b) The burning of beryllium and/or beryllium containing waste, except propellants, is prohibited except in incinerators, emissions from which must comply with the standards.~~

~~(c) Emissions to the atmosphere from rocket-motor test sites shall not cause time-weighted atmospheric concentrations of beryllium to exceed 75 microgram minutes per cubic meter of air within the limits of 10 to 60 minutes, accumulated during any 2 consecutive weeks, in any area in which an effect adverse to public health could occur.~~

~~(d) If combustion products from the firing of beryllium propellant are collected in a closed tank, emissions from such tank shall not exceed 2 grams per hour and a maximum of 10 grams per day.~~

~~(4) Stack Sampling:~~

~~(a) Each owner or operator required to comply with subparagraph (3)(a) of this rule shall test emissions from his source as follows:~~

~~1. Within ninety (90) days of February 9, 1977 in the case of an existing source or a new source which has initial startup date preceding February 9, 1977; or~~

~~2. Within ninety (90) days of startup in the case of a new source which does not have an initial startup date preceding February 9, 1977.~~

~~(b) The Technical Secretary shall be notified at least thirty (30) days prior to an emission test or air sampling test so that he at his option may observe the test.~~

~~(c) Samples shall be taken over such period or periods as are necessary to accurately determine the maximum emission which will occur in any twenty-four (24) hour period. Where emissions depend upon the relative frequency of operation of different types of processes, operating hours, operating capacities, or other factors, the calculation of maximum twenty-four (24) hour period emissions will be based on that combination of factors which are likely to occur during the subject period and which results in the maximum emissions. No changes in the operation shall be made, which would potentially increase emissions above that determined by the most recent source test, until a new emission level has been estimated by calculation and the results reported to the Technical Secretary.~~

~~(d) Sources subject to subparagraph (3)(d) of this rule shall be continuously sampled, during release of combustion products from the tank, in such a manner that compliance with the standards can be determined.~~

~~(e) Ambient air concentrations shall be measured during and after firing of a rocket motor or propellant disposal and in such a manner that the effect of these emissions can be compared with the standard. Such sampling techniques shall be approved by the Technical Secretary.~~

~~(f) All samples shall be analyzed and beryllium emissions and/or other results determined within thirty (30) days after the source test and/or samples are taken. In the case of sampling during a rocket motor firing or propellant disposal this calculation must occur before any subsequent rocket motor firing or propellant disposal at the given site. All determinations shall be reported to the Technical Secretary by written notification before the close of the next business day following such determination.~~

~~(g) Records of emissions test result, air sampling test results, and other data needed to determine total emissions and/or integrated intermittent ambient concentrations shall be retained at the source and made available, for inspection by the Technical Secretary, for a minimum of two (2) years.~~

~~(h) Emission of beryllium shall be determined by the Reference Method, as specified in the *Federal Register,* Volume 38, Number 66, April 6, 1973, or other techniques approved by the Technical Secretary.~~

~~Authority: T.C.A. §§ 4-5-202 and 68-25-105.~~

~~1200-03-11-.04 MERCURY.~~

~~(1) Applicability. The provisions of this Rule are applicable to those air contaminant sources which process mercury ore to recover mercury, use mercury chlor-alkali cells to produce chlorine gas and alkali metal hydroxide, and incinerate or dry wastewater treatment plant sludge. Any facility subject to the provisions of 40 CFR 63, Subpart IIIII – National Emission Standards for Hazardous Air Pollutants: Mercury Emissions from Mercury Cell Chlor-Alkali Plants is not subject to this rule.~~

~~(2) Definitions: Terms used in this rule not defined herein shall have the meaning given to them in chapter 1200-03-02.~~

~~(a) ‘‘Mercury’’ means the element mercury, excluding any associated elements, and includes mercury in particulates, vapors, aerosols, and compounds.~~

~~(b) ‘‘Mercury ore’’ means a mineral mined specifically for its mercury content.~~

~~(c) ‘‘Mercury ore processing facility’’ means a facility processing mercury ore to obtain mercury.~~

~~(d) ‘‘Condenser stack gases’’ means the gaseous effluent evolved from the stack of processes utilizing heat to extract mercury metal from mercury ore.~~

~~(e) ‘‘Mercury chlor-alkali cell’’ means a device which is basically composed of an electrolyzer section and a denuder (decomposer) section and utilizes mercury to produce chlorine gas, hydrogen gas, and alkali metal hydroxide.~~

~~(f) ‘‘Mercury chlor-alkali electrolyzer’’ means a electrolytic device which is part of a mercury-chlor-alkali cell and utilizes a flowing mercury cathode to produce chlorine gas and alkali metal amalgam.~~

~~(g) ‘‘Denuder’’ means a horizontal or vertical container which is part of a mercury chlor-alkali cell in which water and alkali metal amalgam are converted to alkali metal hydroxide, mercury, and hydrogen gas in a short-circuited, electrolytic reaction.~~

~~(h) ‘‘Hydrogen gas stream’’ means a hydrogen stream formed in the chlor-alkali cell denuder.~~

~~(i) ‘‘End box’’ means a container(s) located on one or both ends of a mercury chlor-alkali electrolyzer which serves as a connection between the electrolyzer and denuder for rich and stripped amalgam.~~

~~(j) ‘‘End box ventilation system’’ means a ventilation system which collects mercury emissions from the end-boxes, the mercury pump sumps, and their water collection systems.~~

~~(k) ‘‘Cell room’’ means a structure(s) housing one or more mercury electrolytic chlor-alkali cells.~~

~~(l) ‘‘Sludge’’ means sludge produced by a treatment plant that processes municipal or industrial waste waters.~~

~~(m) ‘‘Sludge dryer’’ means a device used to reduce the moisture content of sludge by heating to temperatures above 65°C (ca. 150°F) directly with combustion gases.~~

~~(3) Emission Standards for Mercury~~

~~(a) Emissions to the atmosphere from mercury ore processing facilities and mercury cell chlor-alkali plants shall not exceed 2,300 grams of mercury per 24-hour period.~~

~~(b) Emissions to the atmosphere from sludge incineration plants, sludge drying plants, or a combination of these that process waste-water treatment plant sludges shall not exceed 3,200 grams of mercury per 24-hour period.~~

~~(4) Stack Sampling:~~

~~(a) Each owner or operator of a facility subject to an emission standard in paragraph (3) of this rule shall test emissions from his source as follows:~~

~~1. Within ninety (90) days of February 9, 1977, an existing source or a new source which has an initial startup date preceding February 9, 1977, or~~

~~2. Within ninety (90) days of startup in the case of a new source which did not have an initial startup date preceding February 9, 1977.~~

~~(b) The Technical Secretary shall be notified at least thirty (30) days prior to an emission test, so that he may at his option observe the test.~~

~~(c) Samples shall be taken over such period or periods as are necessary to accurately determine the maximum emissions which will occur in a twenty-four (24) hour period. No change in the operation shall be made, which would potentially increase emissions above that determined by the most recent source test, until the new emission level has been estimated by calculation and the results reported to the Technical Secretary.~~

~~(d) All samples shall be analyzed, and mercury emissions shall be determined within thirty (30) days after the source test. Each determination will be reported to the Technical Secretary by written notification by the close of the next business day following such determination.~~

~~(e) Records of emission test results and other data needed to determine total emissions shall be retained at the source and made available for inspection by the Technical Secretary for a minimum of two (2) years.~~

~~(f) Sources using mercury chlor-alkali cells may test cell room emissions by passing all cell room air in forced gas streams through a stack suitable for testing in accordance with the above subparagraphs or demonstrate compliance with subparagraph (g) of this paragraph assume ventilation emissions of 1,300 grams/day of mercury.~~

~~(g) An owner or operator may carry out approved designed, maintenance, and housekeeping practices. A list of approved design, maintenance, and housekeeping practices may be obtained from the Technical Secretary.~~

~~(h) Measurement of mercury.~~

~~Mercury shall be determined by the Reference Method as specified in Appendix B of the *Federal Register*, Volume 38, Number 66, April 6, 1973, or Volume 40, Number 199, October 14, 1975, or other techniques approved by the Technical Secretary.~~

~~(i) Emission monitoring.~~

~~Wastewater treatment plant sludge incinerator and drying plants. All such sources for which mercury emissions exceed 1,600 g/day, demonstrated by either method referenced above, shall monitor mercury emissions at intervals of at least once per year by use of Method 105 of Appendix B, *Federal Register*, Volume 40, Number 199, October 14, 1975.~~

~~(5) Sludge Sampling~~

~~(a) As an alternative to the stack sampling requirements of paragraph 1200-03-11-.04(4) compliance with paragraph (3) of this rule may be demonstrated by use of Method 105 of Appendix B of the *Federal Register*, Volume 49, Number 178, September 12, 1984, and the procedures specified in this section.~~

~~(b) The Technical Secretary shall be notified at least 30 days prior to a sludge sampling test, so that he may at his option observe the test.~~

~~(c) The sludge shall be sampled according to Method 105 - Determination of Mercury in Wastewater Treatment Plant Sewage Sludges. A total of three composite samples shall be obtained within an operating period of 24 hours. When the 24-hour operating period is not continuous, the total sampling period shall not exceed 72 hours after the first grab sample is obtained. Samples shall not be exposed to any condition that may result in mercury contamination or loss.~~

~~(d) The maximum 24-hour period sludge incineration or drying rate shall be determined by use of a flow rate measurement device that can measure the mass rate of the sludge charged to the incinerator or dryer with an accuracy of plus or minus 5 percent over its operating range. Other methods of measuring sludge mass charging rates may be used if they have received prior approval by the Technical Secretary.~~

~~(e) The mercury emissions shall be determined by use of the following equation:~~

~~EHg = MQFsm(avg)~~
~~1000~~

~~Where:~~

~~EHg = Mercury emissions, g/day.~~
~~M = Mercury concentration of sludge on a dry solids basis, ug/g.~~
~~Q = Sludge charging rate, kg/day.~~
~~Fsm = Weight fraction of solids in the collected sludge after mixing.~~

~~(f) No changes in the operation of a plant shall be made after a sludge test has been conducted which would potentially increase emissions above the level determined by the most recent sludge test until the new emission level has been estimated by calculation and the results reported to the Technical Secretary.~~

~~(g) All sludge samples shall be analyzed for mercury content within 30 days after the sludge sample is collected. Each determination shall be reported to the Technical Secretary by a registered letter dispatched before the close of the next business day following such determination.~~

~~(h) Records of sludge sampling, charging rates determination, and other data needed to determine mercury content of wastewater treatment plant sludges shall be retained at the source and made available, for inspection by the Technical Secretary, for a minimum of 2 years.~~

~~Authority: T.C.A. §§ 4-5-202, 68-25-105, and 68-201-105.~~

~~1200-03-11-.05 VINYL CHLORIDE.~~

~~(1) (a) This rule applies to plants which produce:~~

~~1. Ethylene dichloride by reaction of oxygen and hydrogen chloride with ethylene,~~

~~2. Vinyl chloride by any process, and/or~~

~~3. One or more polymers containing and fraction of polymerized vinyl chloride.~~

~~(b) This rule does not apply to equipment used in research and development if the reactor used to polymerize the vinyl chloride processed in the equipment has a capacity of no more than 0.19 m3 (50 gal).~~

~~(c) Parts of this rule other than paragraph (2), part (5)(b)1., subparagraphs (5)(c), (5)(d), and (5)(e), and paragraphs (8) through (12) do not apply to equipment used in research and development if the reactor used to polymerize the vinyl chloride processed in the equipment has a capacity of greater than 0.19 m3 (50 gal) and no more than 4.07 m3 (1100 gal).~~

~~(2) Definitions. Terms used in this rule not defined herein shall have the meaning given to them in chapter 1200-03-02.~~

~~(a) ‘‘Ethylene dichloride plant’’ includes any plant which produces ethylene dichloride by reaction of oxygen and hydrogen chloride with ethylene.~~

~~(b) ‘‘Vinyl chloride plant’’ includes any plant which produces, by any process, vinyl chloride as an intermediate or final product.~~

~~(c) ‘‘Polyvinyl chloride plant’’ includes any plant where vinyl chloride alone or in combination with other materials is polymerized.~~

~~(d) ‘‘Slip gauge’’ means a gauge which has a probe that moves through the gas/liquid interface in a storage or transfer vessel and indicates the level of vinyl chloride in the vessel by the physical state of the material the gauge discharges.~~

~~(e) ‘‘Type of resin’’ means the broad classification of resin referring to the basic manufacturing process for producing that resin, including, but not limited to, the suspension, dispersion, latex, bulk, and solution processes.~~

~~(f) ‘‘Grade of resin’’ means the subdivision of resin classification which describes it as a unique resin, i.e., the most exact description of a resin with no further subdivision.~~

~~(g) ‘‘Dispersion resin’’ means a resin manufactured in such a way as to form fluid dispersions when dispersed in a plasticizer or plasticizer/diluent mixtures.~~

~~(h) ‘‘Latex resin’’ means a resin which is produced by a polymerization process which initiates from free radical catalyst sites and is sold undried.~~

~~(i) ‘‘Bulk resin’’ means a resin which is produced by a polymerization process in which no water is used.~~

~~(j) ‘‘Inprocess waste water’’ means any water which, during manufacturing or processing, comes into direct contact with vinyl chloride or polyvinyl chloride or results from the production or use of any raw material, intermediate product, finished product, by-product, or waste product containing vinyl chloride or polyvinyl chloride but which has not been discharged to a wastewater treatment process or discharged untreated as wastewater. Gasholder seal water is not inprocess wastewater until it is removed from the gasholder.~~

~~(k) ‘‘Wastewater treatment process’’ includes any process which modifies characteristics such as BOD, COD, TSS and pH, usually for the purpose of meeting effluent guidelines and standards; it does not include any process the purpose of which is to remove vinyl chloride from water to meet requirements of this rule.~~

~~(l) ‘‘In vinyl chloride service’’ means that a piece of equipment either contains or contacts a liquid that is at least 10 percent vinyl chloride by weight or a gas that is at least 10 percent by volume vinyl chloride as determined according to the provisions of paragraph (8)(g) of this rule. The provisions of paragraph (8)(g) of this rule also specify how to determine that a piece of equipment is not in vinyl chloride service. For the purposes of this rule, this definition must be used in place of the definition of ‘‘in VHAP service’’ defined in subparagraph (k) of rule 1200-03-11-.06(2).~~

~~(m) ‘‘Standard operating procedure’’ means a formal written procedure officially adopted by the plant owner or operator and available on a routine basis to those persons responsible for carrying out the procedure.~~

~~(n) ‘‘Run’’ means the net period of time during which an emission sample is collected.~~

~~(o) ‘‘Ethylene dichloride purification’’ includes any part of the process of ethylene dichloride production which follows ethylene dichloride formation, excluding product storage following the final finishing column.~~

~~(p) ‘‘Vinyl chloride purification’’ includes any part of the process of vinyl chloride production which follows vinyl chloride formation.~~

~~(q) ‘‘Reactor’’ includes any vessel in which vinyl chloride is partially or totally polymerized into polyvinyl chloride.~~

~~(r) ‘‘Reactor opening loss’’ means the emissions of vinyl chloride occurring when a reactor is vented to the atmosphere for any purpose other than an emergency relief discharge as defined in subparagraph (6)(b) of this rule.~~

~~(s) ‘‘Stripper’’ includes any vessel in which residual vinyl chloride is removed from polyvinyl chloride resin, except bulk resin, in the slurry form by the use of heat and/or vacuum. In the case of bulk resin, stripper includes any vessel which is used to remove residual vinyl chloride from polyvinyl chloride resin immediately following the polymerization step in the plant process flow.~~

~~(t) ‘‘Standard temperature’’ means a temperature of 200°C (690°F).~~

~~(u) ‘‘Standard pressure’’ means a pressure of 760 mm of Hg (29.92 in. of Hg).~~

~~(v) ‘‘Relief valve’’ means each pressure relief device including pressure relief valves, rupture disks, and other pressure relief systems used to protect process components from overpressure conditions. ‘Relief valve’’ does not include polymerization shortstop systems, refrigerated water systems, or control valves or other devices used to control flow to an incinerator or other air pollution control device.~~

~~(w) ‘‘Leak’’ means any of several events that indicate interruption of confinement of vinyl chloride within process equipment. Leaks include events regulated under rule 1200-03-11-.06 such as:~~

~~1. An instrument reading of 10,000 ppm or greater measure according to Method 21 (as referenced in subparagraph 1200-03- 16-.01(5)(g)).~~

~~2. Indications of liquid dripping;~~

~~3. A sensor detection of failure of a seal system, failure of a barrier fluid system, or both; and~~

~~4. Detectable emissions as indicated by an instrument reading of greater than 500 ppm above background for equipment designated for no detectable emissions measured according to Test Method 21 (part 21. of subparagraph 1200-03-16-.01(5)(g)). Leaks also include events regulated under paragraph (6)(c)8.(i) of this rule for detection of ambient concentrations in excess of background concentration. A relief valve discharge is not a leak.~~

~~(x) ‘‘Exhaust gas’’ means any offgas (the constituents of which may consist of any fluids, either as a liquid and/or gas) discharged directly or ultimately to the atmosphere that was initially contained in or was in direct contact with the equipment for which exhaust gas limits are prescribed in paragraph (3)(a) and (b); paragraph (4)(b); (5)(b)1., (b)2., (c), (d), and (e); paragraph (6)(c)1.(ii), (c)2., (c)5., (c)6.(ii), and (c)9.(ii) of rule 1200-03-11-.05.~~

~~(y) ''Relief valve discharge'' means any nonleak discharge through a relief valve. ''Relief valve discharge'' does not include discharges ducted to a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm (average for 3-hour period), or equivalent as provided in paragraph (7) of this rule.~~

~~(z) ''3-hour period'' means any three consecutive 1-hour periods (each hour commencing on the hour).~~

~~(3) Emission standard for ethylene dichloride plants.~~

~~(a) An owner or operator of an ethylene dichloride plant shall comply with the requirements of this paragraph and paragraph (6) of this rule.~~

~~(b) Ethylene dichloride purification. The concentration of vinyl chloride in each exhaust gas stream from any equipment used in ethylene dichloride purification is not to exceed 10 ppm (average for 3-hour period), except as provided in paragraph (6)(b) of this rule. This requirement does not preclude combining of exhaust gas streams provided the combined steam is ducted through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm, or equivalent as provided in paragraph (7) of this rule. This requirement does not apply to equipment that has been opened, is out of operation, and met the requirement in subpart (i) of paragraph (6)(c)6. of this rule before being opened.~~

~~(c) Oxychlorination reactor. Except as provided in paragraph (6)(b) of this rule, emissions of vinyl chloride to the atmosphere from each oxychlorination reactor are not to exceed 0.2 g/kg (0.0002 lb/lb) (average for 3-hour period) of the 100 percent ethylene dichloride product from the oxychlorination process.~~

~~(4) Emission standard for vinyl chloride plants.~~

~~(a) An owner or operator of a vinyl chloride plant shall comply with the requirements of this paragraph and paragraph (6) of this rule.~~

~~(b) Vinyl chloride formation and purification: The concentration of vinyl chloride in each exhaust gas stream from any equipment used in vinyl chloride formation and/or purification is not to exceed 10 ppm (average for 3-hour period), except as provided in paragraph (6)(b) of this rule. This requirement does not preclude combining of exhaust gas streams provided the combined stream is ducted through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm, or equivalent as provided in paragraph (7) of this rule. This requirement does not apply to equipment that has been opened, is out of operation, and met the requirement in subpart (i) of paragraph (6)(c)6. of this rule before being opened.~~

~~(5) Emission standard for polyvinyl chloride plants.~~

~~(a) An owner or operator of a polyvinyl chloride plant shall comply with the requirements of this paragraph and paragraph (6) of this rule.~~

~~(b) Reactor. The following requirements apply to reactors:~~

~~1. The concentration of vinyl chloride in each exhaust gas stream from each reactor is not to exceed 10 ppm (average for 3-hour period), except as provided in part 2. of subparagraph (b) of this paragraph and paragraph (6)(b) of this rule.~~

~~2. The reactor opening loss from each reactor is not to exceed 0.02 g vinyl chloride/kg (0.00002 lb vinyl chloride/lb) of polyvinyl chloride product, except as provided in subparts (i) and (ii) of part (g)1. of this paragraph, with the product determined on a dry solids basis. This requirement does not apply to prepolymerization reactors in the bulk process. This requirement does apply to postpolymerization reactors in the bulk process, where the product means the gross product of prepolymerization and postpolymerization.~~

~~3. Manual vent valve discharge. Except for an emergency manual vent valve discharge, there is to be no discharge to the atmosphere from any manual vent valve on a polyvinyl chloride reactor in vinyl chloride service (as defined in paragraph (2)(l) of this rule). An emergency manual vent valve discharge means a discharge to the atmosphere which could not have been avoided by taking measures to prevent the discharge. Within 10 days of any discharge to the atmosphere from any manual vent valve, the owner or operator of the source from which the discharge occurs shall submit to the Technical Secretary a report in writing containing information on the source, nature and cause of the discharge, the date and time of the discharge, the approximate total vinyl chloride loss during the discharge, the method used for determining the vinyl chloride loss (the calculation of the vinyl chloride loss), the action that was taken to prevent the discharge, and measures adopted to prevent future discharges.~~

~~(c) Stripper. The concentration of vinyl chloride in each exhaust gas stream from each stripper is not to exceed 10 ppm (average for 3-hour period), except as provided in paragraph (6)(b) of this rule. This requirement does not apply to equipment that has been opened, is out of operation, and met the requirement in subpart (i) of paragraph (6)(c)6. of this rule before being opened.~~

~~(d) Mixing, weighing, and holding containers. The concentration of vinyl chloride in each exhaust gas stream from each mixing, weighing, or holding container in vinyl chloride service which precedes the stripper (or the reactor if the plant has no stripper) in the plant process flow is not to exceed 10 ppm (average for 3- hour period), except as provided in paragraph (6)(b) of this rule. This requirement does not apply to equipment that has been opened, is out of operation, and met the requirement in subpart (i) of paragraph (6)(c)6. of this rule before being opened.~~

~~(e) Monomer recovery system. The concentration of vinyl chloride in each exhaust gas stream from each monomer recovery system is not to exceed 10 ppm (average for 3-hour period), except as provided in paragraph (6)(b) of this rule. This requirement does not apply to equipment that has been opened, is out of operation, and met the requirements in subpart (i) of paragraph (6)(c)6. of this rule before being opened.~~

~~(f) Sources following the stripper(s): The following requirements apply to emissions of vinyl chloride to the atmosphere from the combination of all sources following the stripper(s) (or the reactor(s) if the plant has no stripper(s)) in the plant process flow including but not limited to, centrifuges, concentrators, blend tanks, filters, dryers, conveyor air discharges, baggers, storage containers, and inprocess waste water, except as provided in subparagraph (g) of this paragraph:~~

~~1. In polyvinyl chloride plants using stripping technology to control vinyl chloride emissions, the weighted average residual vinyl chloride concentration in all grades of polyvinyl chloride resin processed through the stripping operation on each calendar day, measured immediately after the stripping operation is completed, may not exceed:~~

~~(i) 2000 ppm for polyvinyl chloride dispersion resins, excluding latex resins;~~

~~(ii) 400 ppm for all other polyvinyl chloride resins, including latex resins, averaged separately for each type of resin; or~~

~~2. In polyvinyl chloride plants controlling vinyl chloride emissions with technology other than stripping or in addition to stripping, emissions of vinyl chloride to the atmosphere may not exceed:~~

~~(i) 2 g/kg (0.002 lb/lb) product from the stripper(s) (or reactor(s) if the plant has no stripper(s)) for dispersion polyvinyl chloride resins, excluding latex resins, with the product determined on a dry solids basis;~~

~~(ii) 0.4 g/kg (0.0004 lb/lb) product from the stripper(s) (or reactor(s) if the plant has no stripper(s)) for all other polyvinyl chloride resins, including latex resins, with the product determined on a dry solids basis.~~

~~3. The provisions of subparagraph (f) of this paragraph apply at all times including when off specification or other types of resins are made.~~

~~(g) Reactor used as stripper. When a nonbulk resin reactor is used as a stripper this subparagraph may be applied in lieu of part 2. of subparagraph (b) and part 1. of subparagraph (f) of paragraph (5) of this rule:~~

~~1. The weighted average emissions of vinyl chloride from reactor opening loss and all sources following the reactor used as a stripper from all grades of polyvinyl chloride resin stripped in the reactor on each calendar day may not exceed:~~

~~(i) 2.02 g/kg (0.00202 lb/lb) of polyvinyl chloride product for dispersion polyvinyl chloride resins, excluding latex resins, with the product determined on a dry solids basis.~~

~~(ii) 0.42 g/kg (0.00042 lb/lb) of polyvinyl chloride product for all other polyvinyl chloride resins, including latex resins, with the product determined on a dry solids basis.~~

~~(6) Emission standard for ethylene dichloride, vinyl chloride and polyvinyl chloride plants.~~

~~(a) An owner or operator of an ethylene dichloride, vinyl chloride, and/or polyvinyl chloride plant shall comply with the requirements of this paragraph.~~

~~(b) Relief valve discharge. Except for an emergency relief discharge, there is to be no discharge to the atmosphere from any relief valve on any equipment in vinyl chloride service. An emergency relief discharge means a discharge which could not have been avoided by taking measures to prevent the discharge. Within 10 days of any relief valve discharge, the owner or operator of the source from which the relief valve discharge occurs shall submit to the Technical Secretary a report in writing containing information on the source, nature and cause of the discharge, the date and time of the discharge, the approximate total vinyl chloride loss during the discharge, the method used for determining the vinyl chloride loss (the calculation of the vinyl chloride loss), the action that was taken to prevent the discharge, and measures adopted to prevent future discharges.~~

~~(c) Fugitive emission sources:~~

~~1. Loading and unloading lines: Vinyl chloride emissions from loading and unloading lines in vinyl chloride service which are opened to the atmosphere after each loading or unloading operation are to be minimized as follows:~~

~~(i) After each loading or unloading operation and before opening a loading or unloading line to the atmosphere, the quantity of vinyl chloride in all parts of each loading or unloading line that are to be opened to the atmosphere is to be reduced so that the parts combined contain no greater than 0.0038 m3 (0.13 ft3) of vinyl chloride, at standard temperature and pressure; and~~

~~(ii) Any vinyl chloride removed from a loading or unloading line in accordance with subpart (i) of subparagraph (c)1. of this paragraph is to be ducted through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm (average for 3-hour period), or equivalent as provided in paragraph (7) of this rule.~~

~~2. Slip gauges. During loading or unloading operations, the vinyl chloride emissions from each slip gauge in vinyl chloride service are to be minimized by ducting any vinyl chloride discharged from the slip gauge through a control system from which the~~

~~concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm (average for 3-hour period), or equivalent as provided in paragraph (7) of this rule.~~

~~3. Leakage from pump, compressor, and agitator seals:~~

~~(i) Rotating pumps. Vinyl chloride emissions from seals on all rotating pumps in vinyl chloride service are to be minimized by installing sealless pumps, pumps with double mechanical seals or equivalent as provided in paragraph (7) of this rule. If double mechanical seals are used, vinyl chloride emissions from the seals are to be minimized by maintaining the pressure between the two seals so that any leak that occurs is into the pump; by ducting any vinyl chloride between the two seals through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm; or equivalent as provided in paragraph (7) of this rule. Compliance with the provisions of rule 1200-03-11-.06 demonstrates compliance with the provisions of this subparagraph.~~

~~(ii) Reciprocating pumps. Vinyl chloride emissions from seals on all reciprocating pumps in vinyl chloride service are to be minimized by installing double outboard seals, or equivalent as provided in paragraph (7) of this rule. If double outboard seals are used, vinyl chloride emissions from the seals are to be minimized by maintaining the pressure between the two seals so that any leak that occurs is into the pump; by ducting any vinyl chloride between the two seals through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm; or equivalent as provided in paragraph (7) of this rule. Compliance with the provisions of rule 1200-03-11-.06 demonstrates compliance with the provisions of this subparagraph.~~

~~(iii) Rotating compressor. Vinyl chloride emissions from seals on all rotating compressors in vinyl chloride service are to be minimized by installing compressors with double mechanical seals, or equivalent as provided in paragraph (7) of this rule. If double mechanical seals are used, vinyl chloride emissions from the seals are to be minimized by maintaining the pressure between the two seals so that any leak that occurs is into the compressor; by ducting any vinyl chloride between the two seals through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm; or equivalent as provided in paragraph (7) of this rule. Compliance with the provisions of Rule 1200-03-11-.06 demonstrates compliance with the provisions of this subparagraph.~~

~~(iv) Reciprocating compressors. Vinyl chloride emissions from seals on all reciprocating compressors in vinyl chloride service are to be minimized by installing double outboard seals, or equivalent as provided in paragraph (7) of this rule. If double outboard seals are used, vinyl chloride emissions from the seals are to be minimized by maintaining the pressure between the two seals so that any leak that occurs is into the compressor; by ducting any vinyl chloride between the two seals through a control system from which concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm; or equivalent as provided in paragraph (7) of this rule. Compliance with the provisions of rule 1200-03-11-.06 demonstrates compliance with the provisions of this subparagraph.~~

~~(v) Agitator. Vinyl chloride emissions from seals on all agitators in vinyl chloride service are to be minimized by installing agitators with double mechanical seals, or equivalent as provided in paragraph (7) of this rule. If double mechanical seals are used, vinyl chloride emissions from the seals are to be minimized by maintaining the pressure between the two seals so that any leak that occurs is into the agitated vessel; by ducting any vinyl chloride between the two seals through a control system from which the concentration of vinyl~~

~~chloride in the exhaust gases does not exceed 10 ppm; or equivalent as provided in paragraph (7) of this rule.~~

~~4. Leaks from relief valves. Vinyl chloride emissions due to leaks from each relief valve on equipment in vinyl chloride service shall comply with the standards found in subparagraph 1200-03-11-.06(3)(d).~~

~~5. Manual venting of gases. Except as provided in part (5)(b)3. of this rule, all gases which are manually vented from equipment in vinyl chloride service are to be ducted through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm (average for 3-hour period); or equivalent as provided in paragraph (7) of this rule.~~

~~6. Opening of equipment. Vinyl chloride emissions from opening of equipment (including prepolymerization reactors used in the manufacture of bulk resins and loading or unloading lines that are not opened to the atmosphere after each loading or unloading operation) are to be minimized as follows:~~

~~(i) Before opening any equipment for any reason, the quantity of vinyl chloride which is contained therein is to be reduced to an amount which occupies a volume of no more than 2.0 percent of the equipment's containment volume or 0.0950 cubic meters (25 gallons), whichever is larger, at standard temperature and pressure.~~

~~(ii) Any vinyl chloride removed from the equipment in accordance with subpart (c)6.(i) of this paragraph is to be ducted through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm (average for 3-hour period); or equivalent as provided in paragraph (7) of this rule.~~

~~7. Samples. Unused portions of samples containing at least 10 percent by weight vinyl chloride are to be returned to the process or destroyed in a control device from which concentration of vinyl chloride in the exhaust gas does not exceed 10 ppm (average for 3-hour period) or equivalent as provided in paragraph (7) of this rule. Sampling techniques are to be such that sample containers in vinyl chloride service are purged into a closed process system. Compliance with the provisions of rule 1200-03-11-.06 demonstrates compliance with the provisions of this subparagraph.~~

~~8. Leak detection and elimination. Vinyl chloride emissions due to leaks from equipment in vinyl chloride service are to be minimized as follows:~~

~~(i) A reliable and accurate vinyl chloride monitoring system shall be operated for detection of major leaks and identification of the general area of the plant where a leak is located. A vinyl chloride monitoring system means a device which obtains air samples from one or more points on a continuous sequential basis and analyzes the samples with gas chromatography or, if the owner or operator assumes that all hydrocarbons measured are vinyl chloride, with infrared spectrophotometry, flame ion detection, or an equivalent or alternative method. The vinyl chloride monitoring system shall be operated according to a program developed by the plant owner or operator. The owner or operator shall submit a description of the program to the Technical Secretary within 45 days of November 6, 1988.~~

~~Approval of a program will be granted by the Technical Secretary provided he finds:~~

~~(I) The location and number of points to be monitored and the frequency of monitoring provided for in the program are acceptable when they are compared with the number of pieces of equipment in vinyl chloride service and size and physical layout of the plant.~~

~~(II) It contains a definition of leak which is acceptable when compared with the background concentrations of vinyl chloride in the areas of the plant to be monitored by the vinyl chloride monitoring system. Measurements of background concentrations of vinyl chloride in the areas of the plant to be monitored by the vinyl chloride monitoring system are to be included with the description of the program. The definition of leak for a given plant may vary among the different areas within the plant and is also to change over time as background concentrations in the plant are reduced.~~

~~(III) It contains an acceptable plan of action to be taken when a leak is detected.~~

~~(IV) It provides for an acceptable calibration and maintenance schedule for the vinyl chloride monitoring system and portable hydrocarbon detector. For the vinyl chloride monitoring system, a daily span check is to be conducted with a concentration of vinyl chloride equal to the concentration defined as a leak according to item (c)8.(i)(II) of this paragraph. The calibration is to be done with either:~~

~~I. A calibration gas mixture prepared from the gases specified in sections 5.2.1. and 5.2.2. of Test Method 106 and in accordance with section 7.1 of Test Method 106 (as specified in the *Federal Register*, Volume 41, Number 205, of October 21, 1976, beginning on page 46569 as Method 106, as amended in the *Federal Register*, Volume 41, Number 234, Friday, December 3, 1976, and the *Federal Register*, Volume 42, Number 109, of June 7, 1977), or~~

~~II. A calibration gas cylinder standard containing the appropriate concentration of vinyl chloride. The gas composition of the calibration gas cylinder standard is to have been certified by the manufacturer. The manufacturer must have recommended a maximum shelf life for each cylinder so that the concentration does not change greater than +5 percent from the certified value. The date of gas cylinder preparation, certified vinyl chloride concentration, and recommended maximum shelf life must have been affixed to the cylinder before shipment from the manufacturer to the buyer. If a gas chromatograph is used as the vinyl chloride monitoring system, these gas mixtures may be directly used to prepare a chromatograph calibration curve as described in section 7.3 of Test Method 106. The requirements in section 5.2.3.1. and 5.2.3.2. of Test Method 106 for certification of cylinder standards and for establishment and verification of calibration standards are to be followed.~~

~~(ii) For each process unit subject to this rule a formal leak detection and repair program shall be implemented consistent with rule 1200-03-11-.06, except as provided in subpart (iii) of subparagraph (c)8. of this paragraph. This program is to be implemented within 90 days of November 6, 1988. Except as provided in item (V) of subparagraph (c)8.(ii) of this paragraph, an owner or operator shall be exempt from rule 1200-03-11-.06(3)(a)4., (3)(g)1., 2., and 3., and paragraph (7) and from paragraph (8) of this rule for any process unit in which the percentage of leaking valves is demonstrated to less than 2.0 percent, as determined in accordance with the following:~~

~~(I) A performance test as specified in item (II) of subparagraph (c)8.(ii) of this paragraph shall be conducted initially within 90 days of the effective date of these regulations, annually, and at times requested by the Technical Secretary.~~

~~(II) For each performance test, a minimum of 200 or 90 percent, whichever is less, of the total valves in VOC service (as defined in subparagraph 1200-03-11- .01(3)(r)) within the process unit shall be randomly selected and monitored within 1 week by the methods specified in part 1200-03-11-.06(6)(b)1. If an instrument reading of 10,000 ppm or greater is measured, a leak is detected. The leak percentage shall be determined by dividing the number of valves in VOC service for which leaks are detected by the number of tested valves in VOC service.~~

~~(III) If a leak is detected, it shall be repaired in accordance with 1200-03-11-.06(3)(g)4. and 5.~~

~~(IV) The results of the performance test shall be submitted in writing to the Technical Secretary in the first quarterly report following the performance test as part of the reporting requirements of paragraph 1200-03-11-.05(11).~~

~~(V) Any process unit in which the percentage of leaking valves is found to be greater than 2.0 percent according to the performance test prescribed in item (II) of subpart (6)(c)8.(ii) of this rule must comply with all provisions of rule 1200-03-11-.06 within 90 days.~~

~~(iii) Open-ended valves or lines located on multiple service process lines which operate in vinyl chloride service less than 10 percent of the time are exempt from the requirements of subparagraph 1200-03-11-.06(3)(f), provided the open-ended valves or lines are addressed in the monitoring system required by subpart (i) of subparagraph (c)8. of this paragraph. The Technical Secretary may apply this exemption to other existing open-ended valves or lines that are demonstrated to require significant retrofit cost to comply with the requirements of subparagraph 1200-03-11-.06(3)(e).~~

~~9. Inprocess wastewater: Vinyl chloride emissions to the atmosphere from inprocess wastewater are to be reduced as follows:~~

~~(i) The concentration of vinyl chloride in each inprocess wastewater stream containing greater than 10 ppm vinyl chloride measured immediately as it leaves a piece of equipment and before being mixed with any other inprocess wastewater stream is to be reduced to no more than 10 ppm by weight before being mixed with any other inprocess wastewater stream which contains less than 10 ppm vinyl chloride; before being exposed to the atmosphere, before being discharged to a wastewater treatment process; or before being discharged untreated as a wastewater. This paragraph does apply to water which is used to displace vinyl chloride from equipment before it is opened to the atmosphere in accordance with part (5)(b)2. or part (6)(c)6. of this rule, but does not apply to water which is used to wash out equipment after the equipment has already been opened to the atmosphere in accordance with part (5)(b)2. or (6)(c)6. of this rule.~~

~~(ii) Any vinyl chloride removed from the inprocess wastewater in accordance with subpart (i) of subparagraph (c)9. of this paragraph is to be ducted through a control system from which the concentration of vinyl chloride in the exhaust gases does not exceed 10 ppm (average for 3-hour period); or equivalent as provided in paragraph (7) of this rule.~~

~~(d) The requirements in parts 1., 2., 5., 6., 7., and 8. of subparagraph (c) of this paragraph are to be incorporated into a standard operating procedure, and made available upon request for inspection by the Technical Secretary. The standard operating procedure is to include provisions for measuring the vinyl chloride in equipment 4.75 m3 (1,250 gal) in volume for which an emission limit is prescribed in subpart (i) of paragraph (6)(c)6. of this rule after~~

~~opening the equipment and using Test Method 106 (as referenced in subitem (c)8.(i)(IV)I. of this paragraph), a portable hydrocarbon detector, or an alternative method. The method of measurement is to meet the requirements in item (I) or (II) of 1200-03-11-.05(8)(g)5.(i).~~

~~(7) Equivalent equipment and procedures. Upon written application from an owner or operator, the Technical Secretary may approve use of equipment or procedures which have been demonstrated to his satisfaction to be equivalent in terms of reducing vinyl chloride emissions to the atmosphere to those prescribed for compliance with a specific subparagraph of this rule.~~

~~(8) Emission Tests~~

~~(a) The owner or operator of a source to which this rule applies shall test emissions from the source,~~

~~1. Within 90 days of November 6, 1988 in the case of an existing source or a new source which has an initial startup date preceding November 6, 1988, or~~

~~2. Within 90 days of startup in the case of a new source, initial startup of which occurs after November 6, 1988.~~

~~(b) The owner or operator shall provide the Technical Secretary at least 30 days prior notice of an emission test to afford the Technical Secretary the opportunity to have an observer present during the test.~~

~~(c) Any emission test is to be conducted while the equipment being tested is operating at the maximum production rate at which the equipment will be operated and under other relevant conditions as may be specified by the Technical Secretary based on representative performance of the source.~~

~~(d) Reserved~~

~~(e) When at all possible, each sample is to be analyzed within 24 hours, but in no case in excess of 72 hours of sample collection. Vinyl chloride emissions are to be determined within 30 days after the emission test. The owner or operator shall report the determinations to the Technical Secretary by a registered letter dispatched before the close of the next business day following the determination.~~

~~(f) The owner or operator shall retain at the plant and make available, upon request, for inspection by the Technical Secretary, for a minimum of 3 years, records of emission test results and other data needed to determine emissions.~~

~~(g) Unless otherwise specified, the owner or operator shall use the Test Methods in this subparagraph for each test as required by parts (g)1, (g)2, (g)3, (g)4, and (g)5 of this paragraph unless an equivalent method or an alternative method has been approved by the Technical Secretary. If the Technical Secretary finds reasonable grounds to dispute the results obtained by an equivalent or alternative method, he may require the use of a reference method. If the results of the reference and equivalent or alternative methods do not agree, the results obtained by the reference method prevail, and the Technical Secretary may notify the owner or operator that approval of the method previously considered to be equivalent or alternative is withdrawn.~~

~~1. Test Method 106 (as specified in the Federal Register, Volume 41, Number 205, of October 21, 1976, beginning on page 46569 as Method 106, as amended in the Federal Register, Volume 41, Number 234, Friday, December 3, 1976, and the Federal Register, Volume 42, Number 109, of June 7, 1977), is to be used to determine the vinyl chloride emissions from any source for which an emission limit is prescribed in subparagraph (3)(b) or (3)(c), subparagraph (4)(b), or part (5)(b)1 or (5)(b) 2 or subparagraph (c), (d) or (e) of paragraph (5), or to which fugitive emissions are required to be ducted in subparts (c)1(ii), parts (c)2 and (c)5, subpart (c)6(ii), or subpart (c)9(ii) of paragraph (6) of this rule.~~

~~(i) For each run, one sample is to be collected. The sampling site is to be at least two stack or duct diameters downstream and one half diameter upstream from any flow disturbance such as a bend, expansion, contraction, or visible flame. For a rectangular cross section an equivalent diameter is to be determined from the following equation:~~

~~equivalent diameter = 2 (length) (width)~~
~~length + width~~

~~The sampling point in the duct is to be at the centroid of the cross section. The sample is to be extracted at a rate proportional to the gas velocity at the sampling point. The sample is to contain a minimum volume of 50 liters corrected to standard conditions and is to be taken over a period as close to 1 hour as practicable.~~

~~(ii) Each emission test is to consist of three runs. For the purpose of determining emissions, the average of results of all runs is to apply. The average is to be computed on a time weighted basis.~~

~~(iii) For gas streams containing more than 10 percent oxygen concentration of vinyl chloride as determined by Test Method 106 (as referenced in part (8)(g)1 of this rule) is to be corrected to 10 percent oxygen (dry basis) for determination of emissions by using the following equation:~~

~~Cb (corrected) = Cb 10.9~~
~~20.9 - percent O_2~~

~~where:~~

~~Cb (corrected) = The concentration of vinyl chloride in the exhaust gases, corrected to 10.0 percent oxygen.~~

~~Cb = The concentration of vinyl chloride as measured by Test Method 106 as referenced in part (8)(g)1 of this rule.~~

~~20.9 = Percent oxygen in the ambient air at standard conditions.~~

~~10.9 = Percent oxygen in the ambient air at standard conditions, minus the 10.0 percent oxygen to which the correction is being made.~~

~~Percent O_2 = Percent oxygen in the exhaust gas as measured by the Reference Method in part 1200-03-16-.01 (5)(g)3.~~

~~(iv) For those emission sources where the emission limit is prescribed in terms of mass rather than concentration, mass emissions in kg/100 kg are to be determined by using the following equation:~~

~~CBx = (Cb (2.60) Q 10^{-6}) 100~~
~~Z~~

~~where:~~

~~CBx = kg vinyl chloride/100 kg product.~~

~~Cb = The concentration of vinyl chloride as measured by Test Method 106.~~

~~2.60 = Density of vinyl chloride at one atmosphere and 20°C in~~

~~kg/m^3.~~

~~Q = Volumetric flow rate in m^3/hr as determined by the reference method in part 1200-03-16-.01 (5)(g)2.~~

~~10^{-6} = Conversion factor for ppm.~~

~~Z = Production rate (kg/hr).~~

~~2. Test Method 107 or Method 106 (as specified in the Federal Register, Volume 41, Number 205, of October 21, 1976, beginning on page 46569, as amended in the Federal Register, Volume 41, Number 234, Friday, December 3, 1976, and the Federal Register, Volume 42, Number 109, of June 7, 1977) is to be used to determine the concentration of vinyl chloride in each inprocess wastewater stream for which an emission limit is prescribed in subpart (6)(c)9(i) of this rule.~~

~~3. When a stripping operation is used to attain the emission limits in subparagraph (5)(f) and (g) of this rule, emissions are to be determined using Test Method 107 as follows:~~

~~(i) The number of strippers (or reactors used as strippers) and samples and the types and grades of resin to be sampled are to be determined by the Technical Secretary for each individual plant at the time of the test based on the plant's operation.~~

~~(ii) Each sample is to be taken immediately following the stripping operation.~~

~~(iii) The corresponding quantity of material processed by each stripper (or reactor used as a stripper) is to be determined on a dry solids basis and by a method submitted to and approved by the Technical Secretary.~~

~~(iv) At the prior request of the Technical Secretary, the owner or operator shall provide duplicates of the samples required in subpart (g)3 (i) of this paragraph.~~

~~4. Where control technology other than or in addition to a stripping operation is used to attain the emission limit in subparagraph (5)(f) of this rule, emissions are to be determined as follows:~~

~~(i) Test Method 106 (as referenced in part (8)(g) 1 above), is to be used to determine the atmospheric emissions from all of the process equipment simultaneously. The requirements of part 1 of subparagraph (g) of this paragraph are to be met.~~

~~(ii) Test Method 107 (as referenced in part (8)(g) 2 above), is to be used to determine the concentration of vinyl chloride in each inprocess wastewater stream subject to the emission limit prescribed in subparagraph (5)(f) of this rule. The mass of vinyl chloride in kg/100 kg product in each inprocess wastewater stream is to be determined by using the following equation:~~

~~CBX = $\frac{(Cd\ R\ 10^{-6})\ (100)}{Z}$~~

~~where:~~

~~CBx = kg vinyl chloride/100 kg product.~~

~~Cd = the concentration of vinyl chloride as measured by Test Method 107.~~

~~R = water flow rate in 1/hr, determined in accordance with a method which has been submitted to and approved by the~~

~~Technical Secretary.~~

~~10^{-6} = conversion factor for ppm.~~

~~Z = production rate (kg/hr), determined in accordance with a method which has been submitted and approved by the Technical Secretary.~~

~~5. The reactor opening loss for which an emission limit is prescribed in part 2 of paragraph (5)(b) of this rule is to be determined. The number of reactors for which the determination is to be made is to be specified by the Technical Secretary for each individual plant at the time of the determination based on the plant's operation.~~

~~(i) Except as provided in subpart (ii) of subparagraph (g)5. of this paragraph, the reactor opening loss is to be determined using the following equation:~~

~~$C = \frac{W (2.60) (10^{-6}) (Cb)}{YZ}$~~

~~where:~~

~~C = kg vinyl chloride emissions/kg product.~~

~~W = capacity of the reactor in m^3.~~

~~2.60 = density of vinyl chloride at one atmosphere and 20°C in kg/m^3.~~

~~Cb = ppm by volume vinyl chloride as determined by Test Method 106 or a portable hydrocarbon detector which measures hydrocarbons with a sensitivity of at least 10 ppm.~~

~~Y = number of batches since the reactor was last opened to the atmosphere.~~

~~Z = Average kg of polyvinyl chloride produced per batch in the number of batches since the reactor was last opened to the atmosphere.~~

~~(I) If Test Method 106 is used to determine the concentrations of vinyl chloride (Cb), the sample is to be withdrawn at a constant rate with a probe of sufficient length to reach the vessel bottom from the manhole. Samples are to be taken for 5 minutes within 6 inches of the vessel bottom, 5 minutes near the vessel center, and 5 minutes near the vessel top.~~

~~(II) If a portable hydrocarbon detector is used to determine the concentration of vinyl chloride (Cb), a probe of sufficient length to reach the vessel bottom from the manhole is to be used to make the measurements. One measurement will be made within 6 inches of the vessel bottom, one near the vessel center, and one near the vessel top. Measurements are to be made at each location until the reading is stabilized. All hydrocarbons measured are to be assumed to be vinyl chloride.~~

~~(III) The production rate of polyvinyl chloride (Z) is to be determined by a method submitted to and approved by the Technical Secretary.~~

~~(ii) A calculation based on the number of evacuations, the vacuum involved, and the volume of gas in the reactor is hereby approved by the Technical Secretary as an alternative method for determining reactor opening loss for~~

~~postpolymerization reactors in the manufacture of bulk resins. Calculation methods based on techniques other than repeated evacuation of the reactor may be approved by the Technical Secretary for determining reactor opening loss for postpolymerization reactors in the manufacture of bulk resins.~~

~~6. For a reactor that is used as a stripper, the emissions of vinyl chloride from reactor opening loss and all sources following the reactor used as a stripper for which an emission limit is prescribed in subparagraph (5)(g) of this rule are to be determined. The number of reactors for which the determination is to be made is to be specified by the Technical Secretary for each individual plan at the time of the determination based on the plant's operation.~~

~~(i) For each batch stripped in the reactor, the following measurements are to be made:~~

~~(I) The concentration (ppm) of vinyl chloride in resin after stripping, measured according to part (g)3 of this paragraph;~~

~~(II) The reactor vacuum (mm Hg) at end of strip from plant instrument; and~~

~~(III) The reactor temperature (ºC) at end of strip from plant instrument.~~

~~(ii) For each batch stripped in the reactor, the following information is to be determined.~~

~~(I) The vapor pressure (mm Hg) of water in the reactor at end of strip from the following table:~~

~~Reactor vapor temperature (ºC)~~	~~H_2O vapor pressure (mm Hg)~~	~~Reactor temperature (ºC)~~	~~H_2O vapor pressure (mm Hg)~~	~~Reactor temperature (ºC)~~	~~H_2O pressure~~
~~40~~	~~55.3~~	~~62~~	~~163.8~~	~~84~~	~~416.8~~
~~41~~	~~58.3~~	~~63~~	~~171.4~~	~~85~~	~~433.6~~
~~42~~	~~61.5~~	~~64~~	~~179.3~~	~~86~~	~~450.9~~
~~43~~	~~64.8~~	~~65~~	~~187.5~~	~~87~~	~~468.7~~
~~44~~	~~68.3~~	~~66~~	~~196.1~~	~~88~~	~~487.1~~
~~45~~	~~71.9~~	~~67~~	~~205.0~~	~~89~~	~~506.1~~
~~46~~	~~75.6~~	~~68~~	~~214.2~~	~~90~~	~~525.8~~
~~47~~	~~79.6~~	~~69~~	~~223.7~~	~~91~~	~~546.0~~
~~48~~	~~83.7~~	~~70~~	~~233.7~~	~~92~~	~~567.0~~
~~49~~	~~88.0~~	~~71~~	~~243.9~~	~~93~~	~~588.6~~
~~50~~	~~92.5~~	~~72~~	~~254.6~~	~~94~~	~~610.9~~
~~51~~	~~97.2~~	~~73~~	~~265.7~~	~~95~~	~~633.9~~
~~52~~	~~102.1~~	~~74~~	~~277.2~~	~~96~~	~~657.6~~
~~53~~	~~107.2~~	~~75~~	~~289.1~~	~~97~~	~~682.1~~
~~54~~	~~112.5~~	~~76~~	~~301.4~~	~~98~~	~~707.3~~
~~55~~	~~118.0~~	~~77~~	~~314.1~~	~~99~~	~~733.2~~
~~56~~	~~123.8~~	~~78~~	~~327.3~~	~~100~~	~~760.0~~
~~57~~	~~129.8~~	~~79~~	~~341.0~~		
~~58~~	~~136.1~~	~~80~~	~~355.1~~		
~~59~~	~~142.6~~	~~81~~	~~369.7~~		
~~60~~	~~149.4~~	~~82~~	~~384.9~~		
~~61~~	~~156.4~~	~~83~~	~~400.6~~		

~~(II) The partial pressure (mm Hg) of vinyl chloride in reactor at end of strip from the following equation:~~

~~$PPVC = 760 - RV - VPW$~~

~~where:~~

~~PPVC = partial pressure of vinyl chloride, in mm Hg.~~

~~760 = atmospheric pressure at 0°C, in mm Hg.~~

~~RV = absolute value of reactor vacuum, in mm Hg.~~

~~VPW = vapor pressure of water, in mm Hg.~~

~~(III) The reactor vapor space volume (m^3) at end of strip from the following equation:~~

~~$RVSV = \frac{RC - WV - PVCW}{1,400}$~~

~~where:~~

~~RVSV = reactor vapor space volume, in m^3.~~

~~RC = reactor capacity, in m^3.~~

~~WV = volume of water in reactor from recipe, in m^3.~~

~~PVCW = dry weight of polyvinyl chloride in reactor from recipe, in kg.~~

~~1,400 = typical density of polyvinyl chloride, in kg/m^3.~~

~~(iii) For each batch stripped in the reactor, the combined reactor opening loss and emissions from all sources following the reactor used as a stripper is to be determined using the following equation:~~

~~$C = \frac{(PPMVC)(10^{-3}) + (PPVC)(RVSV)(1,002)}{(PVCW)(273 + RT)}$~~

~~where:~~

~~C = g vinyl chloride/kg polyvinyl chloride product.~~

~~PPMVC = concentration of vinyl chloride in resin after stripping, in ppm.~~

~~10^{-3} = conversion factor for ppm.~~

~~PPVC = partial pressure of vinyl chloride determined according to item (g)6 (ii)(II) of this paragraph in mm Hg.~~

~~RVSV = reactor vapor space volume determined according to item (g)6 (ii)(III) of this paragraph in m^3~~

~~1,002 = ideal gas constant in g - K/mm Hg - m^3 for vinyl chloride.~~

~~PVCW = dry weight of polyvinyl chloride in reactor from recipe, in kg.~~

~~273 = conversion factor for C to K.~~

~~RT = reactor temperature, in C.~~

~~(h) Measurement of Vinyl Chloride~~

~~1. Each piece of equipment within a process unit that can responsibly contain equipment in vinyl chloride service is presumed to be in vinyl chloride service unless an owner or operator demonstrates that the piece of equipment is not in vinyl chloride service. For a piece of equipment to be considered not in vinyl chloride service, it must be determined that the percent vinyl chloride content can be reasonably expected not to exceed 10 percent by weight for liquid streams or contained liquid volumes and 10 percent by volume for gas streams or contained gas volumes, which also includes gas volumes above liquid streams or contained liquid volumes. For purposes of determining the percent vinyl chloride content of the process fluid that is contained in or contacts equipment, procedures that conform to the methods described in ASTM Method D-2267 shall be used. (Note: All references to ASTM in this rule refers to the American Society for Testing Materials. Copies of methods are available for purchase by writing to ASTM, 1916 Race Street, Philadelphia, PA 19103 or by writing to the Tennessee Division of Air Pollution Control, 701 Broadway, 4th Floor, Customs House, Nashville, TN 37219. Be sure and specify which method is desired).~~

~~2. (i) An owner or operator may use engineering judgment rather than the procedures in part (h)1 of this paragraph to demonstrate that the percent vinyl chloride content does not exceed 10 percent by weight for liquid streams and 10 percent by volume for gas streams, provided that the engineering judgment demonstrates that the vinyl chloride content clearly does not exceed 10 percent. When an owner or operator and the Technical Secretary do not agree on whether a piece of equipment is not in vinyl chloride service, however, the procedures in part (h)1 of this paragraph shall be used to resolve the disagreement.~~

~~(ii) If an owner or operator determines that a piece of equipment is in vinyl chloride service, the determination can be revised only after following the procedures in part (h)1 of this paragraph.~~

~~3. Samples used in determining the percent vinyl chloride content shall be representative of the process fluid that is contained in or contacts the equipment.~~

~~(9) Emission monitoring~~

~~(a) A vinyl chloride monitoring system is to be used to monitor on a continuous basis the emissions from the sources for which emission limits are prescribed in subparagraphs (3)(b), (3)(c), and (4)(b), part (5)(b)1, subparagraphs (5)(c), and (5)(d), and (5)(e) of this rule, and for any control system to which reactor emissions are required to be ducted in subpart (6)(c)1(ii), parts (6)(c)2 and (6)(c)5, and subparts (6)(c)6(ii) and (6)(c)9(ii) of this rule.~~

~~(b) The vinyl chloride monitoring system(s) used to meet the requirement in subparagraph (a) of this paragraph is to be a device which obtains air samples from one or more points on a continuous sequential basis and analyzes the samples with gas chromotography, or, if the owner or operator assumes that all hydrocarbons measured are vinyl chloride with infrared spectrophotometry, flame ion detection, or an equivalent or alternative method. The vinyl chloride monitoring system used to meet the requirements in subpart (6)(c)8(i) of this rule may be used to meet the requirements of this paragraph.~~

~~(c) A daily span check is to be conducted for each vinyl chloride monitoring system used. For all of the emission sources listed in subparagraph (a) of this paragraph, except the one for which an emission limit is prescribed in subparagraph (3)(c) of this rule, the daily span check is to be conducted with a. concentration of vinyl chloride equal to 10 ppm. For the emission source for which an emission limit is prescribed in subparagraph (3)(c) of this rule the daily span check is to be conducted with a concentration of vinyl chloride which is determined to be equivalent to the emission limit for that source based on the emission test required by paragraph (8) of this rule. The calibration is to be done with either:~~

~~1. A calibration gas mixture prepared from the gases specified in sections 5.2.1 and 5.2.3 of Test Method 106 and in accordance with section 7.1 of Test Method 106 (Method 106 as referenced in part (8)(g)1 of this rule), or~~

~~2. A calibration gas cylinder standard containing the appropriate concentration of vinyl chloride. The gas composition of the calibration gas cylinder standard is to have been certified by the manufacturer. The manufacturer must have recommended a maximum shelf life for each cylinder so that the concentration does not change greater than +5 percent from the certified value. The date of gas cylinder preparation, certified vinyl chloride concentration and recommended maximum shelf life must have been affixed to the cylinder before shipment from the manufacturer to the buyer. If a gas chromatograph is used as the vinyl chloride monitoring system, these gas mixtures may be directly used to prepare a chromatograph calibration curve as described in section 7.3 of Test Method 106. The requirements in sections 5.2.3.1 and 5.2.3.2 of Test Method 106 for certification of cylinder standards and for establishment and verification of calibration standards are to be followed. Test Method 106 (as referenced in part (8)(g)1 of this rule).~~

~~(d) When exhaust gas(es), having emission limits that are subject to the requirement of subparagraph (a) of this paragraph, are emitted to the atmosphere without passing through the control system and required vinyl chloride monitoring system, the vinyl chloride content of the emission shall be calculated (in units of each applicable emission limit) by best practical engineering judgment based on the discharge duration and known VC concentrations in the affected equipment as determined in accordance with Test Method 106 or other acceptable method.~~

~~(e) For each 3-hour period, the vinyl chloride content of emissions subject to the requirements of subparagraphs (a) and (d) of this paragraph shall be averaged (weighted according to the proportion of time that emissions were continuously monitored and that emissions bypassed the continuous monitor) for purposes of reporting excess emissions under part 1200-03-11-.05 (11)(c)1.~~

~~(f) For each vinyl chloride emission to the atmosphere determined in accordance with subparagraph (e) of this paragraph to be in excess of the applicable emission limits, the owner or operator shall record the identify of the source(s), the date, time, and duration of the excess emission, the cause of the excess emission, and the approximate total vinyl chloride loss during the excess emission, and the method used for determining the vinyl chloride loss. This information shall be retained and made available for inspection by the Technical Secretary as required by subparagraph (12)(a) of this rule.~~

~~(10) Initial Report~~

~~(a) An owner or operator of any source to which this rule applies shall submit a statement in writing notifying the Technical Secretary that the equipment and procedural specifications in parts 1, 2, 3, 4, 5, 6, 7, and 8 of subparagraph (6)(c) of this rule are being implemented.~~

~~(b) 1. In the case of an existing source or a new source which has an initial startup date preceding the effective date, the statement is to be submitted within 90 days of November 6, 1988.~~

~~2. In the case of a new source which did not have an initial startup date preceding the effective date, the statement is to be submitted within 90 days of the initial startup date.~~

~~(c) The statement is to contain the following information:~~

~~1. A list of the equipment installed for compliance.~~

~~2. A description of the physical and functional characteristics of each piece of equipment.~~

~~3. A description of the methods which have been incorporated into the standard operating procedures for measuring or calculating the emissions for which emission limits are prescribed in subparts (6)(c)1(i) and (6)(c)6(i) of this rule.~~

~~4. A statement that each piece of equipment is installed and that each piece of equipment and each procedure is being used.~~

~~(11) Reporting~~

~~(a) 1. The owner or operator of any source to which this rule applies shall submit to the Technical Secretary on March 15, June 15, September 15, and December 15 of each year a report in writing containing the information required by this paragraph. The first report is to be submitted following the first full 3-month reporting period after the initial report is submitted.~~

~~2. In the case of an existing source, the approved reporting schedule shall be used. In addition, quarterly reports shall be submitted exactly 3 months following the current reporting dates.~~

~~(b) 1. In the case of an existing source or a new source which has an initial startup date preceding the effective date, the first report is to be submitted within 180 days of November 6, 1988.~~

~~2. In the case of a new source which did not have an initial startup date preceding the effective date, the first report is to be submitted within 180 days of the initial startup date.~~

~~(c) Unless otherwise specified, the owner or operator shall use the test method in subparagraph (8)(g) of this rule to conduct emission tests as required by parts (c)2 and (c)3 of this paragraph, unless an equivalent or alternative method has been approved by the Technical Secretary. If the Technical Secretary finds reasonable grounds to dispute the results obtained by an equivalent or alternative method, he may require the use of a reference method. If the results of the reference and equivalent or alternative methods do not agree, the results obtained by the reference method prevail, and the Technical Secretary may notify the owner or operator that approval of the method previously considered to be equivalent or alternative is withdrawn.~~

~~1. The owner or operator shall include in the report a record of the vinyl chloride content of emissions for each 3-hour period during which average emissions are in excess of the emission limits in 1200-03-11-.05 (3)(a), (b), or (c), 1200-03-11-.05 (4)(a) or (b), 1200-03-11-.05 (5)(a), (b), (c), (d), or (e), or during which average emissions are in excess of the emission limits specified in part (5)(b)2 of this rule or to which fugitive emissions are required to be ducted in subparts (c)1(ii), parts (c)2, (c)5, subpart (c)6(ii), or subpart (c)9(ii) of paragraph (6) of this rule. The number of 3-hour periods for which average emissions were determined during the reporting period shall be reported. If emissions in excess of the emission limits are not detected, the report shall contain a statement that no excess emissions have been detected. The emissions are to be determined in accordance with subparagraph (9)(e) of this rule.~~

~~2. In polyvinyl chloride plants for which a stripping operation is used to attain the emission level prescribed in subparagraph (5)(f) of this rule, the owner or operator shall include in the report a record of the vinyl chloride content in the polyvinyl chloride resin.~~

~~(i) If batch stripping is used, one representative sample of polyvinyl chloride resin is to be taken from each batch of each grade of resin immediately following the completion of the stripping operation, and identified by resin type and grade and the date and time the batch is completed. The corresponding quantity of material processed in each stripper batch is to be recorded and identified by resin type and grade and the date and time the batch is completed.~~

~~(ii) If continuous stripping is used, one representative sample of polyvinyl chloride resin is to be taken for each grade of resin processed or at intervals of 8 hours for each grade of resin which is being processed, whichever is more frequent. The sample is to be taken as the resin flows out of the stripper and identified by resin type and grade and the date and time the sample was taken. The corresponding quantity of material processed by each stripper over the time period represented by the sample during the eight hour period, is to be recorded and identified by resin type and grade and the date and time it represents.~~

~~(iii) The vinyl chloride content in each sample is to be determined by Test Method 107 as prescribed in part (8)(g)3 of this rule.~~

~~(iv) Reserved~~

~~(v) The report to the Technical Secretary by the owner or operator is to include a record of any 24-hour average resin vinyl chloride concentration, as determined in this paragraph, in excess of the limits prescribed in subparagraph (5)(f) of this rule. The vinyl chloride content found in each sample required by subparts (i) and (ii) of subparagraph (c)2. of this paragraph shall be averaged separately for each type of resin, over each calendar day and weighted according to the quantity of each grade of resin processed by the stripper(s) that calendar day, according to the following equation:~~

~~n~~
~~AT = SUM PGiMGi~~
~~i=l =PGiMGi + MG2 + . . .PGnMGn~~
~~QT QT~~

~~Where:~~

~~A = 24-hour average concentration of type T resin in ppm (dry weight basis).~~

~~Q = Total production of type T resin over the 24-hour period, in kg.~~

~~T = Type of resin.~~

~~M = Concentration of vinyl chloride in one sample of grade Gi resin in ppm.~~

~~P = Production of grade Gi resin represented by the sample, in kg.~~

~~Gi = Grade of resin: e.g., G1, G2, G3.~~

~~n = Total number of grades of resin produced during the 24-hour period.~~

~~The number of 24-hour average concentrations for each resin type determined during the reporting period shall be reported. If no 24-hour average resin vinyl chloride concentrations in excess of the limits prescribed in subparagraph (5)(f) of this rule are measured, the report shall state that no excess resin vinyl chloride concentrations were measured.~~

~~(vi) The owner or operator shall retain at the source and make available for inspection by the Technical Secretary for a minimum of 3 years records of all data needed to furnish the information required by subparagraph (c)2. (v) of this paragraph. The records are to contain the following information:~~

~~(I) The vinyl chloride content found in all the samples required in subparts (c)2.(i) and (c)2.(ii) of this paragraph identified by the resin type and grade and the time and date of the sample, and~~

~~(II) The corresponding quantity of polyvinyl chloride resin processed by the stripper(s), identified by the resin type and grade and the time and date it represents.~~

~~3. The owner or operator shall include in the report a record of any emissions from each reactor opening in excess of the emission limits prescribed in part (5)(b)2 of this rule. Emissions are to be determined in accordance with part (8)(g)5 of this rule, except that emissions for each reactor are to be determined. The number of reactor openings during~~

~~the reporting period shall be reported. If emissions in excess of the emission limits are not detected, the report shall include a statement that excess emissions have not been detected.~~

~~4. In polyvinyl chloride plants for which stripping in the reactor is used to attain the emission level prescribed in subparagraph (5)(g) of this rule, the owner or operator shall include in the report a record of the vinyl chloride emissions from reactor opening loss and all sources following the reactor used as a stripper.~~

~~(i) One representative sample of polyvinyl chloride resin is to be taken from each batch of each grade of resin immediately following the completion of the stripping operation, and identified by resin type and grade and the date and time the batch is completed. The corresponding quantity of material processed in each stripper batch is to be recorded and identified by resin type and grade and the date and time the batch is completed.~~

~~(ii) The vinyl chloride content in each sample is to be determined by Test Method 107 (as specified in the Federal Register, Volume 41, Number 205, of October 21, 1976, beginning on page 46569, as amended in the Federal Register, Volume 41, Number 234, Friday, December 3, 1976, and the Federal Register, Volume 42, Number 109, of June 7, l977) as prescribed in part (8)(g)3 of this rule.~~

~~(iii) The combined emissions from reactor opening loss and all sources following the reactor used as a stripper are to be determined for each batch stripped in a reactor according to the procedure prescribed in part (8)(g)6 of this rule.~~

~~(iv) The report to the Technical Secretary by the owner or operator is to include a record of any 24-hour average combined reactor opening loss and emissions from all sources following the reactor used as a stripper as determined in this paragraph, in excess of the limits prescribed in paragraph (5)(g). The combined reactor opening loss and emissions from all sources following the reactor used as a stripper associated with each batch are to be averaged separately for each type of resin, over each calendar day and weighted according to the quantity of each grade of resin stripped in reactors that calendar day as follows:~~

~~For each type of resin (suspension, dispersion, latex, bulk, other), the following calculation is to be performed:~~

~~n~~
~~AT = SUM PGiMGi~~
~~i=l =PGiCGi + PG2CG2 +. .= PGnCGn~~
~~QT QT~~

~~Where:~~

~~A = 24-hour average combined reactor opening loss and emissions from all sources following the reactor used as a stripper, in g vinyl chloride/kg product (dry weight basis).~~

~~Q = Total production of resin in batches for which stripping is completed during the 24-hour period, in kg.~~

~~T = Type of resin.~~

~~C = Average combined reactor opening loss and emissions from all sources following the reactor used as a stripper of all batches of grade Gi resin for which stripping is completed during the 24-hour period, in g vinyl chloride/kg product (dry weight basis) (determined according to procedure prescribed in part 6. (8)(g)6 of this rule.~~

~~P = Production of grade Gi resin in the batches for which C is determined, in kg.~~

~~Gi = Grade of resin, e.g., G1, G2, and G3.~~

~~n = Total number of grades of resin in batches for which stripping is completed during the 14-hour period.~~

~~The number of 24-hour average emissions determined during the reporting period shall be reported. If no 24-hour average combined reactor opening loss and emissions from all sources following the reactor used a stripper in excess of the limits prescribed in subparagraph (5)(g) are determined, the report shall state that no excess vinyl chloride emissions were determined.~~

~~(12) Record Keeping~~

~~(a) The owner or operator of any source to which this rule applies shall retain the following information at the source and make it available for inspection to the Technical Secretary for a minimum of 3 years:~~

~~1. A record of the leaks detected by the vinyl chloride monitoring system as required by part (6)(c)8 of this rule, including the concentrations of vinyl chloride as measured, analyzed, and recorded by the vinyl chloride detector, the location of each measurement, and the date and approximate time of each measurement.~~

~~2. A record of the leaks detected during routine monitoring with the portable hydrocarbon detector and the action taken to repair the leaks, as required by part (6)(c)8 of this rule, including a brief statement explaining the location and cause of each leak detected with the portable hydrocarbon detector, the date and time of the leak, and any action taken to eliminate that leak.~~

~~3. A record of emissions measured in accordance with paragraph (9) of this rule.~~

~~4. A daily operating record for each polyvinyl chloride reactor, including pressures and temperatures.~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.06 Equipment Leakes (Fugitive Emission Sources)~~

~~(1) Applicability~~

~~(a) The provisions of this rule apply to each of the following sources that are intended to operate in volatile hazardous air pollutant (VHAP) service: pumps, compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, valves, flanges and other connectors, product accumulator vessels, and control devices or systems required by this rule.~~

~~(b) The provisions of this rule apply to the sources listed in subparagraph (a) of this paragraph after the date of promulgation of a specific rule in this chapter.~~

~~(c) While the provisions of this rule are effective, a source to which this rule applies that is also subject to the provisions of chapter 16 only will be required to comply with the provisions of this rule.~~

~~(2) Definitions~~

~~Terms used in this rule not defined herein or in paragraph .01 (3) of this chapter shall have the meaning given to them in chapter 1200-03-2.~~

~~(a) ‘‘Closed-vent system’’ means a system that is not open to atmosphere and that is composed of~~

~~piping, connections, and, if necessary, flow-inducing devices that transport gas or vapor from a piece or pieces of equipment to a control device.~~

~~(b) ‘‘Connector’’ means, flanged, screwed, welded, or other joined fittings used to connect two pipe lines or a pipe line and a piece of equipment. For the purpose of reporting and recordkeeping, connector means flanged fittings that are not covered by insulation or other materials that prevent location of the fittings.~~

~~(c) ‘‘Control device’’ means an enclosed combustion device, vapor recovery system, or flare.~~

~~(d) ‘‘Double block and bleed system’’ means two block valves connected in series with a bleed valve or line that can vent the line between the two block valves.~~

~~(e) ‘‘Equipment’’ means each pump, compressor, pressure relief device, sampling connection system, open-ended valve or line, valve, flange or other connector, product accumulator vessel in VHAP service, and any control devices or systems required by this rule.~~

~~(f) ‘‘First attempt at repair’’ means to take rapid action for the purpose of stopping or reducing leakage of organic material to atmosphere using best practices.~~

~~(g) ‘‘In gas/vapor service’’ means that a piece of equipment contains process fluid that is in the gaseous state at operating conditions.~~

~~(h) ‘‘In liquid service’’ means that a piece of equipment is not in gas/vapor service.~~

~~(i) ‘‘In-situ sampling systems’’ means nonextractive samplers or in-line samplers.~~

~~(j) ‘‘In vacuum service’’ means that equipment is operating at an internal pressure which is at least 5 kilopascals (kPa) below ambient pressure.~~

~~(k) ‘‘In VHAP service’’ means that a piece of equipment either contains or contacts a fluid (liquid or gas) that is at least 10 percent by weight a volatile hazardous air pollutant (VHAP) as determined according to the provisions of subparagraph (6)(d) of this rule. The provisions of subparagraph (6)(d) of this rule also specify how to determine that a piece of equipment is not in VHAP service.~~

~~(l) ‘‘In VOC service’’ means, for the purposes of this rule, that (a) the piece of equipment contains or contacts a process fluid that is at least 10 percent VOC by weight and (b) the piece of equipment is not in heavy liquid service (as defined in paragraph 1200-03-16-.43 (2)).~~

~~(m) ‘‘Open-ended valve or line’’ means any valve, except pressure relief valves, having one side of the valve seat in contact with process fluid and one side open to atmosphere, either directly or through open piping.~~

~~(n) ‘‘Pressure release’’ means the emission of materials resulting from the system pressure being greater than the set pressure of the pressure relief device.~~

~~(o) ‘‘Process unit’’ means equipment assembled to produce a VHAP or its derivatives as intermediates or final products, or equipment assembled to use a VHAP in the production of a product. A process unit can operate independently if supplied with sufficient feed or raw materials and sufficient product storage facilities.~~

~~(p) ‘‘Process unit shutdown’’ means a work practice or operational procedure that stops production from a process unit or part of a process unit. An unscheduled work practice or operational procedure that stops production from a process unit or part of a process unit for less than 24 hours is not a process unit shutdown. The use of spare equipment and technically feasible bypassing of equipment without stopping production are not process unit shutdowns.~~

~~(q) ‘‘Product accumulator vessel’’ means any distillate receiver, bottoms receiver, surge control vessel, or product separator in VHAP service that is vented to atmosphere either directly or through a vacuum- producing system. A product accumulator vessel is in VHAP service if the liquid or the vapor in the vessel is at least 10 percent by weight VHAP.~~

~~(r) ‘‘Repaired’’ means that equipment is adjusted, or otherwise altered, to eliminate a leak as indicated by one of the following: an instrument reading of 10,000 ppm or greater, indication of liquids dripping, or indication by a sensor that a seal or barrier fluid system has failed.~~

~~(s) ‘‘Semiannual’’ means a 6-month period; the first semiannual period concludes on the last day of the last month during the 180 days following initial startup for new sources; and the first semiannual period concludes on the last day of the last full month during the 180 days after the effective date of a specific rule that references this rule for existing sources.~~

~~(t) ‘‘Sensor’’ means a device that measures a physical quantity or the change in a physical quantity, such as temperature, pressure, flow rate, pH, or liquid level.~~

~~(u) ‘‘Volatile hazardous air pollutant’’ or ‘‘VHAP’’ means a substance regulated under this chapter for which a standard for equipment leaks of the substance has been proposed and promulgated. Benzene is a VHAP. Vinyl chloride is a VHAP.~~

~~(3) Standards for Volatile Hazardous Air Pollutants~~

~~(a) General~~

~~1. Each owner or operator subject to the provisions of this rule shall demonstrate compliance with the requirements of paragraph (3) for each new and existing source, except as provided in paragraphs (4) and (5).~~

~~2. Compliance with this rule will be determined by review of records, review of performance test results, and inspection using the methods and procedures specified in paragraph (6).~~

~~3. (i) An owner or operator may request a determination of alternative means of emission limitation to the requirements of subparagraphs (3)(b), (3)(c), (3)(e), (3)(f), (3)(g), (3)(h), (3)(i), and (3)(k) as provided in paragraph (5).~~

~~(ii) If the Technical Secretary makes a determination that a means of emission limitation is at least a permissible alternative to the requirements of subparagraphs (3)(b), (3)(c), (3)(e), (3)(f), (3)(g), (3)(h), (3)(i), and (3)(k), an owner or operator shall comply with the requirements of that determination.~~

~~4. Each piece of equipment to which this rule applies shall be marked in such a manner that it can be distinguished readily from other pieces of equipment.~~

~~5. Equipment that is in vacuum service is excluded from the requirements of subparagraphs (3)(b) to (3)(k) if it is identified as required in part (7)(e)5.~~

~~(b) Pumps~~

~~1. (i) Each pump shall be monitored monthly to detect leaks by the methods specified in subparagraph (6)(b), except as provided in part (3)(a)3 and parts 4, 5, and 6 of this subparagraph.~~

~~(ii) Each pump shall be checked by visual inspection each calendar week for indications of liquids dripping from the pump seal.~~

~~2. (i) If an instrument reading of 10,000 ppm or greater is measured, a leak is detected.~~

~~(ii) If there are indications of liquids dripping from the pump seal, a leak is detected.~~

~~3. (i) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected, except as provided in subparagraph (3)(j).~~

~~(ii) A first attempt at repair shall be made no later than 5 calendar days after each leak is detected.~~

~~4. Each pump equipped with a dual mechanical seal system that includes a barrier fluid system is exempt from the requirements of part 1, provided the following requirements are met:~~

~~(i) Each dual mechanical seal system is:~~

~~(I) Operated with the barrier fluid at a pressure that is at all times greater than the pump stuffing box pressure; or~~

~~(II) Equipped with a barrier fluid degassing reservoir that is connected by a closed-vent system to a control device that complies with the requirements of subparagraph (3) (k) or;~~

~~(III) Equipped with a system that purges the barrier fluid into a process stream with zero VHAP emissions to atmosphere.~~

~~(ii) The barrier fluid is not in VHAP service and, if the pump is covered by standards under chapter 16, is not in VOC service.~~

~~(iii) Each barrier fluid system is equipped with a sensor that will detect failure of the seal system, the barrier fluid system, or both.~~

~~(iv) Each pump is checked by visual inspection each calendar week for indications of liquids dripping from the pump seal.~~

~~(v) (I) Each sensor as described in subpart (3)(b)4 (iii) is checked daily or is equipped with an audible alarm, and~~

~~(II) The owner or operator determines, based on design considerations and operating experience, a criterion that indicates failure of the seal system, the barrier fluid system, or both.~~

~~(vi) (I) If there are indications of liquids dripping from the pump seal or the sensor indicates failure of the seal system, the barrier fluid system, or both based on the criterion determined in item (3)(b)4. (v)(II), a leak is detected.~~

~~(II) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected, except as provided in subparagraph (3) (j).~~

~~(III) A first attempt at repair shall be made no later than 5 calendar days after each leak is detected.~~

~~5. Any pump that is designated, as described in part (7)(e)2, for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, is exempt from the requirements of parts (3)(b) 1, (3)(b) 3, and (3)(b) 4 if the pump;~~

~~(i) Has no externally actuated shaft penetrating the pump housing,~~

~~(ii) Is demonstrated to be operating with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, as measured by the method specified in subparagraph (6)(c) and;~~

~~(iii) Is tested for compliance with subpart (3)(b)5. (ii) initially upon designation, annually, and at other times requested by the Technical Secretary.~~

~~6. If any pump is equipped with a closed-vent system capable of capturing and transporting~~

~~any leakage from the seal or seals to a control device that complies with the requirements of subparagraph (3) (k) it is exempt from the requirements of parts 1 through 5.~~

~~7. Any pump that is located within the boundary of an unmanned plant site is exempt from the weekly visual inspection requirement of subparts (3)(b) 1(ii) and (3)(b) 4(iv), and the daily requirements of item (3)(b) 4(v)(I), provided that each pump is visually inspected as often as practicable and at least monthly.~~

~~(c) Compressors~~

~~1. Each compressor shall be equipped with a seal system that includes a barrier fluid system and that prevents leakage of process fluid to atmosphere, except as provided in part (3) (a)3 and parts 8 and 9 of this subparagraph.~~

~~2. Each compressor seal system as required in part 1 shall be:~~

~~(i) Operated with the barrier fluid at a pressure that is greater than the compressor stuffing box pressure; or~~

~~(ii) Equipped with a barrier fluid system that is connected by a closed-vent system to a control device that complies with the requirements of subparagraph (3) (k); or~~

~~(iii) Equipped with a system that purges the barrier fluid into a process stream with zero VHAP emissions to atmosphere.~~

~~3. The barrier fluid shall not be in VHAP service and, if the compressor is covered by standards under chapter 16 shall not be in VOC service.~~

~~4. Each barrier fluid system as described in parts 1 through 3 of this subparagraph shall be equipped with a sensor that will detect failure of the seal system, barrier fluid system, or both.~~

~~5. (i) Each sensor as required in part 4 of this section shall be checked daily or shall be equipped with an audible alarm unless the compressor is located within the boundary of an unmanned plant site.~~

~~(ii) The owner or operator shall determine, based on design considerations and operating experience, a criterion that indicates failure of the seal system, the barrier fluid system, or both.~~

~~6. If the sensor indicates failure of the seal system, the barrier fluid system, or both based on the criterion determined under subpart (3)(c) 5(ii), a leak is detected.~~

~~7. (i) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected, except as provided in subparagraph (3) (j).~~

~~(ii) A first attempt at repair shall be made no later than 5 calendar days after each leak is detected.~~

~~8. A compressor is exempt from the requirements of parts 1 and 2 of this subparagraph if it is equipped with a closed-vent system capable of capturing and transporting any leakage from the seal to a control device that complies with the requirements of subparagraph (3) (k), except as provided in part 9 of this subparagraph.~~

~~9. Any compressor that is designated, as described in part (7)(e)2, for no detectable emission as indicated by an instrument reading of less than 500 ppm above background is exempt from the requirements of parts 1 through 8 of this subparagraph if the compressor:~~

~~(i) Is demonstrated to be operating with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, as measured by the method specified in subparagraph (6)(c); and~~

~~(ii) Is tested for compliance with subpart (3)(c)9. (i) initially upon designation, annually, and at other times requested by the Technical Secretary.~~

~~(d) Pressure relief devices in gas/vapor service~~

~~1. Except during pressure releases, each pressure relief device in gas/vapor service shall be operated with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, as measured by the method specified in subparagraph (6)(c).~~

~~2. (i) After each pressure release, the pressure relief device shall be returned to a condition of no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, as soon as practicable, but no later than 5 calendar days after each pressure release except as provided in subpart (3) (j).~~

~~(ii) No later than 5 calendar days after the pressure release, the pressure relief device shall be monitored to confirm the condition of no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, as measured by the method specified in subparagraph (6)(c).~~

~~3. Any pressure relief device that is equipped with a closed-vent system capable of capturing and transporting leakage from the pressure relief device to a control device as described in subparagraph (3) (k) is exempt from the requirements of parts 1 and 2 of this subparagraph.~~

~~(e) Sampling connecting systems~~

~~1. Each sampling connection system shall be equipped with a closed-purge system or closed vent system except as provided in part (3) (a)3.~~

~~2. Each closed-purge system or closed-vent system as required in part 1 of this subparagraph shall:~~

~~(i) Return the purged process fluid directly to the process line with zero VHAP emissions to atmosphere; or~~

~~(ii) Collect and recycle the purged process fluid with zero VHAP emissions to atmosphere; or~~

~~(iii) Be designed and operated to capture and transport all the purged process fluid to a control device that complies with the requirements of subparagraph (3) (k).~~

~~3. In-situ sampling systems are exempt from the requirements of parts 1 and 2 of this subparagraph.~~

~~(f) Open-ended valves or lines~~

~~1. (i) Each open-ended valve or line shall be equipped with a cap, blind flange, plug, or a second valve, except as provided in part (3) (a)3.~~

~~(ii) The cap, blind flange, plug, or second valve shall seal the open end at all times except during operations requiring process fluid flow through the open-ended valve or line.~~

~~2. Each open-ended valve or line equipped with a second valve shall be operated in a manner such that the valve on the process fluid end is closed before the second valve is closed.~~

~~3. When a double block and bleed system is being used, the bleed valve or line may remain open during operations that require venting the line between the block valves but shall comply with part 1 of this subparagraph at all other times.~~

~~(g) Valves~~

~~1. Each valve shall be monitored monthly to detect leaks by the method specified in subparagraph (6)(b) and shall comply with parts 2 through 5 of this subparagraph, except as provided in parts 6, 7, and 8 of this subparagraph, and subparagraphs (4)(a) or (4)(b), and part (3) (a)3.~~

~~2. If an instrument reading of 10,000 ppm or greater is measured, a leak is detected.~~

~~3. (i) Any valve for which a leak is not detected for 2 successive months may be monitored the first month of every quarter, beginning with the next quarter, until a leak is detected.~~

~~(ii) If a leak is detected, the valve shall be monitored monthly until a leak is not detected for 2 successive months.~~

~~4. (i) When a leak is detected, it shall be repaired as soon as practicable, but no later than 15 calendar days after the leak is detected, except as provided in subparagraph (3) (j).~~

~~(ii) A first attempt at repair shall be made no later than 5 calendar days after each leak is detected.~~

~~5. First attempts at repair include, but are not limited to, the following best practices where practicable:~~

~~(i) Tightening of bonnet bolts;~~

~~(ii) Replacement of bonnet bolts;~~

~~(iii) Tightening of packing gland nuts; and~~

~~(iv) Injection of lubricant into lubricated packing.~~

~~6. Any valve that is designated, as described in part (7)(e)2, for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, is exempt from the requirements of part (3)(g) 1 if the valve:~~

~~(i) Has no external actuating mechanism in contact with the process fluid;~~

~~(ii) Is operated with emissions less than 500 ppm above background, as measured by the method specified in subparagraph (6)(e); and~~

~~(iii) Is tested for compliance with subpart (3)(g)6 (ii) initially upon designation, annually, and at other times requested by the Technical Secretary.~~

~~7. Any valve that is designated, as described in part (7)(f)1, as an unsafe-to-monitor valve is exempt from the requirements of part (3)(g) 1 if:~~

~~(i) The owner or operator of the valve demonstrates that the valve is unsafe to monitor because monitoring personnel would be exposed to an immediate danger as a consequence of complying with part (3)(g) 1; and~~

~~(ii) The owner or operator of the valve has a written plan that requires monitoring of the valve as frequent as practicable during safe-to-monitor times.~~

~~8. Any valve that is designated, as described in part (7)(f)2, as a difficult-to-monitor valve is exempt from the requirements of part (3)(g) 1 if:~~

~~(i) The owner or operator of the valve demonstrates that the valve cannot be monitored without elevating the monitoring personnel more than 2 meters above a support surface;~~

~~(ii) The process unit within which the valve is located is an existing process unit; and~~

~~(iii) The owner or operator of the valve follows a written plan that requires monitoring of the valve at least once per calendar year.~~

~~(h) Pressure relief devices in liquid service and flanges and other connectors.~~

~~1. Pressure relief devices in liquid service and flanges and other connectors shall be monitored within 5 days by the method specified in subparagraph (6)(b) if evidence of a potential leak is found by visual, audible, olfactory, or any other detection method except as provided in part (3) (a)3.~~

~~2. If an instrument reading of 10,000 ppm or greater is measured, a leak is detected.~~

~~3. (i) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected, except as provided in subparagraph (3) (j).~~

~~(ii) The first attempt at repair shall be made no later than 5 calendar days after each leak is detected.~~

~~4. First attempts at repair include, but are not limited to, the best practices described under part (3) (g)5.~~

~~(i) Product accumulator vessels~~

~~Each product accumulator vessel shall be equipped with a closed-vent system capable of capturing and transporting any leakage from the vessel to a control device as described in subparagraph (3) (k) except as provided in part (3) (a)3.~~

~~(j) Delay of repair~~

~~1. Delay of repair of equipment for which leaks have been detected will be allowed if the repair is technically infeasible without a process unit shutdown. Repair of this equipment shall occur before the end of the next process unit shutdown.~~

~~2. Delay of repair of equipment for which leaks have been detected will be allowed for equipment that is isolated from the process and does not remain in VHAP service.~~

~~3. Delay of repair for valves will be allowed if:~~

~~(i) The owner or operator demonstrates that emissions of purged material resulting from immediate repair are greater than the fugitive emissions likely to result from delay of repair, and~~

~~(ii) When repair procedures are effected, the purged material is collected and destroyed or recovered in a control device complying with subparagraph (3) (k).~~

~~4. Delay of repair for pumps will be allowed if:~~

~~(i) Repair requires the use of a dual mechanical seal system that includes a barrier fluid system, and~~

~~(ii) Repair is completed as soon as practicable, but not later than 6 months after the~~

~~leak was detected.~~

~~5. Delay of repair beyond a process unit shutdown will be allowed for a valve if valve assembly replacement is necessary during the process unit shutdown, valve assembly supplies have been depleted, and valve assembly supplies had been sufficiently stocked before the supplies were depleted. Delay or repair beyond the next process unit shutdown will not be allowed unless the next process unit shutdown occurs sooner than 6 months after the first process unit shutdown.~~

~~(k) Closed-vent systems and control devices~~

~~1. Owners or operators of closed-vent systems and control devices used to comply with provisions of this rule shall comply with the provisions of this subparagraph except as provided in part (3) (a)3.~~

~~2. Vapor recovery systems (for example, condensers and adsorbers) shall be designed and operated to recover the organic vapors vented to them with an efficiency of 95 percent or greater.~~

~~3. Enclosed combustion devices shall be designed and operated to reduce the VHAP emissions vented to them with an efficiency of 95 percent or greater or to provide a minimum residence time of 0.50 seconds at a minimum temperature of 760ºC.~~

~~4. (i) Flares used to comply with this rule shall comply with the requirements of 1200-03-16-.01 (11).~~

~~(ii) Flares shall be operated with a flame present at all times, as determined by the methods specified in subparagraph (6)(e) of this rule.~~

~~(iii) Flares shall be used only with the net heating value of the gas being combusted being 11.2 MJ/scm (300 Btu/scf) or greater if the flare is steam-assisted or air-assisted; or with the net heating value of the gas being combusted being 7.45 MJ/scm (200 Btu/scf) or greater if the flare is nonassisted. The net heating value of the gas being combusted shall be determined by the method specified in subparagraph (6)(e) of this rule.~~

~~(iv) Steam-assisted and nonassisted flares shall be designed for and operated with an exit velocity, as determined by the method specified in part (6)(e)4 of this rule, less than 18.3 m/sec (60 ft/sec).~~

~~(v) Air-assisted flares shall be designed and operated with an exit velocity less than the velocity, Vmax, as determined by the method specified in part (6)(e)5 of this rule.~~

~~(vi) Flares used to comply with this subpart shall be steam-assisted, air-assisted, or nonassisted.~~

~~5. Owners or operators of control devices that are used to comply with the provisions of this rule shall monitor these control devices to ensure that they are operated and maintained in conformance with their design.~~

~~6. (i) Closed-vent systems shall be designed for and operated with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background and by visual inspections, as determined by the methods specified in subparagraph (6)(c) of this rule.~~

~~(ii) Closed-vent systems shall be monitored to determine compliance with subparagraph (3)(k) initially, annually, and at other times requested by the Technical Secretary.~~

~~(iii) Leaks, as indicated by an instrument reading greater than 500 ppm and visual~~

~~inspections, shall be repaired as soon as practicable, but not later than 15 calendar days after the leak is detected.~~

~~(iv) A first attempt at repair shall be made no later than 5 calendar days after the leak is detected.~~

~~7. Closed-vent systems and control devices used to comply with provisions of this rule shall be operated at all times when emissions may be vented to them.~~

~~(4) Alternative standards for valves in VHAP service~~

~~(a) Allowable percentages of valves leaking~~

~~1. An owner or operator may elect to have all valves within a process unit comply with an allowable percentage of valves leaking of equal to or less than 2.0 percent.~~

~~2. The following requirements shall be met if an owner or operator decides to comply with an allowable percentage of valves leaking:~~

~~(i) An owner or operator must notify the Technical Secretary that the owner or operator has elected to have all valves within a process unit to comply with the allowable percentage of valves leaking before implementing this alternative standard, as specified in subparagraph (8)(d).~~

~~(ii) A performance test as specified in part (4)(a) 3 shall be conducted initially upon designation, annually, and at other times requested by the Technical Secretary.~~

~~(iii) If a valve leak is detected, it shall be repaired in accordance with parts (3)(g)4 and (3)(g) 5.~~

~~3. Performance tests shall be conducted in the following manner:~~

~~(i) All valves in VHAP service within the process unit shall be monitored within 1 week by the methods specified in subparagraph (6)(b).~~

~~(ii) If an instrument reading of 10,000 ppm or greater is measured a leak is detected.~~

~~(iii) The leak percentage shall be determined by dividing the number of valves in VHAP service for which leaks are detected by the number of valves in VHAP service within the process unit.~~

~~4. Owner or operators who elect to have all valves comply with this alternative standard shall not have a process unit with a leak percentage greater than 2.0 percent.~~

~~5. If an owner or operator decides no longer to comply with subparagraph (4)(a), the owner or operator must notify the Technical Secretary in writing that the work practice standard described in parts (3)(g)1 through (3)(g) 5 will be followed.~~

~~(b) Skip period leak detection and repair~~

~~1. (i) An owner or operator may elect for all valves within a process unit to comply with one of the alternative work practices specified in subparts (4)(b) 2(ii) and (4)(b)2.(iii) of this subparagraph.~~

~~(ii) An owner or operator must notify the Technical Secretary before implementing one of the alternative work practices, as specified in subparagraph (8)(d).~~

~~2. (i) An owner or operator shall comply initially with the requirements for valves, as described in subparagraph (3)(g).~~

~~(ii) After 2 consecutive quarterly leak detection periods with the percentage of valves~~

~~leaking equal to or less than 2.0, an owner or operator may begin to skip 1 of the quarterly leak detection periods for the valves in VHAP service.~~

~~(iii) After 5 consecutive quarterly leak detection periods with the percentage of valves leaking equal to or less than 2.0, an owner or operator may begin to skip 3 of the quarterly leak detection periods for the valves in VHAP service.~~

~~(iv) If the percentage of valves leaking is greater than 2.0, the owner or operator shall comply with the requirements as described in subparagraph (3)(g) but may again elect to use this subparagraph.~~

~~(5) Alternative means of emission limitation~~

~~(a) Permission to use an alternative means of emission limitation shall be governed by the following procedures:~~

~~(b) Where the standard is an equipment, design, or operational requirement:~~

~~1. Each owner or operator applying for permission shall be responsible for collecting and verifying test data for an alternative means of emission limitation.~~

~~2. The Technical Secretary will compare test data for the means of emission limitation to test data for the equipment, design, and operational requirements.~~

~~3. The Technical Secretary may condition the permission on requirements that may be necessary to assure operation and maintenance to achieve the same emission reduction as the equipment, design, and operational requirements.~~

~~(c) Where the standard is a work practice:~~

~~1. Each owner or operator applying for permission shall be responsible for collecting and verifying test data for an alternative means of emission limitation.~~

~~2. For each source for which permission is requested, the emission reduction achieved by the required work practices shall be demonstrated for a minimum period of 12 months.~~

~~3. For each source for which permission is requested, the emission reduction achieved by the alternative means of emission limitation shall be demonstrated.~~

~~4. Each owner or operator applying for permission shall commit in writing each source to work practices that provide for emission reductions equal to or greater than the emission reductions achieved by the required work practices.~~

~~5. The Technical Secretary will compare the demonstrated emission reduction for the alternative means of emission limitation to the demonstrated emission reduction of the required work practices and will consider the commitment in part (5)(c)4.~~

~~6. The Technical Secretary may condition the permission on requirements that may be necessary to assure operation and maintenance to achieve the same emission reduction as the required work practices of this rule.~~

~~(d) An owner or operator may offer a unique approach to demonstrate the alternative means of emission limitation.~~

~~(e) 1. Manufacturers of equipment used to control equipment leaks of a VHAP may apply to the Technical Secretary for permission for an alternative means of emission limitation that achieves a reduction in emissions of the VHAP achieved by the equipment, design, and operational requirements of this rule.~~

~~2. The Technical Secretary will grant permission according to the provisions of subparagraphs (5)(b), (5)(c) and (5)(d).~~

~~(6) Test methods and procedures~~

~~(a) Each owner or operator subject to the provisions of this rule shall comply with the test methods and procedures requirements provided in this paragraph.~~

~~(b) Monitoring, as required in paragraphs (3), (4), and (5), shall comply with the following requirements:~~

~~1. Monitoring shall comply with Reference Method 21 as specified in part 1200-03-16-.01-(5)(g)21.~~

~~2. The detection instrument shall meet the performance criteria of Reference Method 21 (as referenced in 1200-03-16-.01 (5)(g)).~~

~~3. The instrument shall be calibrated before use each day of its use by the procedures specified in Reference Method 21.~~

~~4. Calibration gases shall be:~~

~~(i) Zero air (less than 10 ppm of hydrocarbon in air); and~~

~~(ii) A mixture of methane or n-hexane and air at a concentration of approximately, but less than, 10,000 ppm methane or n-hexane.~~

~~5. The instrument probe shall be traversed around all potential leak interfaces as close to the interface as possible as described in Reference Method 21.~~

~~(c) When equipment is tested for compliance with no detectable emissions, as required in parts (3)(b)5, (3)(c)9, (3)(g)6, (3)(k)6, and subparagraph (3)(d), the test shall comply with the following requirements:~~

~~1. The requirements of parts (6) (b)1 through (6) (b)4 shall apply.~~

~~2. The background level shall be determined, as set forth in Reference Method 21.~~

~~3. The instrument probe shall be traversed around all potential leak interfaces as close to the interface as possible as described in Reference Method 21.~~

~~4. The arithmetic difference between the maximum concentration indicated by the instrument and the background level is compared with 500 ppm for determining compliance.~~

~~(d) 1. Each piece of equipment within a process unit that can conceivably contain equipment in VHAP service is presumed to be in VHAP service unless an owner or operator demonstrates that the piece of equipment is not in VHAP service. For a piece of equipment to be considered not in VHAP service, it must be determined that the percent VHAP content can be reasonably expected never to exceed 10 percent by weight. For purposes of determining the percent VHAP content of the process fluid that is contained in or contacts equipment, procedures that conform to the methods described in ASTM Method D-2267 shall be used. (Note: All references to ASTM in this rule refers to the American Society for Testing Materials. Copies of methods are available for purchase by writing to ASTM, 1916 Race Street, Philadelphia, PA 19103 or by writing to the Tennessee Division of Air Pollution Control, 701 Broadway, 4th Floor Customs House, Nashville, TN 37219. Be sure and specify which method is desired).~~

~~2. (i) An owner or operator may use engineering judgment rather than the procedures in part (6)(d)1 to demonstrate that the percent VHAP content does not exceed 10 percent by weight. When an owner or operator and the Technical Secretary do not agree on whether a piece of equipment is not in VHAP service, however, the procedures in part (6)(d) 1 shall be used to resolve the disagreement.~~

~~(ii) If an owner or operator determines that a piece of equipment is in VHAP service, the determination can be revised only after following the procedures in part (6)(d) 1.~~

~~3. Samples used in determining the percent VHAP content shall be representative of the process fluid that is contained in or contacts the equipment or the gas being combusted in the flare.~~

~~(e) 1. Reference Method 22 (as specified in part 1200-03-16-.01 (5)(g)22) shall be used to determine compliance of flares with the visible emission provisions of this rule.~~

~~2. The presence of a flare pilot flame shall be monitored using a thermocouple or any other equivalent device to detect the presence of a flame.~~

~~3. The net heating value of the gas being combusted in a flare shall be calculated using the following equation:~~

~~n~~
~~HT = K (SUM CiHi)~~
~~i=1~~

~~Where:~~

~~HT = Net heating value of the sample, MJ/ scm: where the net enthalpy per mole of offgas is based on combustion at 25ºC and 760 mm Hg, but the standard temperature for determining the volume corresponding to one mole is 20ºC.~~

~~K = Constant, 1.74 x 10-7 (1/ppm) (g mole/ scm) (MJ/kcal) where standard temperature for (g mole/scm) is 20ºC.~~

~~Ci = Concentration of sample component i in ppm, as measured by Reference Method 18 as specified in 1200-03-16-.01 (5)(g)18 and ASTM D2504-67.~~

~~Hi = Net heat of combustion of sample component i, kcal/g mole. The heats of combustion may be determined using ASTM D2382-76 if published values are not available or cannot be calculated.~~

~~4. The actual exit velocity of a flare shall be determined by dividing the volumetric flowrate (in units of standard temperature and pressure), as determined by Reference Method 2, or 2A, as specified in part 1200-03-16-.01(5)(g)2, as appropriate, by the unobstructed (free) cross section area of the flare tip.~~

~~5. The maximum permitted velocity, Vmax for air-assisted flares shall be determined by the following equation:~~

~~Vmax = 8.76 $ 0.7084 (HT)~~

~~Where:~~

~~Vmax = Maximum permitted velocity, m/sec~~
~~8.706 = Constant.~~
~~0.7084 = Constant.~~
~~HT = The net heating value as determined in part (6)(e)3.~~

~~(7) Recordkeeping requirements~~

~~(a) 1. Each owner or operator subject to the provisions of this rule shall comply with the recordkeeping requirements of this paragraph.~~

~~2. An owner or operator of more than one process unit subject to the provisions of this rule may comply with the recordkeeping requirements for these process units in one recordkeeping system if the system identifies each record by each process unit.~~

~~(b) When each leak is detected as specified in subparagraphs (3)(b), (3)(c), (3)(g), and (3)(h), the following requirements apply:~~

~~1. A weatherproof and readily visible identification, marked with the equipment identification number, shall be attached to the leaking equipment.~~

~~2. The identification on a valve may be removed after it has been monitored for 2 successive months as specified in part (3)(g)3 and no leak has been detected during those 2 months.~~

~~3. The identification on equipment, except on a valve, may be removed after it has been repaired.~~

~~(c) When each leak is detected as specified in subparagraphs (3)(b), (3)(c), (3)(g), and (3)(h), the following information shall be recorded in a log and shall be kept for 2 years in a readily accessible location:~~

~~1. The instrument and operator identification numbers and the equipment identification number.~~

~~2. The date the leak was detected and the dates of each attempt to repair the leak.~~

~~3. Repair methods applied in each attempt to repair the leak.~~

~~4. ‘‘Above 10,000’’ if the maximum instrument reading measured by the methods specified in subparagraph (6)(a) after each repair attempt is equal to or greater than 10,000 ppm.~~

~~5. ‘‘Repair delayed’’ and the reason for the delay if a leak is not repaired within 15 calendar days after discovery of the leak.~~

~~6. The signature of the owner or operator (or designate) whose decision it was that repair could not be effected without a process shutdown.~~

~~7. The expected date of successful repair of the leak if a leak is not repaired within 15 calendar days.~~

~~8. Dates of process unit shutdowns that occur while the equipment is unrepaired.~~

~~9. The date of successful repair of the leak.~~

~~(d) The following information pertaining to the design requirements for closed-vent systems and control devices described in subparagraph (3)(k) shall be recorded and kept in a readily accessible location:~~

~~1. Detailed schematics, design specifications, and piping and instrumentation diagrams.~~

~~2. The dates and descriptions of any changes in the design specifications.~~

~~3. A description of the parameter or parameters monitored, as required in part (3)(k)5, to ensure that control devices are operated and maintained in conformance with their design and an explanation of why that parameter (or parameters) was selected for the monitoring.~~

~~4. Periods when the closed-vent systems and control devices required in subparagraph (3)(b), (3)(c), (3)(d), (3)(e), and (3)(i) are not operated as designed, including periods when a flare pilot light does not have a flame.~~

~~5. Dates of start-ups and shutdowns of the closed-vent systems and control devices required in subparagraphs (3)(b), (3)(c), (3)(d), (3)(e), and (3)(i).~~

~~(e) The following information pertaining to all equipment subject to the requirements in paragraph (3) shall be recorded in a log that is kept in a readily accessible location:~~

~~1. A list of identification numbers for equipment (except welded fittings) subject to the requirements of this rule.~~

~~2. (i) A list of identification numbers for equipment that the owner or operator elects to designate for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, under the provisions of parts (3)(b)5, (3)(c)9, and (3)(g)6.~~

~~(ii) The designation of this equipment as subject to the requirements of parts (3)(b)5, (3)(c)9, and (3)(g)6 shall be signed by the owner or operator.~~

~~3. A list of equipment identification numbers for pressure relief devices required to comply with part (3)(d)1.~~

~~4. (i) The dates of each compliance test required in parts (3)(b)5, (3)(c)9, (3(g)6, and subparagraph (3)(d).~~

~~(ii) The background level measured during each compliance test.~~

~~(iii) The maximum instrument reading measured at the equipment during each compliance test.~~

~~5. A list of identification numbers for equipment in vacuum service.~~

~~(f) The following information pertaining to all valves subject to the requirements of parts (3)(g)7 and (3)(g) 8 of this rule, shall be recorded in a log that is kept in a readily accessible location:~~

~~1. A list of identification numbers for valves that are designated as unsafe to monitor, an explanation for each valve stating why the valve is unsafe to monitor, and the plan for monitoring each valve.~~

~~2. A list of identification numbers for valves that are designated as difficult to monitor, an explanation for each valve stating why the valve is difficult to monitor, and the planned schedule for monitoring each valve.~~

~~(g) The following information shall be recorded for valves complying with subparagraph (4)(b):~~

~~1. A schedule of monitoring.~~

~~2. The percent of valves found leaking during each monitoring period.~~

~~(h) The following information shall be recorded in a log that is kept in a readily accessible location:~~

~~1. Design criterion required in subparts (3)(b)4(v) and (3)(c)5(ii) and an explanation of the design criterion; and~~

~~2. Any changes to this criterion and the reasons for the changes.~~

~~(i) The following information shall be recorded in a log that is kept in a readily accessible location for use in determining exemptions as provided in the applicability section of this rule and other specific rules:~~

~~1. An analysis demonstrating the design capacity of the process unit, and~~

~~2. An analysis demonstrating that equipment is not in VHAP service.~~

~~(j) Information and data used to demonstrate that a piece of equipment is not in VHAP service shall be recorded in a log that is kept in a readily accessible location.~~

~~(8) Reporting requirements~~

~~(a) 1. An owner or operator of any piece of equipment to which this rule applies shall submit a statement in writing notifying the Technical Secretary that the requirements of paragraphs (3), (6), (7), and (8) are being implemented.~~

~~2. In the case of an existing source or a new source which has an initial startup date preceding November 6, 1988, the statement is to be submitted within 90 days of November 6, 1988.~~

~~3. In the case of new sources which did not have an initial startup date preceding November 6, 1988, the statement shall be submitted with the application for approval of construction, as described in paragraph (2) of rule 1200-03-11-.01.~~

~~4. The statement is to contain the following information for each source:~~

~~(i) Equipment identification number and process unit identification.~~

~~(ii) Type of equipment (for example, a pump or pipeline valve).~~

~~(iii) Percent by weight VHAP in the fluid at the equipment.~~

~~(iv) Process fluid state at the equipment (gas/vapor or liquid).~~

~~(v) Method of compliance with the standard (for example, ‘monthly leak detection and repair’’ or ‘‘equipped with dual mechanical seals‘).~~

~~(b) A report shall be submitted to the Technical Secretary semiannually starting 6 months after the initial report required in subparagraph (8)(a), that includes the following information:~~

~~1. Process unit identification.~~

~~2. For each month during the semiannual reporting period.~~

~~(i) Number of valves for which leaks were detected as described in part (3)(g)2 or subparagraph (4)(b).~~

~~(ii) Number of valves for which leaks were not repaired as required in part (3)(g)4.~~

~~(iii) Number of pumps for which leaks were detected as described in part (3)(b)2 and subpart (3)(b)4(vi).~~

~~(iv) Number of pumps for which leaks were not repaired as required in part (3)(b)3 and subpart (3)(b)4(vi).~~

~~(v) Number of compressors for which leaks were detected as described in part (3)(c)6.~~

~~(vi) Number of compressors for which leaks were not repaired as required in part (3)(c)7.~~

~~(vii) The facts that explain any delay of repairs and, where appropriate, why a process unit shutdown was technically infeasible.~~

~~3. Dates of process unit shutdowns which occurred within the semiannual reporting period.~~

~~4. Revisions to items reported according to subparagraph (8)(a) if changes have occurred since the initial report or subsequent revisions to the initial report.~~

~~5. The results of all performance tests to determine compliance with parts (3)(b)5, (3)(c)9, (3)(d)1, (3)(g)6, (3)(k)6 and subparagraphs (4)(a) and (4)(b) conducted within the semiannual reporting period.~~

~~(c) In the first report submitted as required in subparagraph (8)(a), the report shall include a reporting schedule stating the months that semiannual reports shall be submitted. Subsequent reports shall be submitted according to that schedule, unless a revised schedule has been submitted in a previous semiannual report.~~

~~(d) An owner or operator electing to comply with the provisions of subparagraph (4)(a) and (4)(b) shall notify the Technical Secretary of the alternative standard selected 90 days before implementing either of the provisions.~~

~~(e) An application for approval of construction or modification will not be required if –~~

~~1. The new source complies with the standard, paragraph (3).~~

~~2. The new source is not part of the construction of a process unit; and~~

~~3. In the next semiannual report required by subparagraph (8)(b) the information in part (8)(a)4 is reported.~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.07 Equipment Leaks (fugitive Emission Sources) of Benzene~~

~~(1) Applicability~~

~~(a) The provisions of this rule apply to each of the following sources that are intended to operate in benzene service: pumps, compressors, pressure relief devices, sampling connections, systems, open-ended valves or lines, valves, flanges and other connectors, product accumulator vessels, and control devices or systems required by this rule.~~

~~(b) The provisions of this rule do not apply to sources located in coke by-product plants.~~

~~(c) 1. If an owner or operator applies for one of the exemptions in this paragraph, then the owner or operator shall maintain records as required in subparagraph 1200-03-11-.06(7)(i).~~

~~2. Any equipment in benzene services that is located at a plant site designed to produce or use less than 1,000 megagrams of benzene per year is exempt from the requirements of paragraph (3) of this rule.~~

~~3. Any process unit (as defined in 1200-03-11-.06(2)) that has no equipment in benzene service is exempt from the requirements of paragraph (3) of this rule.~~

~~(d) While the provisions of this rule are effective, a source to which this rule applies that is also subject to the provisions of Chapter 16 only will be required to comply with the provisions of this rule.~~

~~(2) Definitions~~

~~(a) ‘‘In benzene service’’ means that a piece of equipment either contains or contacts a fluid (liquid or gas) that is at least 10 percent benzene by weight as determined according to the provisions of 1200-03-11-.06(6)(d). The provisions of 1200-03-11-.06(6)(d) also specify how to determine that a piece of equipment is not in benzene service.~~

~~(b) ‘‘Semiannual’’ means a 6-month period; the first semiannual period concludes on the last day of~~

~~the last month during the 180 days following initial startup for new sources; and the first semiannual period concludes on the last day of the last full month during the 180 days after this rule becomes effective for existing sources.~~

~~(3) Standards for Equipment Leaks (Fugitive Emission Sources) of Benzene~~

~~(a) Each owner or operator subject to the provisions of this rule shall comply with the requirements of rule 1200-03-11-.06.~~

~~(b) An owner or operator may elect to comply with the requirements of 1200-03-11-.06(4)(a) and 1200-03-11-.06(4)(b).~~

~~(c) An owner or operator may apply to the Technical Secretary for a determination of an alternative means of emission limitation that achieves a reduction in emissions of benzene at least equivalent to the reduction in emissions of benzene achieved by the controls required in this rule. In doing so, the owner or operator shall comply with requirements of 1200-03-11-.06(5).~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.08 Emission Standads for Emissions of Radionuclides Other than Radon from Department of Energy Facilities~~

~~(1) Adopted herein by reference are the Federal regulations 40 CFR 61 Subpart H as published in the December 15, 1989 edition of the Federal Register: (See paragraph (6) of this rule for text).~~

~~(2) Agreements regarding waivers, compliance reports, testing, and monitoring between the Department of Energy and the Environmental Protection Agency will be recognized by the Tennessee Division of Air Pollution Control providing these agreements are current, valid, and supported by appropriate documentation.~~

~~(3) With respect to certain terms used in the text of Subpart H presented verbatim in Paragraph 6) below, those terms have the meanings as follows:~~

~~(a) In § 61.93(b), § 61.93(b)(2)(ii), § 61.93(b)(3)(iv), § 61.93(b)(4)(i), and § 61.93(b)(5)(vi) "EPA" means "the Technical Secretary and EPA."~~

~~(b) In § 61.93(b)(2)(iii) "the Administrator" means "the Technical Secretary and the Administrator of EPA", and "EPA" means "the Technical Secretary and EPA."~~

~~(c) In § 61.94(a) "EPA headquarters, and the appropriate regional office" means "the Technical Secretary, EPA headquarters, and the appropriate regional office."~~

~~(d) In § 61.94(b)(8), and § 61.94(d) "EPA" means "the Technical Secretary."~~

~~(e) In § 61.94(c) "the Administrator" means "the Technical Secretary."~~

~~(f) In § 61.95 "the Administrator" means "the Technical Secretary."~~

~~(g) In § 61.96(b) "EPA" means "the Technical Secretary and EPA."~~

~~(4) Until such time that EPA grants delegation of authority to the State of Tennessee to implement and enforce the radionuclide NESHAP, the EPA shall be the implementing agency for the radionuclide NESHAP (such a delegation will be published in the Federal Register by EPA.) Copies of all requests made to EPA by DOE for an alternative monitoring or sampling method pursuant to § 61.93(b), § 61.93(b)(2)(ii), § 61.93(b)(2)(iii), § 61.93(b)(3)(iv), § 61.93(b)(4)(i), § 61.93(b)(5)(vi), and § 61.96(b) shall be provided to the Technical Secretary concurrently with submittal to EPA. Additionally, DOE must immediately submit to the Technical Secretary copies of all EPA's responses to DOE's requests.~~

~~(5) Until such time that EPA grants delegation of authority to the State of Tennessee to implement and enforce the radionuclide NESHAP, the EPA shall be the implementing agency for the radionuclide NESHAP (such a delegation will be published in the Federal Register.) Copies of all applications to~~

~~construct or modify pursuant to § 61.96 shall be submitted to the Technical Secretary concurrently with submittal to EPA. DOE must also submit copies of all EPA's responses to DOE's applications to the Technical Secretary."~~

~~(6) CFR PART 61-Subpart H- National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities.~~

~~SOURCE: 54 FR 51695, Dec. 15, 1989, unless otherwise noted.~~

~~§ 61.90 Designation of facilities.~~

~~The provisions of this subpart apply to operations at any facility owned or operated by the Department of Energy that emits any radionuclide other than radon-222 and radon-220 into the air, except that this subpart does not apply to disposal at facilities subject to 40 CFR part 191, subpart B or 40 CFR part 192.~~

~~§ 61.91 Definitions.~~

~~As used in this subpart, all terms not defined here have the meaning given them in the Clean Air Act or 40 CFR part 61, subpart A. The following terms shall have the following specific meanings:~~

~~(a) Effective dose equivalent means the sum of the products of absorbed dose and appropriate factors to account for differences in biological effectiveness due to the quality of radiation and its distribution in the body of reference man. The unit of the effective dose equivalent is the rem. For purposes of this subpart, doses caused by radon-222 and its respective decay products formed after the radon is released from the facility are not included. The method for calculating effective dose equivalent and the definition of reference man are outlined in the International Commission on Radiological Protection's Publication No. 26.~~

~~(b) Facility means all buildings, structures and operations on one contiguous site.~~

~~(c) Radionuclide means a type of atom which spontaneously undergoes radioactive decay.~~

~~(d) Residence means any home, house, apartment building, or other place of dwelling which is occupied during any portion of the relevant year.~~

~~§ 61.92 Standard.~~

~~Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.~~

~~§ 61.93 Emission monitoring and test procedures.~~

~~(a) To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval. DOE facilities for which the maximally exposed individual lives within 3 kilometers of all sources of emissions in the facility, may use EPA's COMPLY model and associated procedures for determining dose for purposes of compliance.~~

~~(b) Radionuclide emission rates from point sources (stacks or vents) shall be measured in accordance with the following requirements or other procedures for which EPA has granted prior approval:~~

~~(1) Effluent flow rate measurements shall be made using the following methods:~~

~~(i) Reference Method 2 of appendix A to part 60 shall be used to determine velocity and volumetric flow rates for stacks and large vents.~~

~~(ii) Reference Method 2A of appendix A to part 60 shall be used to measure flow rates through pipes and small vents.~~

~~(iii) The frequency of the flow rate measurements shall depend upon the variability of the effluent flow rate. For variable flow rates, continuous or frequent flow rate measurements shall be made. For relatively constant flow rates only periodic measurements are necessary.~~

~~(2) Radionuclides shall be directly monitored or extracted, collected and measured using the following methods:~~

~~(i) Reference Method 1 of appendix A part 60 shall be used to select monitoring or sampling sites.~~

~~(ii) The effluent stream shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in ANSI N13.1-1969 “Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities” (including the guidance presented in appendix A of ANSI N13.1) (incorporated by reference-see §61.18). The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with EPA’s prior approval. Such approval may be granted in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency so as to provide a representative sample of the emissions.~~

~~(iii) Radionuclides shall be collected and measured using procedures based on the principles of measurement described in appendix B, Method 114. Use of methods based on principles of measurement different from those described in appendix B, Method 114 must have prior approval from the Administrator. EPA reserves the right to approve measurement procedures.~~

~~(iv) A quality assurance program shall be conducted that meets the performance requirements described in appendix B, Method 114.~~

~~(3) When it is impractical to measure the effluent flow rate at an existing source in accordance with the requirements of paragraph (b)(1) of this section or to monitor or sample an effluent stream at an existing source in accordance with the site selection and sample extraction requirements of paragraph (b)(2) of this section, the facility owner or operator may use alternative effluent flow rate measurement procedures or site selection and sample extraction procedures provided that:~~

~~(i) It can be shown that the requirements of paragraph (b)(1) or (2) of this section are impractical for the effluent stream.~~

~~(ii) The alternative procedure will not significantly underestimate the emissions.~~

~~(iii) The alternative procedure is fully documented.~~

~~(iv) The owner or operator has received prior approval from EPA.~~

~~(4) (i) Radionuclide emission measurements in conformance with the requirements of paragraph (b) of this section shall be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective dose Radionuclide emission measurements in conformance with the requirements of equivalent in excess of 1% of the standard. All radionuclides which could contribute greater than 10% of the potential effective dose equivalent for a release point shall be measured. With prior EPA approval, DOE may determine these emissions through alternative procedures. For other release points which have a potential to release radionuclides into the air, periodic confirmatory measurements shall be made to verify the low emissions.~~

~~(ii) To determine whether a release point is subject to the emission measurement requirements of paragraph (b) of this section, it is necessary to evaluate the potential for radionuclide emissions for that release point. In evaluating the potential of a release point to discharge radionuclides into the air for the purposes of this section, the estimated radionuclide release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facilities operations were otherwise normal.~~

~~(5) Environmental measurements of radionuclide air concentrations at critical receptor locations may be used as an alternative to air dispersion calculations in demonstrating compliance with the standard if the owner or operator meets the following criteria:~~

~~(i) The air at the point of measurement shall be continuously sampled for collection of radionuclides.~~

~~(ii) Those radionuclides released from the facility, which are the major contributors to the effective dose equivalent must be collected and measured as part of the environmental measurement program.~~

~~(iii) Radionuclide concentrations which would cause an effective dose equivalent of 10% of the standard shall be readily detectable and distinguishable from background.~~

~~(iv) Net measured radionuclide concentrations shall be compared to the concentration levels in Table 2 of appendix E to determine compliance with the standard. In the case of multiple radionuclides being released from a facility, compliance shall be demonstrated if the value for all radionuclides is less than the concentration level in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each radionuclide is less than 1.~~

~~(v) A quality assurance program shall be conducted that meets the performance requirements described in appendix B, Method 114.~~

~~(vi) Use of environmental measurements to demonstrate compliance with the standard is subject to prior approval of EPA. Applications for approval shall include a detailed description of the sampling and analytical methodology and show how the above criteria will be met.~~

~~§ 61.94 Compliance and reporting.~~

~~(a) Compliance with this standard shall be determined by calculating the highest effective dose equivalent to any member of the public at any offsite point where there is a residence, school, business or office. The owners or operators of each facility shall submit an annual report to both EPA headquarters and the appropriate regional office by June 30 which includes the results of the monitoring as recorded in DOE's Effluent Information System and the dose calculations required by § 61.93(a) for the previous calendar year.~~

~~(b) In addition to the requirements of paragraph (a) of this section, an annual report shall include the following information:~~

~~(1) A description of the handling and processing that the radioactive materials undergo at the facility.~~

~~(2) A list of the stacks or vents or other points where radioactive materials are released to the atmosphere.~~

~~(3) A description of the effluent controls that are used on each stack, vent, or other release point and an estimate of the efficiency of each control device.~~

~~(4) Distances from the points of release to the nearest residence, school, business or office~~

~~and the nearest farms producing vegetables, milk, and meat.~~

~~(5) The values used for all other user-supplied input parameters for the computer models (e.g., meteorological data) and the source of these data.~~

~~(6) The name and location of the facility.~~

~~(7) A list of the radioactive materials used at the facility.~~

~~(8) A brief description of all construction and modifications which were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under § 61.96 and associated documentation developed by DOE to support the waiver. EPA reserves the right to require that DOE send to EPA all the information that normally would be required in an application to construct or modify, following receipt of the description and supporting documentation.~~

~~(9) Each report shall be signed and dated by a corporate officer or public official in charge of the facility and contain the following declaration immediately above the signature line: "I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 U.S.C. 1001."~~

~~(c) If the facility is not in compliance with the emission limits of § 61.92 in the calendar year covered by the report, then the facility must commence reporting to the Administrator on a monthly basis the information listed in paragraph (b) of this section, for the preceding month. These reports will start the month immediately following the submittal of the annual report for the year in noncompliance and will be due 30 days following the end of each month. This increased level of reporting will continue until the Administrator has determined that the monthly reports are no longer necessary. In addition to all the information required in paragraph (b) of this section, monthly reports shall also include the following information:~~

~~(1) All controls or other changes in operation of the facility that will be or are being installed to bring the facility into compliance.~~

~~(2) If the facility is under a judicial or administrative enforcement decree, the report will describe the facilities performance under the terms of the decree.~~

~~(d) In those instances where the information requested is classified, such information will be made available to EPA separate from the report and will be handled and controlled according to applicable security and classification regulations and requirements.~~

~~§ 61.95 Recordkeeping requirements.~~

~~All facilities must maintain records documenting the source of input parameters including the results of all measurements upon which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine effective dose equivalent. This documentation should be sufficient to allow an independent auditor to verify the accuracy of the determination made concerning the facility's compliance with the standard. These records must be kept at the site of the facility for at least five years and, upon request, be made available for inspection by the Administrator, or his authorized representative.~~

~~§ 61.96 Applications to construct or modify.~~

~~(a) In addition to any activity that is defined as construction under 40 CFR part 61, subpart A, any fabrication, erection or installation of a new building or structure within a facility that emits radionuclides is also defined as new construction for purposes of 40 CFR part 61, subpart A.~~

~~(b) An application for approval under § 61.07 or notification of startup under § 61.09 does not need to be filed for any new construction of or modification within an existing facility if the effective dose~~

~~equivalent, caused by all emissions from the new construction or modification, is less than 1% of the standard prescribed in § 61.92. For purposes of this paragraph the effective dose equivalent shall be calculated using the source term derived using appendix D as input to the dispersion and other computer models described in § 61.93. DOE may, with prior approval from EPA, use another procedure for estimating the source term for use in this paragraph. A facility is eligible for this exemption only if, based on its last annual report, the facility is in compliance with this subpart.~~

~~(c) Conditions to approvals granted under § 61.08 will not contain requirements for post approval reporting on operating conditions beyond those specified in § 61.94.~~

~~§ 61.97 Exemption from the reporting and testing requirements of 40 CFR 61.10.~~

~~All facilities designated under this subpart are exempt from the reporting requirements of 40 CFR 61.10.~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.09 Inorganic Arsenic Emissions from Glass Manufacturing Plants~~

~~(1) Applicability and designation of source~~

~~(a) The source to which this rule applies is each glass melting furnace that uses commercial arsenic as a raw material. This rule does not apply to pot furnaces.~~

~~(b) Rebricking is not considered construction or modification.~~

~~(2) Definition~~

~~(a) ‘‘Arsenic-containing glass type’’ means any glass that is distinguished from other glass solely by the weight percent of arsenic added as a raw material and by the weight percent of arsenic in the glass produced. Any two or more glasses that have the same weight percent of arsenic in the raw materials as well as in the glass produced shall be considered to belong to one arsenic-containing glass type without regard to the recipe used or any other characteristics of the glass or the method of production.~~

~~(b) ‘‘By-pass the control device’’ means to operate the glass melting furnace without operating the control device to which that furnace’s emissions are directed routinely.~~

~~(c) ‘‘Commercial arsenic’’ means any form of arsenic that is produced by extraction from any arsenic-containing substance and is intended for sale or for intentional use in a manufacturing process. Arsenic that is a naturally occurring trace constituent of another substance is not considered ‘‘commercial arsenic’’.~~

~~(d) ‘‘Cullet’’ means waste glass recycled to a glass melting furnace.~~

~~(e) ‘‘Glass melting furnace’’ means a unit comprising a refractory vessel in which raw materials are charged, melted at high temperature, refined, and conditioned to produce molten glass. The unit includes foundations, superstructure and retaining walls, raw material charger systems, heat exchangers, melter cooling system, exhaust system, refractory brick work, fuel supply and electrical boosting equipment, integral control systems and instrumentation, and appendages for conditioning and distributing molten glass to forming apparatuses. The forming apparatuses, including the float bath used in flat glass manufacturing are not considered part of the glass melting furnace.~~

~~(f) ‘‘Glass produced’’ means the glass pulled from the glass melting furnace.~~

~~(g) ‘‘Inorganic arsenic’’ means the oxides and other noncarbon compounds of the element arsenic included in particulate matter, vapors, and aerosols.~~

~~(h) ‘‘Malfunction’’ means any sudden failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of arsenic are~~

~~increased.~~

~~(i) ''Pot furnace'' means a glass melting furnace that contains one or more refractory vessels in which glass is melted by indirect heating. The openings of the vessels are in the outside wall of the furnace and are covered with refractory stoppers during melting.~~

~~(j) ''Rebricking'' means cold replacement of damaged or worn refractory parts of the glass melting furnace. Rebricking includes replacement of the refractories comprising the bottom, sidewalls, or roof of the melting vessel; replacement of refractory work in the heat exchanger; and replacement of refractory portions of the glass conditioning and distribution system.~~

~~(k) ''Shutdown'' means the cessation of operation of an affected source for any purpose.~~

~~(l) ''Theoretical arsenic emissions factor'' means the amount of inorganic arsenic expressed in grams per kilogram of glass produced, as determined based on a material balance.~~

~~(m) ''Uncontrolled total arsenic emissions'' means the total inorganic arsenic in the glass melting furnace exhaust gas preceding any add- on emission control device.~~

~~(3) Emission Limits~~

~~(a) The owner or operator of an existing glass melting furnace subject to the provisions of this rule shall comply with either part 1 or part 2 of this subparagraph; except as provided in subparagraph (c) of this paragraph.~~

~~1. Uncontrolled total arsenic emissions from the glass melting furnace shall be less than 2.5 Mg per year, or~~

~~2. Total arsenic emissions from the glass melting furnace shall be conveyed to a control device and reduced by at least 85 percent.~~

~~(b) The owner or operator of a new or modified glass melting furnace subject to the provisions of this rule shall comply with either part 1 or part 2 of this subparagraph; except as provided in subparagraph (c) of this paragraph.~~

~~1. Uncontrolled total arsenic emissions from the glass melting furnace shall be less than 0.4 Mg per year, or~~

~~2. Total arsenic emissions from the glass melting furnace shall be conveyed to a control device and reduced by at least 85 percent.~~

~~(c) An owner or operator of a source subject to the requirements of this paragraph may, after approval by the Technical Secretary, bypass the control device to which arsenic emissions from the furnace are directed for a limited period of time for designated purposes such as maintenance of the control device, as specified in paragraph (6)(e).~~

~~(d) At all times, including periods of startup, shutdown, and malfunction, the owner or operator of a glass melting furnace subject to the provisions of this rule shall operate and maintain the furnace and associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent practicable. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Technical Secretary, which may include, but is not limited to, monitoring results, review of operating and maintenance procedures, inspection of the source, and review of other records.~~

~~(4) Emission monitoring~~

~~(a) An owner or operator of a glass melting furnace subject to the emission limits in part (3)(a)2 or part (3)(b)2 shall:~~

~~1. Install, calibrate, maintain, and operate a continuous monitoring system for the~~

~~measurement of the opacity of emissions discharged into the atmosphere from the control device; and~~

~~2. Install, calibrate, maintain, and operate a monitoring device for the continuous measurement of the temperature of the gas entering the control device.~~

~~(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to performance of an emission test required by paragraph (5)(a). Verification of operational status shall, at a minimum, consist of an evaluation of the monitoring system in accordance with the requirements and procedures contained in Performance Specification 1, as specified in rule 1200-03-16-.01(8)(a).~~

~~(c) During the emission test requested in paragraph (5)(a) each owner or operator subject to subparagraph (a) of this paragraph shall:~~

~~1. Conduct continuous opacity monitoring from the beginning of the first test run until the completion of the third test run. Process and control equipment shall be operated in a manner that will minimize opacity of emissions, subject to the Technical Secretary's approval.~~

~~2. Calculate 6-minute opacity averages from 24 or more data points equally spaced over each 6-minute period during the test runs.~~

~~3. Determine, based on the 6-minute opacity averages, the opacity value corresponding to the 97.5 percent upper confidence level of a normal or lognormal (whichever the owner or operator determines is more representative) distribution of the average opacity values.~~

~~4. Conduct continuous monitoring of the temperature of the gas entering the control device from the beginning of the first test run until completion of the third test run.~~

~~5. Calculate 15-minute averages of the temperature of the gas entering the control device during each test run.~~

~~(d) An owner or operator may redetermine the values described in subparagraph (c) of this paragraph during any emission test that demonstrates compliance with the emission limits in part (3)(a)2 or part (3)(b)2.~~

~~(e) The requirements of 1200-03-16-.01(8)(d) and (f) shall apply to an owner or operator subject to subparagraph (a) of this paragraph.~~

~~(f) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments, required under 1200-03-16-.01(8)(d), all continuous monitoring systems shall be in continuous operation and shall meet minimum frequency of operation requirements by completing a minimum of one cycle of sampling and analyzing for each successive 10-second period and one cycle of data recording for each successive 6-minute period.~~

~~(g) An owner or operator subject to subparagraph (a) of this paragraph shall:~~

~~1. Reduce all opacity data to 6-minute averages. Six-minute averages shall be calculated from 24 or more data points equally spaced over each 6-minute period. Data recorded during periods of monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages calculated under this paragraph, and~~

~~2. Calculate 15-minute averages of the temperature of the gas entering the control device for each 15-minute operating period.~~

~~(h) After receipt and consideration of written application, the Technical Secretary may approve alternative monitoring systems for the measurement of one or more process or operating parameters that is or are demonstrated to enable accurate and representative monitoring of a properly operating control device. Upon approval of an alternative monitoring system for an~~

~~affected source, the Technical Secretary will specify requirements to replace the requirements of subparagraphs (a) through (g) of this paragraph for that system.~~

~~(5) Test methods and procedures~~

~~(a) To demonstrate compliance with paragraph (3), the owner or operator shall conduct emission tests, reduce test data, and follow the procedures specified in this paragraph unless the Technical Secretary:~~

~~1. Specifies or approves, in specific cases, the use of a reference method with minor changes in methodology;~~

~~2. Approves the use of an equivalent method;~~

~~3. Approves the use of an alternative method the results of which he has determined to be adequate for indicating whether a specific source is in compliance.~~

~~(b) The owner or operator shall conduct emission tests required by this paragraph:~~

~~1. No later than 90 days after November 6, 1988 for a source that has an initial startup date preceding the effective date; or~~

~~2. No later than 90 days after startup for a source that has an initial startup date after November 6, 1988.~~

~~3. At such other times as may be required by the Technical Secretary.~~

~~4. While the source is operating under such conditions as the Technical Secretary may specify, based on representative performance of the source.~~

~~(c) To demonstrate compliance with part 1 of subparagraph (3)(a) when less than 8.0 Mg per year of elemental arsenic is added to any existing glass melting furnace, or to demonstrate compliance with part 1 of subparagraph (3)(b) when less than 1.0 Mg per year of elemental arsenic is added to any new or modified glass melting furnace, an owner or operator shall:~~

~~1. Derive a theoretical uncontrolled arsenic emission factor (T), in grams of elemental arsenic per kilogram of glass produced, based on material balance calculations for each arsenic- containing glass type (i), produced during the 12-month period, as follows:~~

~~Ti = (Abi x Wbi) + (Aci x Wci) – Agi~~

~~Where:~~

~~Ti = the theoretical uncontrolled arsenic emission factor (g/kg) for each glass type (i).~~

~~Abi = fraction by weight of elemental arsenic in the fresh batch for each glass type (i).~~

~~Wbi = weight (g) of fresh batch melted per kg of glass produced for each glass type (i).~~

~~Aci = fraction by weight of elemental arsenic in cullet for each glass type (i).~~

~~Wci = weight (g) of cullet melted per kg of glass produced for each glass type (i).~~

~~Agi = weight (g) of elemental arsenic per kg glass produced for each glass type (i).~~

~~2. Estimate theoretical uncontrolled arsenic emissions for the 12-month period for each~~

~~arsenic-containing glass type as follows:~~

~~Yi = (Ti x Gi)~~
~~106~~

~~Where:~~

~~Yi = the theoretical uncontrolled arsenic emission estimate for the 12-month period for each glass type (Mg/year).~~

~~Ti = the theoretical uncontrolled arsenic emission factor for each type of glass (i) produced during the 12- month period as calculated in subparagraph (c)(1) of this paragraph (g/kg).~~

~~Gi = the quantity (kg) of each arsenic-containing glass type (i) produced during the 12 month period.~~

~~3. Estimate the total theoretical uncontrolled arsenic emissions for the 12-month period by finding the sum of the values calculated for Yi in part 2 of subparagraph (c) of this paragraph.~~

~~4. If the value determined in part (c)3 of this paragraph is equal to or greater than the applicable limit in part (3)(a)1 or part (3)(b)1, conduct the emission testing and calculations described in parts 1 through 5 of subparagraph (d), of this paragraph. If the value is less than the applicable limit, the source is incompliance and no emission testing or additional calculations are required.~~

~~(d) To demonstrate compliance with part (3)(a)1 when 8.0 Mg per year or more of elemental arsenic are added to any existing glass melting furnace, or to demonstrate compliance with part (3)(b)1 when 1.0 Mg per year or more of elemental arsenic is added to any new or modified glass melting furnace, an owner or operator shall:~~

~~1. Estimate the theoretical uncontrolled arsenic emissions for each glass type for the 12-month period by performing the calculations described in parts 1 and 2 of subparagraph (c), of this paragraph.~~

~~2. Conduct emission testing to determine the actual uncontrolled arsenic emission rate during production of the arsenic- containing glass type with the highest theoretical uncontrolled arsenic emissions as calculated in part (d)1 of this paragraph. The owner or operator shall use the following test methods and procedures:~~

~~(i) Use Method 108, as specified in the Federal Register, Vol. 51, No. 149, August 4, 1986 beginning on page 28035, for determining the arsenic emission rate (g/h). The emission rate shall equal the arithmetic mean of the results of three 60-minute test runs.~~

~~(ii) Use the following methods referenced in 1200-03-16-.01(5)(g):~~

~~(I) Method 1 for sample and velocity traverse.~~

~~(II) Method 2 for velocity and volumetric flowrate.~~

~~(III) Method 3 for gas analysis.~~

~~(IV) For sources equipped with positive pressure fabric filters, use Section 4 of Method 5D as specified in 1200-03-16-.01(5)(g)5(iv) to determine a suitable sampling location and procedure.~~

~~3. Determine the actual uncontrolled arsenic emission factor (Ra) in grams of elemental arsenic per kilogram of glass produced, as follows:~~

~~Ra = Ea P~~

~~Where:~~

~~Ra = the actual uncontrolled arsenic emission factor (g/kg).~~

~~Ea = the actual uncontrolled arsenic emission rate (g/h) from part (d)2 of this paragraph.~~

~~P = the rate of glass production (kg/h), determined by dividing the weight (kg) of glass pulled from the furnace during the emission test by the number of hours (h) taken to perform the test under part (d)2 of this paragraph.~~

~~4. Calculate a correction factor to relate the theoretical and the actual uncontrolled arsenic emission factors as follows:~~

~~F = Ra Ti~~

~~Where:~~

~~F = the correction factor.~~

~~Ra = the actual uncontrolled arsenic emission factor (g/kg) determined in part (d)3 of this paragraph.~~

~~Ti = the theoretical uncontrolled arsenic emission factor (g/kg) determined in part (c)1 of this paragraph for the same glass type for which Ra was determined.~~

~~5. Determine the uncontrolled arsenic emission rate for the 12-month period, as follows:~~

~~n~~
~~U = SUM (Ti x F x Gi)~~
~~i = 1 106~~

~~Where:~~

~~U = the uncontrolled arsenic emission rate for the 12-month period (Mg/year).~~

~~Ti = the theoretical uncontrolled arsenic emission factor for each arsenic-containing glass type (i) produced during the 12-month period, as calculated in part (c)1 of this paragraph (g/kg).~~

~~F = the correction factor calculated in part (d)4 of this paragraph.~~

~~Gi = the quantity (kg) of each arsenic-containing glass type (i) produced during the 12-month period.~~

~~n = the number of arsenic-containing glass types produced during the 12-month period.~~

~~6. If the value determined in part (d)5 of this paragraph is less than the applicable limit in part (3)(a)1 or part (3)(b)1, the source is in compliance.~~

~~(e) To demonstrate compliance with part (3)(a)2 or part (3)(b)2, an owner or operator shall:~~

~~1. Conduct emission testing to determine the percent reduction of inorganic arsenic emissions being achieved by the control device, using the following test methods and procedures:~~

~~(i) Use Method 108, as specified in the Federal Register, Vol. 51 No. 149, August 4,~~

~~1986, beginning on page 28035, to determine the concentration of arsenic in the gas streams entering and exiting the control device. Conduct three 60-minute test runs, each consisting of simultaneous testing of the inlet and outlet gas streams. The gas streams shall contain all the gas exhausted from the glass melting furnace.~~

~~(ii) Use the following methods reference in 1200-03-16-.01(5)(g):~~

~~(I) Method 1 for sample and velocity traverses.~~

~~(II) Method 2 for velocity and volumetric flowrate.~~

~~(III) Method 3 for gas analysis.~~

~~(IV) For sources equipped with positive pressure fabric filters, use Section 4 of Method 5D as specified in 1200-03-16-.01(5)(g)5(iv) to determine a suitable sampling location and procedure.~~

~~2. Calculate the percent emission reduction for each run as follows:~~

$$\cancel{D = \frac{(Cb - Ca)}{Cb} \times 100}$$

~~Where:~~

~~D = the percent emission reduction.~~

~~Cb = the arsenic concentration of the stack gas entering the control device, as measured by Method 108.~~

~~Ca = the arsenic concentration of the stack gas exiting the control device, as measured by Method 108.~~

~~3. Determine the average percent reduction of arsenic by calculating the arithmetic mean of the results for the three runs. If it is at least 85 percent, the source is in compliance.~~

~~(6) Reporting and recordkeeping requirements~~

~~(a) Each owner or operator of a source subject to the requirements of paragraph (3) shall maintain at the source for a period of at least 2 years and make available to the Technical Secretary upon request a file of the following records:~~

~~1. All measurements, including continuous monitoring for measurement of opacity, and temperature of gas entering a control device;~~

~~2. Records of emission test data and all calculations used to produce the required reports of emission estimates to demonstrate compliance with paragraph (3);~~

~~3. All continuous monitoring system performance evaluations, including calibration checks and adjustments;~~

~~4. The occurrence and duration of all start-ups, shutdowns, and malfunctions of the furnace;~~

~~5. All malfunctions of the air pollution control system;~~

~~6. All periods during which any continuous monitoring system or monitoring device is inoperative;~~

~~7. All records of maintenance and repairs for each air pollution control system, continuous monitoring system, or monitoring device.~~

~~(b) Each owner or operator who is given approval by the Technical Secretary to bypass a control device under subparagraph (e) of this paragraph shall maintain at the source for a period of at least 2 years and make available to the Technical Secretary upon request a file of the following records:~~

~~1. The dates the control device is bypassed; and~~

~~2. Steps taken to minimize arsenic emissions during the period the control device was bypassed.~~

~~(c) Each owner or operator of a source subject to the emission limit in part (3)(a)1 or part (3)(b)1 shall determine and record at the end of every 6 months the uncontrolled arsenic emission rate for the preceding and forthcoming 12-month periods. The determinations shall:~~

~~1. Be made by following the procedures in parts 1, 2 and 3 of subparagraph (5)(c); or in part (5)(d)5, whichever is applicable; and~~

~~2. Take into account changes in production rates, types of glass produced, and other factors that would affect the uncontrolled arsenic emission rate.~~

~~(d) Each owner or operator of a source subject to the provisions of this rule shall:~~

~~1. Provide the Technical Secretary 30 days prior notice of any emission test required in paragraph (5) to afford the opportunity to have an observer present; and~~

~~2. Submit to the Technical Secretary a written report of the results of the emission test and associated calculations required in subparagraph (5)(d) or (e), or as applicable, within 60 days after conducting the test.~~

~~3. Submit to the Technical Secretary a written report of the arsenic emission estimates calculated under subparagraph (5)(c):~~

~~(i) Within 45 days after November 6, 1988 for a source that has an initial startup date preceding the effective date; or~~

~~(ii) Within 45 days after startup for a source that has an initial startup date after November 6, 1988.~~

~~4. Submit to the Technical Secretary a written report of the uncontrolled arsenic emission rates determined in accordance with subparagraph (c) of this paragraph, if:~~

~~(i) The emission rate for the preceding 12-month period (or preceding 6-month period for the first 6-month determination) exceeded the applicable limit in part (3)(a)1 or part (3)(b)1.~~

~~(ii) The emission rate for the forthcoming 12-month period will exceed the applicable limit in part (3)(a)1 or part (3)(b)1. In this case, the owner or operator shall also notify the Technical Secretary of the anticipated date of the emission test to demonstrate compliance with the applicable limit in part (3)(a)1 or part (3)(b)1.~~

~~5. Ensure that the reports required in part (d)4 of this paragraph are postmarked by the tenth day following the end of the 6- month reporting period.~~

~~(e) To obtain approval to bypass a control device, as provided in subparagraph (3)(c), an owner or operator of a source subject to this rule may make written application to the Technical Secretary. Each application for such a waiver shall be submitted to the Technical Secretary no later than 60 days before the bypass period would begin and shall include:~~

~~1. Name and address of the owner or operator;~~

~~2. Location of the source;~~

~~3. A brief description of the nature, size, design, and method of operation of the source;~~

~~4. The reason it is necessary to bypass the control device;~~

~~5. The length of time it will be necessary to bypass the control device;~~

~~6. Steps that will be taken to minimize arsenic emissions during the period the control device will be bypassed;~~

~~7. The quantity of emissions that would be released while the control device is bypassed if no steps were taken to minimize emissions;~~

~~8. The expected reduction in emissions during the bypass period due to the steps taken to minimize emissions during this period; and~~

~~9. The type of glass to be produced during the bypass period, and, if applicable, an explanation of why non-arsenic or lower- arsenic-containing glass cannot be melted in the furnace during the bypass period.~~

~~(f) Each owner or operator required to install and operate a continuous opacity monitoring system under paragraph (4) shall:~~

~~1. Submit a written report to the Technical Secretary of the results of the continuous monitoring system evaluation required under subparagraph (4)(b) within 60 days after conducting the evaluation.~~

~~2. Submit a written report to the Technical Secretary every 6 months if excess opacity occurred during the preceding 6-month period. For purposes of this paragraph, an occurrence of excess opacity is any 6-minute period during which the average opacity, as measured by the continuous monitoring system, exceeds the opacity level determined under part 3 of subparagraph (4)(c) or the opacity level redetermined under subparagraph (4)(d).~~

~~3. Ensure that any semiannual report of excess opacity required by part (f)2 of this paragraph is postmarked by the thirtieth day following the end of the 6-month period and includes the following information.~~

~~(i) The magnitude of excess opacity, any conversion factor(s) used, and the date and time of commencement and completion of each occurrence of excess opacity.~~

~~(ii) Specific identification of each occurrence of excess opacity that occurs during start-ups, shutdowns, and malfunctions of the source.~~

~~(iii) The date and time identifying each period during which the continuous monitoring system was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.10 Inorganic Arsenic Emissions from Primary Copper Smelters~~

~~(1) Applicability and designation of source~~

~~(a) The provisions of this rule are applicable to each copper converter at any new or existing primary copper smelter, except as noted in subparagraph (3)(a) of this rule.~~

~~(2) Definitions~~

~~(a) ‘‘Blowing’’ means the injection of air or oxygen-enriched air into a molten converter bath.~~

~~(b) ‘‘Charging’’ means the addition of a molten or solid material to a copper converter.~~

~~(c) ‘‘Control device’’ means the air pollution control equipment used to collect particulate matter emissions.~~

~~(d) ‘‘Converter arsenic charging rate’’ means the hourly rate at which arsenic is charged to the copper converters in the copper converter department based on the arsenic content of the copper matte and of any lead matte that is charged to the copper converters.~~

~~(e) ‘‘Copper converter’’ means any vessel in which copper matte is charged and is oxidized to copper.~~

~~(f) ‘‘Copper converter department’’ means all copper converters at a primary copper smelter.~~

~~(g) ‘‘Copper matte’’ means any molten solution of copper and iron sulfides produced by smelting copper sulfide ore concentrates or calcines.~~

~~(h) ‘‘Holding of a copper converter’’ means suspending blowing operations while maintaining in a heated state the molten bath in the copper converter.~~

~~(i) ‘‘Inorganic arsenic’’ means the oxides and other noncarbon compounds of the element arsenic included in particulate matter, vapors, and aerosols.~~

~~(j) ‘‘Lead matte’’ means any molten solution of copper and other metal sulfides produced by reduction of sinter product from the oxidation of lead sulfide ore concentrates.~~

~~(k) ‘‘Malfunction’’ means any sudden failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of inorganic arsenic are increased.~~

~~(l) ‘‘Opacity’’ means the degree to which emissions reduce the transmission of light.~~

~~(m) ‘‘Particulate matter’’ means any finely divided solid or liquid material, other than uncombined water, as measured by the specified reference method.~~

~~(n) ‘‘Pouring’’ means the removal of blister copper from the copper converter bath.~~

~~(o) ‘‘Primary copper smelter’’ means any installation or intermediate process engaged in the production of copper from copper-bearing materials through the use of pyrometallurgical techniques.~~

~~(p) ‘‘Primary emission control system’’ means the hoods, ducts, and control devices used to capture, convey, and collect process emissions.~~

~~(q) ‘‘Process emissions’’ means inorganic arsenic emissions from copper converters that are captured directly at the source of generation.~~

~~(r) ‘‘Secondary emissions’’ means inorganic arsenic emissions that escape capture by a primary emission control system.~~

~~(s) ‘‘Secondary hood system’’ means the equipment (including hoods, ducts, fans, and dampers) used to capture and transport secondary inorganic arsenic emissions.~~

~~(t) ‘‘Shutdown’’ means the cessation of operation of a stationary source for any reason.~~

~~(u) ‘‘Skimming’’ means the removal of slag from the molten converter bath.~~

~~(3) Standard for new and existing sources~~

~~(a) The provisions of subparagraphs (b) through (f) of this paragraph do not apply to any copper~~

~~converter at a facility where the total arsenic charging rate for the copper converter department averaged over a 1-year period is less than 75 kg/h, as determined under subparagraph (5)(f) of this rule.~~

~~(b) The owner or operator of each copper converter subject to the provisions of this rule shall reduce inorganic arsenic emissions to the atmosphere by meeting the following design, equipment, work practice, and operational requirements:~~

~~1. Install, operate, and maintain a secondary hood system on each copper converter. Each secondary hood system shall consist of a hood enclosure, air curtain fan(s), exhaust system fan(s), and ductwork that conveys the captured emissions to a control device, and shall meet the following specifications:~~

~~(i) The configuration and dimensions of the hood enclosure shall be such that the copper converter mouth, charging ladles, skimming ladles, and any other material transfer vessels used will be housed within the confines or influence of the hood enclosure during each mode of copper converter operation.~~

~~(ii) The back of the hood enclosure shall be fully enclosed and sealed against the primary hood. Portions of the side-walls in contact with the copper converter shall be sealed against the converter.~~

~~(iii) Openings in the top and front of the hood enclosure to allow for the entry and egress of ladles and crane apparatus shall be minimized to the fullest extent practicable.~~

~~(iv) The hood enclosure shall be fabricated in such a manner and of materials of sufficient strength to withstand incidental contact with ladles and crane apparatus with no significant damage.~~

~~(v) One side-wall of the hood enclosure shall be equipped with a horizontal-slotted plenum along the top, and the opposite side-wall shall be equipped with an exhaust hood. The horizontal-slotted plenum shall be designed to allow the distance from the base to the top of the horizontal slot to be adjustable up to a dimension of 76 mm.~~

~~(vi) The horizontal-slotted plenum shall be connected to a fan. When activated, the fan shall push air through the horizontal slot, producing a horizontal air curtain above the copper converter that is directed to the exhaust hood. The fan power output installed shall be sufficient to overcome static pressure losses through the ductwork upstream of the horizontal-slotted plenum and across the plenum, and to deliver at least 22,370 watts (30 air horsepower) at the horizontal-slotted plenum discharge.~~

~~(vii) The exhaust hood shall be sized to completely intercept the airstream from the horizontal-slotted plenum combined with the additional airflow resulting from entrainment of the surrounding air. The exhaust hood shall be connected to a fan. When activated, the fan shall pull the combined airstream into the exhaust hood.~~

~~(viii) The entire secondary hood system shall be equipped with dampers and instrumentation, as appropriate, so that the desired air curtain and exhaust flow are maintained during each mode of copper converter operation.~~

~~2. Optimize the capture of secondary inorganic arsenic emissions by operating the copper converter and secondary hood system at all times as follows:~~

~~(i) Copper converter~~

~~(I) Increase the air curtain and exhaust flow rates to their optimum conditions prior to raising the primary hood and rolling the copper~~

~~converter out for charging, skimming, or pouring.~~

~~(II) Once rolled out, prior to the commencement of skimming or pouring, hold the copper converter in an idle position until fuming from the molten bath has been minimized.~~

~~(III) During skimming, raise the receiving ladle off the ground and position the ladle as close to the copper converter mouth as possible to minimize the drop distance between the converter mouth and the receiving ladle.~~

~~(IV) Control the rate of flow into the receiving ladle to the extent practicable to minimize fuming.~~

~~(V) Upon the completion of each charge, withdraw the charging ladle or vessel used from the confines of the secondary hood in a slow, deliberate manner.~~

~~(VI) During charging, skimming, or pouring, ensure that the crane block does not disturb the air flow between the horizontal-slotted plenum and the exhaust hood.~~

~~(ii) Secondary hood system.~~

~~(I) Operate the secondary hood system under conditions that will result in the maximum capture of inorganic arsenic emissions.~~

~~(II) Within 30 days after November 6, 1988, or within 30 days after the initial operation of each secondary hood system, whichever comes later, provide to the Technical Secretary a list of operating conditions for the secondary hood system that will result in the maximum capture of inorganic arsenic emissions. This list shall specify the operating parameters for the following:~~

~~I. The dimensions of the horizontal slot.~~

~~II. The velocity of air through the horizontal slot during each mode of converter operation.~~

~~III. The distance from the horizontal slot to the exhaust hood.~~

~~IV. The face velocity at the opening of the exhaust hood during each mode of converter operation.~~

~~(III) Operate the secondary hood system under the conditions listed in item (b)2.(ii) (II) of this paragraph, unless otherwise specified by the Technical Secretary.~~

~~(IV) Notify the Technical Secretary in writing within 30 days if there is any change in the operating conditions submitted pursuant to the requirements in item (b)2(ii)(II) of this paragraph that will result in any reduction in the maximum capture of inorganic arsenic emissions.~~

~~3. Comply with the following inspection and maintenance requirements after installing the secondary hood system required in subparagraph (b)1 of this paragraph:~~

~~(i) At least once every month, visually inspect the components of the secondary hood system that are exposed to potential damage from crane and ladle operation, including the hood enclosure, side and back-wall hood seals, and the horizontal slot.~~

~~(ii) Replace or repair any defective or damaged components of the secondary hood~~

~~system within 30 days after discovering the defective or damaged components.~~

~~(c) No owner or operator of a copper converter subject to the provisions of this rule shall cause or allow to be discharged into the atmosphere any copper converter secondary emissions that exit from a control device and contain particulate matter in excess of 11.6 milligrams per dry standard cubic meter.~~

~~(d) The owner or operator of a copper converter subject to the provisions of this rule shall submit a description of a plan for control of inorganic arsenic emissions from the copper converter and associated air pollution control equipment. For existing facilities this plan shall be submitted within 90 days after November 6, 1988. New facilities must submit a completed construction permit application. Approval of a plan for existing sources shall be granted by the Technical Secretary provided he finds that:~~

~~1. It includes a systematic procedure for identifying malfunctions and for reporting them immediately to smelter supervisory personnel.~~

~~2. It specifies the procedures that will be followed to ensure that equipment or process breakdowns due entirely or in part to poor maintenance or other preventable conditions do not occur.~~

~~3. It specifies the measures that will be taken to ensure compliance with subparagraph (b)2 of this paragraph.~~

~~(e) The owner or operator shall implement the plan required under subparagraph (d) of this paragraph unless otherwise specified by the Technical Secretary.~~

~~(f) At all times, including periods of startup, shutdown, and malfunction, the owner or operator of a copper converter subject to the provisions of this rule shall operate and maintain the converter and associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent practicable. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Technical Secretary, which may include, but is not limited to, monitoring results, review of operating and maintenance procedures, inspection of the source, and review of other records.~~

~~(4) Compliance Provisions.~~

~~(a) The owner or operator of each copper converter to which subparagraph (3)(b) through (f) apply shall demonstrate compliance with the requirements of part (3)(b)1 as follows:~~

~~1. The owner or operator of each existing copper converter shall install a secondary hood system to meet the requirements of part (3)(b)1, no later than 90 days after November 6, 1988.~~

~~2. The owner or operator of each new copper converter shall install a secondary hood system to meet the requirements of part (3)(b)1, prior to the initial startup of the converter, except that if startup occurs prior to the effective date, the owner or operator shall meet the requirements of part (3)(b)1 on November 6, 1988.~~

~~(5) Test Methods and Procedures.~~

~~(a) To determine compliance with subparagraph (3)(c), the owner or operator shall conduct emission tests and reduce the test data in accordance with the test methods and procedures contained in this paragraph unless the Technical Secretary:~~

~~1. Specifies or approves, in specific cases, the use of a reference method with minor changes in methodology,~~

~~2. Approves the use of an equivalent method,~~

~~3. Approves the use of an alternative method, the results of which he has determined to be adequate for indicating whether a specific source is in compliance.~~

~~(b) The owner or operator shall conduct the emission tests required in subparagraph (a) of this paragraph:~~

~~1. After achieving the optimum operating conditions submitted under item (3)(b)2(ii)(II) for the equipment required in part (3)(b)1, but no later than 90 days after November 6, 1988 in the case of an existing copper converter or a copper converter that has an initial startup date preceding November 6, 1988.~~

~~2. After achieving the optimum operating conditions submitted under item (3)(b)2(ii)(II) for the equipment required in part (3)(b)1, but no later than 90 days after startup in the case of a new copper converter, initial startup of which occurs after November 6, 1988.~~

~~3. At such other times as may be required by the Technical Secretary.~~

~~(c) The owner or operator shall conduct each emission test under representative operating conditions and at sample locations subject to the Technical Secretary’s approval, and shall make available to the Technical Secretary such records as may be necessary to determine the conditions of the emission test.~~

~~(d) For the purpose of determining compliance with subparagraph (3)(c), the owner or operator shall use reference methods in subparagraph 1200-03-16-.01(5)(g), as follows:~~

~~1. Method 5 for the measurement of particulate matter,~~

~~2. Method 1 for sample and velocity traverses,~~

~~3. Method 2 for velocity and volumetric flow rate,~~

~~4. Method 3 for gas analysis, and~~

~~5. Method 4 for stack gas moisture.~~

~~(e) For Method 5, the sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes when necessitated by process variables or other factors may be approved by the Technical Secretary.~~

~~(f) For the purpose of determining applicability under subparagraph (3)(a), the owner or operator shall determine the converter arsenic charging rate as follows:~~

~~1. Collect daily grab samples of copper matte and any lead matte charged to the copper converters.~~

~~2. Each calendar month, from the daily grab samples collected under subparagraph (f)1 of this paragraph, put together a composite copper matte sample and a composite lead matte sample. Analyze the composite samples individually using Method 108A as specified in the Federal Register, Vol. 51, No. 149, August 4, 1986, beginning on page 28040, to determine the weight percent of inorganic arsenic contained in each sample.~~

~~3. Calculate the converter arsenic charging rate once per month using the following equation:~~

~~$$Rc = \sum_{i=1}^{n} \frac{Ac\ Wci + A1\ Wli}{100\ Hc}$$~~

~~Where:~~

~~Rc is the converter arsenic charging rate (kg/h).~~

~~Ac is the monthly average weight percent of arsenic in the copper matte charged during the month (%) as determined under subparagraph (f)2 of this paragraph.~~

~~A1 is the monthly average weight percent of arsenic in the lead matte charged during the month (%) as determined under subparagraph (f)2 of this paragraph.~~

~~Wci is the total weight of copper matte charged to a copper converter during the month (kg).~~

~~Wli is the total weight of lead matte charged to a copper converter during the month (kg).~~

~~Hc is the total number of hours the copper converter department was in operation during the month (h).~~

~~n is the number of copper converters in operation during the month.~~

~~4. Determine an annual arsenic charging rate for the copper converter department once per month by computing the arithmetic average of the 12 monthly converter arsenic charging rate values (Rc) for the preceding 12-month period.~~

~~(g) An owner or operator may petition the Technical Secretary for a modified sampling and analysis schedule if analyses performed for the first 12-month period after November 6, 1988 show the source to be considerably below the applicability limit prescribed in subparagraph (3)(a) of this rule.~~

~~(6) Monitoring Requirements.~~

~~(a) Each owner or operator of a source that is subject to the emission limit specified in subparagraph (3)(c) of this rule shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of the opacity of emissions discharged from the control device according to the following procedures:~~

~~1. Ensure that each system is installed and operational no later than 90 days after November 6, 1988 for a source that has initial startup date preceding November 6, 1988; and no later than 90 days after startup for other sources. Verification of the operational status shall, as a minimum, consist of an evaluation of the monitoring system in accordance with the requirements and procedures as specified in 1200-03-16-.01(8)(a).~~

~~2. Except for system breakdowns, repairs, calibration checks, and zero span adjustments, ensure that each continuous monitoring system is in continuous operation and meets frequency of operation requirements by completing a minimum of one cycle of sampling and analysis for each successive 10-second period and one cycle of data recording for each successive 6-minute period. Each data point shall represent the opacity measured for one cycle of sampling and analysis and shall be expressed as percent opacity.~~

~~(b) Except as required in subparagraph (c) of this paragraph, calculate 1-hour opacity averages from 360 or more consecutive data points equally spaced over each one-hour period. Data recorded during periods of monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this subparagraph.~~

~~(c) No later than 60 days after each continuous opacity monitoring system required in subparagraph (a) of this paragraph becomes operational, the owner or operator shall establish a reference opacity level for each monitored emission stream according to the following procedures:~~

~~1. Conduct continuous opacity monitoring over a preplanned period of not less than 36 hours during which the processes and emission control equipment upstream of the monitoring system are operating under representative operating conditions subject to the Technical Secretary's approval.~~

~~2. Calculate 6-minute averages of the opacity readings using 36 or more consecutive data points equally spaced over each 6-minute period.~~

~~3. Calculate 1-hour average opacity values using 10 successive 6-minute average opacity values (i.e., calculate a new 1-hour average opacity value every 6 minutes). Determine the highest 1-hour average opacity value observed during the 36-hour preplanned test period.~~

~~4. Calculate the reference opacity level by adding 5 percent opacity to the highest 1-hour average opacity calculated in subpart (c)3 of this paragraph.~~

~~(d) The owner or operator may redetermine the reference opacity level according to the provisions of subparagraphs (c)1 through (c)4 of this paragraph for the copper converter secondary emission stream at the time of each emission test that demonstrates compliance with the emission limit required in subparagraph (3)(c) of this rule.~~

~~(e) With a minimum of 30 days prior notice, the Technical Secretary may require the owner or operator to redetermine the reference opacity level for any monitored emission stream.~~

~~(f) Each owner or operator who is required to install the equipment specified in part (3)(b)1 for the capture of secondary copper converter emissions shall install, calibrate, maintain, and operate a continuous monitoring device on each secondary hood system for the measurement of the air flow through the horizontal-slotted plenum and through the exhaust hood. Each device shall be installed and operational no later than 90 days after November 6, 1988 for a source that has an initial startup preceding November 6, 1988; and no later than 90 days after startup for other sources.~~

~~(g) Each owner or operator subject to the requirements in subparagraph (f) of this paragraph shall establish for each secondary hood system reference air flow rates for the horizontal-slotted plenum and exhaust hood for each mode of converter operation. The reference flow rates shall be established when the equipment is operating under the optimum operating conditions required in subpart (3)(b)2(ii).~~

~~(h) Each owner or operator shall install the continuous monitoring systems and monitoring devices required in subparagraphs (a) and (f) of this paragraph in such a manner that representative measurements of emissions and process parameters are obtained.~~

~~(7) Recordkeeping Requirements~~

~~(a) Each owner or operator subject to the requirements of part (3)(b)1 shall maintain at the source for a period of at least 2 years records of the visual inspections, maintenance, and repairs performed on each secondary hood system as required in part (3)(b)3.~~

~~(b) Each owner or operator subject to the provisions of subparagraph (3)(c) shall maintain at the source for a period of at least 2 years and make available to the Technical Secretary upon request a file of the following records:~~

~~1. All measurements, including continuous monitoring for measurement of opacity;~~

~~2. Records of emission test data and all calculations used to produce the required reports of emission estimates to demonstrate compliance with subparagraph (3)(c);~~

~~3. All continuous monitoring system performance evaluations, including calibration checks and adjustments;~~

~~4. The occurrence and duration of all start-ups, shutdowns, and malfunctions of the copper converters;~~

~~5. All malfunctions of the air pollution control system;~~

~~6. All periods during which any continuous monitoring system or device is inoperative;~~

~~7. All maintenance and repairs performed on each air pollution control system, continuous monitoring system, or monitoring device;~~

~~8. All records of 1-hour average opacity levels for each separate control device; and~~

~~9. For each secondary hood system:~~

~~(i) The reference flow rates for the horizontal-slotted plenum and exhaust hood for each converter operating mode established under subparagraph (6)(g);~~

~~(ii) The actual flow rates; and~~

~~(iii) A daily log of the start time and duration of each converter operating mode.~~

~~(c) Each owner or operator subject to the provisions of this rule shall maintain at the source for a period of at least 2 years and make available to the Technical Secretary upon request the following records:~~

~~1. For each copper converter, a daily record of the amount of copper matte and lead matte charged to the copper converter and the total hours of operation.~~

~~2. For each copper converter department, a monthly record of the weight percent of arsenic contained in the copper matte and lead matte as determined under subparagraph (5)(f).~~

~~3. For each copper converter department, the monthly calculations of the average annual arsenic charging rate for the preceding 12-month period as determined under subparagraph (5)(f).~~

~~(8) Reporting Requirements.~~

~~(a) Each owner or operator subject to the provisions of subparagraph (3)(c) shall:~~

~~1. Provide the Technical Secretary 30 days prior notice of the emission test required in subparagraph (5)(a) to afford the Technical Secretary the opportunity to have an observer present; and~~

~~2. Submit to the Technical Secretary a written report of the results of the emission test required in subparagraph (5)(a) within 60 days after conducting the test.~~

~~(b) Each owner or operator subject to the provisions of subparagraph (6)(a) shall provide the Technical Secretary at least 30 days prior notice of each reference opacity level determination required in subparagraph (6)(c) to afford the Technical Secretary the opportunity to have an observer present.~~

~~(c) Each owner or operator subject to the provisions of subparagraph (6)(a) shall submit to the Technical Secretary:~~

~~1. Within 60 days after conducting the evaluation required in part (6)(a)1, a written report of the continuous monitoring system evaluation;~~

~~2. Within 30 days after establishing the reference opacity level required in subparagraph (6)(c), a written report of the reference opacity level. The report shall also include the opacity data used and the calculations performed to determine the reference opacity level, and sufficient documentation to show that process and emission control equipment were operating normally during the reference opacity level determination; and~~

~~3. A written report each quarter of each occurrence of excess opacity during the quarter. For the purposes of this paragraph, an occurrence of excess opacity is any 1-hour period during which the average opacity, as measured by the continuous monitoring system, exceeds the reference opacity level established under subparagraph (6)(c).~~

~~(d) The owner or operator subject to the provisions of subparagraph (6)(g) shall submit to the Technical Secretary:~~

~~1. A written report of the reference air flow rate within 30 days after establishing the reference air flow rates required in subparagraph (6)(g);~~

~~2. A written report each quarter of all air flow rates monitored during the preceding 3-month period that are less than 80 percent of the corresponding reference flow rate established for each converter operating mode; and~~

~~3. A written report each quarter of any changes in the operating conditions of the emission capture system, emission control device, or the building housing the converters that might increase fugitive emissions.~~

~~(e) All quarterly reports shall be postmarked by the 30th day following the end of each 3-month period and shall include the following information:~~

~~1. The magnitude of each occurrence of excess opacity, any conversion factor(s) used, and the dates and times of commencement and completion of each occurrence of excess opacity, the cause of each exceedance of the reference opacity level, and the measures taken to minimize emissions.~~

~~2. The magnitude of each occurrence of reduced flow rate and the date and time of commencement and completion of each occurrence of reduced flow rate, the cause of the reduced flow rate, and the associated converter operating mode.~~

~~3. Specific identification of each occurrence of excess opacity or reduced flow rate that occurs during startups, shutdowns, and malfunctions of the source.~~

~~4. The date and time identifying each period during which the continuous monitoring system or monitoring device was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.~~

~~5. Specific identification of each change in operating conditions of the emission capture system or control device, or in the condition of the building housing the converters.~~

~~(f) Each owner or operator of a source subject to the provisions of this rule shall submit annually a written report to the Technical Secretary that includes the monthly computations of the average annual converter arsenic charging rate as calculated under part (5)(f)4. The annual report shall be postmarked by the 30th day following the end of each calendar year.~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.11 Inorganic Arsenic Emissions from Arsenic Trioxide and Metallic Arsenic Production Facilities~~

~~(1) Applicability and Designation of Sources~~

~~(a) The provisions of this rule are applicable to each metallic arsenic production plant and to each arsenic trioxide plant that processes low-grade arsenic bearing materials by a roasting condensation process.~~

~~(2) Definitions~~

~~(a) ‘‘Arsenic kitchen’’ means a baffled brick chamber where inorganic arsenic vapors are cooled, condensed, and removed in a solid form.~~

~~(b) ‘‘Control device’’ means the air pollution control equipment used to collect particulate matter emissions.~~

~~(c) ‘‘Curtail’’ means to cease operations to the extent technically feasible to reduce emissions.~~

~~(d) ‘‘Inorganic arsenic’’ means the oxides and other noncarbon compounds of the element arsenic included in particulate matter, vapors, and aerosols.~~

~~(e) ‘‘Malfunction’’ means any sudden failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of inorganic arsenic are increased.~~

~~(f) ‘‘Opacity’’ means the degree to which emissions reduce the transmission of light.~~

~~(g) ‘‘Primary emission control system’’ means the hoods, enclosures, ducts, and control devices used to capture, convey, and remove particulate matter from exhaust gases which are captured directly at the source of generation.~~

~~(h) ‘‘Process emissions’’ means inorganic arsenic emissions that are captured and collected in a primary emission control system.~~

~~(i) ‘‘Roasting’’ means the use of a furnace to heat arsenic plant feed material for the purpose of eliminating a significant portion of the volatile materials contained in the feed.~~

~~(j) ‘‘Secondary emissions’’ means inorganic arsenic emissions that escape capture by a primary emission control system.~~

~~(k) ‘‘Shutdown’’ means the cessation of operation of a stationary source for any purpose.~~

~~(3) Standard for New and Existing Sources~~

~~(a) Within 30 days after November 6, 1988, the owner or operator of each source to which this rule applies shall identify and submit to the Technical Secretary a list of potential sources (equipment and operations) of inorganic arsenic emissions.~~

~~(b) The owner or operator shall submit a description of an inspection, maintenance, and housekeeping plan for control of inorganic arsenic emissions from the potential sources identified under subparagraph (a) of this paragraph. This plan shall be submitted within 90 days after November 6, 1988. Approval of the plan will be granted by the Technical Secretary provided he finds that:~~

~~1. It achieves the following objectives in a manner that does not cause adverse impacts in other environmental media:~~

~~(i) Clean-up and proper disposal, wet-down, or chemical stabilization to the extent practicable (considering access and safety) of any dry, dusty material having an inorganic arsenic content greater than 2 percent that accumulates on any surface within the plant boundaries outside of a dust-tight enclosure.~~

~~(ii) Immediate clean-up and proper disposal, wet-down, or chemical stabilization of spills of all dry, dusty material having an inorganic arsenic content greater than 2 percent.~~

~~(iii) Minimization of emissions of inorganic arsenic to the atmosphere during removal of inorganic arsenic from the arsenic kitchen and from flue pulling operations by properly handling, wetting down, or chemically stabilizing all dusts and materials handled in these operations.~~

~~2. It includes an inspection program that requires all process, conveying, and air pollution control equipment to be inspected at least once per shift to ensure that the equipment is being properly operated and maintained. The program will specify the evaluation criteria and will use a standardized checklist, which will be included as part of the plan required in subparagraph (b) of this paragraph, to document the inspection, maintenance, and housekeeping status of the equipment and that the objectives of subparagraph (b)1 of this paragraph are being achieved.~~

~~3. It includes a systematic procedure for identifying malfunctions and for reporting them immediately to supervisory personnel.~~

~~4. It specifies the procedures that will be followed to ensure that equipment or process malfunctions due entirely or in part to poor maintenance or other preventable conditions do not occur.~~

~~5. It includes a program for curtailing all operations necessary to minimize any increase in emissions of inorganic arsenic to the atmosphere resulting from a malfunction. The program will describe:~~

~~(i) The specific steps that will be taken to curtail each operation as soon as technically feasible after the malfunction is discovered.~~

~~(ii) The minimum time required to curtail each operation.~~

~~(iii) The procedures that will be used to ensure that the curtailment continues until after the malfunction is corrected.~~

~~(c) The owner or operator shall implement the plan required in subparagraph (b) of this paragraph until otherwise specified by the Technical Secretary.~~

~~(d) At all times, including periods of startup, shutdown, and malfunction, the owner or operator of each source to which this rule applies shall operate and maintain the source including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent practicable. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Technical Secretary, which may include, but is not limited to, monitoring results, review of operating and maintenance procedures, inspection of the source, and review of other records.~~

~~(4) Emission Monitoring~~

~~(a) The owner or operator of each source subject to the provisions of this rule shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of the opacity of each arsenic trioxide and metallic arsenic process emission stream that exits from a control device.~~

~~(b) The owner or operator shall install, operate, and maintain each continuous monitoring system for the measurement of opacity required in subparagraph (a) of this paragraph according to the following procedures:~~

~~1. Ensure that each system is installed and operational no later than 90 days after November 6, 1988 for an existing source or a new source that has an initial startup date preceding November 6, 1988. For a new source whose initial startup occurs after the November 6, 1988, ensure that the system is installed and operational no later than 90 days after startup. Verification of the operations status shall, as a minimum, consist of an evaluation of the monitoring system in accordance with the requirements and procedures as specified in 1200-03-16-.01(8)(a).~~

~~2. Except for zero and span drift adjustments required under 1200-03-16-.01(8)(d), and system breakdowns, repairs, and calibration checks ensure that each continuous monitoring system is in continuous operation and meets frequency of operation requirements by completing a minimum of one cycle of sampling and analysis for each successive 10-second period and one cycle of data recording for each successive 6-minute period. Each data point shall represent the opacity measured for one cycle of sampling and analysis and shall be expressed as percent opacity.~~

~~(c) The owner or operator shall calculate 6-minute opacity averages from 36 or more consecutive data points equally spaced over each 6-minute period. Data recorded during periods of~~

~~monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this subparagraph.~~

~~(d) No later than 60 days after each continuous opacity monitoring system required in subparagraph (a) of this paragraph becomes operational, the owner or operator shall establish a reference opacity level for each monitored emission stream according to the following procedures:~~

~~1. Conduct continuous opacity monitoring over a preplanned period of not less than 36 hours during which the processes and emission control equipment upstream of the monitoring system are operating in a manner that will minimize opacity under representative operating conditions subject to the Technical Secretary's approval.~~

~~2. Calculate 6-minute averages of the opacity readings using 36 or more consecutive data points equally spaced over each 6-minute period.~~

~~3. Establish the reference opacity level by determining the highest 6-minute average opacity calculated under subparagraph (d)2 of this paragraph.~~

~~(e) With a minimum of 30 days prior notice, the Technical Secretary may require an owner or operator to redetermine the reference opacity level for any monitored emission stream.~~

~~(f) Each owner or operator shall install all continuous monitoring systems or monitoring devices required in subparagraph (a) of this paragraph in such a manner that representative measurements of emissions or process parameters are obtained.~~

~~(5) Ambient Air Monitoring for Inorganic Arsenic~~

~~(a) The owner or operator of each source to which this rule applies shall operate a continuous monitoring system for the measurement of inorganic arsenic concentrations in the ambient air.~~

~~(b) The ambient air monitors shall be located at sites to detect maximum concentrations of inorganic arsenic in the ambient air in accordance with a plan approved by the Technical Secretary that shall include the sampling and analytical method used.~~

~~(c) The owner or operator shall submit a written plan describing, and explaining the basis for, the design and adequacy of the monitoring network, sampling and analytical procedures, and quality assurance within 45 days after November 6, 1988.~~

~~(d) Each monitor shall be operated continuously except for a reasonable time allowance for instrument maintenance and calibration, for changing filters, or for replacement of equipment needing major repair.~~

~~(e) Filters shall be changed daily and shall be analyzed and concentrations calculated within 30 days after filters are collected.~~

~~(f) The Technical Secretary at any time may require changes in, or expansion of, the sampling program, including sampling and analytical protocols and network design.~~

~~(6) Record Keeping Requirements~~

~~(a) Each owner or operator of a source subject to the provisions of this rule shall maintain at the source for a period of at least 2 years the following records: All measurements, including continuous monitoring for measurement of opacity; all continuous monitoring system performance evaluations, including calibration checks and adjustments; all periods during which the continuous monitoring system or monitoring device is inoperative; and all maintenance and repairs made to the continuous monitoring system or monitoring device.~~

~~(b) Each owner or operator shall maintain at the source for a period of at least 2 years a log for each plant department in which the operating status of process, conveying, and emission control equipment is described for each shift. For malfunctions and upsets, the following information shall be recorded in the log:~~

~~1. The time of discovery.~~

~~2. A description of the malfunction or upset.~~

~~3. The time corrective action was initiated.~~

~~4. A description of corrective action taken.~~

~~5. The time corrective action was completed.~~

~~6. A description of steps taken to reduce emissions of inorganic arsenic to the atmosphere between the time of discovery and the time corrective action was taken.~~

~~(c) Each owner or operator subject to the provisions of this rule shall maintain for a period of at least 2 years records of 6-minute average opacity levels for each separate control device.~~

~~(d) Each owner or operator subject to the provisions of paragraph (7) shall maintain for a period of at least 2 years records of ambient inorganic arsenic concentrations at all sampling sites and other data needed to determine such concentrations.~~

~~(7) Reporting Requirements~~

~~(a) Each owner or operator subject to the provisions of subparagraph (4)(a) shall provide the Technical Secretary at least 30 days prior notice of each reference opacity level determination required in subparagraph (4)(a) to afford the Technical Secretary the opportunity to have an observer present.~~

~~(b) Each owner or operator subject to the provisions of subparagraph (4)(a) shall submit to the Technical Secretary:~~

~~1. Within 60 days of conducting the evaluation required in part 1 of subparagraph (4)(b), a written report of the continuous monitoring system evaluation;~~

~~2. Within 30 days of establishing the reference opacity level required in subparagraph (4)(d), a written report of the reference opacity level. The report shall also include the opacity data used and the calculations performed to determine the reference opacity level, and sufficient documentation to show that process and emission control equipment were operating normally during the reference opacity level determination; and~~

~~3. A written report each quarter of each occurrence of excess opacity during the quarter. For the purposes of this paragraph, an occurrence of excess opacity is any 6-minute period during which the average opacity, as measured by the continuous monitoring system, exceeds the reference opacity level established under subparagraph (4)(d).~~

~~(c) All quarterly reports of excess opacity shall be postmarked by the 30th day following the end of each quarter and shall include the following information:~~

~~1. The magnitude of excess opacity, any conversion factor(s) used, and the dates and times of commencement and completion of each occurrence of excess opacity, the cause of each exceedance of the reference opacity level, and the measures taken to minimize emissions.~~

~~2. Specific identification of each period of excess opacity that occurred during startups, shutdowns, and malfunctions of the source.~~

~~3. The date and time identifying each period during which the continuous monitoring system or monitoring device was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.~~

~~(d) Each owner or operator subject to this rule shall submit a written report semiannually to the~~

~~Technical Secretary that describes the status and results, for the reporting period, of any pilot plant studies on alternative arsenic trioxide production processes. Conclusions and recommendations of the studies shall also be reported.~~

~~(e) All semiannual progress reports required in subparagraph (d) of this paragraph shall be postmarked by the 30th day following the end of each 6-month period.~~

~~(f) Each owner or operator of a source to which this rule applies shall submit a written report each quarter to the Technical Secretary that includes the following information:~~

~~1. All ambient inorganic arsenic concentrations measured at all monitoring sites in accordance with paragraph (5) of this rule.~~

~~2. A description of any modifications to the sampling network, during the reporting period, including any major maintenance, site changes, calibrations, and quality assurance information including sampling and analytical precision and accuracy estimates.~~

~~(g) All quarterly reports required in subparagraph (f) of this paragraph shall be postmarked by the 30th day following the end of each quarter.~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.12 through 1200-03-11-.16 Reserved~~

~~Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.~~

~~1200-03-11-.17 National Emission Standards for Radon Emissions From Department of Energy Facilities.~~

~~(1) Adopted herein by reference are the Federal regulations 40 CFR 61 Subpart Q as published in the December 15, 1989 edition of the Federal Register: (See Paragraph (3) of this Rule for text).~~

~~(2) Agreements regarding waivers, compliance reports, testing, and monitoring between the Department of Energy and the Environmental Protection Agency will be recognized by the Tennessee Division of Air Pollution Control providing these agreements are current, valid, and supported by appropriate documentation.~~

~~(3) 40 CFR PART 61-subpart Q-National Emission Standards for Radon Emissions From Department of Energy Facilities~~

~~SOURCE: 54 FR 51701, Dec. 15, 1989, unless otherwise noted.~~

~~§ 61.190 Designation of facilities.~~

~~The provisions of this subpart apply to the design and operation of all storage and disposal facilities for radium-containing material (i.e., byproduct material as defined under section 11.e(2) of the Atomic Energy Act of 1954 (as amended)) that are owned or operated by the Department of Energy that emit radon-222 into air, including these facilities: The Feed Materials Production Center, Fernald, Ohio; the Niagara Falls Storage Site, Lewiston, New York; the Weldon Spring Site, Weldon Spring, Missouri; the Middlesex Sampling Plant, Middlesex, New Jersey; the Monticello Uranium Mill Tailings Pile, Monticello, Utah. This subpart does not apply to facilities listed in, or designated by the Secretary of Energy under title I of the Uranium Mill Tailings Control Act of 1978.~~

~~§ 61.191 Definitions.~~

~~(a) As used in this subpart, all terms not defined here have the meaning given them in the Clean Air Act or subpart A of part 61. The following terms shall have the following specific meanings:~~

~~(b) Facility means all buildings, structures and operations on one contiguous site.~~

~~(c) Source means any building, structure, pile, impoundment or area used for interim storage or disposal that is or contains waste material containing radium in sufficient concentration to emit~~

~~radon-222 in excess of this standard prior to remedial action.~~

~~§ 61.192 Standard.~~

~~No source at a Department of Energy facility shall emit more than 20 pCi/ m^2-s of radon-222 as an average for the entire source, into the air. This requirement will be part of any Federal Facilities Agreement reached between Environmental Protection Agency and Department of Energy.~~

~~§ 61.193 Exemption from the reporting and testing requirements of 40 CFR 61.10.~~

~~All facilities designated under this subpart are exempt from the reporting requirements of 40 CFR 61.10.~~

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Amendment

Subparagraph (a) of paragraph (11) of Rule 1200-03-16-.01 General Provisions is amended by deleting in its entirety and substituting instead the following:

(a) Introduction

This paragraph contains requirements for control devices used to comply with applicable rules of ~~chapters 11 and 16~~ Chapter 0400-30-38 and this chapter. The requirements are placed here for administrative convenience and only apply to facilities covered by rules referring to this paragraph.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-20
Limits on Emissions Due to Malfunctions, Startups, and Shutdowns

Amendment

Paragraph (1) of Rule 1200-03-20-.03 Notice Required When Malfunction Occurs is amended by deleting it in its entirety and substituting instead the following:

(1) When any air contaminant source malfunctions in such a manner as to cause the emission of air contaminants in excess of the applicable emission standards contained in Division 1200-03 or any permit issued thereto, or of sufficient duration to cause damage to property or public health, the owner or operator of the air contaminant source shall promptly notify the Technical Secretary of such malfunction and provide a statement giving all pertinent facts, including the estimated duration of the malfunction**.** Violations of the visible emission standard (excluding visible emissions caused by hazardous air pollutants named in Chapter ~~1200-03-11~~ 0400-30-38) which occur for less than 20 minutes in one day (midnight to midnight) need not be reported. Prompt notification will be within 24 hours of the malfunction and shall be provided by telephone to the Division's Nashville office. The Technical Secretary shall be notified when the malfunction has been corrected. In attainment and unclassified areas if emissions other than from sources designated as significantly impacting on a nonattainment area 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, notification is not required. 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.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-21
General Alternate Emission Standards

Amendment

Subparagraph (d) of paragraph (2) of Rule 1200-03-21-.01 General Alternate Emission Standard is amended by deleting it in its entirety and substituting instead the following:

(d) The pollutants involved in the alternate emission standard must be comparable emissions, and no interpollutant trades are allowed. Air contaminant sources subject to the standards in Chapter ~~1200-3-11~~ 0400-30-38 cannot apply the alternate emission standard to hazardous air contaminants. Air contaminant sources subject to emission standards in Chapter 1200-03-16, or ~~Rule 1200-3-9-.01(4)~~ paragraph (4) of Rule 1200-03-09-.01 or subparagraph (5(b) of Rule 1200-03-09-.01~~(5)(b)~~ cannot use an alternate emission standard, except for reductions in actual emissions below the level required in these rules. Such reduction may be used as credit for existing source. However, all applicable standards and requirements established under ~~Rule 1200-3-9-.01(4)~~ paragraph (4) of Rule 1200-03-09-.01, under Chapters ~~1200-3-11 and 1200-3-16~~ 0400-30-38 and 1200-06-16, and according to a lowest-achievement-emission-rate (LAER) determination under ~~Rule 200-3-9-.01(5)~~ paragraph (5) of Rule 1200-03-09-.01 must be complied with and are not superseded or replaced by the alternate emission standard.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-26
Administrative Fees Schedule

Amendments

Part 1 of subparagraph (i) of paragraph (2) of Rule 1200-03-26.02 Construction and Annual Emission Fees is amended by deleting it in its entirety and substituting instead the following:

1. Each pollutant regulated under ~~chapter 1200-03-11 HAZARDOUS AIR CONTAMINANTS~~ Chapter 0400-30-38 Emission Standards for Hazardous Air Pollutants (Excluding Transitory Asbestos from construction, demolition, and renovation).

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Subpart (i) of part 1 of subparagraph (i) of paragraph (3) of Rule 1200-03-26.02 Construction and Annual Emission Fees is amended by deleting it in its entirety and substituting instead the following:

(i) Sources that are subject to federally promulgated hazardous air pollutant standards that can be imposed under ~~Chapter 1200-03-11, Chapter 1200-03-31, or~~ Chapter 0400-30-38 or Chapter 1200-03-31 will place such regulated emissions in the specific hazardous air pollutant under regulation. If the pollutant is also in the family of volatile organic compounds or the family of particulates, the pollutant shall not be placed in that respective family category.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

Chapter 1200-03-31
Case by Case Determinations of Hazardous Air Pollutant Control Requirements

Amendments

Chapter 1200-03-31 Case by Case Determinations of Hazardous Air Pollutant Control Requirements is amended by deleted in its entirety and substituting instead the following:

Chapter 1200-03-31
Case by Case Determinations of Hazardous Air Pollutant Control Requirements

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Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.02~~ 1200-03-31-.02 Definitions - The following definitions are applicable to this ~~Chapter~~ chapter:

(1) “Major Source” means any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of any hazardous air pollutant or 25 tons per year of any combination of hazardous air pollutants. In addition, the provisions of subpart ~~1200-3-9-.02~~ (11)(b)14(i) of Rule 1200-03-09-.02 are recognized as to the grouping or aggregation of emissions for the purpose of calculating emission potential as it relates to the applicability thresholds of this definition. Additionally, electric utility steam generating units will not be regulated as major sources until the United States Environmental Protection Agency decides that they should be so regulated pursuant to Section 112(n) of the federal Clean Air Act.

(2) “Area Source” means any stationary source of hazardous air pollutants that is not a major source. Mobile sources such as vehicles, trains, planes, ships et cetera are not area sources.

(3) “New Source” means a stationary source that emits hazardous air pollutants as they are defined in this paragraph and is constructed or reconstructed on or after the date that the United States Environmental Protection Agency approves the major source operating permit program submitted by the State of Tennessee in accordance with Section 502(d) of the federal Clean Air Act.

(4) “Stationary Source” shall have the meaning given to it in subparagraph ~~1200-3-2-.01~~ (1)(ddd) of Rule 1200-03-02-.01.

(5) “Existing Source” is any stationary source that emits hazardous air pollutants as they are defined in ~~this~~ paragraph (6) of this rule and is not a new source.

(6) “Hazardous Air Pollutant” - means any of the following air contaminants:

CAS No.	Chemical name

75070	Acetaldehyde
60355	Acetamide
75058	Acetonitrile
98862	Acetophenone
53963	2-Acetylaminofluorene
107028	Acrolein
79061	Acrylamide
79107	Acrylic acid
107131	Acrylonitrile
107051	Allyl chloride
92671	4-Aminobiphenyl
62533	Aniline
90040	o-Anisidine
1332214	Asbestos
71432	Benzene (including benzene from gasoline)
92875	Benzidine
98077	Benzotrichloride
100447	Benzyl chloride
92524	Biphenyl
117817	Bis(2-ethylhexyl)phthalate(DEHP)
542881	Bis(chloromethyl) ether
75252	Bromoform
106990	1,3-Butadiene
156627	Calcium cyanamide
133062	Captan
63252	Carbaryl
75150	Carbon disulfide
56235	Carbon tetrachloride
463581	Carbonyl sulfide
120809	Catechol
133904	Chloramben
57749	Chlordane
7782505	Chlorine
79118	Chloroacetic acid
532274	2-Chloroacetophenone
108907	Chlorobenzene
510156	Chlorobenzilate
67663	Chloroform
107302	Chloromethyl methyl ether
126998	Chloroprene
1319773	Cresols/Cresylic acid (isomers and mixture)
95487	o-Cresol
108394	m-Cresol
106445	p-Cresol
98828	Cumene
94757	2,4-D, salts and esters
3547044	DDE
334883	Diazomethane
132649	Dibenzofurans
96128	1,2-Dibromo-3-chloropropane
84742	Dibutylphthalate
106467	1,4-Dichlorobenzene(p)
91941	3,3-Dichloro benzidene
111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)
542756	1,3-Dichloropropene
62737	Dichlorvos
111422	Diethanolamine
121697	N,N-Diethyl aniline (N,N-Dimethylaniline)
64675	Diethyl sulfate
119904	3,3-Dimethoxybenzidine

60117	Dimethyl aminoazobenzene
119937	3,3'-Dimethyl benzidine
79447	Dimethyl carbamoyl chloride
68122	Dimethyl formamide
57147	1,1-Dimethyl hydrazine
131113	Dimethyl phthalate
77781	Dimethyl sulfate
534521	4,6-Dinitro-o-cresol, and salts
51285	2,4-Dinitrophenol
121142	2,4-Dinitrotoluene
123911	1,4-Dioxane (1,4-Diethyleneoxide)
122667	1,2-Diphenylhydrazine
106898	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
106887	1,2-Epoxybutane
140885	Ethyl acrylate
100414	Ethyl benzene
51796	Ethyl carbamate (Urethane)
75003	Ethyl Chloride (Chloroethane)
106934	Ethylene dibromide (Dibromoethane)
107062	Ethylene dichloride (1,2-Dichlorethane)
107211	Ethylene glycol
151564	Ethylene imine (Aziridine)
75218	Ethylene oxide
96457	Ethylene thiourea
75343	Ethylidene dichloride (1,1-Dichloroethane)
50000	Formaldehyde
76448	Heptachlor
118741	Hexachlorobenzene
87683	Hexachlorobutadiene
77474	Hexachlorocyclopentadiene
67721	Hexachloroethane
822060	Hexamethylene-1,6-diisocyanate
680319	Hexamethylphosphoramide
110543	Hexane
302012	Hydrazine
7647010	Hydrochloric acid
7664393	Hydrogen fluoride (Hydrofluoric acid)
123319	Hydroquinone
78591	Isophorone
58899	Lindane (all isomers)
108316	Maleic anhydride
67561	Methanol
72435	Methoxychlor
74839	Methyl bromide (Bromomethane)
74873	Methyl chloride (Chloromethane)
71556	Methyl chloroform (1,1,1-Trichloroethane)
60344	Methyl hydrazine
74884	Methyl iodide (Iodomethane)
108101	Methyl isobutyl ketone (Hexone)
624839	Methyl isocyanate
80626	Methyl methacrylate
1634044	Methyl tert butyl ether
101144	4,4-Methylene bis(2-chloronaniline)
75092	Methylene chloride (Dichloromethane)
101688	Methylene diphenyl diisocyanate (MDI)
101779	4,4'-Methylenedianiline
91203	Naphthalene
98953	Nitrobenzene
92933	4-Nitrobiphenyl
100027	4-Nitrophenol
79469	2-Nitropropane

684935	N-Nitroso-N-methylurea
62759	N-Nitrosodimethylamine
59892	N-Nitrosomorpholine
56382	Parathion
82688	Pentachloronitrobenzene (Quintobenzene)
87865	Pentachlorophenol
108952	Phenol
106503	p-Phenylenediamine
75445	Phosgene
7803512	Phosphine
7723140	Phosphorus
85449	Phthalic anhydride
1336363	Polychlorinated biphenyls (Arochlors)
1120714	1,3-Propane sultone
57578	beta-Propiolactone
123386	Propionaldehyde
114261	Propoxur (Baygon)
78875	Propylene dichloride (1,2-Dichloropropane)
75569	Propylene oxide
75558	1,2-Propylenimine (2-Methyl aziridine)
91225	Quinoline
106514	Quinone
100425	Styrene
96093	Styrene oxide
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin
79345	1,1,2,2-Tetrachloroethane
127184	Tetrachoroethylene (Perchloroethylene)
7550450	Titanium tetrachloride
108883	Toluene
95807	2,4-Toluene diamine
584849	2,4-Toluene diisocyanate
95534	o-Toluidine
8001352	Toxaphene (chlorinated camphene)
120821	1,2,4-Trichlorobenzene
79005	1,1,2-Trichloroethane
79016	Trichloroethylene
95954	2,4,5-Trichlorophenol
88062	2,4,6-Trichlorophenol
121448	Triethylamine
1582098	Trifluralin
540841	2,2,4-Trimethylpentane
108054	Vinyl acetate
593602	Vinyl bromide
75014	Vinyl chloride
75354	Vinylidene chloride (1,1-Dichloroethylene)
1330207	Xylenes (isomers and mixture)
95476	o-Xylenes
108383	m-Xylenes
106423	p-Xylenes
0	Antimony Compounds
0	Arsenic Compounds (inorganic including arsine)
0	Beryllium Compounds
0	Cadmium Compounds
0	Chromium Compounds
0	Cobalt Compounds
0	Coke Oven Emissions
0	Cyanide compounds[1]
0	Glycol ethers[2, 6]

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[1] X'CN where X = H' or any other group where a formal dissociation may occur. For example KCN or $Ca(CN)_2$

[2] Include mono- and di-ethers of ethylene glycol, diethylene glycol, and triethylene glycol $R-(OCH_2CH_2)_n-$ OR'.

0 Lead Compounds
0 Manganese Compounds
0 Mercury Compounds
0 Fine mineral fibers[3]
0 Nickel Compounds
0 Polycyclic Organic Matter[4]
0 Radionuclides (including radon)[5]
0 Selenium Compounds

(7) “Federal Clean Air Act” means the federal statutes found at 42 U.S.C. 7401 et seq. as amended by Public Law No. 101-549 (November 15, 1990).

(8) “MACT” means maximum achievable control technology. It is a case by case determination of what constitutes a maximum achievable reduction of hazardous air pollutants considering the costs of achieving the emission reduction and any non-air quality health and environmental impacts and energy requirements. MACT may include but is not limited to: control equipment, work practice standards, emission standards, process modifications or raw materials substitution and/or reformulation.

(9) “GACT” means generally available control technology. It is a case by case determination of what constitutes reasonable and proper control for hazardous air pollutants from area sources. GACT may include, but is not limited to: control equipment, work practice standards, emission standards, process modification or raw materials substitution and/or reformulation.

(10) Reserved.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.03~~ 1200-03-31-.03 Intent of the Board

For Case by Case Determinations of Hazardous Air Pollutant Control Requirements:

(1) The role of the United States Environmental Protection Agency is recognized by the Board as being essential in the setting of case by case determinations of hazardous air pollutant control requirements. The federal Agency is in the unique position to conduct research and compile national data bases as to the source by source control levels that are being achieved or proposed in the regulation of hazardous air pollutants. As the State of Tennessee does not fully possess these abilities, the Technical Secretary shall ~~avail himself of~~ utilize the federal Agency's resources prior to setting a case by case hazardous air pollutant requirement. In addition, the Technical Secretary shall recognize any federal law, federal regulation, or lawfully promulgated policy of the United States Environmental Protection Agency pertaining to case by case determinations of hazardous air pollutant requirements as the minimum acceptable criteria prior to the setting of a case by case hazardous air pollutant requirement under the provisions of this rule.

Where:
n = 1, 2, or 3:
R = alkyl C7 or less; or
R = phenyl or alkyl substituted phenyl;
R’ = H or alkyl C7 or less; or
OR’ consisting of carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate.

This action deletes each individual compound in a group called the surfactant alcohol ethoxylates and their derivatives (SAED) from the glycol ethers category in the list of hazardous air pollutants (HAP) established by section 112(b)(1) of the Clean Air Act (CAA).

[3] Includes mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.

[4] Includes organic compounds with than one benzene ring, and which have a boiling point greater than or equal to 100^0 C.

[5] a type of atom which spontaneously undergoes radioactive decay.

[6] The substance ethylene glycol monobutyl ether (EGBE, 2-Butoxyethanol) (Chemical Abstract Service (CAS) Number 111-76-2) is deleted from the list of hazardous air pollutants established by 42 U.S.C. 7412(b)(1).

(2) The Technical Secretary may consider other applicable criteria in the absence of any data or requirement of the United States Environmental Protection Agency. In such case, the Technical Secretary shall rely upon generally accepted engineering principles and any unique aspects of a source category as a whole that would be a prohibitory factor in the imposition of a requirement for industries in that source category.

(3) To the extent possible, it is the Board's intent to impose MACT and GACT limitations equivalent to that required by the United States Environmental Protection Agency at the time of the case by case determination. Should there be a prudent reason to be more stringent than the federal equivalent the Technical Secretary may issue a more stringent MACT or GACT requirement. In exercise of the authority to issue a more stringent requirement, the Technical Secretary shall issue a determination specifying the rationale employed in the setting of a more stringent requirement. The determination shall accompany the permit in which the case by case determination is declared. As the declaration of a case by case requirement will be specified on a permit, disputes regarding the imposition of MACT or GACT are to be resolved in the manner prescribed by ~~rule 1200-3-9-.05~~ Rule 1200-03-09-.05. If GACT is done on a permit by rule basis, the Board will view the public hearing process as the permittee's opportunity to object to the requirements of GACT. However, the permittee may appeal the applicability of GACT to their operations as to commenced date or emission/production magnitude applicability thresholds present at their source.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.04~~ 1200-03-31-.04 Standard for Existing Sources

(1) Major sources will be issued an operating permit pursuant to the provisions of paragraph ~~1200-3-9-.02~~ (11) of Rule 1200-03-09-.02 listing their current hazardous air pollutant emission rate on a pollutant by pollutant basis. These "hollow permits" will remain in effect until one or more of the following activities occur:

(a) When the United States Environmental Protection Agency promulgates MACT for a source specific category pursuant to Sections 112(d) or (h) of the federal Clean Air Act, the Technical Secretary shall specify MACT for all existing major sources in that category as a revision to their "hollow permit". Upon written notification from the Technical Secretary, the source shall have 180 days to prepare their application for a MACT permit revision and submit it to the Technical Secretary. The Technical Secretary shall process the application by issuing a permit within 9 months of receipt of a complete application. MACT revisions to hollow permits shall be issued within 18 months of promulgation. A compliance schedule to attain MACT by a date certain shall be made part of the permit. The length of the schedule to attain compliance shall be determined by the complexities of coming into compliance and the Board's intent to be equivalent to the federal MACT. The Technical Secretary shall provide that the source's compliance schedule is at least as long as the federal rules allow. In most areas, this should not exceed three years. The Technical Secretary is authorized to grant up to a one-year extension to comply as long as it does not conflict with the federal requirements and there is sufficient justification to grant the additional time.

(b) If the United States Environmental Protection Agency fails to meet the Federal Clean Air Act schedules prescribed in Section 112(e)(1) and/or (3) for timely promulgation of MACT requirements thereby invoking the "MACT hammer" provisions at Section 112(j) of the federal Clean Air Act, the Technical Secretary shall specify MACT for all sources in the source category in question as a permit revision to their "hollow permit". Sources subject to the missed MACT standard shall file a complete MACT permit revision application with the Technical Secretary no later than 18 months after the federally missed deadline for the source category. The Technical Secretary shall process the MACT permit revision application by issuing a permit within 18 months of his receipt of a complete application.

(2) Area sources that are not exempt from the requirement to obtain a permit pursuant to ~~rule 1200-3-9-.04~~ Rule 1200-03-09-.04 will be issued an operating permit specifying GACT with an appropriate compliance schedule to achieve that requirement by a date certain within 18 months of the United States Environmental Protection Agency's promulgation of a source specific GACT standard if they are in that source specific category. The date to achieve compliance shall be no less than that allowed by the federal rule which promulgated GACT for that source category. If a source is not exempted from the requirement to obtain a permit pursuant to ~~rule 1200-3-9-.04~~ Rule 0400-30-09-.04, it shall be the duty of such area

source owner or operator to register their annual emissions of hazardous air pollutants with the Technical Secretary utilizing the forms prescribed by the Technical Secretary. In the interest of efficiency, the Technical Secretary may bring proposed regulations to the Board that would permit area sources by rule on a source category specific basis. It is the intent of the Board that such rule would be effective within 18 months of the federal GACT promulgation. The rule will also provide that compliance with GACT shall be attained no later than that specified by the equivalent federal rule.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.05~~ 1200-03-31-.05 Standard for New Sources

(1) Major sources shall utilize MACT as prescribed by the Technical Secretary upon start up regardless of whether or not the United States Environmental Protection Agency has established MACT under Section 112(d) or (h) of the Federal Clean Air Act. MACT shall be prescribed on the source's construction permit and transferred to the source's operating permit upon ~~start up~~ startup of the facility.

(2) Area sources that are not exempt from the requirement to obtain a permit in accordance with ~~rule 1200-3-9-.04~~ Rule 1200-03-09-.04 shall utilize GACT as prescribed by the Technical Secretary upon start up **if** the United States Environmental Protection Agency has established GACT under Section 112(d)(5). GACT shall be prescribed on the source's construction permit and transferred to the source's operating permit upon ~~start up~~ startup of the facility.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.06~~ 1200-03-31-.06 Opportunity for Early Reductions Schedule

(1) The owner or operator of an existing source of hazardous air pollutants may be issued an operating permit allowing ~~6~~ six additional years to comply with a future MACT commencing on the compliance date of that MACT limit if each of the following criteria are satisfied:

(a) The source will utilize control and/or work practices that will result in a 90 per centum or more reduction in emissions of hazardous air pollutants (95 per centum in the case of hazardous air pollutants which are particulates).

1. The reduction shall be determined with respect to verifiable and actual emissions in a base year not earlier than calendar year 1987.

2. If there is evidence that emissions in the base year 1987, or any subsequent base year are artificially or substantially greater than emissions in other years prior to the implementation of the early emission reductions, the Technical Secretary shall require the use of an arithmetic average of the years commencing upon the suspect year and ending upon the period of time when the person seeking the early reductions schedule files their plan for the purpose of determining base year emission levels.

3. The Technical Secretary may allow a source to use 1985 or 1986 emission data for the purpose of determining base year emissions if the source has submitted such data to ~~him~~ the Technical Secretary in a form that can be used to make the baseline calculations and further that such information was in ~~his~~ the Technical Secretary's possession prior to November 15, 1990.

(2) The early emission reduction must occur prior to the federal proposal of a source category specific MACT standard to which the source will be subject. Federal proposal will be considered effective when the United States Environmental Protection Agency publishes the standard in the Federal Register. The reduction need not actually occur prior to the federal proposal if the source owner or operator has committed to an enforceable schedule that extends no further than January 1, 1994.

(3) A major source operating permit must be issued to the source owner or operator pursuant to the provisions of paragraph ~~1200-3-9-.02~~ (11) of Rule 1200-03-09-.02 detailing the schedule to attain the early emission reductions and the enforceable emission limit that is to be attained. For the purposes of this ~~subparagraph~~ paragraph, the Technical Secretary shall issue the permit within ~~9~~ nine months of a complete application.

(4) The early reductions of less toxic hazardous air pollutants shall not be credited toward the reduction of highly toxic hazardous air pollutants (such as, but not limited to chlorinated dioxins and furans) that pose high risks of adverse public health effects associated with exposure to small quantities of such highly toxic hazardous air pollutants. The Technical Secretary shall use the relative risks of chlorinated dioxins and furans as a qualitative benchmark in determining whether or not a hazardous air pollutant is highly toxic.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.07~~ 1200-03-31-.07 Residual Risk and Revisions to MACT

(1) MACT standards are subject to revision if the United States Environmental Protection Agency determines that the existing MACT standards are insufficient to protect the public pursuant to the residual risk provisions of Section 112(f) of the federal Clean Air Act. Upon such finding, the Technical Secretary shall modify previously set MACT limitations in that source category to conform to the federally promulgated revised MACT standards within 18 months of such federal promulgation. ~~Said~~ The modification will be a permit revision to the source's operating permit consistent with the provisions of paragraph ~~1200-3-9-.02~~ (11) of Rule 1200-03-09-.02. The Technical Secretary shall prescribe a compliance schedule on the permit amendment that will specify an expeditious date to attain compliance with the revised MACT standards. The length of the schedule will be determined by the complexities of coming into compliance and the Board's desire to be equivalent to any federally revised MACT requirements.

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.08~~ 1200-03-31-.08 through ~~1200-31-1-.12~~ 1200-03-31-.12 Reserved

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

~~1200-3-31-.13 National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities~~ 1200-03-31-.13 Reserved

~~(1) Applicability~~

~~(a) The provisions of this rule apply to the owner or operator of each dry cleaning facility that uses perchloroethylene.~~

~~(b) Each dry cleaning system that commences construction or reconstruction on or after December 9, 1991, shall be in compliance with the provisions of this rule beginning on September 15, 1993 or immediately upon startup, whichever is later, except for dry cleaning systems complying with Section 112(i)(2) of the Clean Air Act as amended Nov. 15, 1990.~~

~~(c) Each dry cleaning system that commenced construction or reconstruction before December 9, 1991, and each new transfer machine system and its ancillary equipment that commenced construction or reconstruction on or after December 9, 1991, and before September 22, 1993, shall comply with subparagraphs 1200-3-31-.13 (3)c), (d), (i), (j), (k), (l), and (m), 1200-3-31-.13 (4)(d), and 1200-3-31-.13 (5)(a) (b), (d)1, (d)2, (d)3, (d)4, and (e) beginning on December 15, 1993, and shall comply with other provisions of this rule by September 15, 1996.~~

~~(d) Each existing dry-to-dry machine and its ancillary equipment located in a dry cleaning facility that includes only dry-to-dry machines and each existing transfer machine system and its ancillary equipment and each new transfer machine system and its ancillary equipment installed between December 9, 1991, and September 22, 1993, as well as each existing dry-to-dry machine and its ancillary equipment, located in a dry cleaning facility that includes both transfer machine system(s) and dry-to-dry machine(s) is exempt from 1200-3-31-.13(3), 1200-3-31-.13(4), and 1200-3-31-.13(5), except subparagraphs 1200-3-31-.13(3)(c), (d), (i), (j), (k), (l), and (m), 1200-3-31-.13(4)(d), and 1200-3-31-.13(5)(a) (b), (d)1, (d)2., (d)3., (d)4, and (e) if the total perchloroethylene consumption of the dry cleaning facility is less than 530 liters (140 gallons) per year. Consumption is determined according to 1200-3-31-.13(4)(d).~~

~~(e) Each existing transfer machine system and its ancillary equipment, and each new transfer machine system and its ancillary equipment installed between December 9, 1991, and September 22, 1993, located in a dry cleaning facility that includes only transfer machine system(s) is exempt from 1200-3-31-.13(3), 1200-3-31-.13 (4), and 1200-3-31-.13(5), except subparagraphs 1200-3-31-.13(3)(c), (d), (i), (j), (k), (l), and (m), 1200-3-31-.13(4)(d), and 1200-3-31-.13(5)(a) (b), (d)1, (d)2., (d)3., (d)4, and (e) if the perchloroethylene consumption of the dry cleaning facility is less than 760 liters (200 gallons) per year. Consumption is determined according to 1200-3-31-.13(4)(d).~~

~~(f) If the total yearly perchloroethylene consumption of a dry cleaning facility determined according to 1200-3-31-.13(4)(d) is initially less than the amounts specified in subparagraph (d) or (e) of this paragraph, but later exceeds those amounts, the existing dry cleaning system(s) and new transfer machine system(s) and its (their) ancillary equipment installed between December 9, 1991, and September 22, 1993, in the dry cleaning facility must comply with 1200-3-31-.13(3), 1200-3-31-.13(4), and 1200-3-31-.13(5) by 180 calendar days from the date that the facility determines it has exceeded the amounts specified, or by September 15, 1996, whichever is later.~~

~~(g) A dry cleaning facility is a major source if the facility emits or has the potential to emit more than 9.1 megagrams per year (10 tons per year) of perchloroethylene to the atmosphere. In lieu of measuring a facility's potential to emit perchloroethylene emissions or determining a facility's potential to emit perchloroethylene emissions, a dry cleaning facility is a major source if:~~

~~1. It includes only dry-to-dry machine(s) and has a total yearly perchloroethylene consumption greater than 8,000 liters (2,100 gallons) as determined according to 1200-3-31-.13(4)(d); or~~

~~2. It includes only transfer machine system(s) or both dry-to-dry machine(s) and transfer machine system(s) and has a total yearly perchloroethylene consumption greater than 6,800 liters (1,800 gallons) as determined according to 1200-3-31-.13(4)(d).~~

~~(h) A dry cleaning facility is an area source if it does not meet the conditions of Subparagraph (g) of this Paragraph.~~

~~(i) If the total yearly perchloroethylene consumption of a dry cleaning facility determined according to 1200-3-31-.13(4)(d) is initially less than the amounts specified in Subparagraph (g) of this Paragraph, but then exceeds those amounts, the dry cleaning facility becomes a major source and all dry cleaning systems located at that dry cleaning facility must comply with the appropriate requirements for major sources under 1200-3-31-.13(3), 1200-3-31-.13(4), and 1200-3-31-.13(5) by 180 calendar days from the date that the facility determines it has exceeded the amount specified, or by September 15, 1996, whichever is later.~~

~~(j) All coin-operated dry cleaning machines are exempt from the requirements of this Rule.~~

~~(2) Definitions~~

~~(a) "Administrator" means the Administrator of the United States Environmental Protection Agency.~~

~~(b) "Ancillary equipment" means the equipment used with a dry cleaning machine in a dry cleaning system including, but not limited to, emission control devices, pumps, filters, muck cookers, stills, solvent tanks, solvent containers, water separators, exhaust dampers, diverter valves, interconnecting piping, hoses, and ducts.~~

~~(c) "Articles" mean clothing, garments, textiles, fabrics, leather goods, and the like, that are dry cleaned.~~

~~(d) "Area source" means any perchloroethylene dry cleaning facility that meets the conditions of 1200-3-31-.13(1)(h).~~

~~(e) "Biweekly" means any 14-day period of time.~~

~~(f) "Carbon adsorber" means a bed of activated carbon into which an airÄperchloroethylene gas-vapor stream is routed and which adsorbs the perchloroethylene on the carbon.~~

~~(g) "Coin-operated dry cleaning machine" means a dry cleaning machine that is operated by the customer (that is, the customer places articles into the machine, turns the machine on, and removes articles from the machine).~~

~~(h) "Colorimetric detector tube" means a glass tube (sealed prior to use), containing material impregnated with a chemical that is sensitive to perchloroethylene and is designed to measure the concentration of perchloroethylene in air.~~

~~(i) "Construction", for purposes of this Rule, means the fabrication (onsite), erection, or installation of a dry cleaning system subject to this Rule.~~

~~(j) "Desorption" means regeneration of a carbon adsorber by removal of the perchloroethylene adsorbed on the carbon.~~

~~(k) "Diverter valve" means a flow control device that prevents room air from passing through a refrigerated condenser when the door of the dry cleaning machine is open.~~

~~(l) "Dry cleaning" means the process of cleaning articles using perchloroethylene.~~

~~(m) "Dry cleaning cycle" means the washing and drying of articles in a dry-to-dry machine or transfer machine system.~~

~~(n) "Dry cleaning facility" means an establishment with one or more dry cleaning systems.~~

~~(o) "Dry cleaning machine" means a dry-to-dry machine or each machine of a transfer machine system.~~

~~(p) "Dry cleaning machine drum" means the perforated container inside the dry cleaning machine that holds the articles during dry cleaning.~~

~~(q) "Dry cleaning system" means a dry-to-dry machine and its ancillary equipment or a transfer machine system and its ancillary equipment.~~

~~(r) "Dryer" means a machine used to remove perchloroethylene from articles by tumbling them in a heated air stream (see reclaimer).~~

~~(s) "Dry-to-dry machine" means a one-machine dry cleaning operation in which washing and drying are performed in the same machine.~~

~~(t) "Exhaust damper" means a flow control device that prevents the air-perchloroethylene gas-vapor stream from exiting the dry cleaning machine into a carbon adsorber before room air is drawn into the dry cleaning machine.~~

~~(u) "Existing" means commenced construction or reconstruction before December 9, 1991.~~

~~(v) "Filter" means a porous device through which perchloroethylene is passed to remove contaminants in suspension. Examples include, but are not limited to, lint filter (button trap), cartridge filter, tubular filter, regenerative filter, prefilter, polishing filter, and spin disc filter.~~

~~(w) "Heating coil" means the device used to heat the air stream circulated from the dry cleaning machine drum, after perchloroethylene has been condensed from the air stream and before the stream reenters the dry cleaning machine drum.~~

~~(x) "Major source" means any dry cleaning facility that meets the conditions of 1200-3-31-.13 1)(g).~~

~~(y) "Muck cooker" means a device for heating perchloroethylene-laden waste material to volatilize and recover perchloroethylene.~~

~~(z) "New" means commenced construction or reconstruction on or after December 9, 1991.~~

~~(aa) "Perceptible leaks" mean any perchloroethylene vapor or liquid leaks that are obvious from:~~

~~1. The odor of perchloroethylene;~~

~~2. Visual observation, such as pools or droplets of liquid; or~~

~~3. The detection of gas flow by passing the fingers over the surface of equipment.~~

~~(bb) "Perchloroethylene consumption" means the total volume of perchloroethylene purchased based upon purchase receipts or other reliable measures.~~

~~(cc) "Reclaimer" means a machine used to remove perchloroethylene from articles by tumbling them in a heated air stream (see dryer).~~

~~(dd) "Reconstruction", for purposes of this Rule, means replacement of a washer, dryer, or reclaimer; or replacement of any components of a dry cleaning system to such an extent that the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable new source.~~

~~(ee) "Refrigerated condenser" means a vapor recovery system into which an air-perchloroethylene gas-vapor stream is routed and the perchloroethylene is condensed by cooling the gas-vapor stream.~~

~~(ff) "Refrigerated condenser coil" means the coil containing the chilled liquid used to cool and condense the perchloroethylene.~~

~~(gg) "Responsible official" means one of the following:~~

~~1. For a corporation: A president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more dry cleaning facilities;~~

~~2. For a partnership: A general partner;~~

~~3. For a sole proprietorship: The owner; or~~

~~4. For a municipality, State, Federal, or other public agency: Either a principal executive officer or ranking official.~~

~~(hh) "Room enclosure" means a stationary structure that encloses a transfer machine system, and is vented to a carbon adsorber or an equivalent control device during operation of the transfer machine system.~~

~~(ii) "Source", for purposes of this Rule, means each dry cleaning system.~~

~~(jj) "Still" means any device used to volatilize and recover perchloroethylene from contaminated perchloroethylene.~~

~~(kk) "Temperature sensor" means a thermometer or thermocouple used to measure temperature.~~

~~(ll) "Transfer machine system" means a multiple-machine dry cleaning operation in which washing and drying are performed in different machines. Examples include, but are not limited to:~~

~~1. A washer and dryer(s),~~

~~2. A washer and reclaimer(s), or~~

~~3. A dry-to-dry machine and reclaimer(s).~~

~~(mm) "Washer" means a machine used to clean articles by immersing them in perchloroethylene. This includes a dry-to-dry machine when used with a reclaimer.~~

~~(nn) "Water separator" means any device used to recover perchloroethylene from a water-perchloroethylene mixture.~~

~~(oo) "Year or Yearly" means any consecutive 12-month period of time.~~

~~(3) Standards.~~

~~(a) The owner or operator of each existing dry cleaning system and of each new transfer system and its ancillary equipment installed between December 9, 1991, and September 22, 1993," shall comply with either (a)1 or 2 of this Subparagraph and shall comply with (a)3 of this Subparagraph if applicable.~~

~~1. Route the air-perchloroethylene gas-vapor stream contained within each dry cleaning machine through a refrigerated condenser or an equivalent control device.~~

~~2. Route the air-perchloroethylene gas-vapor stream contained within each dry cleaning machine through a carbon adsorber installed on the dry cleaning machine prior to September 15, 1993.~~

~~3. Contain the dry cleaning machine inside a room enclosure if the dry cleaning machine is a transfer machine system located at a major source. Each room enclosure shall be:~~

~~(i) Constructed of materials impermeable to perchloroethylene; and~~

~~(ii) Designed and operated to maintain a negative pressure at each opening at all times that the machine is operating.~~

~~(b) The owner or operator of each new dry cleaning system and its ancillary equipment and each new transfer machine system and its ancillary equipment installed after September 22, 1993:~~

~~1. Shall route the air-perchloroethylene gas-vapor stream contained within each dry cleaning machine through a refrigerated condenser or an equivalent control device;~~

~~2. Shall eliminate any emission of perchloroethylene during the transfer of articles between the washer and dryer(s); and~~

~~3. Shall pass the air-perchloroethylene gas-vapor stream from inside the dry cleaning machine drum through a carbon adsorber or equivalent control device immediately before or as the door of the dry cleaning machine is opened if the dry cleaning machine is located at a major source.~~

~~(c) The owner or operator shall close the door of each dry cleaning machine immediately after transferring articles to or from the machine, and shall keep the door closed at all other times.~~

~~(d) The owner or operator of each dry cleaning system shall operate and maintain the system according to the manufacturers' specifications and recommendations.~~

~~(e) Each refrigerated condenser used for the purposes of complying with Subparagraph (a) or (b) of this Paragraph and installed on a dry-to-dry machine, dryer, or reclaimer:~~

~~1. Shall be operated to not vent or release the air-perchloroethylene gas-vapor stream contained within the dry cleaning machine to the atmosphere while the dry cleaning machine drum is rotating;~~

~~2. Shall be monitored according to 1200-3-31-.13(4)(a)1; and~~

~~3. Shall be operated with a diverter valve, which prevents air drawn into the dry cleaning machine when the door of the machine is open from passing through the refrigerated condenser.~~

~~(f) Each refrigerated condenser used for the purpose of complying with subparagraph (a) of this paragraph and installed on a washer:~~

~~1. Shall be operated to not vent the air-perchloroethylene gas-vapor contained within the washer to the atmosphere until the washer door is opened;~~

~~2. Shall be monitored according to 1200-3-31-.13(4)(a)2; and~~

~~3. Shall not use the same refrigerated condenser coil for the washer that is used by a dry-to-dry machine, dryer, or reclaimer.~~

~~(g) Each carbon adsorber used for the purposes of complying with Subparagraphs (a) or (b) of this paragraph:~~

~~1. Shall not be bypassed to vent or release any air-perchloroethylene gas-vapor stream to the atmosphere at any time; and~~

~~2. Shall be monitored according to the applicable requirements in 1200-3-31-.13 (4)(b) or (c).~~

~~(h) Each room enclosure used for the purposes of complying with Subparagraph (a)3 of this Paragraph:~~

~~1. Shall be operated to vent all air from the room enclosure through a carbon adsorber or an equivalent control device; and~~

~~2. Shall be equipped with a carbon adsorber that is not the same carbon adsorber used to comply with Subparagraph (a)2 or (b)3 of this Paragraph.~~

~~(i) The owner or operator of an affected facility shall drain all cartridge filters in their housing, or other sealed container, for a minimum of 24 hours, or shall treat such filters in an equivalent manner, before removal from the dry cleaning facility.~~

~~(j) The owner or operator of an affected facility shall store all perchloroethylene and wastes that contain perchloroethylene in solvent tanks or solvent containers with no perceptible leaks.~~

~~(k) The owner or operator of a dry cleaning system shall inspect the following components weekly for perceptible leaks while the dry cleaning system is operating:~~

~~1. Hose and pipe connections, fittings, couplings, and valves;~~

~~2. Door gaskets and seatings;~~

~~3. Filter gaskets and seatings;~~

~~4. Pumps;~~

~~5. Solvent tanks and containers;~~

~~6. Water separators;~~

~~7. Muck cookers;~~

~~8. Stills;~~

~~9. Exhaust dampers;~~

~~10. Diverter valves; and~~

~~11. Cartridge filter housings.~~

~~(l) The owner or operator of a dry cleaning facility with a total facility consumption below the applicable consumption levels of 1200-3-31-.13(1)(d) or (e) shall inspect the components listed in Subparagraph (k) of this Paragraph biweekly for perceptible leaks while the dry cleaning system is operating.~~

~~(m) The owner or operator of a dry cleaning system shall repair all perceptible leaks detected under Subparagraph (k) of this Paragraph within 24 hours. If repair parts must be ordered, either a written or verbal order for those parts shall be initiated within 2 working days of detecting such a leak. Such repair parts shall be installed within 5 working days after receipt.~~

~~(n) If parameter values monitored under Subparagraphs (e), (f), or (g) of this Paragraph do not meet the values specified in 1200-3-31-.13(4)(a), (b), or (c), adjustments or repairs shall be made to the dry cleaning system or control device to meet those values. If repair parts must be ordered, either a written or verbal order for such parts shall be initiated within 2 working days of detecting such a parameter value. Such repair parts shall be installed within 5 working days after receipt.~~

~~(4) Test methods and monitoring~~

~~(a) When a refrigerated condenser is used to comply with 1200-3-31-.13(3)(a)1 or (b)1:~~

~~1. The owner or operator shall measure the temperature of the air-perchloroethylene gas-vapor stream on the outlet side of the refrigerated condenser on a dry-to-dry machine, dryer, or reclaimer weekly with a temperature sensor to determine if it is equal to or less than 7.2 ºC (45 ºF). The temperature sensor shall be used according to the manufacturer's instructions and shall be designed to measure a temperature of 7.2 ºC (45 ºF) to an accuracy of ± 1.1 ºC (± 2 ºF).~~

~~2. The owner or operator shall calculate the difference between the temperature of the air-perchloroethylene gas-vapor stream entering the refrigerated condenser on a washer and the temperature of the air-perchloroethylene gas-vapor stream exiting the refrigerated condenser on the washer weekly to determine that the difference is greater than or equal to 11.1 ºC (20 ºF).~~

~~(i) Measurements of the inlet and outlet streams shall be made with a temperature sensor. Each temperature sensor shall be used according to the manufacturer's instructions, and designed to measure at least a temperature range from 0 ºC (32 ºF) to 48.9 ºC (120 ºF) to an accuracy of + 1.1 ºC (+ 2 ºF).~~

~~(ii) The difference between the inlet and outlet temperatures shall be calculated weekly from the measured values.~~

~~(b) When a carbon adsorber is used to comply with 1200-3-31-.13(3)(a)2 or exhaust is passed through a carbon adsorber immediately upon machine door opening to comply with 1200-3-31-.13(3)(b)3, the owner or operator shall measure the concentration of perchloroethylene in the exhaust of the carbon adsorber weekly with a colorimetric detector tube, while the dry cleaning machine is venting to that carbon adsorber at the end of the last dry cleaning cycle prior to desorption of that carbon adsorber to determine that the perchloroethylene concentration in the exhaust is equal to or less than 100 parts per million by volume. The owner or operator shall:~~

~~1. Use a colorimetric detector tube designed to measure a concentration of 100 parts per million by volume of perchloroethylene in air to an accuracy of ± 25 parts per million by volume; and~~

~~2. Use the colorimetric detector tube according to the manufacturer's instructions; and~~

~~3. Provide a sampling port for monitoring within the exhaust outlet of the carbon adsorber that is easily accessible and located at least 8 stack or duct diameters downstream from~~

~~any flow disturbance such as a bend, expansion, contraction, or outlet; downstream from no other inlet; and 2 stack or duct diameters upstream from any flow disturbance such as a bend, expansion, contraction, inlet, or outlet.~~

~~(c) If the air-perchloroethylene gas-vapor stream is passed through a carbon adsorber prior to machine door opening to comply with 1200-3-31-.13(3)(b)3, the owner or operator of an affected facility shall measure the concentration of perchloroethylene in the dry cleaning machine drum at the end of the dry cleaning cycle weekly with a colorimetric detector tube to determine that the perchloroethylene concentration is equal to or less than 300 parts per million by volume. The owner or operator shall:~~

~~1. Use a colorimetric detector tube designed to measure a concentration of 300 parts per million by volume of perchloroethylene in air to an accuracy of ± 75 parts per million by volume; and~~

~~2. Use the colorimetric detector tube according to the manufacturer's instructions; and~~

~~3. Conduct the weekly monitoring by inserting the colorimetric detector tube into the open space above the articles at the rear of the dry cleaning machine drum immediately upon opening the dry cleaning machine door.~~

~~(d) When calculating yearly perchloroethylene consumption for the purpose of demonstrating applicability according to 1200-3-31-.13(1), the owner or operator shall perform the following calculation on the first day of every month:~~

~~1. Sum the volume of all perchloroethylene purchases made in each of the previous 12 months, as recorded in the log described in 1200-3-31-.13(5)(d)1.~~

~~2. If no perchloroethylene purchases were made in a given month, then the perchloroethylene consumption for that month is zero gallons.~~

~~3. The total sum calculated in Subparagraph (d) of this Paragraph is the yearly perchloroethylene consumption at the facility.~~

~~(5) Recordkeeping and reporting requirements~~

~~(a) Each owner or operator of a dry cleaning facility shall notify the Technical Secretary in writing within 270 calendar days after September 23, 1993 (i.e., June 18, 1994) and provide the following information:~~

~~1. The name and address of the owner or operator;~~

~~2. The address (that is, physical location) of the dry cleaning facility;~~

~~3. A brief description of the type of each dry cleaning machine at the dry cleaning facility;~~

~~4. Documentation as described in 1200-3-31-.13(4)(d) of the yearly perchloroethylene consumption at the dry cleaning facility for the previous year to demonstrate applicability according to 1200-3-31-.13(1); or an estimation of perchloroethylene consumption for the previous year to estimate applicability with 1200-3-31-.13(1); and~~

~~5. A description of the type of control device(s) that will be used to achieve compliance with 1200-3-31-.13(3)(a) or (b) and whether the control device(s) is currently in use or will be purchased.~~

~~6. Documentation to demonstrate to the Administrator's satisfaction that each room enclosure used to meet the requirements of 1200-3-31-.13(3)(a)3 meets the requirements of 1200-3-31-.13(3)(a)3(i) and (ii).~~

~~(b) Each owner or operator of a dry cleaning facility shall submit to the Technical Secretary by registered mail on or before the 30th day following the compliance dates specified in 1200-3-31-~~

~~.13(1)(b) or (c) or June 18, 1994, whichever is later, a notification of compliance status providing the following information and signed by a responsible official who shall certify its accuracy:~~

~~1. The yearly perchloroethylene solvent consumption limit based upon the yearly solvent consumption calculated according to 1200-3-31-.13(4)(d);~~

~~2. Whether or not they are in compliance with each applicable requirement of 1200-3-31-.13(3); and~~

~~3. All information contained in the statement is accurate and true.~~

~~(c) Each owner or operator of an area source dry cleaning facility that exceeds the solvent consumption limit reported in Subparagraph (b) of this paragraph shall submit to the Technical Secretary on or before the dates specified in 1200-3-31-.13(1)(f) or (i), a notification of compliance status providing the following information and signed by a responsible official who shall certify its accuracy:~~

~~1. The new yearly perchloroethylene solvent consumption limit based upon the yearly solvent consumption calculated according to 1200-3-31-.13(4)(d);~~

~~2. Whether or not they are in compliance with each applicable requirement of 1200-3-31-.13(3); and~~

~~3. All information contained in the statement is accurate and true.~~

~~(d) Each owner or operator of a dry cleaning facility shall keep receipts of perchloroethylene purchases and a log of the following information and maintain such information on site and show it upon request for a period of 5 years:~~

~~1. The volume of perchloroethylene purchased each month by the dry cleaning facility as recorded from perchloroethylene purchases; if no perchloroethylene is purchased during a given month then the owner or operator would enter zero gallons into the log;~~

~~2. The calculation and result of the yearly perchloroethylene consumption determined on the first day of each month as specified in 1200-3-31-.13(4)(d);~~

~~3. The dates when the dry cleaning system components are inspected for perceptible leaks, as specified in 1200-3-31-.13(3)(k) or (l), and the name or location of dry cleaning system components where perceptible leaks are detected;~~

~~4. The dates of repair and records of written or verbal orders for repair parts to demonstrate compliance with 1200-3-31-.13(3)(m) and (n);~~

~~5. The date and temperature sensor monitoring results, as specified in 1200-3-31-.13(4) if a refrigerated condenser is used to comply with 1200-3-31-.13(3)(a) or (b); and~~

~~6. The date and colorimetric detector tube monitoring results, as specified in 1200-3-31-.13(4), if a carbon adsorber is used to comply with 1200-3-31-.13(3)(a)2 or (b)3.~~

~~(e) Each owner or operator of a dry cleaning facility shall retain onsite a copy of the design specifications and the operating manuals for each dry cleaning system and each emission control device located at the dry cleaning facility.~~

~~(6) Determination of equivalent emission control technology~~

~~(a) Any person requesting that the use of certain equipment or procedures be considered equivalent to the requirements under 1200-3-31-.13(3) shall collect, verify, and submit to the Technical Secretary and Administrator the following information to show that the alternative achieves equivalent emission reductions:~~

~~1. Diagrams, as appropriate, illustrating the emission control technology, its operation and integration into or function with dry-to-dry machine(s) or transfer machine system(s) and their ancillary equipment during each portion of the normal dry cleaning cycle;~~

~~2. Information quantifying vented perchloroethylene emissions from the dry-to-dry machine(s) or transfer machine system(s) during each portion of the dry cleaning cycle with and without the use of the candidate emission control technology;~~

~~3. Information on solvent mileage achieved with and without the candidate emission control technology. Solvent mileage is the average weight of articles cleaned per volume of perchloroethylene used. Solvent mileage data must be of continuous duration for at least 1 year under the conditions of a typical dry cleaning operation. This information on solvent mileage must be accompanied by information on the design, configuration, operation, and maintenance of the specific dry cleaning system from which the solvent mileage information was obtained;~~

~~4. Identification of maintenance requirements and parameters to monitor to ensure proper operation and maintenance of the candidate emission control technology;~~

~~5. Explanation of why this information is considered accurate and representative of both the short-term and the long-term performance of the candidate emission control technology on the specific dry cleaning system examined;~~

~~6. Explanation of why this information can or cannot be extrapolated to dry cleaning systems other than the specific system(s) examined; and~~

~~7. Information on the cross-media impacts (to water and solid waste) of the candidate emission control technology and demonstration that the cross-media impacts are less than or equal to the cross-media impacts of a refrigerated condenser.~~

~~(b) For the purpose of determining equivalency to control equipment required under 1200-3-31-.13(3), the Technical Secretary and the Administrator will evaluate the petition to determine whether equivalent control of perchloroethylene emissions has been adequately demonstrated.~~

~~(c) Where the Technical Secretary and the Administrator determine that certain equipment and procedures may be equivalent, the Administrator will publish a notice in the Federal Register proposing to consider this equipment or these procedures as equivalent. After notice and opportunity for public hearing, the Administrator will publish the final determination of equivalency in the Federal Register.~~

Authority: T.C.A. §§ 68-201-101 et seq. and 4-5-201 et seq.

TN Department of Environment & Conservation

Small Business Environmental Assistance Program

Offering free, confidential environmental assistance for small businesses in Tennessee

Who are we?

John LeCroy

- Regional Director of External Affairs
- Manager of SBEAP
- Located in Knoxville

Donovan Grimwood

- Small Business Environmental Ombudsman
- Provides technical assistance
- Located in Nashville

Crystal Warren

- Outreach and education
- Provides technical assistance
- Located in Memphis

Why do we exist?

- Clean Air Act Amended of 1990
  - Section 507
  - Mandates the establishment of a small business stationary source technical and environmental compliance assistance program.
  - Outlines the role of the Small Business Environmental Ombudsman
  - Provides for the creation of a Compliance Advisory Panel (CAP)

- APC 1200-03-26-.02(1)(c)8.
  - Provides direct and indirect support for SBEAP.

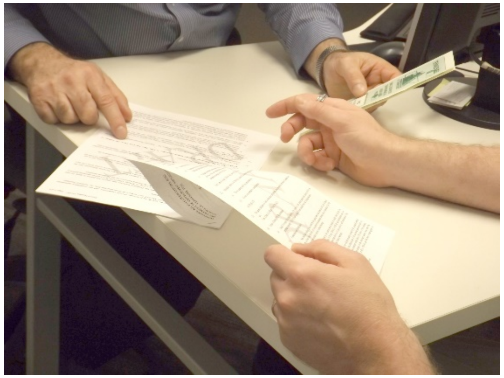
How do we define a small business?

- The Clean Air Act Amended 1990 Section 507 defines a small business as:
  - 100 or fewer employees
  - Not a major stationary source
  - Does not emit 50 tons or more per year of a regulated pollutant
  - Emits less than 75 tons per year of all regulated pollutants
- TN has further included
  - Is not a Large Quantity Generator of hazardous waste

Why are small businesses important?

- 2020 Small Business Administration data
  - 620,125 small businesses in TN (business size 1-500 employees)
  - Represent 99.5% of all employers
  - Employ 42.1% of the workforce
- Economic and Community Development
  - 142,428 small businesses (business size 1-100 employees)
  - 470,330 non-employer firms (such as independent contractors)
  - 53.3% of private sector working population
- August 2021 Data Axel database search
  - Rough estimate of 261,029 small businesses with potential environmental issues or questions
  - 175,722 with 1-4 employees
  - 5,292 different industrial categories

How do we help small businesses?



- Assistance is **FREE**
  - There is no charge for asking for help.
  - Everyone needs help sometimes
- Assistance is **CONFIDENTIAL**
  - No information is shared with regulatory agencies, unless the client gives SBEAP permission.
- Direct technical assistance
  - SBEAP consultants provide **technical assistance** on any environmental question a small business may have.
  - Includes assistance with:
    - Permit applications
    - Understanding permits and rules
    - Understanding recordkeeping or reporting requirements
    - General environmental questions
    - Navigating State government

How does this help the regulatory divisions?

- Allows for direct answers to small business questions
  - Promotes greater understanding and less confusion of requirements
  - Facilitates more complete and accurate permit applications
  - Teaches more accurate records and reporting
  - Provides APC better understanding of activities at a business
  - Fosters relationships with small businesses which makes them more willing to ask for help to be in compliance rather than wait until enforcement
  - Encourages getting into and maintaining compliance rather than a revolving door of enforcement

2020 SBEAP Statistics & Collaboration

- Directly assisted
  - 216 assistance requests
  - 96 categories of businesses
  - 152 assistances as of July 2021

- **Most common industry groups:**
  - GDF: 16
  - State Government (internal and external to TN): 14
  - Consultants: 13
  - Small Scale Meat Processing: 8
  - Citizen: 7
  - Agribusiness (includes Small Scale Meat Processing): 39

2020 Industry Types Assisted

- Abrasive Blasting
- Adhesive manufacturing
- Aerospace
- Agriculture
- Anti-Bacterial
- Asphalt
- Association
- Athletic Equipment Manufacturing
- Auto body painting
- Auto Parts
- Biocharr
- Boating
- Car Wash
- Carbon Fiber Recycling
- CBD retail
- Citizen

- Cleaning
- Clothing consignment
- Clothing printing
- Coffee roasting
- Commercial Building
- Compostable manufacturing
- Compounding manufacturer
- Construction
- Construction Materials
- Consultant
- Cosmetics Manufacturing
- Distillery
- Dry Cleaner
- Excavating
- Feed supply
- Fiber extrusion

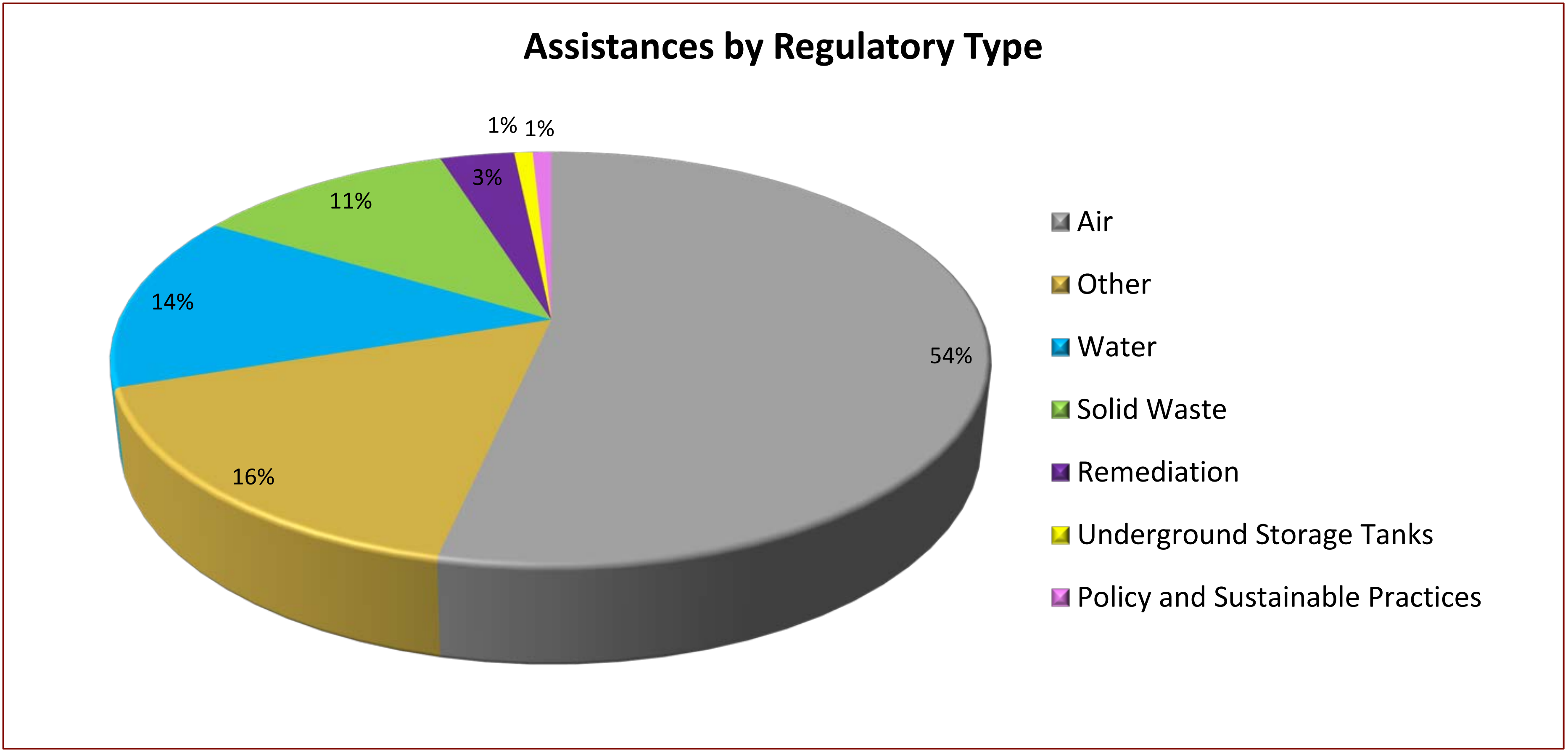
- Foam Fabrication
- Furniture Manufacturing
- Garden Center
- GDF
- Hand Sanitizer
- Hardwood Manufacturing
- Hemp processing
- Historical grants
- House cleaning
- Individual
- Indoor skydiving
- Instructor
- Livestock
- Local Government
- Machinery mfg
- Manufacturing

- Metal Fabrication
- Mobile Car Detailing
- Mobile Food Truck
- Mold Remediation
- Mulch
- NGO
- Nuclear Fuel
- Other State SBEAP
- Packaging
- Paint manufacturing
- Painting Contractor
- Manufacturing
- Metal Fabrication
- Pallet manufacturing
- Pesticide distribution
- Pet Crematory

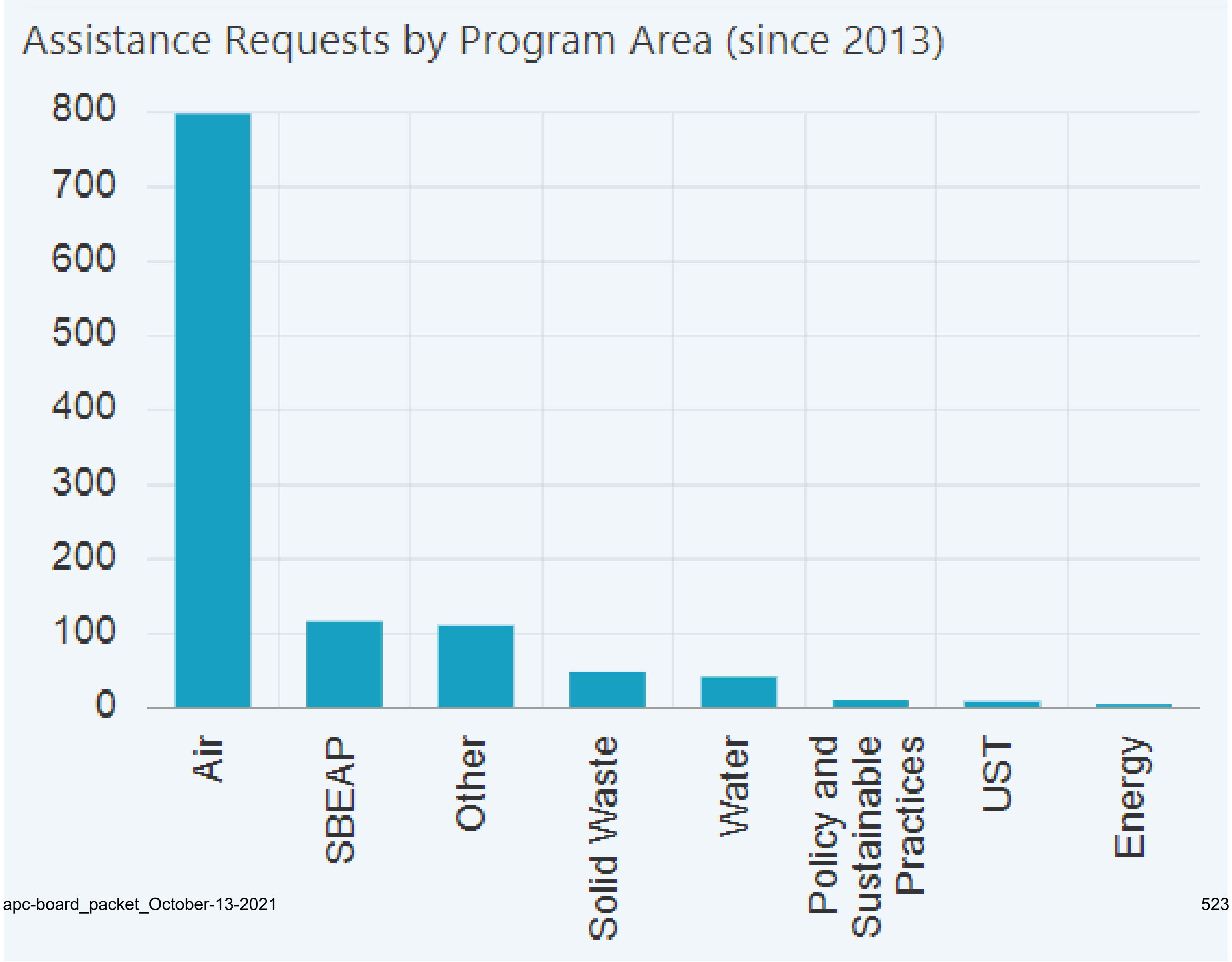
- Pigment Manufacturing
- Plastic manufacturer
- Poultry
- Powdered Metals
- Pressure Washing
- Printing
- Propane distribution
- Quarry
- Ready-Mix Concrete
- Real Estate
- Recycling
- Reinforced Plastic Composites
- Remediation
- Residential
- Rock Crushing
- Sawmill

- Scrap Metal
- Shampoo Manufacturing
- Sidewalk installer
- Small Scale Meat Processing
- Smoke shop
- State Government
- Sterilization
- Supplier
- Surface Coating
- Textile Manufacturer
- Tile Manufacturer
- Tire shop
- Trailer Manufacturing
- Transportation
- Used Car
- Warehouse

SBEAP 2020 Statistics



SBEAP Historical Statistics



How else do we support Air Pollution Control?

- SBEAP worked with APC on the Ready-Mix Concrete Batch Plant General Permit
- SBEAP took lead on research to determine if human crematories could more easily be determined as insignificant sources of air emissions.
- 2020 saw the launch of the SBEAP Agribusiness section
  - This is currently the most visited section of the SBEAP website.
  - Guidance on CBD extraction and Small-Scale Meat Processing were developed. States such as Oregon have requested permission to use our information.
- Through the National Steering Committee of the SBEAPs, helped develop comments on EPA's Other Solid Waste Incinerator rules.
- Worked with APC, OGC, and OPSP for comments on adding n-Propyl Bromide to EPA HAP list.

What our clients say

- “Our business is very fortunate to have remained open and strong. We appreciate your timely response. Your group is always a great resource”
- “This is really great! You have helped us out significantly! We want to not only be compliant with the state and federal regulations, but provide an environment for our employees that is safe for their short term and long term health and wellbeing…You are doing small companies in this state a great service.“
- “We want to thank you so very very very much for all of your help on this. Without you, I do not know what we would have done.”

Connecting to others

- Cross Departmental collaboration:
  - Dept. of Agriculture
  - Economic and Community Development
- Connect with associations and external stakeholders
  - Compliance Advisory Panel
  - Participate in conferences such as TEC, CRMA, Green Expo
  - Offer to participate in workshops and training opportunities
- National Steering Committee of SBEAPs
  - Donovan is Vice-Chair of the NSC and co-Chair of the Technical Subcommittee
  - Crystal is alternative Representative for Region IV to the NSC
  - Participate in Promotional and Website subcommittees and newly formed Environmental Justice work group

SBEAP Technical Assistance provides Regulation Education by

Workshops

Website

Site visits

Direct contact

Upcoming Outreach Events

CRMA
CHATTANOOGA
REGIONAL MANUFACTURERS ASSOCIATION

- Environmental Health and Safety Summit in November

TN
EC
TENNESSEE
ENVIRONMENTAL
CONFERENCE

- TN Environmental Conference in October

How to get in touch with the SBEAP

www.tn.gov/sbeap

800-734-3619

BGSBEAP@tn.gov

TN Small Biz Buzz

@TNSmallBizBuzz