October 15, 2021

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Comments submitted via email to: daq.publiccomments@ncdenr.gov

Re: Conservation Organizations Comments on North Carolina's Proposed Regional Haze State Implementation Plan (SIP) for North Carolina Class I Areas for the Second Planning Period (2019 - 2028)

Dear Mr. Strait:

The National Parks Conservation Association, Sierra Club, Southern Environmental Law Center, CleanAIRE NC, Coalition to Protect America's National Parks, and NC League of Conservation Voters, Appalachian Voices, Alliance to Protect our People and the Places We Live, NAACP Stokes County Branch, Center for Biological Diversity, Environment North Carolina and North Carolina Conservation Network ("Conservation Organizations") submit the following and attached comments regarding the North Carolina Department of Environmental Quality, Division of Air Quality's (DAQ), Proposed Regional Haze State Implementation Plan (SIP) for North Carolina Class I Areas for the Second Planning Period (2019 - 2028).

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

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

The **Coalition to Protect America's National Parks** ("Coalition") is a non-profit organization composed of over 1,900 retired, former and current employees of the National Park Service ("NPS"). The Coalition studies, speaks, and acts for the preservation of America's National Park System. As a group, we collectively represent over 40,000 years of experience managing and protecting America's most precious and important natural, cultural, and historic resources.

CleanAIRE NC (Action and Innovation to Restore the Environment North Carolina [CANC]) is a North Carolina non-profit advocacy organization. We represent healthcare professionals, educators, scientists, and thousands of other advocates from communities across North Carolina. Together we advance solutions that address three powerful determinants of health in North Carolina: climate change, air pollution, and environmental justice. Through advocacy, education, and research, we are working to protect what connects us and ensure that all North Carolinians have access to clean air and a livable climate.

Southern Environmental Law Center is the largest nonprofit, nonpartisan environmental legal advocacy organization rooted in and focused on the South. The mission of the Southern Environmental Law Center is to protect the basic right to clean air, clean water, and a livable climate; to preserve our region's natural treasures and rich biodiversity; and to provide a healthy environment for all.

The **North Carolina League of Conservation Voters** is a pragmatic, results-oriented, nonpartisan advocacy organization whose mission is to protect the health and quality of life for all North Carolinians. We elect environmental champions, advocate for environmental policies that protect our communities, and hold elected leaders accountable for their decisions. We have worked for over 50 years to create the political environment that will protect our natural environment.

Founded in 1997, **Appalachian Voices** brings people together to protect the forests, land, air, and water of Central and Southern Appalachia and advance a just transition to a generative and equitable clean energy economy.

The **Alliance to Protect our People and the Places We Live (**APPL) is a grassroots organization working on statewide climate change and environmental justice issues, with a particular focus on eastern North Carolina.

The **Stokes County Branch of the NAACP** is a non-profit public interest organization with members who live near and experience air and water pollution from Duke Energy's Belews Creek coal-fired power plant. The NAACP is the nation's oldest and largest civil rights organization whose mission is to ensure the political, educational, social and economic equality of rights of all persons and to eliminate racial hatred and discrimination.

The **Center for Biological Diversity** works to protect endangered species and save life on Earth through science, legal action, media, and policy advocacy. The Center has won protections for more than 440 rare species and secured 230 million acres of critical habitat.

Environment North Carolina is a statewide, citizen-based environmental advocacy organization working for a cleaner, greener, healthier future.

NC Conservation Network is a state-level environmental group that advocates for a safer, healthier North Carolina. Our members and supporters across the state visit the wilderness areas and parks that the haze plan is supposed to protect, and breathe the air harmed by ongoing emissions.

As detailed below, DAQ's proposed SIP will not result in reasonable progress towards improving visibility at the Class I areas its sources impact, including those located in North Carolina: the Great Smoky Mountains National Park; Shining Rock, Linville Gorge and Joyce Kilmer-Slickrock Wilderness Areas; and Swanquarter National Wildlife Refuge as well as Class I areas in neighboring states. To satisfy the Clean Air Act ("Act") and Regional Haze Rule ("RHR") the flaws identified in these comments and in the attached technical reports by Joe Kordzi[1] and D. Howard Gebhart[2, 3] must be corrected before submittal to EPA, including:

- DAQ's technical analyses for its sources are inconsistent with the Act and RHR requirements;
- DAQ's draft SIP lacks requirements for new emission reductions during this planning period, there are no practically enforceable emission limitations and therefore the plan does not make reasonable progress;
- Despite the Act's four-factor analysis requirements, DAQ dismisses cost-effective upgrades and new controls, asserting that visibility considerations are too small to warrant them;
- DAQ fails to meaningfully consider and adapt its SIP to address the Federal Land Managers' ("FLMs") comments; and
- DAQ fails to analyze environmental justice impacts and ensure the SIP will reduce emissions and minimize harms to disproportionately affected communities.

[1] Joe Kordzi, "A Review of the North Carolina Regional Haze State Implementation Plan" (Oct. 2021). Mr. Kordzi is an independent air quality consultant and engineer with extensive experience in the regional haze program. ("Kordzi Report") (Enclosure 1)
[2] D. Howard Gebhart, "Technical Review of North Carolina Regional Haze State Implementation Plan Second Round of Regional Haze State Implementation Plans Supplemental Report" (Oct. 2021). ("Gebhart October 2021 Report") (Enclosure 2) Mr. Gebhart is an air quality meteorologist with 40 years of experience in air quality permitting, specializing in air dispersion modeling; and his CV is attached to his report.
[3] D. Howard Gebhart, "Technical Review of VISTAS Visibility Modeling for the Second Round of Regional Haze State Implementation Plans" (May 2021). ("Gebhart October 2021 Report") (Enclosure 3)

We incorporate by reference and attach the two technical reports. Additionally, we incorporate by reference and attach the testimony presented by D. Howard Gebhart and Ulla Reeves at DAQ's public hearing on October 6, 2021.[4, 5]

[4] D. Howard Gebhart, "Testimony of Howard Gebhart on Behalf of NPCA and Other Conservation Organizations" (Oct. 6, 2021) (Mr. Gebhart opened his remarks by providing a brief summary of his qualifications and expertise. He explained that he has "more than 40 years experience as an air quality professional with a specialized expertise in air quality modeling." Further, that his "comments here focus on the air quality modeling, but address general air modeling concerns like emission inputs and how the modeling results have been applied." Finally he explained that his "comments are not specific to the technical details of the CAMx model, but instead are generic concerns that are applicable to any modeling study." (Enclosure 9)

[5] Ulla Reeves, Senior Advocacy Manager in the Clean Air Program of the NPCA, "Testimony of Ulla Reeves on Behalf of NPCA" (Oct. 6, 2021). (Enclosure 10)

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I. Introduction and Background

Congress set aside national parks and wilderness areas to protect our natural heritage for generations. Our national parks and wilderness areas are iconic, treasured landscapes. These special places are designated "Class I Areas" under the CAA and as such, their air quality is entitled to the highest level of protection. To improve air quality in our most treasured landscapes, Congress passed the visibility protection provisions of the CAA in 1977, establishing "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in the mandatory class I Federal areas which impairment results from manmade air pollution."[6] "Manmade air pollution" is defined as "air pollution which results directly or indirectly from human activities."[7] In order to protect Class I Areas' "intrinsic beauty and historical and archeological treasures," the regional haze program establishes a national regulatory floor and requires states to design and implement plans to curb haze-causing emissions within their jurisdictions. Each state must submit for EPA review a SIP designed to make reasonable progress toward achieving natural visibility conditions.[8]

A regional haze SIP must provide "emissions limits, schedules of compliance and other measures as may be necessary to make reasonable progress towards meeting the national goal."[9] Two of the most critical features of a regional haze SIP are the requirements for Best Available Retrofit Technology ("BART") limits on pollutant emissions and a long-term strategy for making reasonable progress towards the national visibility goal.[10] The haze requirements in the CAA present an unparalleled opportunity to protect and restore regional air quality by curbing visibility-impairing emissions from a host of polluting facilities that harm our communities and muddy our skies.

Unfortunately, the promise of natural visibility is unfulfilled because the air across Class I Areas remains polluted by industrial sources, including the sources covered in our comments. Notably, as detailed in the Kordzi Report and summarized below, DAQ excluded from a four-factor analysis the following facilities:

- Duke Energy Carolinas, LLC, Marshall Steam Station;
- Duke Energy Carolinas, LLC, Belews Creek Steam Station;
- Duke Energy Progress, Roxboro Steam Electric Plant; and
- Duke Energy Carolinas, LLC, Cliffside Steam Station Facility.

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[6] 42 U.S.C. § 7491(a)(1).
[7] *Id.* § 7491(g)(3).
[8] *Id.* § 7491(b)(2).
[9] 40 C.F.R. § 51.308(d)(3).
[10] *Id.*

Where DAQ is relying on retirements or operation changes to justify a no control and no upgrade option, DAQ should make those changes enforceable as SIP measures. To the extent that a state declines to evaluate additional pollution controls for any source based on that source's planned retirement or decline in utilization, it must incorporate those operating parameters or assumptions as enforceable limitations in the second planning period SIP. The Clean Air Act requires that "[e]ach state implementation plan . . . *shall*" include "enforceable limitations and other control measures" as necessary to "meet the applicable requirements" of the Act.[11] The Regional Haze Rule similarly requires each state to include "enforceable emission limitations" as necessary to ensure reasonable progress toward the national visibility goal.[12] Moreover, where a source plans to permanently cease operations or projects that future operating parameters (*e.g.*, limited hours of operation or capacity utilization) will differ from past practice, and if this projection affects whether additional pollution controls are cost-effective or necessary to ensure reasonable progress, then the state "must" make those parameters or assumptions into enforceable limitations.[13]

Our comments and the Kordzi Report further identify issues with DAQ's proposed four-factor analysis for the following sources:

- Blue Ridge Canton Mill;
- Domtar Plymouth Mill; and
- PCS Phosphate Aurora Plant.

Finally, given the impacts to North Carolina's Class I areas from sources in Ohio and Pennsylvania, DAQ should have engaged with Ohio and Pennsylvania requesting that the states evaluate and mitigate emissions from the:

- Cardinal and Kyger Creek coal-fired power plants in Ohio; and
- Seward coal-fired power plant in Pennsylvania.[14]

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

II. Requirements for Periodic Comprehensive Revisions for Regional Haze SIPs

In developing its long-term strategy, a state must consider its anthropogenic sources of visibility impairment and evaluate different emission reduction strategies including and beyond those prescribed by the

[11] 42 U.S.C. § 7410(a)(2)(A).
[12] *See generally* 40 C.F.R. § 51.308(d)(3).
[13] *See* 40 C.F.R. pt. 51, App. Y § (IV)D.4.d.2.
[14] North Carolina did not engage Ohio or Pennsylvania. Proposed SIP, Appendix F-1.

BART provisions.[15] A state should consider "major and minor stationary sources, mobile sources and area sources."[16] At a minimum, a state must consider the following factors in developing its long-term strategy:

> (A) Emission reductions due to ongoing air pollution control programs, including measures to address reasonably attributable visibility impairment;
> (B) Measures to mitigate the impacts of construction activities;
> (C) Emissions limitations and schedules for compliance to achieve the reasonable progress goal;
> (D) Source retirement and replacement schedules;
> (E) Smoke management techniques for agriculture and forestry management purposes including plans as currently exist within the State for these purposes;
> (F) Enforceability of emission limitations and control measures; and
> (G) The anticipated net effect on visibility due to projected changes in point, area, and mobile emissions over the period addressed by the long-term strategy.[17]

Additionally, a state:

> Must include in its implementation plan a description of the criteria it used to determine which sources or groups of sources it evaluated and how the four factors were taken into consideration in selecting the measures for inclusion in its long-term strategy.[18]

In developing its plan, the state must document the technical basis for the SIP, including monitoring data, modeling, and emission information, including the baseline emission inventory upon which its strategies are based.[19] All of this information is part of a state's revised SIP and subject to public notice and comment. A state's reasonable progress analysis must consider the four factors identified in the CAA and regulations. *See* CAA 169A(g)(1); 40 C.F.R. § 51.308(f)(2)(i) ("the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected anthropogenic source of visibility impairment.")

EPA's 2017 RHR Amendments made clear that states are to first conduct the required four-factor analysis for selected sources, and then use the results from its four-factor analyses and determinations to develop the reasonable progress goals.[20] Specifically, EPA explained in its final notice that it proposed, took and responded to comments and amended 40 C.F.R. § 51.308(f) to eliminate the cross-reference to 40 C.F.R. §51.308(d) to "codify …[its] long-standing interpretation of the way in which the existing regulations were intended to operate" to track "the actual [SIP] planning sequence" as follows, thus, states are required to:

- [C]alculate baseline, current and natural visibility conditions, progress to date and the [Uniform Rate of Progress] URP;
- [D]evelop a long-term strategy for addressing regional haze by evaluating the four factors to determine what emission limits and other measures are necessary to make reasonable progress;

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[15] 40 C.F.R. § 51.308(f).
[16] *Id.* § 51.308(f)(2)(i).
[17] *Id.* § 51.308(f)(2)(iv).
[18] 40 C.F.R. § 51.308(f)(2)(i).
[19] 40 C.F.R. § 51.308(f)(2)(i).
[20] 82 Fed. Reg. 3078, 3090-1 (Jan. 10, 2017).

- [C]onduct regional-scale modeling of projected future emissions under the long-term strategies to establish RPGs and then compare those goals to the URP line; and
- [A]dopt a monitoring strategy and other measures to track future progress and ensure compliance.[21]

Moreover, in promulgating the RHR EPA stated that:

> The CAA requires states to determine what emission limitations, compliance schedules and other measures are necessary to make reasonable progress by considering the four factors. The CAA does not provide that states may then reject some control measures already determined to be reasonable if, in the aggregate, the controls are projected to result in too much or too little progress. Rather, the rate of progress that will be achieved by the emission reductions resulting from all reasonable control measures is, by definition, a reasonable rate of progress. … [I]f a state has reasonably selected a set of sources for analysis and has reasonably considered the four factors in determining what additional control measures are necessary to make reasonable progress, then the state's analytical obligations are complete if the resulting RPG for the most impaired days is below the URP line. *The URP is not a safe harbor*, however, and states may not subsequently reject control measures that they have already determined are reasonable.[22]

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

The state's SIP revisions must also meet certain procedural and consultation requirements.[23] The state must consult with the FLMs and look to the FLMs' expertise of the lands and knowledge of the way pollution harms them to guide the state to ensure SIPs do what they must to help restore natural skies.[24] The rule also requires that in "developing any implementation plan (or plan revision) or progress report, the State must include a description of how it addressed any comments provided by the Federal Land Managers."[25]

In May 2020, NPCA shared the petition it submitted to the previous EPA Administrator – which sought reconsideration of the 2019 RH guidance[26] – alongside a cover letter to North Carolina.[27] In addition to NPCA, Sierra Club, Natural Resources Defense Council, Western Environmental Law Center, Appalachian Mountain

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[21] *Id.* at 3091.
[22] *See*, 82 Fed. Reg. 3078, 3093 (Jan. 10, 2017) (emphasis added).
[23] For example, in addition to the RHR requirements, states must also follow the SIP processing requirements in 40 C.F.R. §§ 51.104, 51.102.
[24] 40 C.F.R. § 51.308(i).
[25] *Id.* § 51.308(i)(3).
[26] EPA issued the 2019 Final Guidance on August 20, 2019 via Memorandum from Peter Tsirigotis, Director at EPA Office of Air Quality Planning and Standards to EPA Air Division Directors. Guidance on Regional Haze State Implementation Plans for the Second Implementation Period, EPA-457/B-19-003 (Aug. 2019), https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf. ("EPA 2019 RH Guidance")
[27] "Petition for Reconsideration of Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," submitted by National Parks Conservation Association, Sierra Club, Natural Resources Defense Council, Coalition to Protect America's National Parks, Appalachian Mountain Club, Western Environmental Law Center and Earthjustice, to former EPA Administrator Andrew Wheeler (May 8, 2020). ("Conservation Organizations Petition"). (Enclosure 4)

Club, Coalition to Protect America's National Parks, and Earthjustice, signed the petition for reconsideration. As of the date of this comment letter, EPA has not responded to the Petition. Until EPA withdraws the illegal approaches in the 2019 guidance, we trust states will not follow those approaches, instead adhering closely to the regulation itself and working to achieve reasonable progress toward the CAA goal of Class I visibility restored to natural conditions.[28]

On July 9, 2021, EPA issued a memorandum titled, "Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period."[29] EPA's July 2021 Memo provides important information regarding development of SIPs for all states for the regional haze second planning period in response to questions and information EPA is receiving from states and stakeholders and clarifies and provides information on existing statutory and regulatory requirements.[30] Because EPA's Memo is directly relevant to—and in some cases, confirms—numerous flaws in the DAQ's proposed SIP, as explained below and in the attached technical reports, we urge DAQ to reevaluate its proposed SIP. We strongly encourage DAQ to take the time necessary to carefully review and consider all the information in EPA's July 2021Memo and develop supporting information and make necessary adjustments to its proposed SIP.

Finally, the duty to ensure reasonable progress requirements are met for purposes of the SIP rests with the state. While a state may request information and analysis from its sources, and importantly collaborate with its regional planning organization throughout the haze planning process, the state is ultimately accountable for preparing, adopting, and submitting a compliant SIP to EPA. Further, North Carolina's SIP must be supported by a reasoned analysis that includes and cites to the technical support documentation it proposes to rely on and use as part of its SIP revision.[31]

III. DAQ's Source Selection Methodology is Flawed

DAQ's source selection methodology screens out nearly all sources of visibility-impairing pollution from consideration. EPA's July 2021 Memo made clear that DAQ's source selection methodology is flawed and cannot be approved by EPA. EPA made clear that States must secure additional emission reductions that build on progress already achieved; there is an expectation that reductions add to ongoing and upcoming reductions under other CAA programs.[32] In evaluating sources for emission reductions, EPA emphasized that:

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[28] The Petition explained that, as issued, the Final Guidance conflicts with this statutory objective, previous rulemaking and guidance; misdirects states as to how they can go about complying with their legal obligations to make reasonable progress towards restoring natural visibility to protected public lands; and otherwise fails to set expectations that comport with legal requirements for the second planning period. Further, we petitioned the prior Administrator to replace it with guidance that comports with the CAA and the RHR, 42 U.S.C. §§ 7491, 7492; 82 Fed. Reg. 3078 (Jan. 10, 2017); 71 Fed. Reg. 60,612 (Oct. 13, 2006); 70 Fed. Reg. 39,104 (July 6, 2005); 64 Fed. Reg. 35,714 (July 1, 1999), and aids states in making progress towards achieving the national goal of natural visibility conditions at all Class I Areas. Conservation Organizations Petition at 1-2. The Petition includes a detailed analysis of the issues. As of the date of this comment letter, EPA has not responded to our Petition.

[29] EPA Memorandum from Peter Tsirigotis, Director, Office of Air Quality Planning and Standards, to Regional Air Division Directors, "Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period," (July 9, 2021) ("EPA July 2021 Memo"), https://www.epa.gov/visibility/clarifications-regarding-regional-haze-state-implementation-plans-second-implementation. (Enclosure 5)

[30] *Id.*

[31] *See, e.g.,* 40 C.F.R. §§ 51.100, 51.102, 51.103, 51.104, 51.105 and Appendix V to Part 51.

[32] *EPA July 2021 Memo* at 2.

> Source selection is a critical step in states' analytical processes. All subsequent determinations of what constitutes reasonable progress flow from states' initial decisions regarding the universe of pollutants and sources they will consider for the second planning period. States cannot reasonably determine that they are making reasonable progress if they have not adequately considered the contributors to visibility impairment. Thus, while states have discretion to reasonably select sources, this analysis should be designed and conducted to ensure that source selection results in a set of pollutants and sources the evaluation of which has the potential to meaningfully reduce their contributions to visibility impairment.[33]

Therefore, it is generally not reasonable to exclude from further evaluation larger sources of visibility-impairing pollution. Yet DAQ selected only three sources for a four-factor analysis and excluded all of Duke Energy's coal-fired power plants in the state. DAQ also does not appear to have requested four-factor analyses for any sources in other states.

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

As explained in the May 12, 2021, letter to the Air Division Directors of the VISTAS states, we commissioned an expert modeler to better understand the VISTAS approach and found critical problems with the VISTAS model itself as well as the approach recommended to Southeastern states.[34]

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

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

Figure 1. Summary of VISTAS II CAMx Modeling Flaws and Consequences

	Flawed Modeling Inputs and Methods	Consequences of Reliance on VISTAS Inputs By States in Preparing SIPs
1	Inaccurately reflects sulfate concentrations in the Southeast U.S.	Would excuse heavy sulfur dioxide (SO_2) polluters from review.
2	Used Electric Generating Unit (EGU) emission profiles from 2011 to project the EGUs emissions in 2028, inaccurately assuming that EGUs will operate in 2028 as they did in 2011.	Would fail to identify EGUs that must be analyzed for emission reductions because the model results do not accurately reflect the actual/most recent EGUs' contributions to visibility impairment.
3	Used outdated monitoring data that does not represent the dramatic shift in nitrate contribution to visibility impairment in	Would erroneously exclude problematic sources from review and avoid emission controls for large NO_X emitting sources

[33] *Id.* at 3.
[34] Letter from Stephanie Kodish, NPCA, Leslie Griffith, SELC, and David Rogers, Sierra Club to VISTAS State Air Directors, "Significant Flaws in VISTAS Regional Haze CAMx Modeling and Methods; Recommendations to Develop Compliant State Implementation Plans" (May 12, 2021). (Enclosure 6)

	the Southeast over the last 5-10 years. This shift was not reflected in future predictions.	because the modeling inputs failed to properly identify EGUs and other point sources with large NO_X emissions as contributing to Class I area visibility impairment.
4	Used high thresholds and unnecessary filters to select sources to analyze for emission reducing measures.	Would result in an unreasonably low number of industrial sources selected by each state for an emission control reasonable progress four-factor analysis.

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

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

- Selected only three point sources affecting Class I sites. In contrast, NPCA identified 27 major industrial facilities in North Carolina that likely degrade visibility in 24 regional Class I Areas;
- Failed to require any further emission reduction measures from the three selected facilities;
- Is allowing 45,273 tons of NO_X and 36,313 tons of SO_2 emissions from major industrial sources to continue dirtying the air in our national parks and wilderness areas and communities;[35] and
- Ignores the fact that many of these major sources are located in communities of color and where many people live below the poverty line.

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

B. DAQ Unreasonably Excluded Sources

In its proposed SIP, DAQ explains that it relied on the VISTAS approach, explaining that: "[f]or Class I areas in North Carolina, a total of 19 facilities exceeded the ≥1.00% PSAT threshold for sulfate only" but only "[t]hree of these facilities are located in North Carolina, and the NCDAQ requested four-factor analyses from those facilities for the reduction of SO_2 emissions."[36]

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

[35] Emissions data was obtained from EPA's 2017 National Emissions Inventory (NEI) and EPA's 2019 Air Markets Data Program (AMPD) for power plants.

[36] PRE-HEARING DRAFT Regional Haze State Implementation Plan for North Carolina Class I Areas (2019 – 2028 Planning Period) at v.

- DAQ fails to address important contributors to visibility impairment at North Carolina's Class I areas and as such, fails to generate "reasonable progress" toward the national goal of achieving natural visibility conditions.[37]

- DAQ must assess nitrate.[38]

- The 2028 projected emissions that DAQ relies on to rule out selecting coal-fired power plants are based on unsecured future assumptions.[39, 40] Notably, DAQ relies on projections that show reduced emissions that are not assured. If DAQ intends to keep relying on these assumptions, it needs to make them a reality by incorporating retirements or other process changes into the SIP as enforceable requirements.

- DAQ must explain its decision to base its source selection on projected 2028 emissions instead of actual emissions.[41]

- The Fractional Bias Analysis presented by North Carolina was flawed as it was predicated on the unsubstantiated assumption that the PSAT modeling results were a true and accurate representation of the existing visibility impairment at North Carolina's Class I areas.[42] Additionally, use of the fractional bias calculation approach is suspect because when comparing the model's output to observed values, DAQ did not use monitored or measured values for the observed values, and instead used the Area of Influence (AoI) values.[43] The "AoI values are not known values and are simply other predicted values…"[44]

- DAQ does not provide a reasoned basis for using a 1.00% PSAT threshold for selecting facilities.[45]

- DAQ's reply to the FLM's criticism of its source selection strategy is inadequate.[46]

C. Source DAQ Wrongly Exempted from the Four-Factor Analysis Requirement and Should Have Required Controls for NO_X and SO_2

1. Duke Energy Carolinas, LLC, Marshall Steam Station

The Marshall Steam Station is fired by coal and located on Lake Norman in Catawba County. The 2,090 MW power plant has four coal-fired units. DAQ did not examine the four coal-fired units, despite the fact that the facility emits significant visibility impairing pollution. Upon evaluation, it is apparent that emission control systems are underperforming.[47] All four units are equipped with wet scrubbers[48] and "Units 1, 2 and 4 are

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37 *Gebhart October 2021 Report* at 1-3.
38 *Kordzi Report* at 2.
39 *Id.*
40 *Gebhart October 2021 Report* at 5-6.
41 *Id.*
42 *Gebhart October 2021 Report* at 3-5
43 *Id.* at 3-6
44 *Id.* at 10.
45 *Id.* at 8.
46 *Id.*
47 *Kordzi Report* at 15.
48 *Id.*

equipped with SNCR systems and Unit 3 is equipped with a SCR system."[49] The "wet scrubber systems on all four units are operated erratically, but during 2010 – 2011 have demonstrated the ability to continuously operate well below 0.10 lbs/MMBtu."[50] While "during 2010 – 2011, the SNCR systems for Units 1, 2, and 4 appear to have previously operated at a lower NO_X level of approximately 0.20 lbs/MMBtu, with some months significantly below that level."[51] Similarly, "the SCR system for Unit 3 is operated very erratically, but has demonstrated the ability from 2010 – 2011 to consistently operate below 0.05 lbs/MMBtu."[52] Therefore, as the Kordzi Report explains:

> Thus, without any capital upgrade cost (and likely minimal operating and maintenance costs), the Marshall units are quite capable of much better NO_X and SO_2 performance. It appears the only reason they do not is that they are not required by permit condition to do so. Additional reductions may also be possible with very moderate and likely cost-effective upgrades. NC DEQ should therefore have required—and should require—that the Marshall units undergo four-factor analyses.[53]

To the extent DAQ relies on increased natural gas burning, that should be made practically enforceable in the SIP.

2. Duke Energy Carolinas, LLC, Belews Creek Steam Station

The Belews Creek Steam Station, bypassed by DAQ for a four factor analysis, is located on Belews Lake and the Dan River in Stokes County and is a 2,240 MW facility consisting of two nearly identical 1,120 MW units.[54] Both of the units have wet scrubbers and SCR systems to control pollutants.[55]

DAQ's 2028 SO_2 and NO_X emission projections from the Belews Creek Steam Station are significantly less than the facility emitted in 2020. However, DAQ fails to include any SIP emission limitations that would ensure that 2028 projections become reality. "NC DEQ should either base its projected 2028 emissions on historical data, or ensure that any significant deviations from historical data are made enforceable in the SIP."[56]

Additionally, similar to the underperformance of the wet scrubber and SCR systems at the Marshall coal-fired plant discussed above, the Belews Creek facility's emission control systems are also underperforming.[57] As explained in the Kordzi Report:

> Likely, the reason for the lax performance of these control systems is that Belews Creek's permit doesn't require better performance. Thus, very cost-effective controls are available for both units for likely just the increase in reagent, potentially better catalyst management and additional electricity for running all absorber pumps.[58]

DAQ should require a four-factor analysis for this facility, investigate these issues and require reductions at this plant.

[49] *Id.*
[50] *Id*. at 18.
[51] *Id.*
[52] *Id.*
[53] *Id.*
[54] *Id.*
[55] *Id.*
[56] *Id.* at 19.
[57] *Id.* at 19-21.
[58] *Id.* at 21.

3. Duke Energy Progress, Roxboro Steam Electric Plant

The Roxboro Steam Electric Plant is a 2,422 MW coal-fired facility located on Hyco Lake in Semora and not selected for a four factor analysis. The plant consists of four units. As explained in the Kordzi Report, the units are controlled with Electrostatic Precipitators (ESPs) and SCR systems, but share a wet scrubber and a stack.[59] Neither DAQ's projections for 2028 for NO_X nor SO_2 are based on historical data.[60] DAQ's SIP projections for 2028 must either be based on historical emission data or made enforceable in the SIP.

Finally, both the wet scrubber and SCR systems are underperforming.[61] For example, the SCR systems "all have demonstrated the ability to continuously operate at approximately 0.10 lbs/MMBtu,"[62] and "[i]t is likely all the SCR systems could operate at 0.05 lbs/MMBtu on a monthly average basis, as discussed in the review of the Cardinal facility."[63]

DAQ should require a four-factor analysis for this facility, investigate these issues and require commensurate emission reductions.

4. Duke Energy Carolinas, LLC, Cliffside Steam Station Facility

The Cliffside facility is located in Cleveland and Rutherford counties and consists of two remaining coal-fired units: 621 MW and 910 MW, both of which are fitted with wet scrubbers and SCR systems to control emissions. Neither were evaluated for reasonable progress reductions. As discussed above for the other Duke Energy plants, there is a large discrepancy between the Cliffside actual historical emissions and DAQ's projected 2028 emissions.[64] DAQ's SIP projections for 2028 must either be based on historical emission data or made enforceable in the SIP.[65]

Given the addition of natural gas to the station for both units, there is likely considerable room for emission reductions.[66] Moreover, both units have demonstrated the capacity to control SO_2 and NO_X below present levels.[67] Therefore, despite emission increases at one of the units, which is likely because the permit does not require better performance, cost-effective controls are likely available for these units.[68]

DAQ should require a four-factor analysis for this facility, investigate these issues and require emission reductions at these units.

In recent years, the Cliffside, Marshall, and Belews Creek plants have been permitted to co-fire coal and natural gas in varying amounts. However, none of these plants are required to burn any minimum amount of natural gas. If DAQ ruled out four-factor analysis for these plants based on assumptions that they will increasingly burn natural gas instead of coal by 2028, those assumptions need to be made into enforceable requirements in the SIP.

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[59] *Id.*
[60] *Id.* at 22.
[61] *Id.* at 22-24.
[62] *Id.* at 24.
[63] *Id.*
[64] *Id*. 24-25.
[65] *Id.*
[66] *Id*. at 26.
[67] *Id.*
[68] *Id.*

IV. DAQ's Reliance on the "Glide Path" Violates the Clean Air Act and Regional Haze Rule

DAQ attempts to justify deferring any further emission reductions for every major source in the state by pointing out that Class I areas appear to be trending below these area's glide path or URP, which DAQ suggests is sufficient to achieve reasonable progress.[69] EPA has made clear, however, that meeting or exceeding the URP does *no*t obviate the need for states to conduct a robust analysis and making a technical demonstration that additional controls or emission reductions are not reasonable. "[A]n evaluation of the four statutory factors is required . . . regardless of the Class I area's position on the glidepath . . . . the URP does not establish a 'safe harbor' for the state in setting its progress goals."[70] Rather, states must "determine what emission limitations, compliance schedules and other measures are necessary to make reasonable progress by considering the four factors" and must not reject "control measures determined to be reasonable" based on the degree of progress.[71] Indeed, in its July 8, 2021 Memo, EPA reiterated that the uniform rate of progress is "not a safe harbor," and that it is not appropriate to reject cost-effective emission reductions on the basis that visibility in a particular Class I area is on the glide path. Instead, states are required to "evaluate and determine emission reduction measures that are necessary to make reasonable progress *by considering the four statutory factors*."[72] Here, DAQ's decision to defer reasonable and cost-effective controls to another planning period, simply because Class I areas are on the glidepath, is contrary to the Clean Air Act and the Regional Haze Rule.

DAQ's "glide path" rationale is also misplaced because the agency failed to evaluate the Clean Air Act's reasonable progress factors in determining whether emission reductions may be necessary to ensure reasonable progress towards natural visibility in each Class I area that North Carolina sources affect, as required by the Regional Haze Rule.[73] Indeed, the Regional Haze Rule explicitly requires North Carolina to make meaningful reductions to ensure reasonable progress towards the national goal of restoring visibility. In so doing, North Carolina 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 were taken into consideration. As discussed above, the Kordzi Report considers each of the sources with the greatest impacts at the Class I areas, and concludes that there are cost-effective control measures available, or at a minimum, that those facilities should have their emissions limits tightened to ensure current levels do not rise.

V. DAQ Improperly Refuses to Require Emission Reductions Based on Purported Emission Reductions from Existing Clean Air Act Programs.

DAQ relies heavily on the continued implementation of various air quality rules and programs to ensure reasonable progress.[74] DAQ's reliance on existing air quality programs is misplaced. First, as discussed above

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[69] *See, e.g*., Proposed SIP at 231.

[70] 81 Fed. Reg. 66,331, 66,631 (Sept. 27, 2016); *see also* 81 Fed. Reg. 296, 326 (Jan. 5, 2016) (determining, as part of the reasonable progress federal implementation plan for Texas, "the uniform rate of progress is not a 'safe harbor' under the Regional Haze Rule."); EPA, Responses to Comments at 120, Promulgation of Air Quality Implementation Plans; State of Texas; Regional Haze and Interstate Visibility Transport Federal Implementation Plan: Best Available Retrofit Technology and Interstate Transport Provisions, EPA Docket No. EPA-R06-OAR-2016-6011 (June 2020) ("EPA has repeatedly and consistently taken the position that meeting a specific reasonable progress goal is not, itself, a "safe harbor," and does not relieve the state of the obligation to consider additional measures for reasonable progress. If it is reasonable to make more progress than the URP, a state must do so, as EPA explained in the 1999 regional haze rule) (citing 64 Fed. Reg. at 35732); *see also* 81 Fed. Reg. at 66,370 ("EPA's longstanding interpretation of the regional haze rule is that 'the URP does not establish a 'safe harbor' for the state in setting its progress goals.") (quoting 79 Fed. Reg. 74818, 74834)).

[71] 82 Fed. Reg. at 3093; see also 81 Fed. Reg. at 66,631.

[72] *EPA July 2021 Memo* at 15-16 (emphasis added).

[73] *See* 40 C.F.R. § 51.308(f)(2) ("Each State must submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I Federal area within the State *and for each mandatory Class I Federal area located outside the State that may be affected by emissions from the State*.") (emphasis added); *id*. § 51.308(f)(3)(ii)(A)-(B).

[74] *See, e.g*., Proposed SIP at 231.

and in the attached Kordzi Report, there are cost-effective pollution control measures that are readily achievable for many of North Carolina's sources. In fact, several of the sources are already capable of achieving on a continuous basis better emission rates than they are currently displaying. Second, reasonable progress requires that states consider the four statutory factors and adopt and include in their SIPs enforceable emission limitations to achieve reasonable progress toward the elimination of all anthropogenic pollution in Class I areas. This means that states must secure meaningful emission reductions that build on progress already achieved. There is an expectation that reductions are additive to ongoing and upcoming reductions under other CAA programs. Indeed, as EPA's July 2021 Memo makes clear:

> [A] state should generally not reject cost-effective and otherwise reasonable controls merely because there have been emission reductions since the first planning period owing to other ongoing air pollution control programs or merely because visibility is otherwise projected to improve at Class I areas. More broadly, we do not think a state should rely on these two additional factors to summarily assert that the state has already made sufficient progress and, therefore, no sources need to be selected or no new controls are needed regardless of the outcome of four-factor analyses.[75]

VI. DAQ Must Reconsider and Adapt Its SIP to Address Comments from the FLMs

The RHR and the CAA require that states consult with the FLMs that manage the Class I Areas impacted by a state's sources.[76] Because the FLMs' role is to manage their resources – including air quality – DAQ should meaningfully consider and adapt its SIP measures to address comments and suggestions from the FLMs.

DAQ has neither fully considered nor adapted its proposed SIP to reflect concerns raised and information received during FLM consultation. Representations at public meetings with stakeholders that the FLMs are satisfied with the DAQ's proposed SIP are contrary to the comments the NPS and Forest Service ("USFS" provided to the State.[77] The DAQ should reconsider the NPS and USFS comments and make changes to resolve the serious concerns these agencies raised. For example the NPS consultation explained that:

- "[S]ignificant additional progress is necessary before the ultimate visibility goal of no human caused visibility impairment is realized at Great Smoky Mountains NP. It is with this in mind that we provided SIP review feedback during our consultation call, summarized here.[78]
- The NPS Air Resource Division's May 17, 2021, email to DAQ "outlined several concerns with the VISTAS and North Carolina analysis methods/approaches and outcomes in this round of SIP development. Our primary concerns relevant to the North Carolina draft SIP are the exclusion of NO_X from reasonable progress four-factor analyses and the screening thresholds used for source selection."[79]

Regarding DAQ's proposed SIP approach to exclude NO_X emissions, the NPS explained that:

> 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

[75] *EPA July 2021 Memo* at 13.
[76] 40 C.F.R. § 51.308(i)(2).
[77] *E.g.*, DAQ Remarks at the public hearing on October 6, 2021.
[78] Proposed SIP, Appendix H1-H3 at pdf 64, Cover email from Melanie Peters, NPS, to Randy Strait, DAQ (June 4, 2021)
[79] *Id.*

decline and the seasonality of most-impaired days shifts, NO_X emissions are increasingly important for many VISTAS Class I areas.[80]

NPS took issue with DAQ's modeling approach, explaining that:

> The North Carolina rationale for excluding NO_X emissions from reasonable progress four-factor analyses is based on an outdated modeling base year (2011) and associated inaccurate assumptions about the current and future distribution of most-impaired days in the modeling assessment. We recognize that the modeling methods follow EPA guidance and are technically correct, however the result is not representative of current conditions. The importance of ammonium nitrate and the distribution of most-impaired days has changed significantly since the 2011 base year. In 2011, ammonium sulfate-dominated extinction on the 20% most-impaired days which occurred mostly during the warmer, summer months. Currently, ammonium nitrate extinction which is highest during the cooler months of the year is now included among the 20% most-impaired days. As a result, 2028 projections based on the 2011 most-impaired days miss the importance of ammonium nitrate extinction. This is supported by the past five-years of IMPROVE monitoring data.[81]

The NPS' detailed recommendations for the errors in the draft SIP explain that:

> The NPS recommends that North Carolina acknowledge more recent monitoring data in their source selection process and consider NO_X emission reduction opportunities as relevant to addressing 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 North Carolina that could be addressed under the regional haze program.[82]

The NPS also expressed serious concerns regarding DAQ's source selection methodology, putting the VISTAS states on notice in April 2020: this concern "stems from the screening thresholds used that resulted in the selection of very few sources for analysis and offers less protection for the more-impacted Class I areas."[83] The metric used by North Carolina, which relied on the VISTAS approach "used a two-part screening process. Both steps used an individual-facility-percent-of-total-impact screening metric. This type of metric biases the results against the more-visually-impacted Class I areas."[84] The NPS explains that:

> *[S]ource impacts would have to be 80 times larger to identify a source for analysis* in the most-visually-impaired VISTAS Class I area compared to the least-visually-impaired Class I area.[85]

NPS concludes by noting that its evaluation indicates that NOx controls at Blue Ridge Paper Products and the Duke Energy sources could be improved. It advised "that North Carolina undertake or require full four-factor analysis on the six identified facilities to assess the NO_X control opportunities available in this planning period

[80] *Id.*
[81] *Id.* at 64-65.
[82] *Id.* at 65.
[83] *Id.* at 66.
[84] *Id.*
[85] *Id.* (emphasis added)

… including the "35–39% NO_X emission control efficiency achieved by the existing SNCR at Duke Energy Marshall Steam Station units 1, 2, and 4."[86]

Concerns expressed by the USFS echo those from the NPS. In particular, the USFS requested that "NC DAQ consider evaluating NO_X sources, along with SO_2 sources, for reasonable progress during this planning period."[87]

DAQ did not meaningfully consider the FLM comments, instead DAQ's responses summarizes the process it followed, ignored many of the FLM comments, and provided responses that fail to take into consideration the requirements of the Act, regional haze rule and EPA's direction to states.[88] For example, DAQ's:

- Suggestion that further research is needed to understand the factors contributing to the nitrate fraction at the Class I areas (*e.g*., emission sources, weather, and meteorology),[89] is unavailing.[90] DAQ's responses as to why it ignored NO_X are also inconsistent with EPA's direction.[91]
- Response to the FLM's that its source selection process is consistent with EPA's direction is misplaced. DAQ erroneously suggests EPA's direction to states allows it to rely on its progress to date as an offramp.[92] As discussed in Section IV. these comments, there is no "offramp" to the reasonable progress four-factor analysis requirement. Moreover, DAQ's response to the FLMs failed to consider and apply EPA's July 2021 Memo.[93]
- Assertion that its source selection process was "superior to the Q/d approach" is simply wrong.[94] As explained by the NPS – and in these comments and the attached reports – DAQ's source selection process is significantly flawed and does not follow the requirements of the Act, RHR and EPA's directions to states. Moreover, despite DAQ's SIP release *after* EPA's July 2021 Memo, DAQ's response to the FLM comments fails to take into consideration EPA's direction on source selection.
- Misses the mark in responding to the FLMs comments regarding a four-factor analysis for NO_X at the five Duke Energy coal-fired power plants:

    - Duke Energy Carolinas, LLC - Belews Creek Steam Station,
    - Duke Energy Carolinas, LLC - Cliffside Steam Station,
    - Duke Energy Progress, LLC - Roxboro Steam Electric Plant,
    - Duke Energy Progress, LLC - Mayo Electric Generating Plant, and
    - Duke Energy Carolinas, LLC - Marshall Steam Station.

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[86] *Id.* at 66-67.
[87] Draft SIP, Appendix H1-H3, Letter and Attachment from James E. Melonas, Forest Supervisor, Forest Service, U.S. Department of Agriculture, to Michael Abraczinskas Director, North Carolina Division of Air Quality, at pdf 100 (June 3, 2021)
[88] *Draft SIP Narrative*, Section 10.
[89] *Draft SIP Narrative* at 332.
[90] Furthermore, it is inappropriate for DAQ to suggest that its reliance on EPA's agreement that using an outdated 2011 modeling platform was sufficient, since EPA's final action and decision on SIPs does not come until after public comment and notice. Finally, if fund were not available to update the modeling platform, then DAQ should have selected methodology that could use the more recent modeling data.
[91] *EPA July 2021 Memo* at 4. ("Consistent with the first planning period, EPA generally expects that each state will analyze sulfur dioxide (SO2) and nitrogen oxide (NOx) in selecting sources and determining control measures." (citation omitted))
[92] *Draft SIP Narrative* at 347 ("…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").
[93] *EPA 2021 July Memo* at 16-17 ("Additional consultation and coordination requirements of the RHR provide states with important information and considerations from FLMs and other states relevant to the reasonable progress analysis.")
[94] *Draft SIP Narrative* at 345.

DAQ erroneously asserts that all these facilities are "well controlled for NO_X" and that it is not reasonable to request the facilities conduct a four-factor analysis.[95] As explained by the FLMs and detailed in these comments and the attached reports, there are cost-effective options to improve on the current NO_X control technologies, which as EPA has explained, the state's SIP should consider.[96]

Contrary to the RHR requirement that the Federal Land Managers' recommendations are to "meaningfully inform the State's decisions on the long-term strategy,"[97] DAQ's responses to the FLMs are unreasonable. The FLM consultation process is designed to inform development of the SIP, which has not occurred here.

VII. DAQ's Analyses are Inconsistent with the Clean Air Act and Regional Haze Rule Requirements

The RP and technical analyses must be based on accurate information that is consistent with the Act and EPA's implementing regulations. As discussed in the attached report by Joe Kordzi, and fully incorporated by reference into these comments, DAQ's proposed analyses rely on inflated cost effectiveness analysis by using incorrect information for interest rate, equipment life, control efficiency, and retrofit and other factors. Furthermore, the proposed SIP unreasonably screened sources from the required four-factor analysis based on faulty assumptions regarding the effectiveness of current controls, and does not require sources to support suggested assumptions and proposed conclusions.

VIII. DAQ's State-to-State Consultation Process was Inadequate

"Congress was clear that both downwind states (*i.e.*, "a State in which any [mandatory Class I Federal] area . . . is located) and upwind states (*i.e.*, "a State the emissions from which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area") must revise their SIPs to include measures that will make reasonable progress at all affected Class I areas."[98] "This consultation obligation is a key element of the regional haze program. Congress, the states, the courts and the EPA have long recognized that regional haze is a regional problem that requires regional solutions. *Vermont v. Thomas*, 850 F.2d 99, 101 (2d Cir. 1988)."[99] Congress intended this provision of the Clean Air Act to "equalize the positions of the States with respect to interstate pollution," (S. Rep. No. 95-127, at 41 (1977)) and EPA's interpretation of this requirement accomplishes this goal by ensuring that downwind states can seek recourse from EPA if an upwind state is not doing enough to address visibility transport.[100]

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

> (ii) The State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area to develop coordinated

[95] *Draft SIP Narrative* at 349.
[96] *EPA 2021 July Memo* at 4.
[97] 40 C.F.R. § 51.308(i)(2).
[98] 82 Fed. Reg. 3078, 3094 (Jan. 10, 2017).
[99] *Id.* at 3085.
[100] *Id.*

emission management strategies containing the emission reductions necessary to make reasonable progress.
(A) The State must demonstrate that it has included in its implementation plan all measures agreed to during state-to-state consultations or a regional planning process, or measures that will provide equivalent visibility improvement.
(B) The State must consider the emission reduction measures identified by other States for their sources as being necessary to make reasonable progress in the mandatory Class I Federal area.[101]

The RHR also requires that the

> [P]lan revision … must provide procedures for continuing consultation between the State … on the implementation of the visibility protection program required by this subpart, including development and review of implementation plan revisions and progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibility in mandatory Class I Federal areas.[102]

In its 2017 amendments to the RHR EPA explained that "states must exchange their four-factor analyses and the associated technical information that was developed in the course of devising their long-term strategies. This information includes modeling, monitoring and emissions data and cost and feasibility studies."[103] In the event of a recalcitrant state, "[t]o the extent that one state does not provide another other state with these analyses and information, or to the extent that the analyses or information are materially deficient, the latter state should document this fact so that the EPA can assess whether the former state has failed to meaningfully comply with the consultation requirements."[104]

A. DAQ Failed to Consult with Ohio

Although DAQ consulted with several states, there is nothing in the record demonstrating that North Carolina and Ohio exchanged their four-factor analyses and the associated technical information, including modeling, monitoring and emissions data and cost and feasibility studies, to determine whether additional emission reductions are necessary to ensure reasonable progress. DAQ failed to consult with Ohio about the coal-fired power plants that impact North Carolina's Class I areas. Thus, it has failed to meet the RHR provision that requires that "[t]he State must consult with those States that have emissions that are reasonably anticipated to contribute to visibility impairment in the mandatory Class I Federal area *to develop coordinated emission management strategies* containing the emission reductions necessary to make reasonable progress (emphasis added)."[105] In Ohio these coal-fired power plants include the Cardinal and Kyger plants, both of which have additional emission reductions that are cost effective.

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[101] 40 C.F.R. § 51.308(f)(2) (emphasis added); see also, 64 Fed. Reg. 35,765, 35,735 (July 1, 1999) (In conducting the four-factor analysis, EPA explained that "…the State must consult with other States which are anticipated to contribute to visibility impairment in the Class I area under consideration … any such State must consult with other States before submitting its long-term strategy to EPA.")
[102] 40 C.F.R. § 51.308(f)(4).
[103] 82 Fed. Reg. at 3088 (emphasis added).
[104] *Id.*
[105] 40 C.F.R. § 51.308(f)(2)(ii)

1. Cardinal Power Plant

The SCR and wet scrubbers are underperforming at the Cardinal Power Plant.[106] "[I]t appears the only thing preventing the Cardinal units from achieving … [the level] of SCR performance [it historically achieved] … is the lack of an enforceable NO_X limit requiring it."[107] While Ohio performed a four-factor analysis on the three Cardinal units, it wrongly concluded no controls were necessary. As detailed in the Korzi Report, it appears likely that additional NO_X reductions could be achieved very cost-effectively.[108] DAQ should have instructed Ohio at the front end of the SIP development process that controls were needed at Cardinal to protect North Carolina's Class I areas. DAQ did not. Furthermore, in addition to NO_X, additional SO_2 reductions could be a matter of Cardinal simply running its scrubber systems at full capacity continuously or utilizing common scrubber upgrades.[109]

DAQ should have requested a four-factor analysis and mitigations for the Cardinal Power Plant from Ohio.

2. Kyger Creek Power Plant

As explained in the Kordzi Report, it appears the "it appears the only thing preventing the Kyger Creek SCR units from consistently achieving this level of performance is the lack of an enforceable NO_X limit requiring it."[110] And "although Ohio performed a four-factor analysis on the Cardinal units, it wrongly concluded no controls were necessary"[111] For example, "simply running its SCR systems at full capacity all year round would likely be very cost-effective. Further SCR optimization may result in even more cost-effective controls."[112] More SO_2 reduction could be a matter of Kyger Creek simply running its scrubber systems at full capacity continuously or utilizing common scrubber upgrades.[113]

DAQ should have requested a four-factor analysis and mitigations for the Kyger Power Plant from Pennsylvania.

B. DAQ Failed to Consult with Pennsylvania

DAQ also failed to consult with Pennsylvania and the impacts from the Seward Power Plant, which consists of two 262.5 MW units that fire waste coal from abandoned refuse piles in the area.[114] The plant is also permitted to burn pet coke.[115] Both units utilize circulating fluidized bed combustors, which use limestone to control SO_2 emissions, and are also equipped with Novel Integrated Desulfurization (NID) systems. Both units are also equipped with SNCR to control NO_X.[116] As demonstrated in the graphs presented in the Kordzi Report,

[106] *Id*. at 26-31.
[107] *Id*. at 31.
[108] *Id*.
[109] *Id*.
[110] *Id*. at 35.
[111] *Id*.
[112] *Id*.
[113] *Id*.
[114] *Id*. at 36.
[115] *Id*.
[116] *Id*.

> [T]he NO_X and SO_2 controls for these units are not operated at a consistent level and are capable of better performance than recently exhibited. For instance, at multiple times, the SNCR systems have controlled NO_X to below 0.8 lbs/MMBtu, but typically operate much above that level. Also, in 2010 – 2012, the NID systems have controlled SO_2 to below 0.4 lbs/MMBtu but have gradually risen over time to approximately 0.6 lbs/MMBtu. Thus, without any capital upgrade cost (and likely minimal operating and maintenance costs), the Seward units are quite capable of much better NO_X and SO_2 performance. It appears the only reason they do not is that they are not required by a permit condition to do so. Additional reductions may also be possible with very moderate and likely cost-effective upgrades.[117]

DAQ should have requested a four-factor analysis and mitigations for the Seward Power Plant from Pennsylvania.[118]

IX. Even for Selected Sources, DAQ's SIP Falls Short

The technical analyses DAQ includes in the proposed SIP are flawed in numerous ways, as explained in detailed in the attached Kordzi Report. Once these flaws are corrected, it is clear that there are cost-effective controls and emission reductions measures from these sources that would ensure reasonable progress toward natural visibility in the Class I areas affected by North Carolina sources.

A. Blue Ridge Paper Product Canton Mill

DAQ should require that the Blue Ridge Paper Product (BRPP) Canton Mill perform a four-factor analysis for NO_X. There are significant unabated NO_X emissions from several units at BRPP and the facility is located only 16.9 km from the Shining Rock Wilderness Area.[119] Considering these large NOx emissions, DAQ should require that the BRPP perform a NOx four-factor analysis.

For SO_2 emissions, DAQ should also investigate upgrades to the BRPP scrubbers to obtain additional SO_2 reductions. DAQ also needs to confirm BRPP's 2028 emission projections for SO_2, which as explained in the Kordzi report, are not documented and emission limits do not correlate to annual totals.[120] While BRPP has reduced SO_2 at the Mill,[121] neither the company nor DAQ provide information demonstrating the installed/upgraded SO_2 controls are in fact operating at their peak efficiencies, which should be explored, documented and integrated as enforceable limits in the haze SIP.[122] Because all the scrubbers are required to do performance testing, DAQ should present this information and assess the performance potential of upgrading

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[117] *Id.* at 36-37.
[118] *Id.*
[119] *Id.* at 38.
[120] *Id.*
[121] Id. at 37 (explaining the BRPP described these reductions as follows, "BRPP has reduced its SO2 emissions by thousands of tons since 2016. BRPP has shutdown or modified several major SO2 emissions sources in order to reduce facility-wide SO2 emissions. BRPP installed two new gas-fired package boilers and shut down its Big Bill and Peter G coal-fired boilers in 2017, resulting in a reduction in total SO2 emissions of 2,300 tons per year (tpy). In late 2018, BRPP transitioned the Nos. 10 and 11 Recovery Furnaces from startup and shutdown on No. 6 fuel oil to startup and shutdown on ultra-low sulfur diesel, resulting in an SO2 emissions reduction of 1,050 tpy. In the summer of 2018, BRPP commenced operation of a new wet scrubber on its Riley Coal Boiler and a new wet scrubber on its No. 4 Power Boiler. The addition of these control devices has resulted in a reduction of SO2 emissions by 2,050 tpy from Riley Coal Boiler and 1,175 tpy from No. 4 Power Boiler. BRPP optimized the operation of the Riley Bark Boiler's wet scrubber to improve SO2 emissions control and reduce actual emissions by about 600 tpy. BRPP also installed an SO2 ambient monitor and completed an SO2 modeling exercise to establish enforceable permit limits that will be incorporated into the State Implementation Plan (SIP) and ensure these SO2 emissions reductions are permanent. Average 2014-2016 actual SO2 emissions were approximately 7,600 tpy but actual 2019 SO2 emissions were only 405 tons.")
[122] *Id.* at 39.

the scrubbers, which may be as simple as using more caustic.[123] While BRPP asserts adding more caustic is not possible, its assertion is not documented – and with the performance testing data information DAQ has the information to ascertain whether BRPP's assertion is correct.[124] Finally, DAQ should require that BRPP evaluate use of lower sulfur coal as part of its four-factor analysis.[125]

Finally, the Kordzi Report discusses six issues with the analysis of installation of a DSI systems for the Riley and No. 4 Power Boilers, which was prepared to analyze additional SO_2 controls for these boilers. DAQ should address and document the questions raised, and correct the DSI cost analyses as necessary.[126]

B. Domtar Plymouth Mill

DAQ should require that the Domtar Plymouth Mill perform a NO_X four-factor analysis. The Mill has a number of large NO_X sources and is located only 69 km from the Swanquarter Wilderness Area.[127] Given the proximity to the Class I area and significant NO_X emissions, DAQ must require a NO_X four-factor analysis to be completed.

There are a number of issues with how DAQ treats the SO_2 reasonable progress assessment Domtar submitted to DAQ for Hog Fuel Boilers Nos. 1 and 2 at the Mill. For Hog Fuel Boiler No. 1, DAQ makes numerous assertions regarding controls, and did not require a four-factor evaluation.[128] However, while DAQ admits none of the fuel restrictions or controls are enforceable in the SIP, it did not require a four-factor evaluation. DAQ must either require the four-factor analysis or include enforceable measures in the SIP.

AQ's refusal to require a wet scrubber on the No. 2 Hog Boiler is erroneously based on the low visibility benefits at the Swanquarter Wilderness Area.[129] The scrubber is cost-effective, at $3,600/ton.[130] DAQ's justification is improper in light of EPA's recent clarification memo, which explains that "a state should not use visibility to summarily dismiss cost-effective potential controls."[131] EPA's memo further indicates that if a state "has identified cost-effective controls for its sources but rejects most (or all) such cost-effective controls across those sources based on visibility benefits [the state] is likely to be improperly using visibility as an additional factor."[132] Because wet scrubbers satisfy an accurate four factor analysis, DAQ should require it at Hog Boiler No. 2 and include enforceable provisions in the SIP for limiting emissions.

As described in detail in the Kordzi Report, DAQ must revise its SIP to address various issues with the Domtar four-factor review. As a first order concern, DAQ should require that the entire facility be reviewed for a NO_X four-factor analysis. In addition, the No. 1 Hog Fuel Boiler should be reviewed for a SO2 four-factor analysis, and a wet scrubber should be required on the No. 2 Hog Fuel Boiler, while increasing Domtar's wet

[123] *Id.*
[124] *Id.*
[125] *Id.*
[126] *Id.* at 39-40.
[127] *Id*. at 42.
[128] As discussed DAQ's *Draft SIP Narrative* at 292, "Since the boiler [No. 1] now burns only low-sulfur fuels, it is no longer a significant source of SO2 emissions. These fuel restrictions and emissions decreases are not state or federally enforceable, but they can be used to inform a reasonable projection of the actual emission level for 2028. For this reason, No. 1 Hog Fuel Boiler is considered to be effectively controlled for SO2 and was not included in the four-factor analysis evaluation."
[129] *Id.*
[130] *Id.*
[131] *EPA July 2021 Memo* at 13.
[132] *Id.*

scrubber efficiency based on what is it capable of controlling. Lastly, DAQ should address a number of incorrect and undocumented information in the analysis.[133]

C. PCS Phosphate Aurora Plant

DAQ fails to provide documentation and propose SIP emission limitations that reflect the projected 2018 SO_2 emissions.[134] For example, there are no calculations to verify the 2028 emission projections provided by the company; the company relies on a periodic catalyst replacement schedule of every three years and yet there are no enforceable requirements that cover this commitment; and the SO_2 emission limits are not proposed for inclusion in the SIP, rather, DAQ proposes relying on a consent decree (that will ultimately be discharged by the court).[135]

The CAA requires states to submit implementation plans that "contain such emission limits, schedules of compliance and other measures as may be necessary to make reasonable progress toward meeting the national goal" of achieving natural visibility conditions at all Class I Areas.[136] The RHR requires that states must revise and update its regional haze SIP, and the "periodic comprehensive revisions must include the "enforceable emissions limitations, compliance schedules, and other measures that are necessary to make reasonable progress as determined pursuant to [51.308](f)(2)(i) through (iv)."[137] The emission limitations and other requirements of the RHR must be adopted into the SIP. Under the RHR, RPGs adopted by a state with a Class I area must be based only on emission controls measures that have been adopted and are enforceable in the SIP.[138] EPA's Guidance explains that the requirements in 40 C.F.R. § 51.308(d)(3)(v)(F):

> [R]equires SIPs to include enforceable emission limitations and/or other measures to address regional haze, deadlines for their implementation, and provisions to make the measures practicably enforceable including averaging times, monitoring requirements, and record keeping and reporting requirements.[139]

These requirements were confirmed in EPA's recent clarification memo.[140] Of significant concern to commenters is that contrary to these requirements, there is no enforceable requirement in the SIP that the plant

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[133] *Id.* at 43-46.
[134] *Id.* at 47.
[135] *Id.*
[136] 42 U.S.C. §§ 7491(a)(1), (b)(2).
[137] 40 C.F.R. § 51.308(f)(2); 40 C.F.R. § 51.308(d)(3)(v)(F)(Enforceability of emission limitations and control measures).
[138] 40 C.F.R. § 51.308(f)(3).
[139] "EPA Guidance on Regional Haze State Implementation Plans for the Second Implementation Period," at 42-43 (Aug. 20, 2019), https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf. (While NPCA filed a Petition for Reconsideration regarding EPA's issuance of the 2019 Guidance (Enclosure 4), it does not dispute the information in the Guidance referenced here regarding enforceable limitations, which cite to EPA's longstanding statements found in the "General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990, 74 Fed. Reg. 13498 (April 16, 1992).
[140] *EPA July 2021 Memo* at 9 ("The existence of an enforceable emission limit or other enforceable requirement (e.g., a work practice standard or operational limit) reflecting a source's existing measures may also be evidence that the source will continue implementing those measures. A federally enforceable and permanent requirement provides the greatest certainty and, therefore, is the preferred and best evidence. EPA will consider these and other types of limits and operational requirements as part of its weight-of-evidence evaluation. To be relevant, the limit should reflect the emission rate the source is actually achieving with its existing measures. A limit that is significantly higher than the emission rate a source is actually achieving does not keep the source from increasing its rate in the future. States should provide information on any enforceable emission limits associated with sources' existing measures. States should also clearly identify the instrument in which the relevant limit(s) exist (by providing, e.g., the applicable permit number and where it can be found) and provide information on the specific permit provision(s) on which they are relying. If the instrument is not publicly available or readily accessible, a state should provide a copy of the instrument to EPA with its SIP submission.")

will meet the 2028 SO_2 projections upon which DAQ proposes to rely.[141] DAQ's SIP must include enforceable emission limitations that reflect the SO_2 projections and emission reductions.

X. The Proposed SIP Does Not Contain New Provisions to Ensure Emission Limitations are Permanent, Enforceable and Apply at All Times

Contrary to the technical analysis presented in the Kordzi Report demonstrating cost-effective controls at numerous sources, the proposed SIP does not include any new controls at any source.[142] Moreover, DAQ's analysis in excluding coal-fired power plants from analysis assumes significant emission reductions by 2028 at those facilities. However, contrary to the requirements in the Act and regulations, as discussed elsewhere in these comments, DAQ fails to make those reductions enforceable in the SIP. Furthermore, DAQ relies the retirements to avoid the four factor analysis and further measures to reduce emissions. If DAQ is relying in any way on possible or projected operations changes or retirements at Duke Energy's coal plants – which appears to be the case – the agency needs to make sure those changes will actually happen by incorporating them into the SIP.

DAQ does propose including some permit provisions into the SIP,[143] however, those SIP provisions reflect existing limits and existing controls for the Domtar Paper Company in Plymouth, North Carolina and the PCS Phosphate plant located in Aurora, North Carolina – no new emission reductions are proposed.

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

DAQ has both state and federal obligations to meaningfully consider and advance environmental justice in its regional haze SIP. Unfortunately, the draft SIP's cursory consideration of environmental justice falls short of these commitments.

A. Environmental Justice in North Carolina

"The Environmental Justice Program at [North Carolina's Department of Environmental Quality (DEQ)] … works to ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies."[144] DEQ's website explains that:

> The challenge ahead of the department is integrating this perspective into the core mission of the department, along with the legal and scientific lens guiding how DEQ employees pursue their work now. DEQ's mission, 'Provide science-based environmental stewardship for the health and prosperity of all North Carolinians,' can only be accomplished if fighting for Environmental Justice is part of every DEQ activity.[145]

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[141] *Id.*
[142] *Draft SIP Narrative* at 298-299.
[143] *Draft SIP Narrative* at 300-304.
[144] North Carolina Environmental Quality, "Environmental Justice," https://deq.nc.gov/outreach-education/environmental-justice.
[145] *Id.*

Congruent with these statements, the DEQ's mission, and the summary of the DEQ's "EJ Program" in the SIP Narrative,[146] the DAQ's scientific and legal efforts supporting development and implementation of the regional haze program *must* provide for environmental stewardship for all North Carolinians, including those in environmental justice communities.

B. Consideration of Environmental Justice to Comply with Executive Orders

There are additional legal grounds for considering environmental justice when determining reasonable progress controls. Under the CAA, states are permitted to include in a SIP measures that are authorized by state law but go beyond the minimum requirements of federal law.[147] Ultimately, EPA will review the haze plan that North Carolina submits, and EPA will be required to ensure that its action on North Carolina's haze plan addresses any disproportionate environmental impacts of the pollution that contributes to haze. Executive Orders in place since 1994, require federal executive agencies such as EPA to:

> [M]ake achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations"[148]

On January 27, 2021, the current Administration signed "Executive Order on Tackling the Climate Crisis at Home and Abroad."[149] The new Executive Order on climate change and environmental justice amended the 1994 Order and provides that:

> It is the policy of [this] Administration to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; … protects public health … delivers environmental justice …[and that] … [s]uccessfully meeting these challenges will require the Federal Government to pursue such a coordinated approach from planning to implementation, coupled with substantive engagement by stakeholders, including State, local, and Tribal governments.[150]

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

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[146] *Draft SIP Narrative* at 350.

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

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

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

[150] *Id.* at § 201.

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

EPA's 2021 Clarification Memo directs states to take into consideration environmental justice concerns and impacts in issuing any SIP revision for the second planning period.[151] EPA's 2019 Regional Haze Guidance for the Second Planning Period specifies, "States may also consider any beneficial non-air quality environmental impacts."[152] This includes consideration of environmental justice in keeping with other agency policies. For example, EPA also pointed to another agency program that states could rely upon for guidance in interpreting how to apply the non-air quality environmental impacts standard:[153]

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

A collection of EPA policies and guidance related to the National Environmental Policy Act ("NEPA") is available at https://www.epa.gov/nepa/national-environmental-policy-act-policies-and-guidance. One of these policies concerns Environmental Justice.[154] North Carolina should consider these sources in conducting a meaningful environmental justice analysis.

D. DAQ's Environmental Justice Analysis is Inadequate

While we appreciate DAQ's efforts to prepare an environmental justice analysis, it falls short. DAQ's proposed SIP explains that it overlaid the State's Class I areas with maps of potentially underserved block groups, which was then used to inform the specific EJ focused outreach for the RH program.[155] While this is a useful first step, DAQ must do more.

DAQ must involve and consider the environmental justice communities impacted by harms from the reasonable progress sources. DAQ's SIP ignores the fact that many of the reasonable progress sources are located in communities of color and many live below the poverty line. For example, PCS Phosphate Company (Aurora) and Domtar Paper Company are located in vulnerable areas where the people of color is higher than 64% and the percentage of poverty rate is higher than 30%.

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

In addition to the NEPA guidance materials referenced above, EPA provides a wealth of additional material.[156] The most important aspect of assessing Environmental Justice is to identify the areas where people

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[151] *EPA July 2021 Memo* at 16.
[152] *EPA 2019 RH Guidance* at 49.
[153] *Id.* at 33.
[154] *See*, EPA Environmental Justice Guidance for National Environmental Policy Act Reviews, https://www.epa.gov/nepa/environmental-justice-guidance-national-environmental-policy-act-reviews.
[155] *Draft SIP Narrative* at 351. DAQ also includes two reports from EPA'S EJSCREEN tool, a one-mile radius around the Shining Rock Wilderness Area, and a one-mile radius around the Swanquarter Wilderness Area.
[156] *See,* EPA: Learn About Environmental Justice, https://www.epa.gov/environmentaljustice/learn-about-environmental-justice. (Enclosure 7)

are most vulnerable or likely to be exposed to different types of pollution. EPA's EJSCREEN tool can assist in that task. It uses standard and nationally consistent data to highlight places that may have higher environmental burdens and vulnerable populations.[157]

F. EPA Must Consider Environmental Justice

As occurred in the first planning period, if a state fails to submit its SIP on time, or if EPA finds that all or part of a state's SIP does not satisfy the Regional Haze regulations, then EPA must promulgate its own Federal Implementation Plan to cover the SIP's inadequacy ("FIP"). Should EPA promulgate a FIP that reconsiders a state's four-factor analysis, it is completely free to reconsider any aspect of that state' analysis. The two Presidential Executive Orders referenced above require that federal agencies integrate Environmental Justice principles into their decision-making. EPA has a lead role in coordinating these efforts, and recently EPA Administrator Regan directed all EPA offices to clearly integrate environmental justice considerations into their plans and actions.[158] Consequently, should EPA promulgate a FIP, it has an obligation to integrate Environmental Justice principles into its decision-making. The non-air quality environmental impacts of compliance portion of the third factor, is a pathway for doing so.

Consistent with legal requirements and government efficiency, we urge DAQ to take impacts to EJ communities, into consideration as it evaluates or reevaluates sources identified above that emit that visibility impairing pollution.

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

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

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

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[157] *See*, EPA EJSCREEN: Environmental Justice Screening and Mapping Tool, Additional Resources and Tools Related to EJSCREEN, https://www.epa.gov/ejscreen/additional-resources-and-tools-related-ejscreen.

[158] *See*, EPA News Release, EPA Administrator Announces Agency Actions to Advance Environmental Justice, *Administrator Regan Directs Agency to Take Steps to Better Serve Historically Marginalized Communities* (April 7, 2021), https://www.epa.gov/newsreleases/epa-administrator-announces-agency-actions-advance-environmental-justice. (Enclosure 8)

Consistent with legal requirements and government efficiency, we urge DAQ to take impacts to EJ communities, into consideration as it evaluates or reevaluates sources identified above that emit that visibility impairing pollution.

Conclusion

We urge DAQ to reevaluate its proposed SIP in light of these comments and EPA's July 8, 2021 Memo, which confirms that the proposed SIP is fundamentally flawed. Due to the deficiencies outlined above and in the attached reports, the state must revise and reissue a valid haze SIP for public notice and comment. Please do not hesitate to contact us with any questions or to discuss the matters raised in these comments.

Sincerely,

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Enclosures

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Robert Hodanbosi, Director, Air Pollution Control, Ohio Environmental Protection Agency
Krishnan Ramamurthy, Deputy Secretary for Waste, Air, Radiation and Remediation, Pennsylvania Department of Environmental Protection

List of Enclosures

1. Kordzi, Joe, “A Review of the North Carolina Regional Haze State Implementation Plan,” (Oct. 2021).

2. Gebhart, D. Howard, “Technical Review of North Carolina Regional Haze State Implementation Plan Second Round of Regional Haze State Implementation Plans Supplemental Report” (Oct. 2021).

3. Gebhart, D. Howard, “Technical Review of VISTAS Visibility Modeling for the Second Round of Regional Haze State Implementation Plans” (May 2021).

4. “Petition for Reconsideration of Guidance on Regional Haze State Implementation Plans for the Second Implementation Period,” submitted by National Parks Conservation Association, Sierra Club, Natural Resources Defense Council, Coalition to Protect America's National Parks, Appalachian Mountain Club, Western Environmental Law Center and Earthjustice, to former EPA Administrator Andrew Wheeler (May 8, 2020).

5. EPA Memorandum, from Peter Tsirigotis, Director, Office of Air Quality Planning and Standards, to Regional Air Division Directors, “Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period,” (July 9, 2019), https://www.epa.gov/visibility/clarifications-regarding-regional-haze-state-implementation-plans-second-implementation.

6. Letter from Stephanie Kodish, NPCA, Leslie Griffith, SELC, and David Rogers, Sierra Club to VISTAS State Air Directions, “Significant Flaws in VISTAS Regional Haze CAMx Modeling and Methods; Recommendations to Develop Compliant State Implementation Plans” (May 12, 2021).

7. EPA: Learn About Environmental Justice, https://www.epa.gov/environmentaljustice/learn-about-environmental-justice.

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

9. D. Howard Gebhart, “Testimony of Howard Gebhart on Behalf of NPCA and Other Conservation Organizations” (Oct. 6, 2021).

10. Ulla Reeves, Senior Advocacy Manager in the Clean Air Program of the NPCA, “Testimony of Ulla Reeves on Behalf of NPCA” (Oct. 6, 2021).

Enclosure 1

A Review of the North Carolina Regional Haze State Implementation Plan

Prepared by

Joe Kordzi, Consultant

On behalf of

National Parks Conservation Association
Sierra Club
CleanAire NC
Southern Environmental Law Center

October 2021

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Executive Summary

This is a report concerning a review of the North Carolina Regional Haze State Implementation Plan (SIP).[1] Emissions and controls information for all EGUs were downloaded from EPA's Air Markets Program Data (AMPD) website.[2] Additional information was obtained from the Energy Information Agency (EIA).[3] Lastly, the most recently issued Title V operating permits for a number of units were reviewed.

This report indicates that the North Carolina Regional Haze State Implementation Plan (SIP) is significantly flawed in a number of areas. The most significant flaws include the following:

- The SIP only addresses visibility impairment from sulfate. Although sulfate does indeed dominate visibility impairment at all of North Carolina's Class I Areas, nitrate also contributes and a number of likely cost-effective NOx controls are available and should have been examined.

- North Carolina wrongly uses the visibility progress achieved at its Class I Areas as a safe harbor against additional cost-effective controls.

- North Carolina's source selection process is flawed, as it resulted in few sources to examine for four-factor analyses. Much of this is due to the SIP's selection threshold and it exclusive reliance on Particulate Source Apportionment Technology (PSAT).

- North Carolina bases its modeling and control cost analyses on 2028 emission projections. In some cases, these emissions projections are much less than historical and current source emissions. In these cases, either more current emissions should have been used, or these assumed reductions should have been secured by enforceable commitments that were made a part of the SIP.

- North Carolina ignored likely cost-effective controls, mainly in the form of upgrades to Selective Catalytic Reduction (SCR) and scrubber systems at Electricity Generating Units (EGUs) located in North Carolina, and via the consultation process, in other states.

- The SIP suffers from a general lack of documentation, especially in its control cost analyses.

These flaws make it evident that the North Carolina Regional Haze SIP does not comply with the Regional Haze Rule in a number of key areas and must be revised.

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[1] https://deq.nc.gov/about/divisions/air-quality/air-quality-planning/state-implementation-plans/regional-haze-state-sip.
[2] See https://ampd.epa.gov/ampd/. This information is compiled and assessed in spreadsheets that are included in this analysis.
[3] See https://www.eia.gov/electricity/data/eia923/.

1 General

1.1 NC DEQ should Improve its Source Data Gathering

In preparation for this report, on July 18, 2021, the following request was made to the North Carolina Department of Environmental Quality (NC DEQ) through North Carolina's public records request process:

> (1) Documents in electronic format (spreadsheets, databases and the like) containing the unit-specific annual and/or monthly SO_2, NOx, and particulate matter of all non-EGU stationary sources of pollution in North Carolina for the most current and the prior four years. Please note that I am requesting the information on a unit-specific basis.
>
> (2) Any information that summarizes the types of pollution controls currently installed on the units for which the emissions are provided.

On July 29, 2021, NC DEQ provided a partial response to Part (1). However, the provided spreadsheets contain formatting issues (e.g., numbers entered as text and improperly merged cells) that make it very difficult to properly analyze the data. Also, some of the data (e.g., Blue Ridge Paper Products Canton Mill) is inconsistent with that in NC DEQ's SIP. It is suggested that NC DEQ improve its data gathering and warehousing for its sources.

1.2 NC DEQ's Documentation is Lacking

Little documentation has been provided to support a number of assertions contained in some cost-effectiveness calculations. For those cost-analyses that do not employ Control Cost Manual approved algorithms or cost models, adequate documentation (e.g., vendor quotes, actual costs from a similar facility, generally accepted estimates) should be provided to support any of the capital control costs. It is assumed the NC DEQ has procedures to protect confidential business information, should that be asserted.

1.3 NC DEQ Should Have Considered Area Sources

Section 40 CFR 51.308(f)(2)(i) indicates that states should consider evaluating major and minor stationary sources or groups of sources, mobile sources, and area sources. NC DEQ barely mentions area (nonpoint) sources, only describing how its inventories were developed. However, Table 4-2 indicates that nonpoint sources are significant contributors to North Carolina's NOx and SO_2 2011 state inventory. Tables 7-15 through 7-19 indicate that nonpoint sources are often the second leading SO_2 source type contributor and the third leading NOx source type contributor to North Carolina's Class I Areas. It is not apparent how NC DEQ satisfies section 51.308(f)(2)(i), when there does not appear to be any real consideration of how nonpoint sources could be analyzed and potentially controlled.

2 NC DEQ's Source Selection is Highly Flawed

2.1 NC DEQ Should have Assessed Nitrate

In Section 7.8.1, NC DEQ indicates that for the three facilities it identified for four-factor analyses,[4] it only requested that the facilities assess SO_2. NC DEQ bases this position on the fact that SO_2 is the predominant visibility impairing pollutant for North Carolina Class I Areas, as evidenced by modeling information it has presented such as summarized in Figures 6-17 to 6-31. These figures do indeed indicate that SO_2 is the predominant anthropogenic visibility impairing pollutant. However, NC DEQ also states the following on page 113:

> 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 North Carolina's 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.

Despite this clear evidence that nitrate impacts are increasing, NC DEQ has passed up many opportunities to require that sources perform NOx four-factor analyses. In fact, Table 7-7 indicates that, excluding mobile sources, EGUs are the largest source of NOx in North Carolina. As is detailed in a number of comments later in this report, many opportunities are cited that concern EGUs that already have installed the best NOx control available—SCR systems. In every case, these EGU SCR systems have previously demonstrated an ability to control NOx to a much higher level than they are currently achieving. The only apparent reason for this lax performance is that NC DEQ's permits do not require them to perform better. Thus, the "control" that would be evaluated would likely involve little to no capital expense, since the infrastructure is already present. Instead, the costs that would be evaluated may well be confined to additional reagent and perhaps better catalyst management.

On page 348, the NPS states that they recommended the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) EWRT*Q/d approach to source ID, which would have brought in an additional 5 Duke facilities into consideration. The NPS specifically noted:

> However, our initial evaluation indicates that NOx controls at these facilities could be improved. Specifically, we recommend that North Carolina evaluate options to improve on the current NOx control efficiencies, especially the 35–39% NOx emission control efficiency achieved by the existing SNCR at Duke Energy Marshall Steam Station units 1, 2, and 4. There were existing NOx

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[4] Throughout this report, a "four-factor" analysis is a short hand reference to the requirements under 40 CFR 51.308(f)(2)(i): "The State must evaluate and determine the emission reduction measures that are necessary to make reasonable progress by considering the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected anthropogenic source of visibility impairment."

> controls associated with these units when the SNCR was added. This percent control efficiency represents the additional control efficiency that the SNCR contributed. These numbers do not represent the overall control efficiency associated with these units.

EPA's recent Clarification Memo establishes an expectation that states will minimally consider SO_2 and NOx, absent strong documentation such consideration would be unreasonable.[5] As indicated in this report, it would have been relatively easy to identify opportunities to reduce NOx, making NOx consideration more than reasonable. NC DEQ should have included NOx in its overall visibility strategy and (the problems relating to its use and interpretation of PSAT aside) required all sources that underwent four-factor analyses to do so for both SO_2 and NOx. In addition, NC DEQ should have, regardless of the Area of Influence (AoI) and PSAT results and/or their interpretation, taken advantage of the low hanging fruit presented to them and assessed EGUs for SCR system upgrades. These upgrades are very likely to be very cost-effective.

2.2 NC DEQ's 2028 Projected Emissions are Based on Unsecured Future Assumptions

Beginning on page 178, NC DEQ discusses its strategy for ranking sources that impact the visibility of its Class I Areas. NC DEQ indicates that it used 2028 emission projections for its AoI analysis, consistent with the Regional Haze Guidance. However, the Regional Haze Guidance also cautions states regarding the use of 2028 emissions. For instance, it states:[6]

> Generally, the estimate of a source's 2028 emissions is based at least in part on information on the source's operation and emissions in a representative historical period. However, there may be circumstances under which it is reasonable to project that 2028 operations will differ significantly from historical emissions. Enforceable requirements are one reasonable basis for projecting a change in operating parameters and thus emissions; energy efficiency, renewable energy, or other such programs where there is a documented commitment to participate and a verifiable basis for quantifying any change in future emissions due to operational changes may be another. A state considering using assumptions about future operating parameters that are significantly different than historical operating parameters should consult with its EPA Regional office.

Since it used projected 2028 emissions in lieu of actual emissions, NC DEQ has based its source selection strategy on unsecured assumptions of future emission profiles. EPA cautions states against this practice in its Clarification Memo:[7]

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[5] Memorandum from Peter Tsirigotis, Dir., EPA, to Reg'l Air Dirs., Regions 1–10 (July 8, 2021), hereafter referred to as the "Clarification Memo," available here: https://www.epa.gov/visibility/clarifications-regarding-regionalhaze-state-implementation-plans-second-implementation. See page 4.

[6] Guidance on Regional Haze State Implementation Plans for the Second Implementation Period, EPA-457/B-19-003, August 2019." Hereafter referred to as the "Regional Haze Guidance." Page 17.

[7] Clarification Memo. See page 9.

> Information on a source's past performance using its existing measures may help to inform the expected future operation of that source. If either a source's implementation of its existing measures or the emission rate achieved using those measures has not been consistent in the past, it is not reasonable to assume that the source's emission rate will remain consistent and will not increase in the future [emphasis added]. To this end, states should include data for a representative historical period demonstrating that the source has consistently implemented its existing measures and has achieved, using those measures, a reasonably consistent emission rate. For most sources, data from the most recent 5 years (if available) is sufficient to make this showing. Information pertinent to a source's implementation of its existing measures going forward is also critical to a state's demonstration. States should provide data and information on the source's projected emission rate (e.g., for 2028), including assumptions and inputs to those projections. States should justify those assumptions and inputs and explain why it is reasonable to expect that the source's emission rate will not increase in the future.

To the extent that a state declines to evaluate additional pollution controls for any source based on that source's planned retirement or decline in utilization, it must incorporate those operating parameters or assumptions as enforceable limitations in the second planning period SIP. The Clean Air Act requires that "[e]ach state implementation plan . . . *shall*" include "enforceable limitations and other control measures" as necessary to "meet the applicable requirements" of the Act. 42 U.S.C. § 7410(a)(2)(A). The Regional Haze Rule, under Section 51.308(d)(3) similarly requires each state to include "enforceable emission limitations" as necessary to ensure reasonable progress toward the national visibility goal. Moreover, under EPA's guidance document for the second planning period, states cannot rely on a source's remaining useful life to avoid conducting a four-factor analyses unless the source has "an enforceable commitment to be retired or replaced by 2028."[8] This is consistent with EPA's longstanding approach to control determinations under the mandatory BART Guidelines.[9] Thus, consistent with EPA's past practice, the agency's regulations, and the requirements of the Clean Air Act itself, North Carolina cannot simply decline to evaluate additional cost-effective controls for a source that intends to retire or reduce operations unless those operating parameters are included as enforceable limitations in the second planning period SIP.

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[8] Guidance on Regional Haze State Implementation Plans for the Second Implementation Period, EPA-457/B-19-003 August 2019. See page 22. Also see page 34: "To the extent such a requirement is being relied upon for a reasonable progress determination, the measure would need to be included in the SIP and/or be federally enforceable. See 40 CFR 51.308(f)(2)."

[9] 70 FR 39167 (July 6, 2005): "When you project that future operating parameters (e.g., limited hours of operation or capacity utilization, type of fuel, raw materials or product mix or type) will differ from past practice, and if this projection has a deciding effect in the BART determination, then you must make these parameters or assumptions into enforceable limitations. In the absence of enforceable limitations, you calculate baseline emissions based upon continuation of past practice."

Therefore, NC DEQ should either have based its projected 2028 emissions on historical data, or ensured that any significant deviations from that historical data were made enforceable. Because, as is discussed in various places in this report, NC DEQ's 2028 projected emissions have allowed facilities to avoid a four-factor analysis, this must be corrected.

For instance, in Table 7-41, NC DEQ indicates that it revised its 2028 projected SO_2 emissions for Cliffside from 1,082 to 161 tons. In Table 7-42, NC DEQ indicates that it revised its 2028 projected NOx emissions from 1,948 to 327 tons. Below are Cliffside's recent SO_2 and NOx annual emissions:

Table 1. Cliffside Recent SO_2 Annual Emissions

Unit	2018 SO_2 (tons)	2019 SO_2 (tons)	2020 SO_2 (tons)
5	441	628	320
6	908	754	499
Totals	1,349	1,383	819

Table 2. Cliffside Recent NOx Annual Emissions

Unit	2018 NOx (tons)	2019 NOx (tons)	2020 NOx (tons)
5	875	1,283	962
6	1,075	1,203	1,110
Totals	1,950	2,486	2,072

As can be seen from the above tables, NC DEQ's revised SO_2 and NOx 2028 emissions are multiples below what the facility emitted in 2020. The facility's Title V permit (04044T45, effective March 18, 2021) indicates that the two active EGUs, Units 5 and 6, are permitted to burn coal, natural gas, or fuel oil in any percentage. Duke's Consent Decree also does not appear to place any restrictions on these units as to operations or fuel.[10] Thus, there does not appear to be any enforceable mechanism that would limit the facility's future SO_2 emissions to the level projected by NC DEQ. The only potential insight to NC DEQ's extreme underestimate of Cliffside's 2028 emissions may be on page 276, where NC DEQ indicates that under Duke's 2020 Integrated Resource Plan (IRP) Projections, Unit 5 is projected to be retired in 2026. The Regional Haze Guidance indicates, in order to implement this under Section 51.308(f)(2)(iv)(C) of the Regional Haze Rule, Source retirement and replacement schedules, North Carolina must include an enforceable commitment in its SIP.[11] That aside, even just Unit 6's 2020 emissions alone are greater than NC DEQ's 2028 facility-wide projections, making clear that the unit has

[10] https://www.epa.gov/sites/default/files/2015-09/documents/duke-energy-consent-decree-civil-action-1cv1262_0.pdf.
[11] See Regional Haze Guidance, page 22.

the potential to emit significant SO_2 and should undergo a four-factor analysis to assess cost-effective, enforceable emission reductions.

A number of other examples of NC DEQ basing its source selection modeling on 2028 emissions that are significantly below recent emissions, without any apparent enforceable mechanism, are cited within this report. NC DEQ should reassess all of its projected 2028 point source emissions and only base deviations from recent historical emission data on enforceable commitments. After having done so, NC DEQ should then reassess whether additional sources should have been selected for four-factor analyses.

2.3 NC DEQ's PSAT Source Selection Methodology is Flawed

NC DEQ PSAT tagged facilities to determine their contribution to North Carolina Class I Areas if the AoI contribution was >= 3% sulfate + nitrate. NC DEQ has not presented any real explanation to justify this threshold, other than stating on page 231 that this was the same threshold used by Tennessee. As noted by NC DEQ, "For the facilities selected for PSAT analysis by other VISTAS states, 8 facilities had an AoI contribution of ≥3% *and an additional 11 facilities had an AoI contribution of ≥1% and ≤3% for one or more Class I areas in the Southeast or neighboring regions* (emphasis added). Thus, some states did indeed select a lower threshold for identifying sources for PSAT tagging, and it appears that NC DEQ's 3% threshold is a significant but arbitrary determinant in its SIP. The result of NC DEQ's 3% threshold is that only five facilities in North Carolina were PSAT tagged. Had NC DEQ selected a 1% threshold, then according to Tables 7-20 through 7-24, 13 sources would have been selected for PSAT tagging. NC DEQ further notes the following:

> In addition, the NCDAQ 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 North Carolina'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 NCDAQ believes that the facilities selected by North Carolina and other VISTAS states for PSAT modeling is a reasonable number of facilities for which to evaluate further for reasonable progress analyses.

This position is further reiterated in NC DEQ's reply to FLM comments on page 347 criticizing its source selection strategy that, "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."

As the above information indicates, NC DEQ acknowledges it could have selected a lower AoI threshold for PSAT tagging, but uses the progress its Class I Areas have made as a safe harbor against further reductions. As the Regional Haze Rule indicates, this is specifically prohibited:[12]

> Treating the URP as a safe harbor would be inconsistent with the statutory requirement that states assess the potential to make further reasonable progress towards natural visibility goal in every implementation period. Even if a state is currently on or below the URP, there may be sources contributing to visibility impairment for which it would be reasonable to apply additional control measures in light of the four factors. Although it may conversely be the case that no such sources or control measures exist in a particular state with respect to a particular Class I area and implementation period, this should be determined based on a four-factor analysis for a reasonable set of in-state sources that are contributing the most to the visibility impairment that is still occurring at the Class I area. It would bypass the four statutory factors and undermine the fundamental structure and purpose of the reasonable progress analysis to treat the URP as a safe harbor, or as a rigid requirement.

Thus, the Regional Haze Rule makes it clear that states should not eliminate sources that could have cost-effective controls from consideration because a reasonable progress goal is below the URP. EPA's recent Clarification Memo reinforces this point:[13]

> The 2017 RHR preamble and the August 2019 Guidance clearly state that it is not appropriate to use the URP in this way, i.e., as a "safe harbor." The URP is a planning metric used to gauge the amount of progress made thus far and the amount left to make. It is not based on consideration of the four statutory factors and, therefore, cannot answer the question of whether the amount of progress made in any particular implementation period is "reasonable progress." This concept was explained in the RHR preamble. Therefore, states must select a reasonable number [of] sources and evaluate and determine emission reduction measures that are necessary to make reasonable progress by considering the four statutory factors.

It is quite possible that had NC DEQ selected an AoI threshold lower than 3% sulfate + nitrate, additional sources would have had PSAT contributions greater than 1.00% for sulfate or nitrate, and would therefore have been selected for a four-factor analysis. NC DEQ's source selection strategy may therefore be predetermining the four-factor analysis methodology and therefore must be revised.[14] As indicated elsewhere in this report, there are in fact a number of sources that likely do have cost-effective controls available.

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[12] 82 FR 3099 (January 10, 2017).

[13] Clarification Memo, page 15.

[14] Note that as discussed in a subsequent comment, NC DEQ's PSAT-AoI correlation that it apparently uses to discount an AOI-only source selection criteria is flawed.

2.4 NC DEQ's Reply to FLMs Criticism of its Source Selection Strategy is not Adequate

As indicated above, the FLMs criticized NC DEQ's source selection strategy. One key comment from the NPS is summarized by NC DEQ on page 344 and in more detail in Appendix H2:

> Our source selection concern stems from the screening thresholds used that resulted in the selection of very few sources for analysis and offers less protection for the more-impacted Class I areas. We advised VISTAS states of this concern in April 2020. VISTAS states, including North Carolina, used a two-part screening process. Both steps used an individual-facility-percent-of-total-impact screening metric. This type of metric biases the results against the more-visually impacted Class I areas. In fact, source impacts would have to be 80 times larger to identify a source for analysis in the most-visually-impaired VISTAS Class I area compared to the least-visually-impaired Class I area. 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-visually-impaired VISTAS Class I area).

In other words, use of a blanket percentage contribution threshold over many states with many Class I Areas is not appropriate. This is because source contributions at the most impaired Class I Areas would have to be much greater than at the least impacted Class I Areas in order to reach the percentage contribution threshold and be selected for a four-factor analysis. The FLM's concern is an eminently valid observation. NC DEQ does not dispute this point and instead simply offers up the invalid safe harbor response noted above.

2.5 NC DEQ's PSAT Threshold is not Supported

On page 266, NC DEQ states that it selected facilities to analyze for reasonable progress with at least a 1.00% PSAT threshold for sulfate or nitrate. NC DEQ doesn't explain this selection other than asserting that other VISTAS states used that threshold as well. NC DEQ should explain (1) why it selected this threshold, and (2) justify this threshold in light of the threshold EPA used to determine which Texas sources should receive a four-factor analysis in the Texas FIP.[15] Here EPA determined it was reasonable in dirty background modeling (which is what VISTAS employed) to require any individual unit with at least a 0.3% extinction contribution at any Class I Area to undergo a four-factor analysis. As is demonstrated in detail in other comments, had NC DEQ selected just a slightly lower threshold, it would have conducted four-factor analyses on a number of sources with proven available and likely very cost-effective controls.

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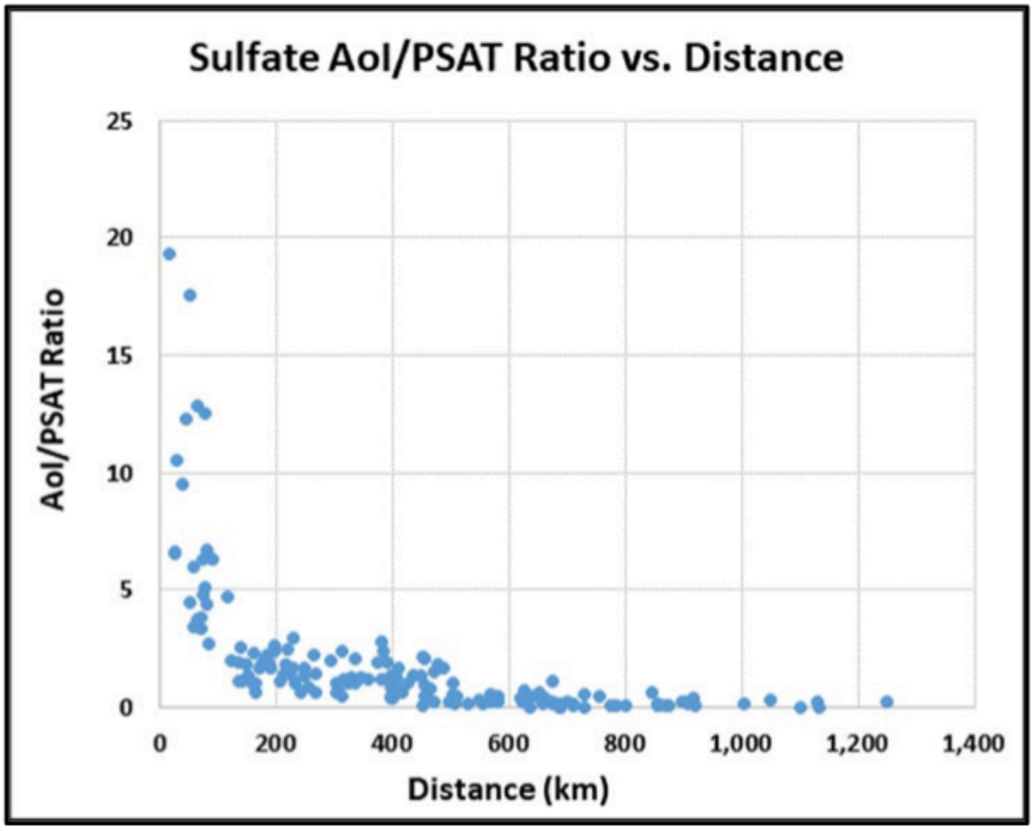
[15] Technical Support Document for the Oklahoma and Texas Regional Haze Federal Implementation Plans, (FIP TSD), November 2014. See the discussion beginning on page A-49. Available here: https://www.regulations.gov/document/EPA-R06-OAR-2016-0611-0052.

2.6 NC DEQ's PSAT - AoI Correlation is a Misinterpretation of the Data

On page 262, NC DEQ compares its PSAT source selection results to the sources it would have selected had it stopped at AoI source selection. NC DEQ presents Figure 7-77, which consists of three graphs that indicate the ratios of AoI/PSAT contributions for sulfate, nitrate, and sulfate + nitrate as a function of distance from the facility to the Class I area. Below is the figure relating to sulfate:

Figure 1. NC DEQ's Figure 7-77: Ratio of AoI/PSAT % Contributions for Sulfate as a Function of Distance from the Facility to the Class I Area



In the above figure, each point represents one facility's ratio of its AoI to PSAT sulfate contribution at a Class I Area versus its distance to that Class I Area. At first glance, it appears to resemble an exponential decline function. However, inspection of the points closest to zero indicates that the scatter in the data greatly increases. For example, the point with the smallest distance has a value of about 19, whereas the next two closest points, that are only slightly farther away, have values of about 11 and 7. Moving only slightly farther away results in values that range from about 3 to 13. The amount of scatter in the data decreases with distance, but is still significant out to at least 400 km. This indicates that the correlation is likely invalid at distances of perhaps 100 km or less.

Following this NC DEQ makes a fractional bias calculation. This is a common technique that has long been used to compare a model's output to observed values. The equation is as follows:[16]

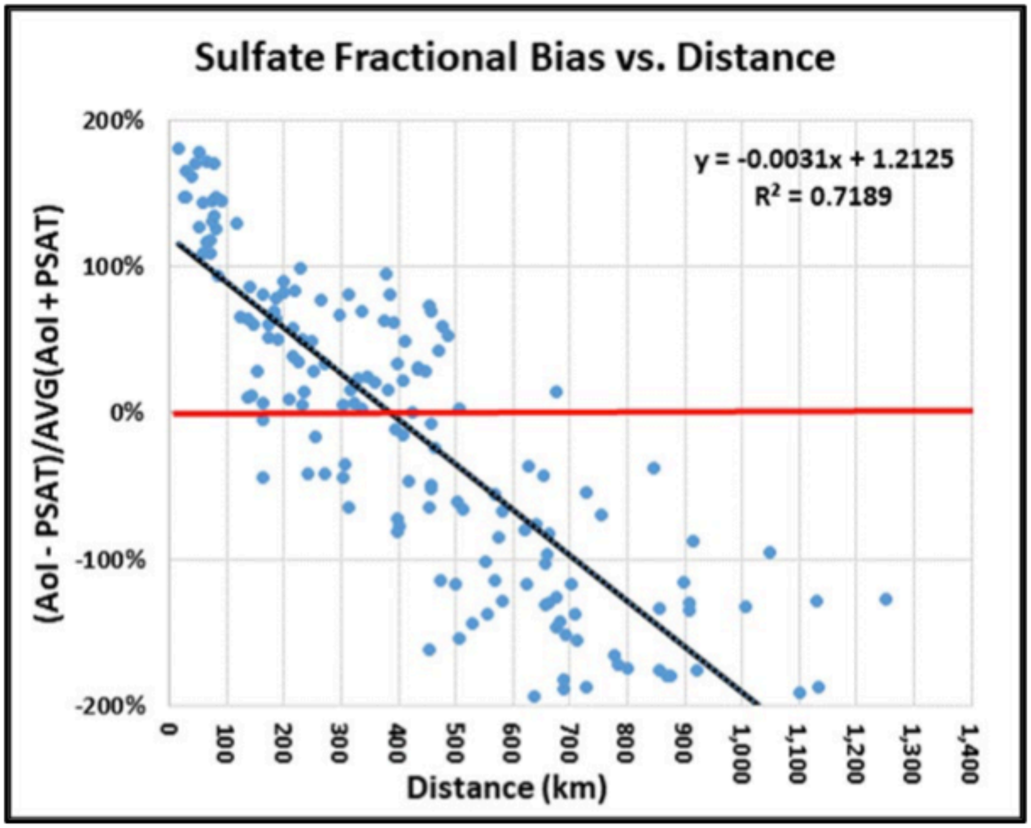
$$FB = 2\,x\,\left(\frac{OB - PR}{OB + PR}\right)$$

where OB = observed values, and PR = predicted (modeled) values.

Typically, the observed values are monitored or measured values that can be viewed as known values, against which the predicted (modeled) values are compared. In this case, NC DEQ uses the AoI values as the observed values and the PSAT values as the predicted values. However, the AoI values are not known values and are simply other predicted values; albeit predicted differently than the PSAT values. Therefore, NC DEQ's use of the fractional bias calculation in this instance is suspect. That aside, NC DEQ presents graphs of its fractional bias calculations. Below is the figure relating to sulfate:

Figure 2. NC DEQ's Figure 7-78: Fractional Bias for Sulfate as a Function of Distance from the Facility to the Class I Area

[16] See for instance: https://www.epa.gov/sites/production/files/2020-10/documents/model_eval_protocol.pdf.



As can be seen from the above figure, there is again a great deal of scatter in the data. Calculated fractional bias values range from zero to 100% or greater for points that are essentially the same distance from the Class I Area. This means that at any given distance there is a wide range in the difference in correlation between the AoI and PSAT values. This is evident from an examination of the AoI and PSAT results in Tables 7-29 and 7-30. As a consequence, NC DEQ's conclusion on page 262 that "if the facility is <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," is unfounded. NC DEQ also states, "Therefore, AoI impacts for nearby sources can be adjusted downward to remove the systematic bias in the contributions." As demonstrated, however, NC DEQ's correlation is invalid and the sources that NC DEQ eliminated from consideration based on that conclusion should be re-examined.

Furthermore, as Tables 7-29 and 7-30 indicate, there are very large differences in the AoI versus PSAT calculated percent contributions of key sources on North Carolina's Class I Areas. The above discussion does not adequately explain these differences. Such large differences cast doubt on the validity of NC DEQ's decision to only tag sources for PSAT if the AoI contribution was >= 3% sulfate + nitrate.

In addition to the flaws identified above in NC DEQ's fractional bias calculation, there are also significant technical issues concerning whether PSAT modeling accurately represents visibility impacts from emission sources in close proximity to Class I areas.[17] Thus, NC DEQ should revisit this issue.

2.7 NC DEQ's PSAT Documentation Should be Updated

On page 232 of its SIP, NC DEQ states:

> The original PSAT results were based on the initial 2028 SO2 and NOx point source emissions, which may be found in Appendix B-1 (Task 2A and Task 3A reports). As previously discussed, the 2028 EGU and non-EGU point emissions were updated for a new 2028 model run, but PSAT modeling was not redone with the revised emissions because of time and resource constraints. Details of the updated emissions may be found in Appendix B-2 (Task 2B and Task 3B reports). 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 (Roadmap).

In its letters to sources informing them they must perform four-factor analyses, NC DEQ notes that it has in fact adjusted the PSAT modeling, presumably using the linear scaling described above. For example, in its letter to Blue Ridge Paper, NC DEQ states:

> The DAQ used the revised 2028 SO_2 emissions you provided and recalculated BRPP's [Blue Ridge Paper Products] contribution to visibility impairment for the 20% most impaired days at Shining Rock Wilderness Area using the Particulate Matter Source Apportionment Technology (PSAT) modeling approach referenced in my June 18, 2020 letter. The revised PSAT results indicate that BRPP' s contribution of SO2 emissions to visibility impairment would increase from 1.08% to 1.30% in 2028.

On page 285, NC DEQ indicates that these revised PSAT results were revised again, "to account for issues imbedded in the modeled emissions for elv3 (see Appendix B of this SIP)." In BRPP's case, the 1.30% impact at Shining Rock Wilderness Area (SHRO) increased to 1.36%. NC DEQ provides the twice revised PSAT impacts only for BRPP, Domtar, and PCS Phosphate in Table 7-47. In Domtar's case, the impacts also increased but in PCS Phosphate's case, the impacts decreased. NC DEQ states these revisions did not change the selection of facilities for a reasonable progress assessment, and references Appendix B (Task 6 – Benchmark Run #7 Report Review and 2028 elv3 Reassessment) of the Task 3A report. However, a review of that material seemed to contain emission inventory revisions and does not appear to indicate how NC

[17] See the accompanying report "Technical Review of North Carolina Regional Haze State Implementation Plan, Second Round of Regional Haze State Implementation Plans, Supplemental Report, by D. Howard Gebhart, October 2021."

DEQ actually revised its PSAT results. Further confusing this issue, Table 7-30 indicates that BRPP's sulfate + nitrate contribution to SHRO is 1.234, which does not seem to align with either of the above discussed revisions (similar apparent discrepancies occur in comparing the figures in cited in letters sent to the other two facilities). NC DEQ should explain these further apparent discrepancies.

Regarding all of this, NC DEQ should do the following:

- Make it absolutely clear in the body of its SIP, why it twice revised its PSAT results.
- Indicate how it made those revisions, including repeatable calculations.
- Revise the PSAT information in Tables 7-30 through 7-35 and any other references to PSAT results in the SIP.
- Revise the SIP narrative in section 7 to include this revised information.
- Discuss on a case-by-case basis (this report's objection to NC DEQ's 1% PSAT threshold aside) why it did or did not select facilities for a four-factor analysis.

2.8 NC DEQ's Reasoning for not Selecting Duke Energy Sources is Flawed

On page 270, NC DEQ discusses why it did not select any Duke Energy power plants to undergo four-factor analyses. Part of its reasoning is wrapped up in its conclusion that AoI results for sulfates are at least three times higher than the PSAT results for facilities that are <100 Km from a given Class I area. As discussed above, this blanket pronouncement is based on faulty analysis and thus cannot be used to exempt the Duke Energy sources from four-factor analyses. NC DEQ also reasons that it is likely that North Carolina's EGU fleet will undergo changes to mitigate carbon dioxide emissions that will require moving away from coal to less carbon intensive fuels, which has not been accounted for in the EGU projections supporting the AoI and PSAT analyses. Part of NC DEQ's reluctance to review Duke Energy sources also seems to be contained in its 2028 emission projections. NC DEQ presents Tables 7-41 and 7-42, which contrast Duke Energy power plant historical emissions with initial 2028 projections and revised projections. In many cases, NC DEQ's revised 2028 projections are greatly reduced from its original 2028 projections and in fact recent historical emissions. Again, as discussed above in other comments and reflected in regulations and guidance, absent an enforceable commitment memorialized in the SIP, NC DEQ cannot assume that any source's emissions will drop. NC DEQ should re-evaluate its 2028 emissions projections, and re-evaluate Duke Energy sources for four-factor analyses.

3 NC DEQ Wrongly Ignored Likely Cost-Effective Controls

On page 266 NC DEQ explains that all VISTAS states used a 1.00% PSAT threshold by facility for screening sources for reasonable progress. On page 267, NC DEQ states that 19 facilities exceeded the 1.00% PSAT threshold for sulfate but that it reviewed facilities with <1% sulfate or <1% nitrate contribution to one or more of the Class I areas in North Carolina. NC DEQ concluded that, "[b]ased on this review, the NCDAQ did not identify any uncontrolled or lightly controlled facilities that were large contributors to anthropogenic light extinction at any of North Carolina's Class I areas." NC DEQ does not present this analysis.

As a first order concern, it is unclear what NC DEQ means by "lightly controlled." From a Regional Haze regulatory standpoint, such a term has no meaning. In fact, as this report indicates, easily performed preliminary analyses would have revealed that many of these sources have proven controls available that are likely very cost-effective. However, the Regional Haze Rule has long recognized that upgrades to scrubbers are also generally cost-effective and should be examined by states to ensure reasonable progress.[18] More recently, the Clarification Memo reaffirmed that guidance when it stated:[19]

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 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.

Given EPA's previous findings that scrubber upgrades can achieve 98% control for Wet Flue Gas Desulfurization (WFGD, or "wet scrubber") and 95% for Spray Dryer Absorber (SDA, or "dry scrubber"), NC DEQ must evaluate the cost-effectiveness of those emission limits under the four statutory factors. Many significant wet scrubber upgrades involve relatively low capital expenditures (e.g., liquid to gas improvements such as rings or trays, new spray headers/nozzles, etc.) and often consist of simply running all available absorbers and pumps and utilizing better reagent management or simply using more reagent and/or organic acid additives such as Dibasic Acid (DBA).

Similarly, as discussed above, many EGUs have demonstrated the ability of their SCR systems to consistently achieve much lower NOx levels than they are currently emitting. In these cases, the only costs would be associated with additional reagent and/or better catalyst management practices. In almost all cases, as documented in the comments reviewing the Cardinal facility below, modern SCR systems should be capable of achieving NOx levels of 0.05 lbs/MMBtu or lower, based on a 30 boiler operating day average.

It is acknowledged that, depending on the configuration, the reduced load that some of these EGUs have experienced introduces additional complications such as less than optimum exhaust gas temperature at the catalyst, and ammonium bisulfate deposition. In such instances, additional maintenance costs and possibly reheater or lower temperature catalyst capital costs may be justified. However, these costs do not relate to infeasibility. Rather, they are all

[18] For instance, see the Final Regional Haze Rule update, 82 Fed. Reg. 3088 (January 10, 2017): Here, EPA explains that Texas' analysis was in part rejected because it did not properly consider EGU scrubber upgrades. Also see the BART Final Rule, 70 Fed. Red. 39171 (July 6, 2005): "For those BART-eligible EGUs with preexisting post-combustion SO_2 controls achieving removal efficiencies of at least 50 percent, your BART determination should consider cost effective scrubber upgrades designed to improve the system's overall SO_2 removal efficiency."

[19] Clarification Memo. See page 7.

identifiable, solvable, and ultimately can be included in the cost analysis. Duke Energy is highly experienced in this area, as evidenced by its work at the Gibson Station.[20]

NC DEQ should therefore reassess its source selection process and look for opportunities, many of which are discussed within this report, to upgrade existing scrubber and SCR systems. It is very likely NC DEQ will find that these controls will in most cases be very cost-effective.

Below is a review of a number of these sources that demonstrates opportunities for scrubber and SCR system upgrades. This is not a comprehensive review and other examples may exist. Some of these sources are located in North Carolina and are therefore under NC DEQ's direct authority for review. Other sources are located in other states, but significantly impact the visibility at North Carolina Class I Areas. For these external sources, NC DEQ should have formally requested reductions through the consultation process, instead of merely requesting that these sources be reviewed.

3.1 NC DEQ Should have Examined the Marshall Facility for Upgrades to NOx and SO_2 Controls

The Marshall Power Plant in North Carolina is listed in Tables 7-31 to 7-35 as having multiple PSAT impacts at Great Smoky Mountains National Park (GRSM) of 0.32%, 0.35% at Joyce Kilmer-Slickrock Wilderness Area (JOYC), 0.87% at Linville Gorge Wilderness Area (LIGO), 0.73% at SHRO, and 0.62% at Swanquarter Wilderness Area (SWAN). It consists of four coal-fired units of 350 MW, 350 MW, 711 MW, and 711 MW. All are equipped with wet scrubbers. Units 1, 2 and 4 are equipped with SNCR systems and Unit 3 is equipped with a SCR system. However, as indicated below, these controls are underperforming. Below are 30 day monthly averages for the Marshall Units:[21]

[20] https://www.power-eng.com/coal/boilers/scr-performance/.
[21] See the workbook, "NC EGU Emissions.xlsx."

Figure 3. Marshall Unit 1 Historical SO_2 and NOx Monthly Emissions

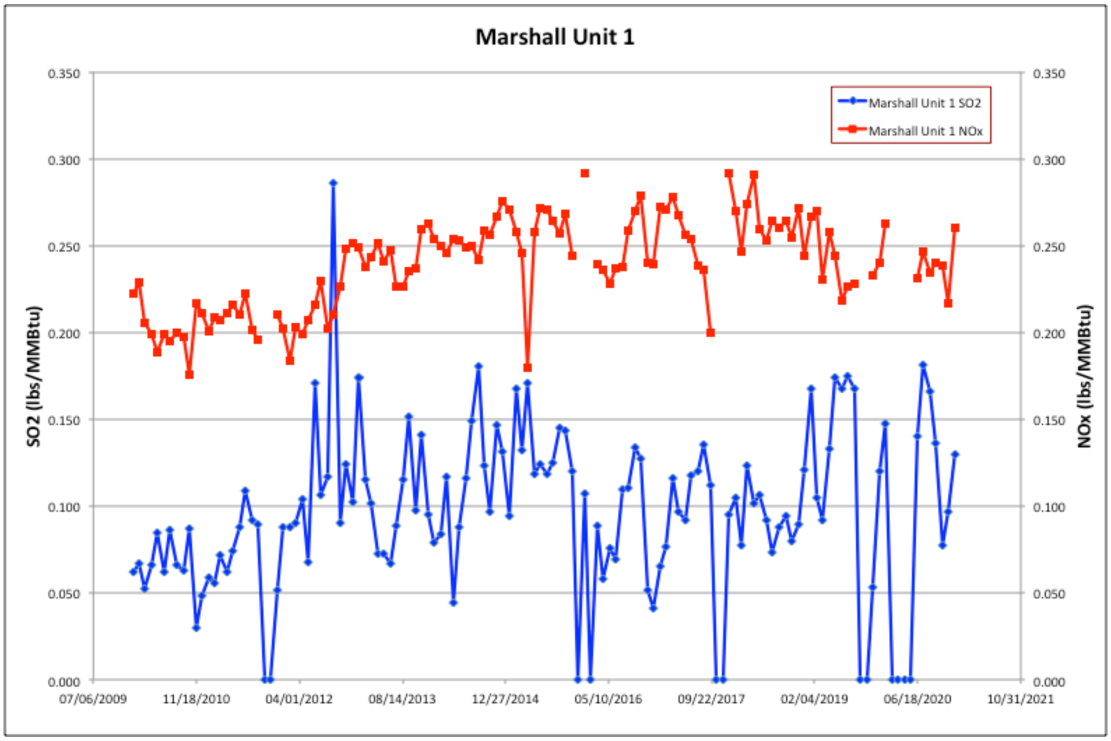


Figure 4. Marshall Unit 2 Historical SO_2 and NOx Monthly Emissions

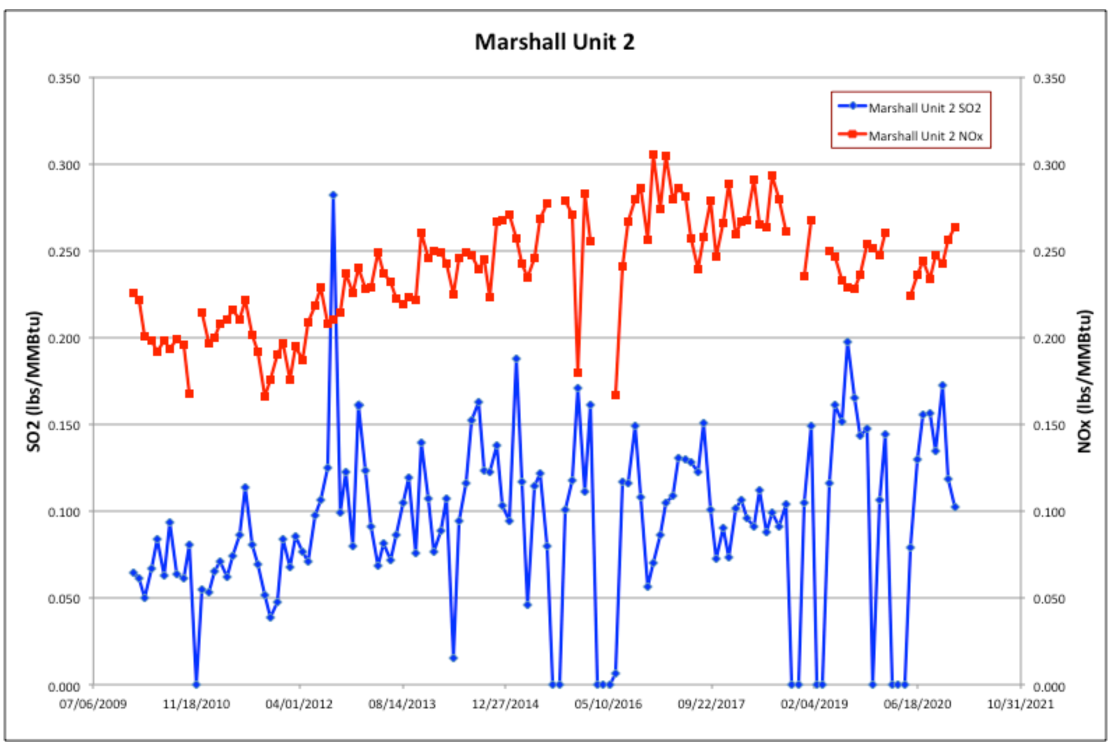


Figure 5. Marshall Unit 3 Historical SO_2 and NOx Monthly Emissions

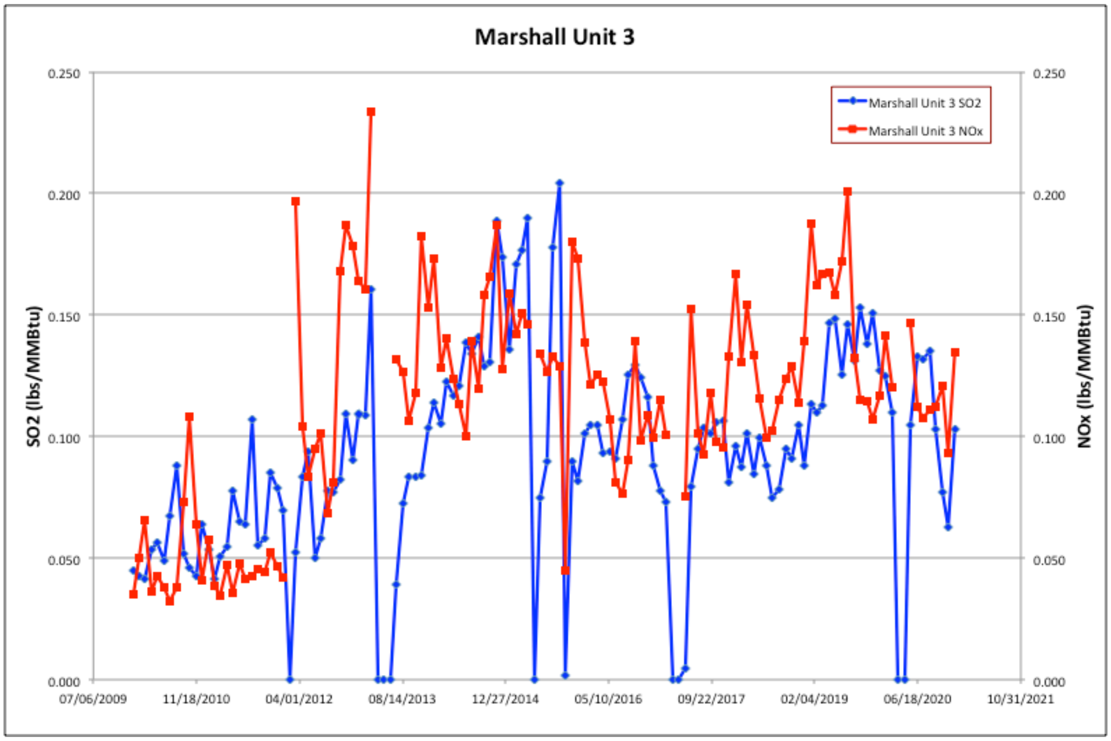
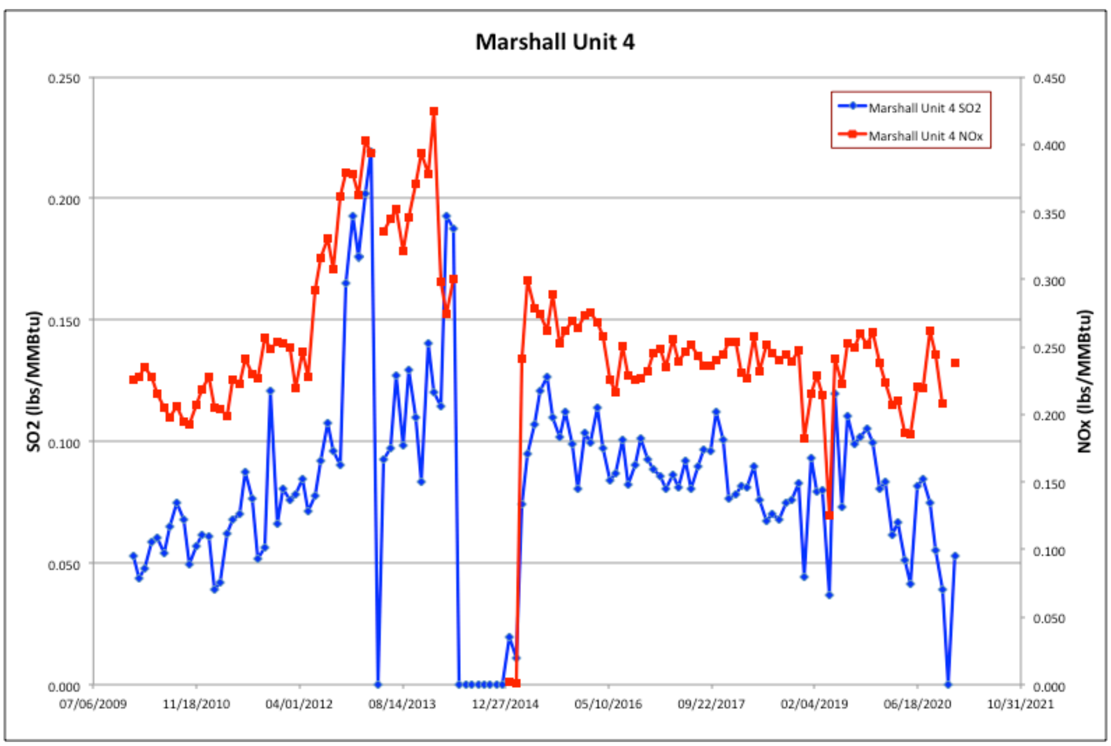


Figure 6. Marshall Unit 4 Historical SO_2 and NOx Monthly Emissions



From the above graphs, it can be seen that the NOx and SO_2 controls for all four units are not operated at a consistent level and are capable of better performance than recently exhibited.[22] For instance, during 2010 – 2011, the SNCR systems for Units 1, 2, and 4 appear to have previously operated at a lower NOx level of approximately 0.20 lbs/MMBtu, with some months significantly below that level. Also, the SCR system for Unit 3 is operated very erratically, but has demonstrated the ability from 2010 – 2011 to consistently operate below 0.05 lbs/MMBtu. This level of performance is in keeping with some of the best operated SCR systems in the U.S, as is discussed in the review of the Cardinal facility. Similarly, the wet scrubber systems on all four units are operated erratically, but during 2010 – 2011 have demonstrated the ability to continuously operate well below 0.10 lbs/MMBtu. Thus, without any capital upgrade cost (and likely minimal operating and maintenance costs), the Marshall units are quite capable of much better NOx and SO_2 performance. It appears the only reason they do not is that they are not required by permit condition to do so. Additional reductions may also be possible with very moderate and likely cost-effective upgrades. NC DEQ should therefore have required—and should require—that the Marshall units undergo four-factor analyses.

On page 348, NC DEQ states "Coal units 3 and 4 currently have the capability to burn natural gas and coal units 1 and 2 are scheduled to be upgraded to burn natural gas in the fall of 2021." Marshall's Title V permit indicates that all four units are already permitted to burn natural gas without any apparent restriction. Therefore, NC DEQ should consider requiring provisions in the SIP for a complete switch to natural gas. Such a change would result in a SO_2 reduction of approximately 3,000 tpy, based on the facility's 2020 SO_2 emissions.

3.2 NC DEQ Should have Examined the Belews Creek Facility for Upgrades to NOx and SO_2 Controls

The Duke Energy Belews Creek Power Plant in NC was not selected for PSAT tagging. It consists of two nearly identical 1,120 MW units. Both are equipped with wet scrubbers and SCR systems. Both units are permitted to burn natural gas up to 50% of the boiler ratings. However, an examination of EIA-923 data indicates that Unit 2 has not reported burning any natural gas and Unit 1 has began burning natural gas in 2020, with some, but inconsistent usage every month.

In Table 7-41, NC DEQ indicates that it revised its 2028 projected SO_2 emissions for Belews Creek from 4,946 to 1,385 tons. In Table 7-42, NC DEQ indicates that it revised its 2028 projected NOx emissions from 5,264 to 1,867 tons. Below are Belews Creek's recent SO_2 and NOx annual emissions:

[22] Note that because all units are permitted to also burn natural gas, EIA Form 923 (https://www.eia.gov/electricity/data/eia923/) was checked to determine which months indicated any unit did so from 2017 through 2020. This analysis indicated that only Unit 3 burned natural gas during 11/2020 – 12/2020. Thus, the analysis described herein is not impacted from burning natural gas.

Table 3. Belews Creek Recent SO_2 Annual Emissions

Unit	2018 SO_2 (tons)	2019 SO_2 (tons)	2020 SO_2 (tons)
1	2,460	1,570	719
2	1,659	1,801	1,154
Totals	4,119	3,371	1,873

Table 4. Belews Creek Recent NOx Annual Emissions

Unit	2018 NOx (tons)	2019 NOx (tons)	2020 NOx (tons)
1	4,731	2,822	2,675
2	2,540	2,847	1,792
Totals	7,272	5,668	4,467

As can be seen from the above tables, NC DEQ's revised SO_2 2028 emissions are significantly less than the facility emitted in 2020. Presumably the SO_2 revision is connected to statements made by Duke Energy that recent infrastructure changes will "allow 40% natural gas co-firing on both units."[23] However, there does not appear to be any permit or other enforceable requirement that Belews Creek fire any natural gas, except during startup. There does not appear to be any plausible explanation for NC DEQ's very significant decrease in 2028 NOx emissions. Current facility NOx emissions are more than double NC DEQ's revised 2028 emissions. Again, as has been discussed above, NC DEQ should either base its projected 2028 emissions on historical data, or ensure that any significant deviations from historical data are made enforceable in the SIP.

As indicated below, both the wet scrubber and SCR systems are underperforming. Below are 30-day monthly averages for the Belews Creek Units:[24]

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[23] See: https://www.duke-energy.com/our-company/about-us/power-plants/belews-creek-steam-station.

[24] See the workbook, "NC EGU Emissions.xlsx."

Figure 7. Belews Creek Unit 1 Historical SO_2 and NOx Monthly Emissions

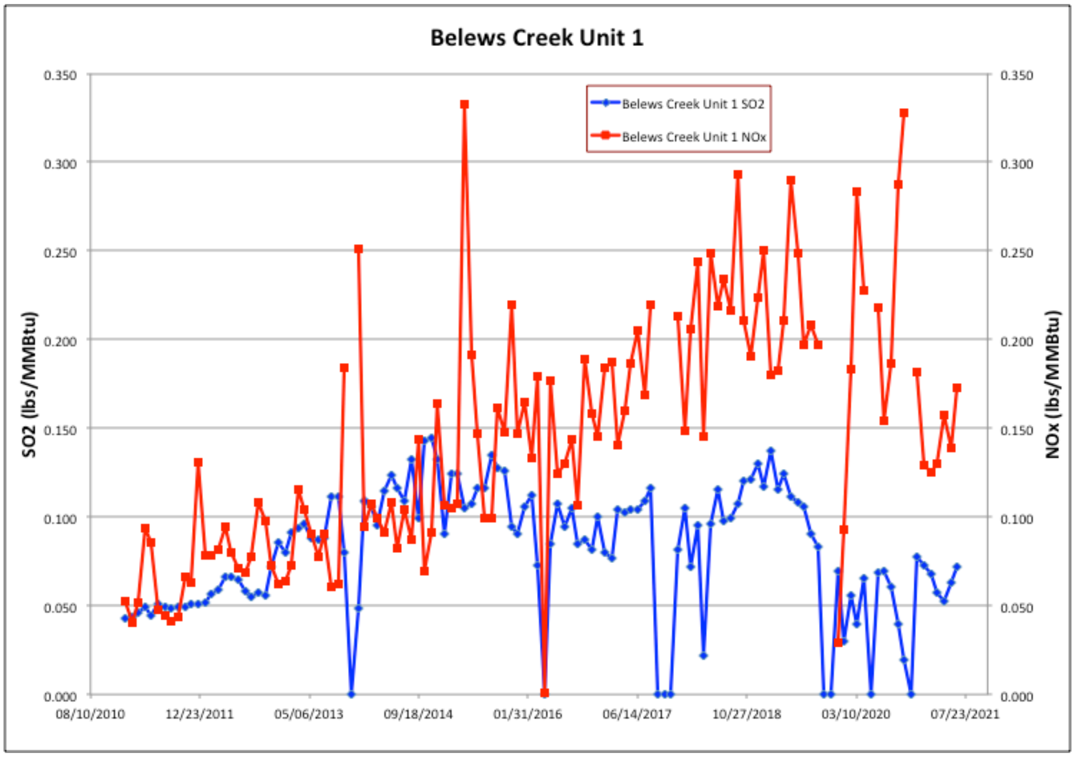
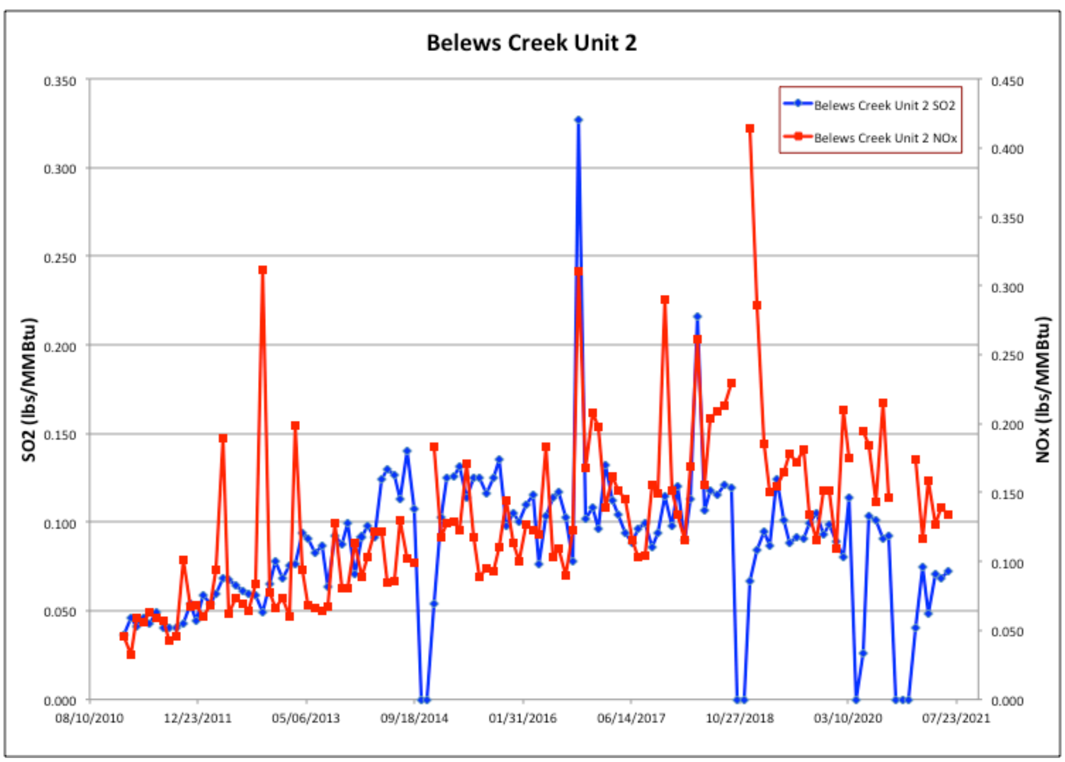


Figure 8. Belews Creek Unit 2 Historical SO_2 and NOx Monthly Emissions



As can be seen from the above graphs, both the SCR and scrubber systems have demonstrated the capability to consistently control SO_2 and NOx to 0.05 lbs/MMBtu or better on a monthly average basis for both units (which are nearly identical and have identical controls). However, the performance of these systems has steadily degraded over time. In addition, NOx control is especially erratic. Unit 1's SO_2 dip in 2020 is likely due to the start of its usage of natural gas. However, even with that, the SO_2 rate is still much higher than 0.05 lbs/MMBtu. Likely, the reason for the lax performance of these control systems is that Belews Creek's permit doesn't require better performance. Thus, very cost-effective controls are available for both units for likely just the increase in reagent, potentially better catalyst management and additional electricity for running all absorber pumps. NC DEQ should have required a four-factor analysis for this facility and investigated this issue.

3.3 NC DEQ Should have Examined the Roxboro Facility for Upgrades to NOx and SO_2 Controls

The Duke Energy Roxboro Power Plant in North Carolina was not selected for PSAT tagging. It is commonly represented as consisting of four units: 411 MW, 657 MW, 745 MW, and 745 MW. However, it appears from an examination of aerial photography that Units 3 and 4 are each composed of dual boilers, each with separate Electrostatic Precipitators (ESPs) and SCR systems, but sharing a wet scrubber and a stack. Because emissions data are split into Units 1, 2, 3A, 3B, 4A, and 4B, it is assumed that each pair of twin units share a monitor with emissions data being apportioned, and this appears to be born out by the emissions data.

In Table 7-41, NC DEQ indicates that it revised its 2028 projected SO_2 emissions for Roxboro from 6,665 to 2,258 tons. In Table 7-42, NC DEQ indicates that it revised its 2028 projected NOx emissions from 4,528 to 1,532 tons, but that does not appear to be an enforceable limitation. Below are Roxboro's recent SO_2 and NOx annual emissions:

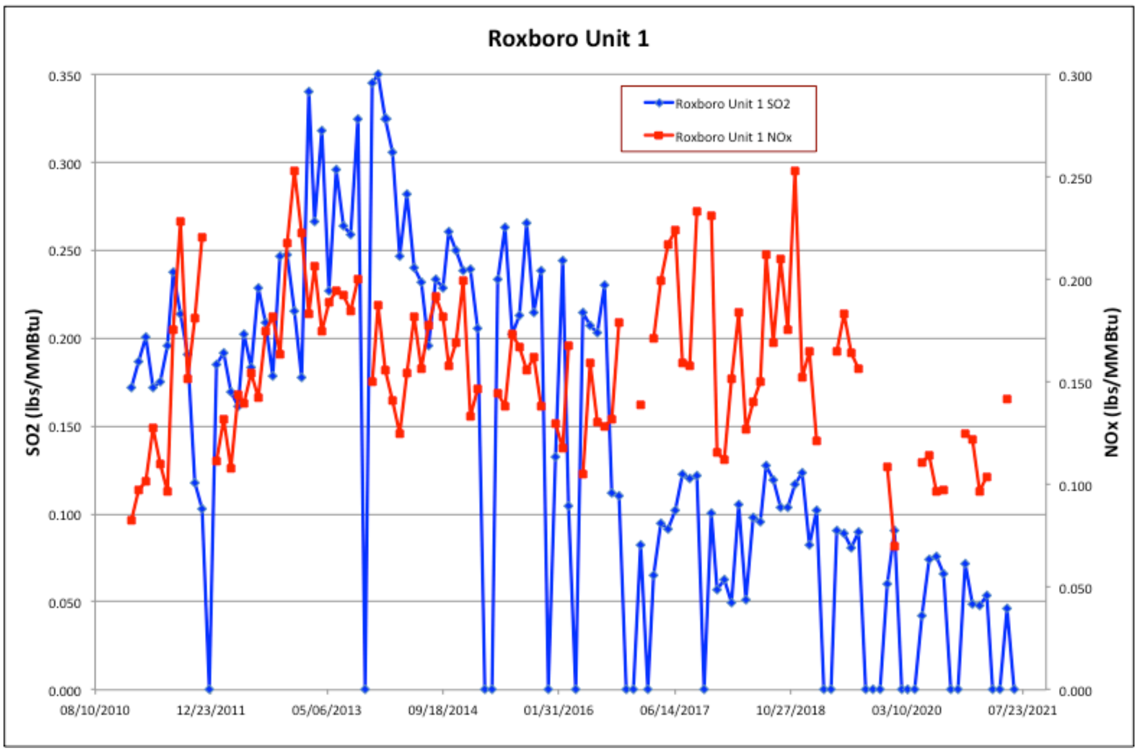
Table 5. Roxboro Recent SO_2 and NOx Annual Emissions

Unit	2018 SO_2 (tons)	2019 SO_2 (tons)	2020 SO_2 (tons)	2018 NOx (tons)	2019 NOx (tons)	2020 NOx (tons)
1	444	278	203	709	452	317
2	1,207	615	740	1,762	827	998
3A	442	666	503	768	882	699
3B	471	656	508	878	694	768
4A	571	988	376	835	948	499
4B	470	940	307	689	898	395
Totals	3,605	4,143	2,637	5,641	4,701	3,676

As can be seen from the above tables, NC DEQ's revised SO_2 2028 emissions are slightly less than the facility emitted in 2020 and its revised NOx 2028 emissions are much less. Current facility NOx emissions are more than double NC DEQ's revised 2028 emissions. Again, as has been discussed above, NC DEQ should either base its projected 2028 emissions on historical data, or ensure that any significant deviations from that historical data are made enforceable in the SIP.

As indicated below, both the wet scrubber and SCR systems are underperforming. Below are 30-day monthly averages for the Roxboro Units:[25]

Figure 9. Roxboro Unit 1 Historical SO_2 and NOx Monthly Emissions



[25] See the workbook, "NC EGU Emissions.xlsx."

Figure 10. Roxboro Unit 2 Historical SO_2 and NOx Monthly Emissions

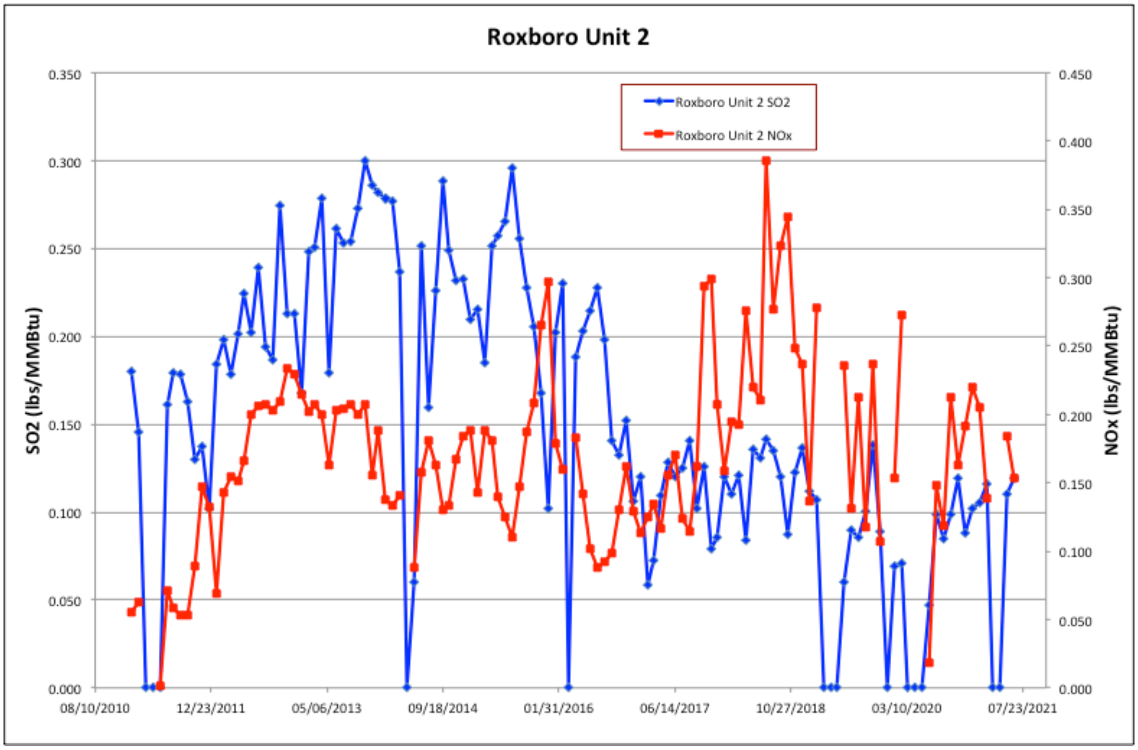


Figure 11. Roxboro Unit 3B Historical SO_2 and NOx Monthly Emissions

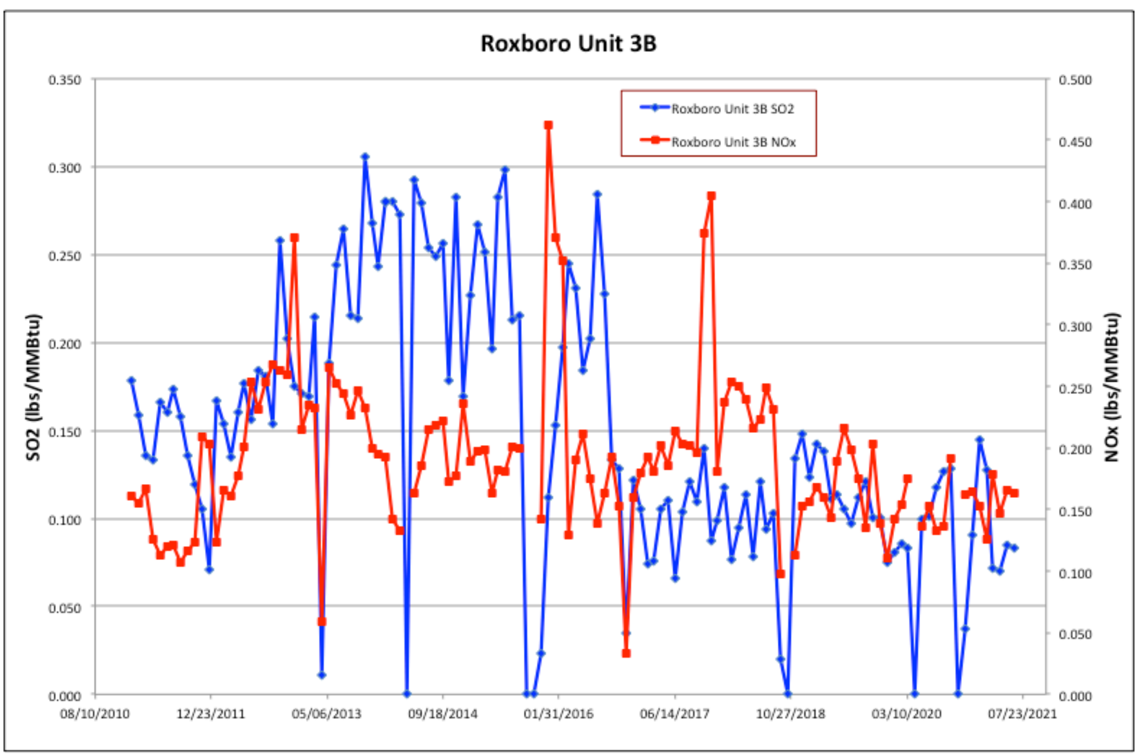
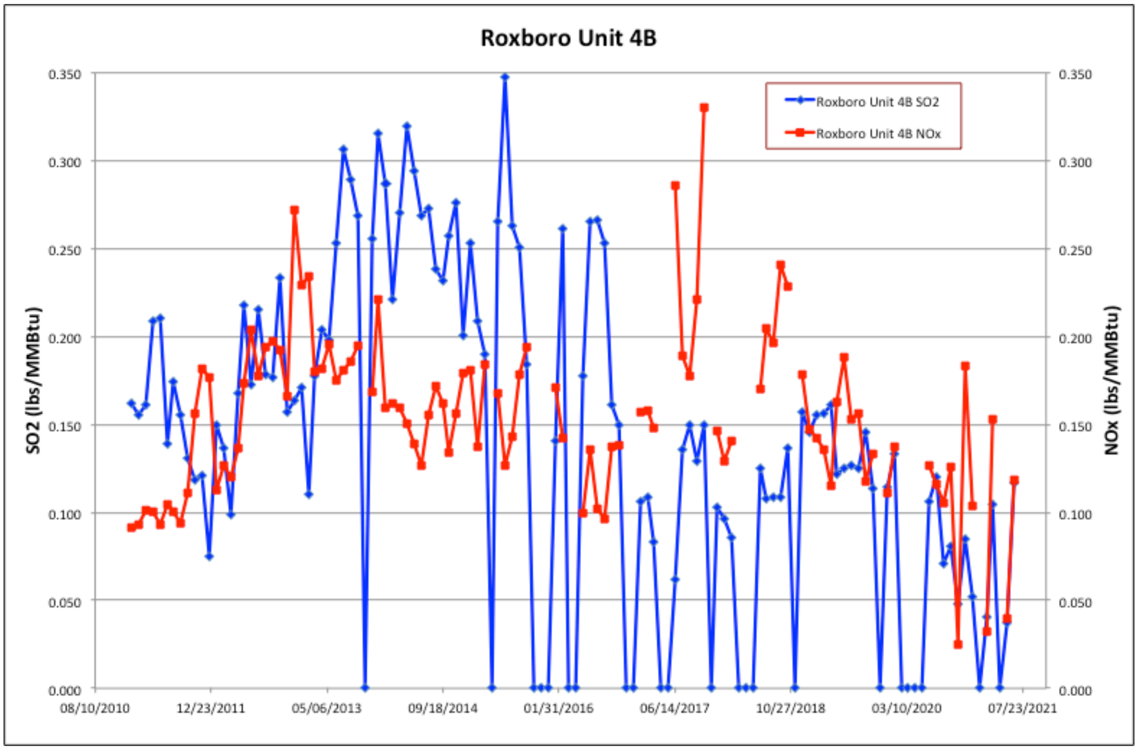


Figure 12. Roxboro Unit 4B Historical SO_2 and NOx Monthly Emissions

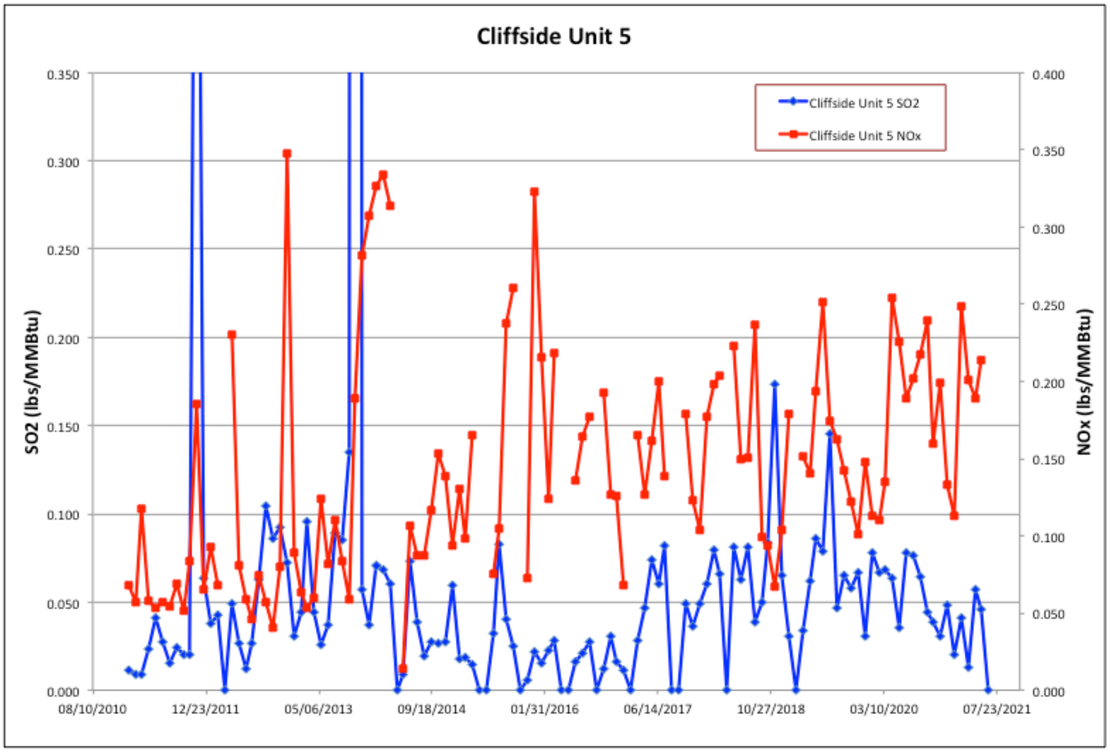


As can be seen from the above graphs, the scrubber systems have demonstrated the capability to consistently control SO_2 to approximately 0.075 lbs/MMBtu or better on a monthly average basis. Although the units have all decreased their SO_2 emissions beginning approximately in September 2016, the wet scrubber systems are still significantly underperforming. The SCR systems have been operated very erratically, although all have demonstrated the ability to continuously operate at approximately 0.10 lbs/MMBtu. It is likely all the SCR systems could operate at 0.05 lbs/MMBtu on a monthly average basis, as discussed in the review of the Cardinal facility. Thus, very cost-effective controls are available for all the scrubber and SCR systems for just the increase in reagent, potentially better catalyst management and additional electricity for running all absorber pumps. NC DEQ should have required a four-factor analysis for this facility and investigated this issue.

3.4 NC DEQ Should have Examined the Cliffside Facility for Upgrades to NOx and SO_2 Controls

The Duke Energy Cliffside Power Plant in North Carolina was not selected for PSAT tagging. It consists of two remaining units: 621 MW and 910 MW. Both units are fitted with wet scrubber and SCR systems. As has been discussed above in another comment, there is a large difference between Cliffside's actual emissions and NC DEQ's projected 2028 emissions, which do not appear to be secured by an enforceable mechanism. Below are 30 day monthly averages for the Cliffside Units:[26]

Figure 13. Cliffside Unit 5 Historical SO_2 and NOx Monthly Emissions



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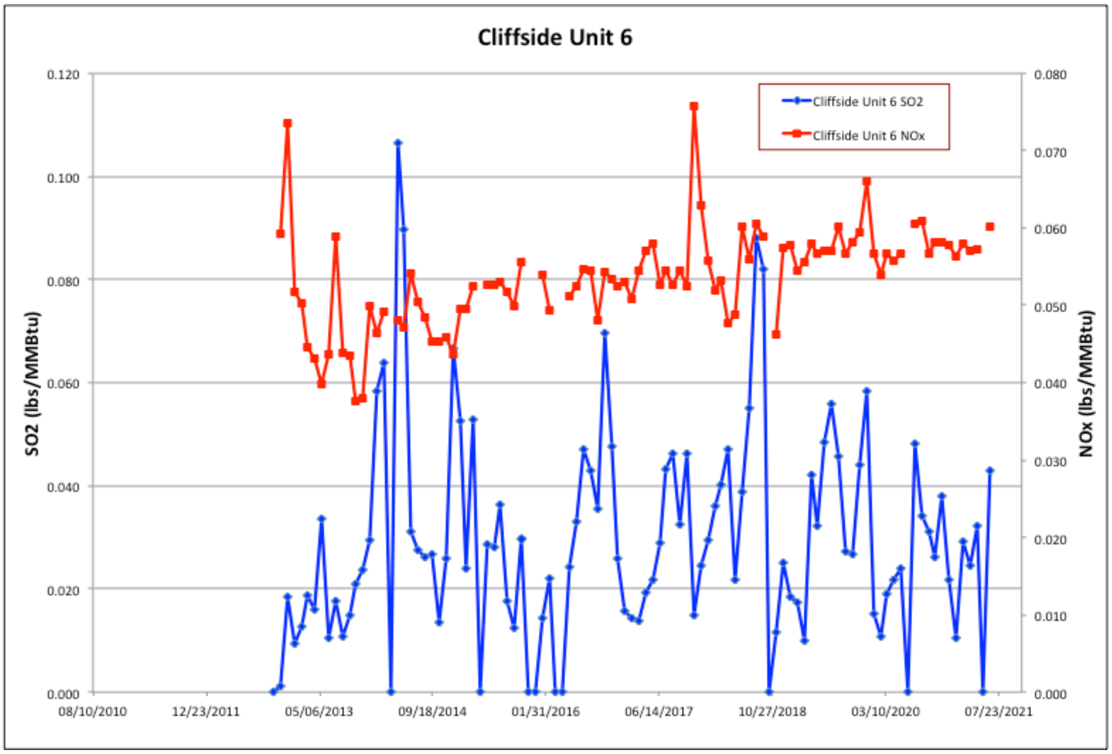
[26] See the workbook, "NC EGU Emissions.xlsx."

Figure 14. Cliffside Unit 6 Historical SO_2 and NOx Monthly Emissions

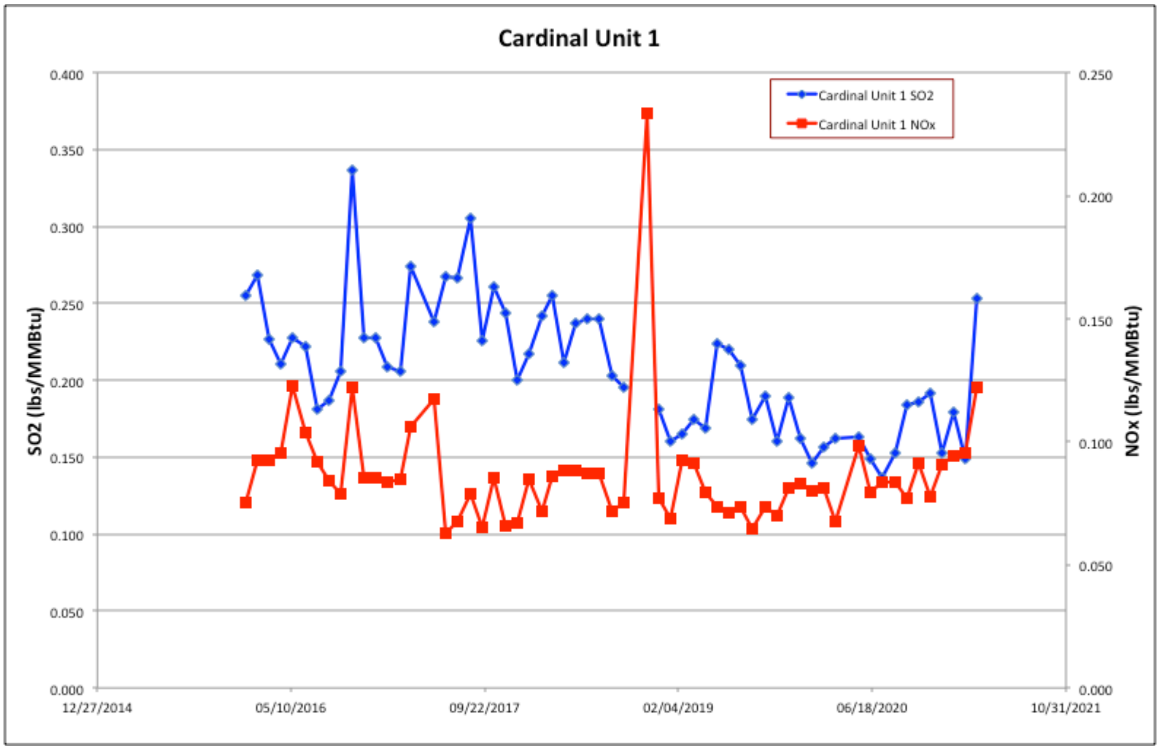


Duke Energy states that in 2018, natural gas was added to the station, allowing up to 40% natural gas co-firing on unit 5 and up to 100% on unit 6. EIA-923 data indicates that both units began using natural gas at the beginning of 2019. Unit 6 appears well controlled for NOx and SO_2, but has demonstrated the capability to control NOx slightly below its present levels. Considering that the facility is now burning natural gas in addition to coal, there is likely considerable room for improvement. Unit 5 has demonstrated the ability to consistently control SO_2 to below 0.04 lbs/MMBtu. However, recently Unit 5's SO_2 levels have climbed somewhat. Unit 5 has demonstrated the ability to consistently control NOx to approximately 0.05 lbs/MMBtu on a monthly basis. However, over the past ten years Unit 5's NOx level has steadily climbed. Likely, the reason for the lax performance of these control systems is that Cliffside's permit doesn't require better performance. Thus, very cost-effective controls are available for these units for likely just the increase in reagent and potentially better catalyst management and additional electricity for running all absorber pumps. NC DEQ should have required a four-factor analysis for this unit and investigated this issue.

3.5 NC DEQ Should have Objected to Ohio not Improving Controls at the Cardinal EGU

The Cardinal Power Plant in Ohio is listed in Tables 7-31 to 7-35 as having multiple PSAT SO_2 impacts at GRSM of 0.88%, 0.79% at JOYC, 0.61% at LIGO, 0.50% at SHRO, and 1.97% at SWAN. It consists of three coal-fired units of 615 MW, 615 MW, and 650 MW. All are equipped with wet scrubbers and SCR systems. However, as indicated below, these controls are underperforming. Below are 30 day monthly averages for the Cardinal Units:[27]

Figure 15. Cardinal Unit 1 Monthly Average SO_2 and NOx emissions.



[27] See the workbook, "OH EGU Emissions.xlsx," worksheet "OH Selected Monthly." Note that in some cases the scales have been modified to separate the SO_2 and NOx curves.

Figure 16. Cardinal Unit 2 Monthly Average SO_2 and NOx emissions.

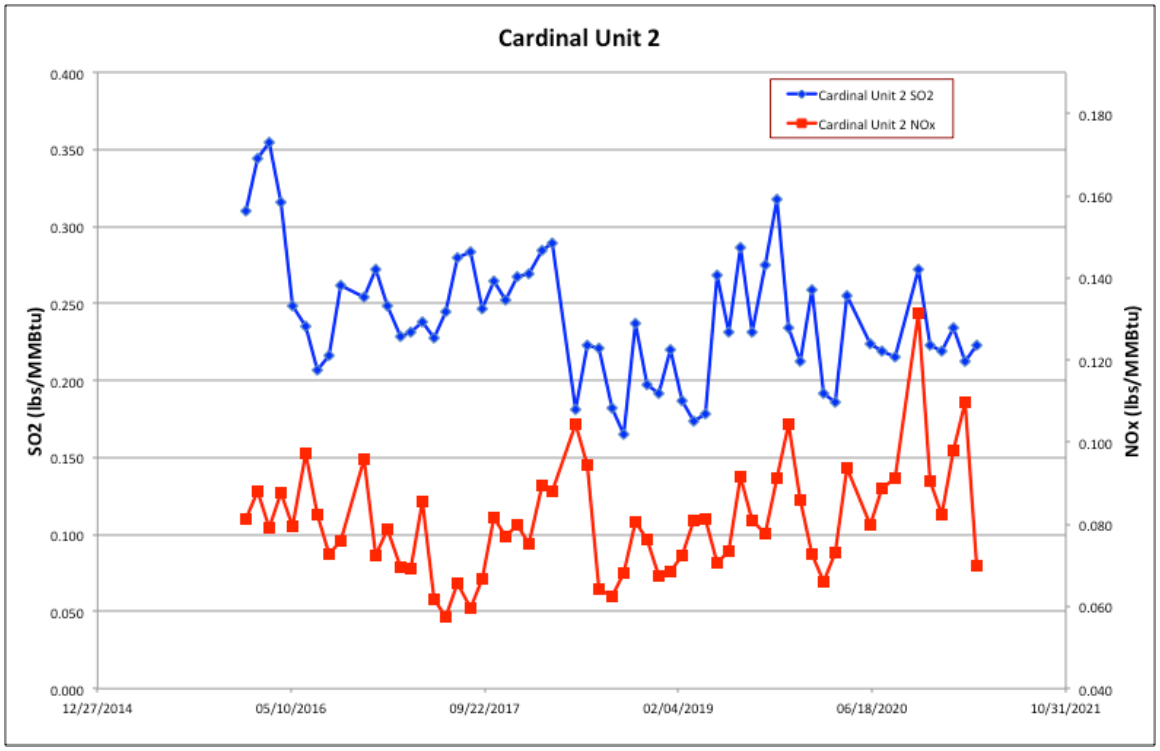
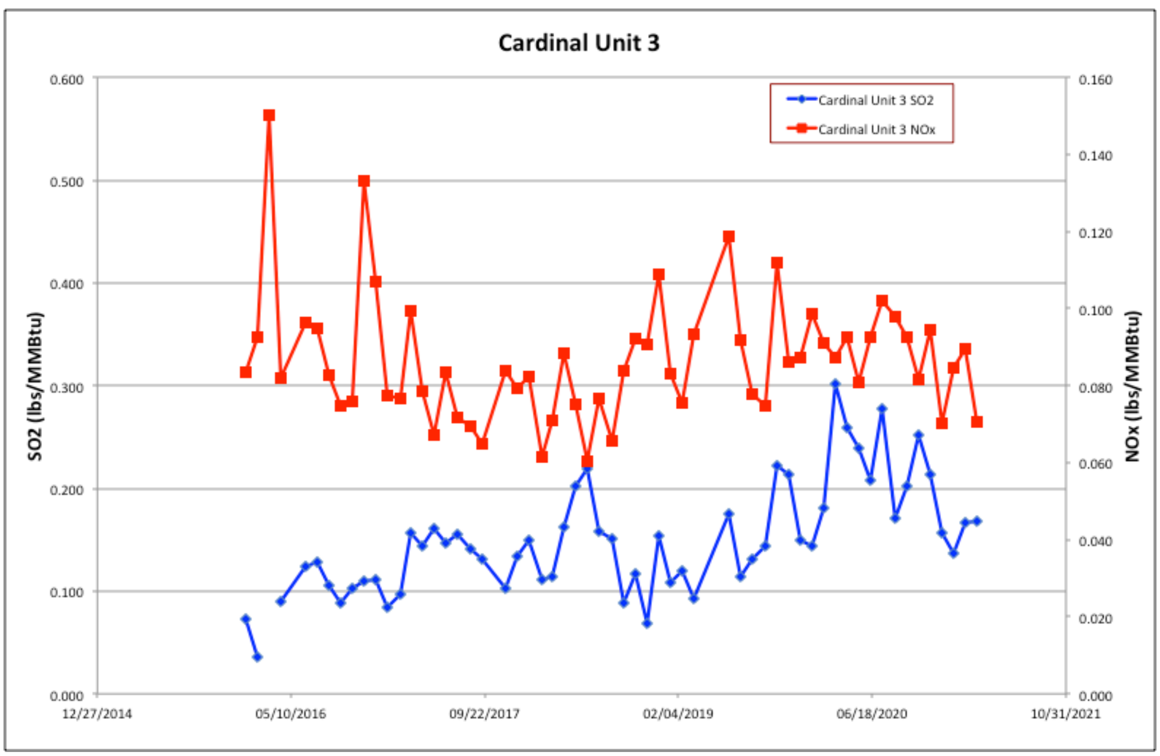


Figure 17. Cardinal Unit 3 Monthly Average SO_2 and NOx emissions.



It can be seen from the above graphs, that the monthly SO_2 emissions for the Cardinal units are fairly variable, which suggests that Cardinal's scrubbers can be further optimized.

Similar observations can be made regarding the performance of the Cardinal SCR systems. It appears from the above graphs that the performance of Cardinal's SCR systems is suboptimal, with recent monthly NOx averages typically ranging from 0.06 – 0.12 lbs/MMBtu.

SCR systems can often be upgraded very cost-effectively by selecting catalyst that is better optimized to the SCR inlet temperature, optimizing the ammonia injection system to improve the ammonia mixing and distribution, optimizing catalyst rejuvenation/regeneration, or simply using more reagent. As the Control Cost Manual states, [28]

> Theoretically, SCR systems can be designed for NOx removal efficiencies up close to 100 percent. 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 NOx controls such as LNB or FGR [Flue Gas Recirculation] 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).

Thus retrofit SCR systems for coal-fired EGUs can typically be relied upon to achieve at least 90% control with a floor of 0.04 lbs/MMBtu. In some cases, coal-fired EGU SCR systems can continuously achieve less than 0.04 lbs/MMBtu on a 30-day rolling average basis. In fact, Cardinal Unit 1 formerly had one of the best performing SCR units in the U.S., as the following graphs indicate:

[28] Control Cost Manual, Chapter 2 Selective Catalytic Reduction, June 2019. See pdf page 5.

Figure 18. Cardinal Unit 1 Historical 30 Boiler Operating Day (BOD) NOx Performance

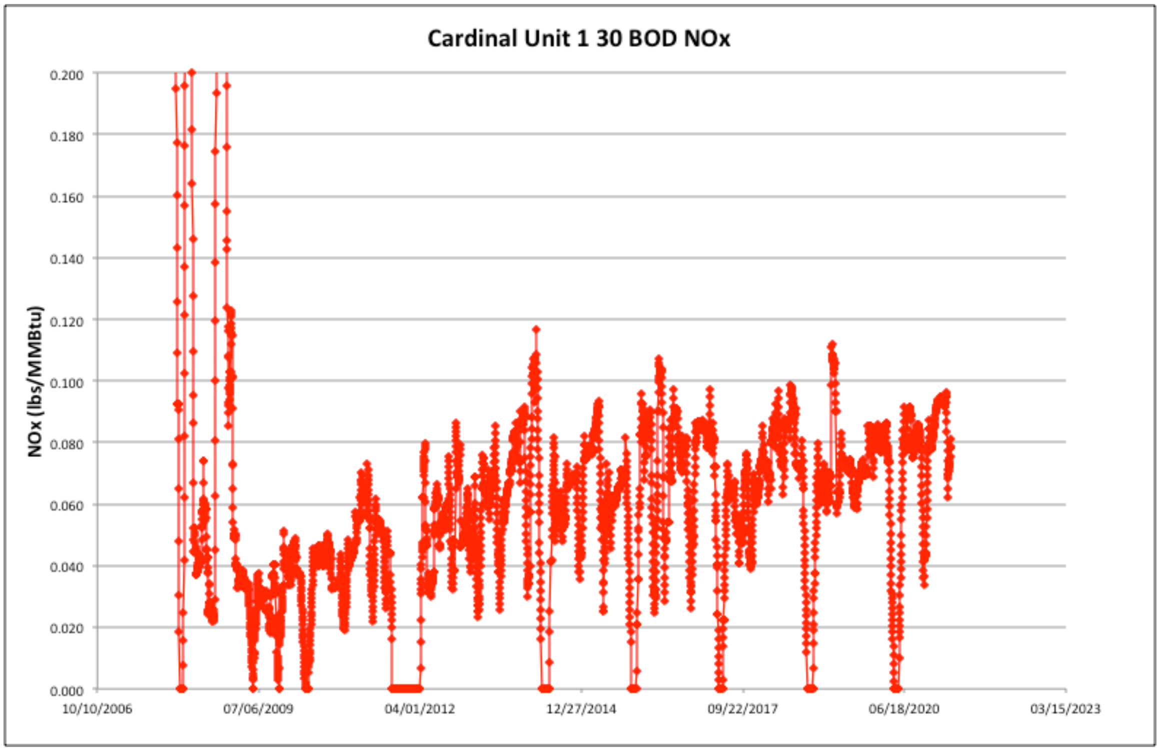
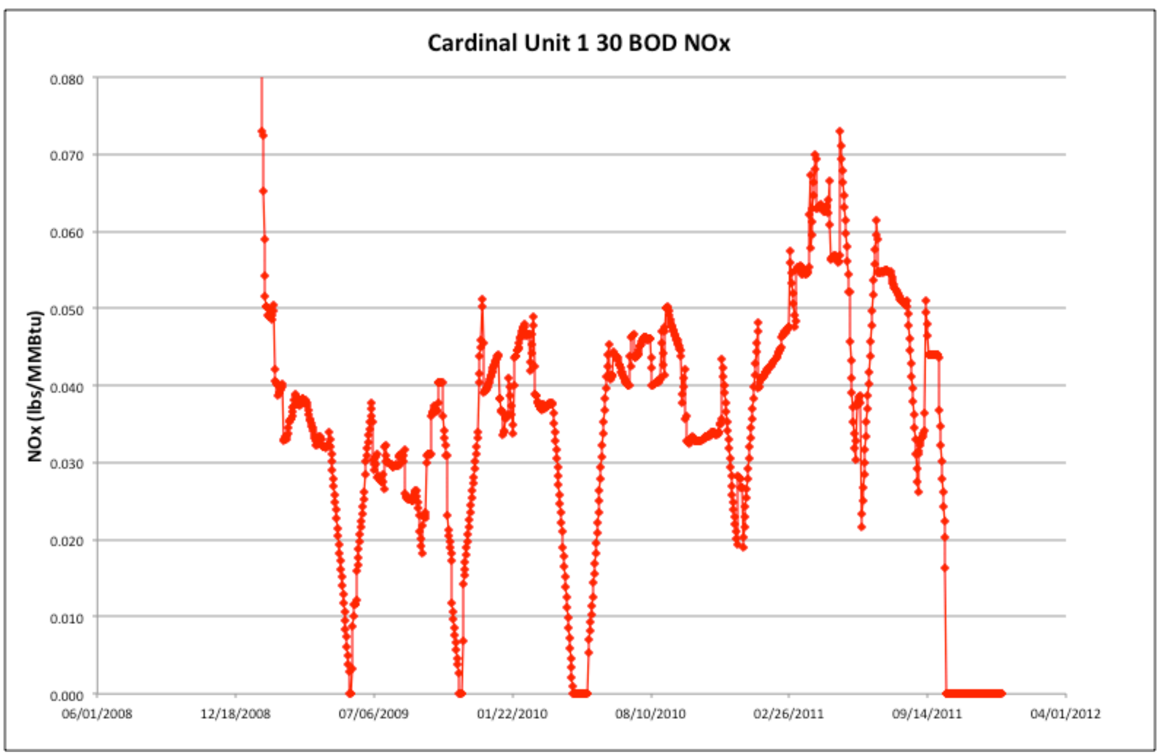


Figure 19. Cardinal Unit 1 Selected Historical 30 BOD NOx Performance



The above figures illustrate the Cardinal Unit 1 SCR system performance during two different time intervals. The NOx emissions are plotted based on a 30 BOD average.[29] As can be seen from Figure 6, the Cardinal Unit 1's SCR performance has gradually worsened over time. Figure 7 illustrates the SCR performance for the first two years after it was first installed. As can be seen, the SCR system is capable of sustained performance under 0.04 lbs/MMBtu. An examination of Cardinal Units 2 and 3 SCR systems reveals similar capabilities. In fact, the performance of the Cardinal Units' SCR systems was formerly so good that EPA included it in its survey of the best coal-fired EGU SCR systems to support its New Mexico FIP, which concluded that SCR systems for the San Juan Generating Station were not only cost-effective, but should be required to meet a NOx rate of 0.50 on a 30 BOD average.[30] Cardinal's Title V permit does not appear to specify any NOx emission limits for the units that would approach 90% control.[31] Thus, it appears that the only thing preventing the Cardinal units from achieving this level of SCR performance again is the lack of an enforceable NOx limit requiring it. Consequently, although Ohio performed a four-factor analysis on the Cardinal units, it wrongly concluded no controls were necessary.[32] NC DEQ should have objected to this conclusion, as it appears likely that additional NOx reductions could be achieved very cost-effectively. More SO_2 reduction could be a matter of Cardinal simply running its scrubber systems at full capacity continuously or utilizing common scrubber upgrades discussed in another comment.

3.6 NC DEQ Should have Objected to Ohio not Improving Controls at the Kyger Creek EGU

The Kyger Creek Power Plant in Ohio is listed in Tables 7-31 to 7-35 as having multiple PSAT SO_2 impacts at GRSM of 0.85%, 0.74% at JOYC, 0.70% at LIGO, 0.56% at SHRO, and 0.43% at SWAN. It consists of five coal-fired units of 217 MW each. Units 1 and 2 share a scrubber

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[29] Emissions were downloaded from https://ampd.epa.gov/ampd/. EGU emission limits based on rolling 30 BOD averages are preferred over those conditioned based on 30 day running averages because they de-emphasize emission spikes that occur when units are started, shut down, or malfunction. This results from only counting the days when the unit operates in the averaging. Note that EPA states that EGUs should in fact be conditioned on rolling 30 BOD averages in the BART Final Rule (70 FR 39172).

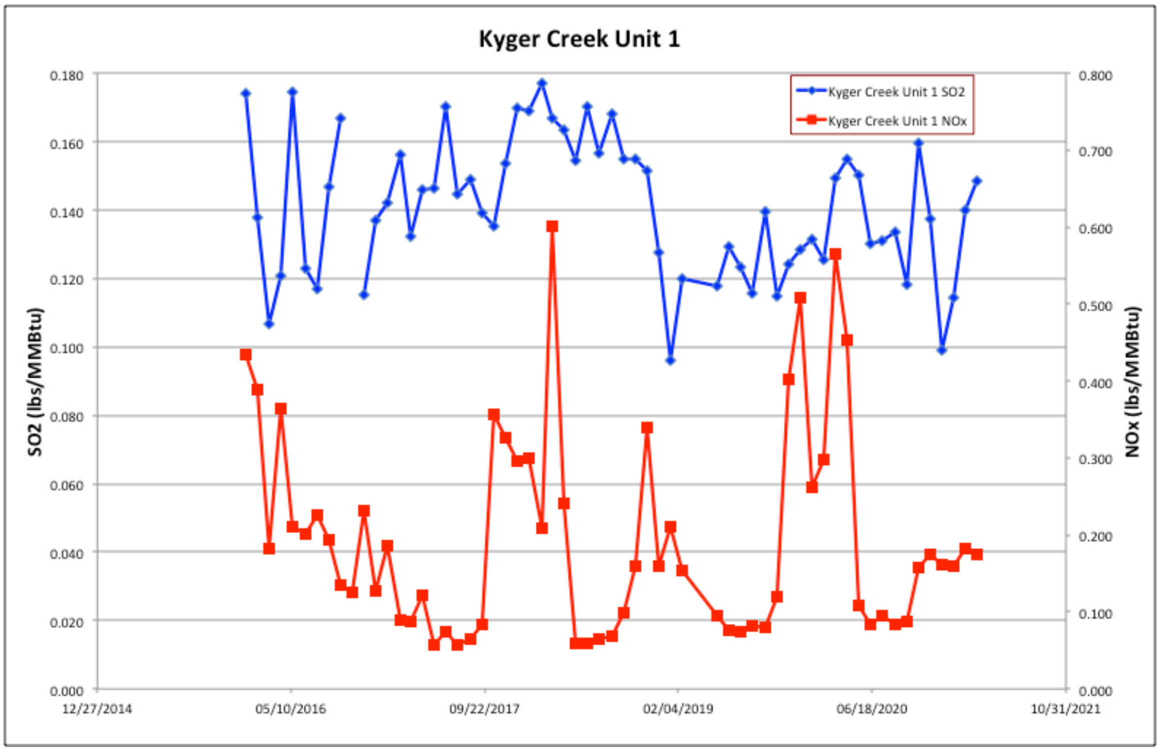
[30] See EPA's proposal at 76 FR 491 (January 11, 2011) and its final at 76 FR 52388 (August 22, 2011). In particular, see the discussion at 76 FR 52404: "The Havana Unit 9 data shows that it has operated under 0.05 lbs/MMBtu from mid-2009 to the end of 2010 on a continuous basis. In fact, this unit has operated under 0.035 lbs/MMBtu for much of that time. The Parish Unit 7 data shows that it has operated under 0.05 lbs/MMBtu from mid-2006 to mid 2010 on a continuous basis. In fact, this unit has operated for months at approximately 0.035 lbs/MMBtu, and for approximately 2 years at approximately 0.04 lbs/MMBtu. The Parish Unit 8 data show that it has operated almost continuously under 0.045 lbs/MMBtu since the beginning of 2006. Other units' data show months of continuous operation below 0.05 lbs/ MMBtu. We believe this data demonstrates that similar coal fired units that have been retrofitted with SCRs are capable of achieving NOx emission limits of 0.05 lbs/MMBtu on a continuous basis." Also see this document in which the SCR performance of the Cardinal and other top performing SCR systems discussed above was graphed: https://www.regulations.gov/document/EPA-R06-OAR-2010-0846-0129.

[31] FINAL Division of Air Pollution Control Title V Permit for Cardinal Power Plant (Cardinal Operating Company), Facility ID: 0641050002, Permit Number: P0089700, Permit Type: Renewal, Issued: 01/07/2021, Effective: 01/28/2021, Expiration: 01/28/2026.

[32] See Regional Haze State Implementation Plan for the Second Implementation Period, Prepared by: The Ohio Environmental Protection Agency Division of Air Pollution Control, DRAFT May 2021. Page 27.

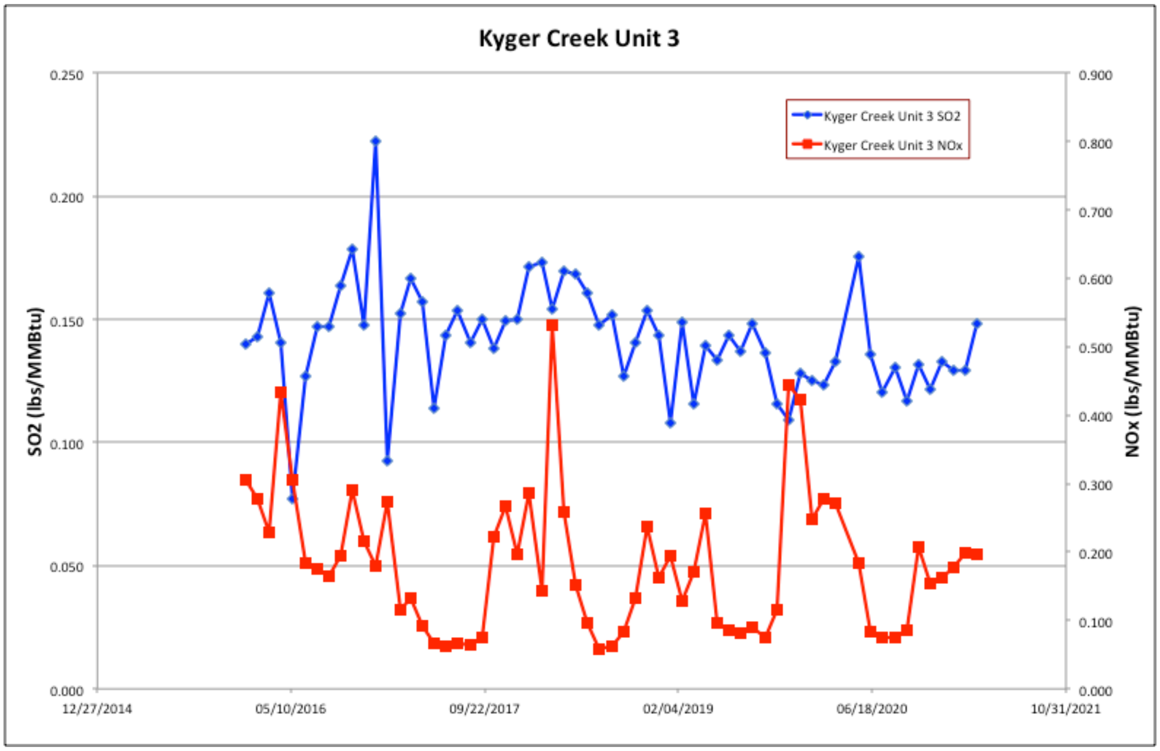
and CEMS and Units 3, 4, and 5 share a scrubber and CEMS. Thus, the monitoring data available from EPA's AMPD website is apportioned and cannot be thought of as being particular to each unit. Analysis indicates the NOx and SO_2 data for Units 1 and 2 are very similar and that for Units 3, 4, and 5 are very similar. Therefore, only monitoring data for Units 1 and 3 are referenced below:[33]

Figure 20. Kyger Creek Unit 1 Recent Monthly Average SO_2 and NOx emissions



[33] See the workbook, "OH EGU Emissions.xlsx," worksheet "OH Selected Monthly." Note that in some cases the scales have been modified to separate the SO_2 and NOx curves.

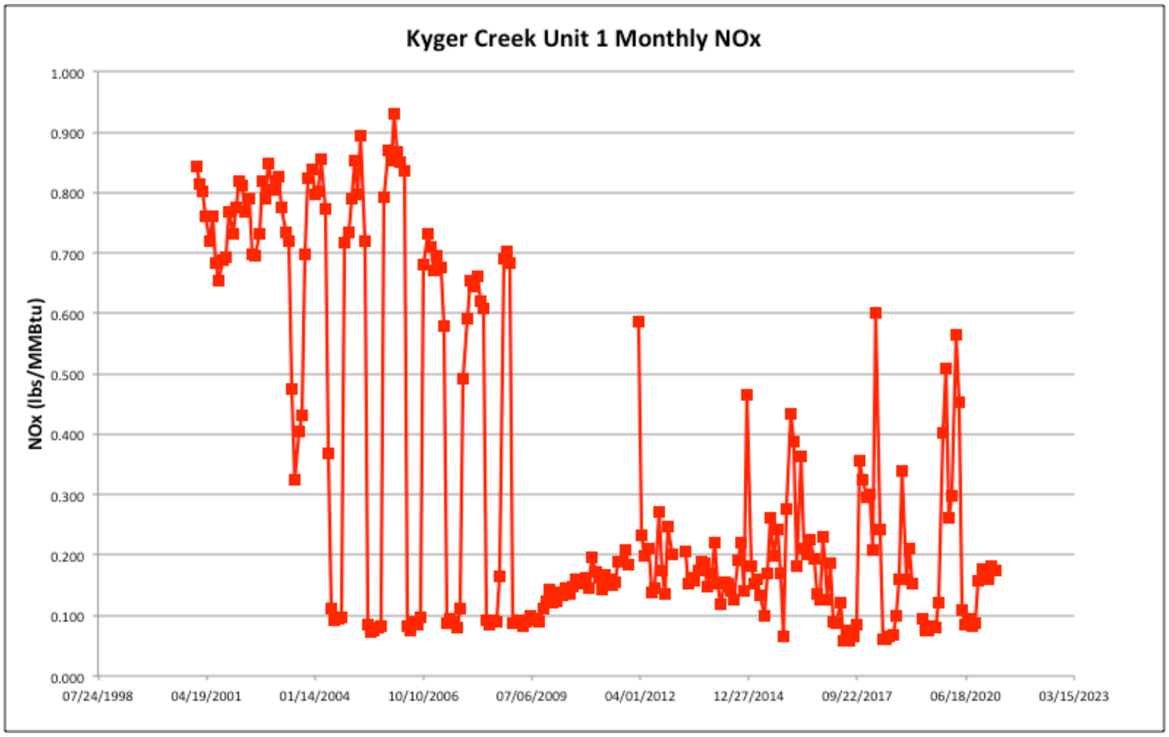
Figure 21. Kyger Creek Unit 3 Recent Monthly Average SO_2 and NOx emissions



As can be seen from the above graphs, the monthly SO_2 emissions for the Kyger Creek units are fairly variable, which suggests that Cardinal's scrubbers can be further optimized.

Also, the performance of the Kyger Creek SCR systems alternates between 3-4 month periods of good NOx removal (approximately 0.06 – 0.08 lbs/MMBtu) with the rest of the time consisting of poor NOx removal. It seems evident the facility only utilizes its SCR systems at their full capabilities during ozone season. This indicates that the true current performance potential of the Kyger Creek SCR systems is likely at least 0.06 lbs/MMBtu. The pre-SCR NOx level of Unit 1 is shown below:

Figure 22. Kyger Creek Unit 1 Historical Monthly NOx Emissions



Averaging the monthly NOx rates prior to the SCR installation in May, 2003 yields the following:

Table 7. Kyger Creek Unit 1 Pre-SCR Average Monthly NOx Rates

Month	Year	Avg. NOx Rate (lb/MMBtu)
1	2001	0.843
2	2001	0.814
3	2001	0.802
4	2001	0.761
5	2001	0.719
6	2001	0.761
7	2001	0.684
8	2001	0.654
9	2001	0.687
10	2001	0.694
11	2001	0.768
12	2001	0.733

1	2002	0.775
2	2002	0.820
3	2002	0.811
4	2002	0.767
5	2002	0.790
6	2002	0.699
7	2002	0.694
8	2002	0.732
9	2002	0.819
10	2002	0.789
11	2002	0.849
12	2002	0.804
1	2003	0.820
2	2003	0.827
3	2003	0.775
4	2003	0.734
Avg. Monthly NOx		0.765

Therefore, assuming a relatively consistent coal nitrogen content, and a floor of 0.06 lbs/MMBtu, a gross approximation of the current continuous SCR system performance potential (again when operating during ozone season) is approximately 92%.[34].

Thus, it appears the only thing preventing the Kyger Creek SCR units from consistently achieving this level of performance is the lack of an enforceable NOx limit requiring it. Consequently, although Ohio performed a four-factor analysis on the Cardinal units, it wrongly concluded no controls were necessary.[35] NC DEQ should have objected to this conclusion, as it appears likely that additional NOx reductions could be achieved very cost-effectively. At a minimum simply running its SCR systems at full capacity all year round would likely be very cost-effective. Further SCR optimization may result in even more very cost-effective controls. More SO_2 reduction could be a matter of Kyger Creek simply running its scrubber systems at full capacity continuously or utilizing common scrubber upgrades discussed in another comment.

3.7 NC DEQ Should have Objected to Pennsylvania not Improving Controls at the Seward EGU

The Seward Power Plant in Pennsylvania is listed in Tables 7-31 to 7-35 as having multiple PSAT impacts at GRSM of 0.31%, 0.29% at JOYC, 0.56% at LIGO, 0.36% at SHRO, and

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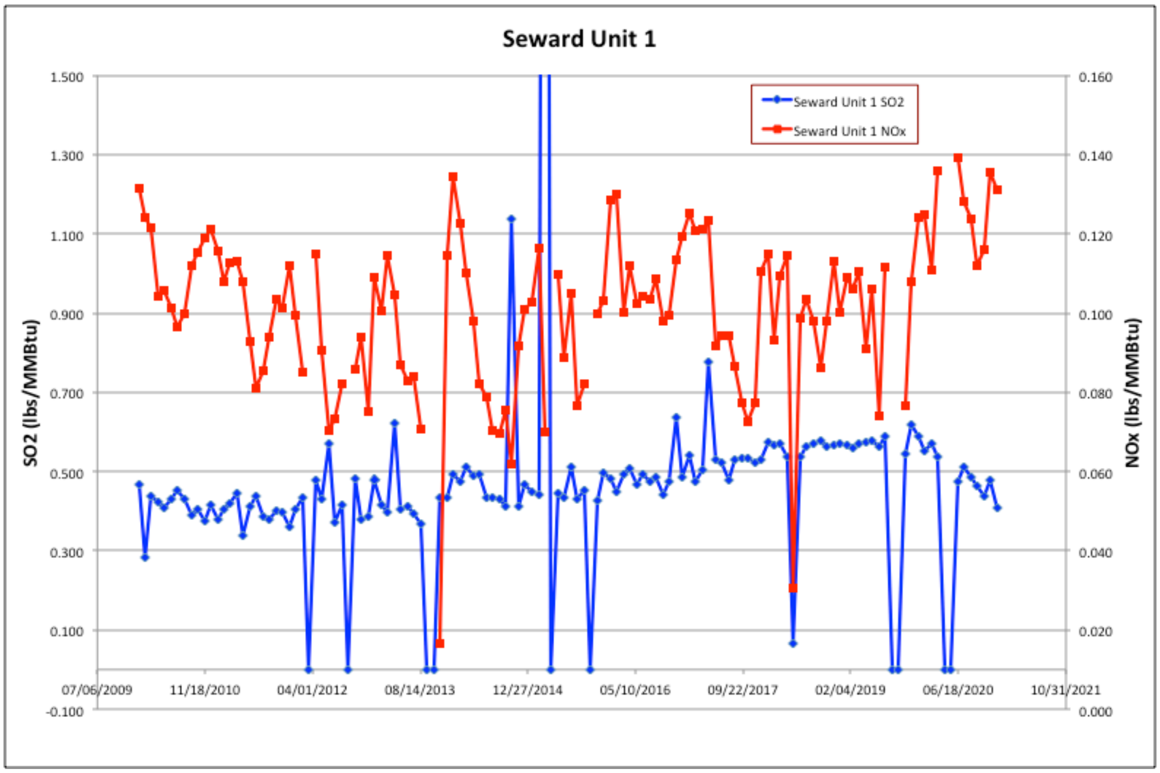
[34] ((0.765-0.060)/0.765) x 100% = 92.16%. Note that Kyger Creek states on page 4 of Appendix L4, Attachment 1, "the baseline emission rate for Kyger Creek Station boilers prior to SCR installation as defined in 40 CFR Section 76.6, is an emission rate of 0.84 lb/mmBtu." Based on the emissions noted above, this appears too high.

[35] See Regional Haze State Implementation Plan for the Second Implementation Period, Prepared by: The Ohio Environmental Protection Agency Division of Air Pollution Control, DRAFT May 2021. Page 35.

0.99% at SWAN. It consists of two 262.5 MW essentially identical units built in 2004 on the site of a former retired coal-fired power plant. Both units fire waste coal from abandoned coal refuse piles in the area. Seward is also permitted to burn pet coke. Both units utilize circulating fluidized bed combustors, which use limestone to control SO_2 emissions, and are also equipped with Novel Integrated Desulfurization (NID) systems. Both units are also equipped with SNCR to control NOx. Below are 30-day monthly averages for Seward Unit 1 (Unit 2 is similar since it appears they share a monitor):[36]

Figure 23. Seward Unit 1 Historical SO_2 and NOx Monthly Emissions



From the above graphs, it can be seen that the NOx and SO_2 controls for these units are not operated at a consistent level and are capable of better performance than recently exhibited. For instance, at multiple times, the SNCR systems have controlled NOx to below 0.8 lbs/MMBtu, but typically operate much above that level. Also, in 2010 – 2012, the NID systems have controlled SO_2 to below 0.4 lbs/MMBtu but have gradually risen over time to approximately 0.6 lbs/MMBtu. Thus, without any capital upgrade cost (and likely minimal operating and maintenance costs), the Seward units are quite capable of much better NOx and SO_2 performance. It appears the only reason they do not is that they are not required by a permit condition to do so. Additional reductions may also be possible with very moderate and likely

[36] See the workbook “NC EGU Emissions.xlsx.”

cost-effective upgrades. NC DEQ should therefore have requested from Pennsylvania that the Seward units undergo four-factor analyses.

4 Review of the Blue Ridge Canton Mill Four-Factor Analysis

In this section, the four-factor analyses for the Blue Ridge Paper Products (BRPP) Canton Mill are reviewed.[37] The Title V permit for this facility was also reviewed.[38] BRPP focuses on three sources: The Riley Boiler, the No. 4 Power Boiler, and the Riley Bark Boiler.

4.1 NC DEQ should require that the BRPP Canton Mill perform a NOx four-factor analysis

On page 1-2 of its report, BRPP states that "Prior to incorporation of those emissions limits into the permit in September 2019, the Mill spent a significant amount of capital to make changes that decreased actual SO_2 emissions by over 5,000 tons per year." Elsewhere in a letter to NC DEQ, BRPP elaborates on this:[39]

> BRPP has reduced its SO_2 emissions by thousands of tons since 2016. BRPP has shutdown or modified several major SO_2 emissions sources in order to reduce facility-wide SO_2 emissions. BRPP installed two new gas-fired package boilers and shut down its Big Bill and Peter G coal-fired boilers in 2017, resulting in a reduction in total SO_2 emissions of 2,300 tons per year (tpy). In late 2018, BRPP transitioned the Nos. 10 and 11 Recovery Furnaces from startup and shutdown on No. 6 fuel oil to startup and shutdown on ultra-low sulfur diesel, resulting in an SO_2 emissions reduction of 1,050 tpy. In the summer of 2018, BRPP commenced operation of a new wet scrubber on its Riley Coal Boiler and a new wet scrubber on its No. 4 Power Boiler. The addition of these control devices has resulted in a reduction of SO_2 emissions by 2,050 tpy from Riley Coal Boiler and 1,175 tpy from No. 4 Power Boiler. BRPP optimized the operation of the Riley Bark Boiler's wet scrubber to improve SO_2 emissions control and reduce actual emissions by about 600 tpy. BRPP also installed an SO_2 ambient monitor and completed an SO_2 modeling exercise to establish enforceable permit limits that will be incorporated into the State Implementation Plan (SIP) and ensure these SO_2 emissions reductions are permanent. Average 2014-2016 actual SO_2 emissions were approximately 7,600 tpy but actual 2019 SO_2 emissions were only 405 tons.

The emission control upgrades the BRPP instituted have indeed resulted in significant reductions in SO_2 (potential upgrades to these controls will be discussed in another comment). However,

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[37] These analyses are located in Appendices G1. These analyses went through revisions and this report's review concentrated on the latest version, dated May, 2021.

[38] Permit No. 08961T29, effective 6/2/2020, and expires 10/31/2021. It is assumed this short period reflects a reassessment following a number of performance testing requirements discussed in the permit.

[39] Pdf page 13 of Appendix G1.

neither NC DEQ nor BRPP mention the still significant NOx emissions from this facility. Information from NC DEQ, obtained from North Carolina's public records request process, specifies the trend of the current significant NOx emissions over time (omitting retired sources and refueling):

Table 8. Blue Ridge Paper Products Canton Mill Historic NOx Emissions (tons)

Source	2015	2016	2017	2018	2019
G11039 - Riley Boiler	915.8	972.0	613.0	752.1	681.8
G11040 – No. 4 Power Boiler	543.2	582.5	500.1	547.2	585.9
G08020 – No. 10 Recovery furnace black liquor solids	506.7	525.3	526.2	510.4	506.7
G11042 – Riley Bark Boiler	498.8	294.0	445.4	366.0	394.5
G09029 – No. 5 Lime Kiln	110.9	126.6	114.7	108.6	111.7

As can be seen from the above table, the BRPP Canton Mill has a number of large sources that have not significantly reduced their NOx emissions as was done for SO_2 emissions. As indicated in table 7-29, this facility is located only 16.9 km from SHRO. However, although NC DEQ selected this facility to receive a four-factor analysis for SO_2 , it did not require BRPP to assess NOx.[40] Considering these large NOx emissions, NC DEQ should require that the BRPP Canton Mill perform a NOx four-factor analysis.

4.2 NC DEQ Should Confirm BRPP's 2028 SO_2 Projections

In Table 7-48 of its SIP, NC DEQ presents the 2019 and projected 2028 SO2 emissions for the BRPP Canton Mill. NC DEQ does not state how the 2028 SO2 emissions were projected to 2028. Although it presents the permit limits (in lbs/hr) for each of the three units analyzed, it does not correlate these emission limits to annual totals. It does not appear there are any operational limitations in the facility's Title V permit that would preclude 24/7 operation. Assuming that is correct, as the following table indicates, the facility's 2028 SO_2 projections could be potentially low:

Table 9. Comparison of BRPP Canton Mill 2028 SO_2 Projections (tons)

Source	Permitted limit (lbs/hr)	SIP SO_2 emissions (tons)	Public Records Emissions (tons)	Initial 2028 Projection (tons)	Revised Projection (tons)	Permitted Maximum (tons)
G11039 - Riley Boiler	61.32	115.1	111.6	115.1	183.8	268.6
G11040 – No. 4 Power Boiler	82.22	195.2	226.4	195.2	195.2	360.1

40 See the letter from Michael Abraczinskas to Wallace McDonald, dated June 18, 2020 in Appendix G1.

G11042 – Riley Bark Boiler	68.00	55.1	88.5	55.1	64.8	297.8
Total for three units	N/A	365.4	426.5	365.4	443.7	926.5

NC DEQ should confirm whether the facility is permitted to produce these SO_2 totals and if so, why it projected much lower values for 2028. This should include a comparison of historical annual hours of operation for these sources.

4.3 NC DEQ Should Investigate Upgrades to BRPP's Scrubbers

As indicated above, BRPP has significantly reduced SO_2 at the Canton Mills plant. However, there is little in the facility's four-factor analysis to demonstrate that the installed/upgraded SO_2 controls are in fact operating at their peak efficiencies. On page 287 of its SIP, NC DEQ states that the wet scrubbers for the Riley Boiler, the No. 4 Power Boiler, and the Riley Bark Boiler are equipped with wet scrubbers with efficiencies of 90%. The facility's permit states that the scrubber for the Riley Bark Boiler is a venturi wet scrubber, but no information could be found in either the permit, NC DEQ's SIP, or BRPP's four-factor analysis that describes the types of scrubbers installed on the other boilers. On page 289, NC DEQ states that it is technically infeasible to upgrade these scrubbers. No information has been presented to document these statements. It appears from the permit that all of these scrubbers are required to undergo performance testing. Therefore, NC DEQ should present this information and assess the performance potential of upgrading these scrubbers. This may be as simple as using more caustic. BRPP states on page 2-5 of its report that this is not possible, but that assertion should be documented and it appears that NC DEQ has the data to do so. BRPP should also evaluate the use of lower sulfur coal as part of its four-factor analyses.

4.4 NC DEQ Should Confirm or Correct Aspects of BRPP's DSI Cost Analyses

4.4.1 In Table A-2 of its report, BRPP indicates that the inlet to a DSI system for the Riley Boiler would be 0.14 lbs/MMBtu. This value is very low and obviously does not reflect uncontrolled coal-fired SO_2. Presumably, since the boiler is equipped with an ESP and some type of scrubber, this value reflects the installation of a DSI system downstream of the existing wet scrubber. BRPP should verify this is the only installation strategy. BRPP states that this figure is based on "Projected 2028 emissions divided by projected 2028 fuel use." This is a very inaccurate method to arrive at such an important input to the DSI cost analysis, especially considering the required performance testing and monitoring required by its permit. BRPP should provide data to support this figure. A similar comment also pertains to BRPP's DSI cost-analysis for the No. 4 Power Boiler.

4.4.2 On page 2-8 of its report, BRPP justified its 50% DSI SO_2 control stating, "The Sargent and Lundy report indicates that 50% SO_2 control can be achieved when injecting trona prior to an ESP without increasing particulate matter emissions." However, that figure does not reflect the maximum control efficiency of DSI using an ESP. The same report that BRPP cites indicates that the maximum removal efficiency for milled Trona with an

ESP is 80%. Considering that BRPP recently rebuilt its ESPs, it should do an analysis of whether a higher DSI control efficiency can be achieved. A similar comment also pertains to BRPP's DSI cost-analysis for the No. 4 Power Boiler.

4.4.3 In its DSI cost analysis for the Riley Boiler, BRPP should explain its calculation of a 35 MW boiler equivalent, which assumes a 399 MMBtu/hr value with only a 30% efficiency. This efficiency appears low and BRPP should provide documentation for it, as it is a key input into the DSI cost-effectiveness calculation. A similar comment also pertains to BRPP's DSI cost-analysis for the No. 4 Power Boiler.

4.4.4 In its DSI cost analysis for the Riley Boiler, BRPP assumes an owners cost of $257,778. This is a disallowed cost under the Control Cost Manual methodology, which states "owner's costs and AFUDC costs are capital cost items that are not included in the EPA Control Cost Manual methodology, and thus are not included in the total capital investment (TCI) estimates in this section."[41] A similar comment also pertains to BRPP's DSI cost-analysis for the No. 4 Power Boiler.

4.4.5 Based on 2%, and 1% of TCI, BRPP assumes general and administrative and insurance costs of $108,267 and $54,133 in its DSI cost analysis for the Riley Boiler. These costs may be appropriate when calculating cost-effectiveness using primary design equations, as is done in some chapters of the Control Cost Manual. However, these costs are not part of the standard IPM methodologies (Sargent & Lundy under contract to EPA) and are not appropriate when using those algorithms. All of these algorithms are based on statistical calculations of public and proprietary cost figures and inherently assume these costs. A similar comment also pertains to BRPP's DSI cost-analysis for the No. 4 Power Boiler.

4.4.6 The DSI cost figures calculated by BRPP are based on IPM algorithms produced by Sargent and Lundy under contract to EPA. The newest version, used by BRPP, produces costs in 2016 dollars.[42] On page 291 of its SIP, NC DEQ states, "[t]he calculations were done using 2020 dollars." However, that would require using the Chemical Engineering Plant Cost Index (CEPCI) to make that adjustment and it does not appear that NC DEQ has done that. Doing so would result in a multiplier to the annualized cost of 596.2 / 541.7.

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[41] Control Cost Manual, Section 4, Chapter 2, Selective Catalytic Reduction, June 2019, pdf page 65. Also see Section 5, SO_2 and Acid Gas Controls, Chapter 1 Wet and Dry Scrubbers for Acid Gas Control, April 2021, page 1-49.

[42] See the S&L documentation beginning on pdf page 115 of the BRPP four-factor analyses (Appendix B).

5 Review of the Domtar Plymouth Mill Four-Factor Analysis

In this section, the four-factor analyses for the Domtar Paper Company Plymouth Mill are reviewed.[43] The Title V permit for this facility was also reviewed.[44] Domtar focuses on only one source, the No. 2 Hog Fuel Boiler.

5.1 NC DEQ Should Revisit its SO_2 Control Assumption for the No. 1 Hog Boiler

On page 292 of its SIP, NC DEQ states that the No. 1 Hog Fuel Boiler has not been reviewed for a four-factor analysis due to the following reasoning:

> This unit is permitted to combust high-volume low-concentration (HVLC) pulp mill gases but cannot currently do so because the supply lines have been physically severed. The plant intends to maintain this disconnection indefinitely. Since the boiler now burns only low sulfur fuels, it is no longer a significant source of SO_2 emissions. These fuel restrictions and emissions decreases are not state or federally enforceable, but they can be used to inform a reasonable projection of the actual emission level for 2028. For this reason, No. 1 Hog Fuel Boiler is considered to be effectively controlled for SO_2 and was not included in the four-factor analysis evaluation.

As NC DEQ indicates, these fuel restrictions are not state enforceable, despite Domtar's permit being recently revised on June 14, 2021. The permit allows Domtar to burn No. 2 fuel oil and High-Volume Low-Concentration (HVLC) gases. The sulfur restriction on that No. 2 fuel oil is 2.3%, which means that it is not a low sulfur fuel.[45] Switching to ULSD would qualify as a low sulfur fuel. As Domtar indicates on page 1-5 of its report, these HVLC gases have been the main source of SO_2 emissions from the No. 1 Hog Fuel Boiler. Therefore, unless the permitted capability to burn HVLC in Hog Fuel Boiler 1 is made state and federal enforceable, NC DEQ should evaluate that source for an SO_2 four-factor analysis.

5.2 NC DEQ should Require the Domtar Plymouth Mill Perform a NOx four-factor Analysis

Neither NC DEQ nor Domtar discuss the significant NOx emissions from this facility. Information from NC DEQ, obtained from North Carolina's public records request process, specifies the trend of the current significant NOx emissions over time (omitting retired sources and refueling):

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[43] These analyses are located in Appendices G2. This analysis went through revisions and this report's review concentrated on the latest version, dated June, 2021.

[44] Permit No 04291T48, effective 6/14/2021, and expires 5/31/2026. It is assumed this short period reflects a reassessment following a number of performance testing requirements discussed in the permit.

[45] It appears from its permit that the No. 1 Hog Fuel Boiler is restricted to only 48 hours of No. 2 fuel annually, in order to retain its "unit designed to burn gas 1 subcategory," under 40 CFR 63.7499(l). NC DEQ should confirm this restriction.

Table 10. Domtar Plymouth Mill Historic NOx Emissions (tons)

Source	2015	2016	2017	2018	2019
ES-10-25-0110 – No. 5 Recovery Boiler	918.9	927.6	884.3	756.2	739.6
ES-65-25-0310 No. 2 Hog Fuel Boiler	453.0	483.8	473.0	412.4	460.0
ES-64-25-0290 No. 1 Hog Fuel Boiler	407.0	327.3	360.0	355.4	121.0
Total for three units	1,778.9	1,738.7	1,717.3	1,524	1,320.6

As can be seen from the above table, the Domtar Plymouth Mill has a number of large NOx sources. As indicated in table 7-29 of the SIP, this facility is located only 69 km from SWAN. However, although NC DEQ selected this facility to receive a four-factor analysis, it did not require BRPP to assess NOx.[46] Considering these large NOx emissions, NC DEQ should require that the Domtar Plymouth Mill perform a NOx four-factor analysis.

5.3 NC DEQ Should Require a Wet Scrubber on Domtar Plymouth Mill's No. 2 Hog Boiler

On page 294 of its SIP, NC DEQ indicates that the cost-effectiveness of a wet scrubber on the No. 2 Hog Boiler is $3,660/ton. Despite this control being clearly cost-effective (issues discussed below aside), NC DEQ determines that the control is not warranted because the visibility benefit on SWAN is too low. First, it should be noted that NC DEQ has found that the Domtar facility has impacts, albeit much smaller, on other Class I Areas as well. Therefore, any reductions at Domtar will improve visibility at multiple Class I Areas.

Secondly, EPA's recent clarification memo indicates that NC DEQ is improperly considering visibility. EPA's clarification memo also explains that "a state should not use visibility to summarily dismiss cost-effective potential controls." [47] The clarification memo further notes that if a state "has identified cost-effective controls for its sources but rejects most (or all) such cost-effective controls across those sources based on visibility benefits [the state] is likely to be improperly using visibility as an additional factor."[48] That is exactly the case with North Carolina's SIP.

It is important that NC DEQ integrate into its SIP strategy the clarification memo's counsel that "[e]valuation of control measures for relatively smaller sources (with commensurate smaller visibility benefits from each individual source) will be needed to continue making reasonable progress towards the national goal ... as many of the largest individual visibility impairing

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[46] See the letter from Michael Abraczinskas to Wallace McDonald, dated June 18, 2020 in Appendix G1.
[47] Clarification Memo. See page 13.
[48] *Ibid*.

sources have either already been controlled (under the RHR or other CAA [Clean Air Act] or state programs) or have retired."[49] Therefore, NC DEQ should not reject otherwise feasible and cost-effective controls based on its view that only minimal visibility impacts will result. Thus, NC DEQ should require a wet scrubber on Domtar Plymouth Mill's No. 2 Hog Boiler.

5.4 NC DEQ Should Increase Domtar's Wet Scrubber Efficiency

In its wet scrubber cost analysis, Domtar assumes a 95% efficiency. Domtar's vendor states that its scrubber is a spray tower design but does not state whether its 95% efficiency is in fact the maximum achievable for the scrubber design or merely what was requested by Domtar. In fact, the vendor's website advertises wet scrubber spray tower designs with an efficiency of up to 99%.[50] Other vendors offer similar designs and efficiencies.[51] Therefore, unless Domtar and its vendor justify a lower efficiency, NC DEQ should assume that Domtar's wet scrubber is capable of at least 98% removal on a continuous basis, which is the same as modern wet scrubbers fitted to coal-fired power plants.

5.5 There are a Number of Apparently Incorrect or Undocumented Charges in Domtar's Wet Scrubber Cost Analysis

5.5.1 Beginning on page 2-7, Domtar discusses why it believes a retrofit factor of 1.3 is justified for its wet scrubber cost analysis. Domtar states:

> U.S. EPA indicates that a retrofit factor is appropriate when estimating the cost to install a control system on an existing facility, in order to address the unexpected magnitude of anticipated cost elements; the costs of unexpected delays; the cost of re-engineering and re-fabrication; and the cost of correcting design errors. A retrofit factor can be used to reflect additional difficulty associated with installing auxiliary equipment, special care in placing equipment, additional insulation and painting of piping and ductwork, additional site preparation, extra engineering or supervision during installation, and unanticipated delays that cause lost production costs. The manual [Control Cost Manual] states that at the study cost level, a retrofit factor of as much as 50% is justified, and even at the detailed cost level, a retrofit factor is often added."[52]

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[49] *Ibid*.
[50] See: https://www.ldxsolutions.com/technologies/wet-scrubbers/
[51] See for instance: https://www.bionomicind.com/wet-scrubbers/9500-spray-tower-scrubber.cfm
[52] It is important to understand the context in which this last sentence is presented in the Control Cost Manual, Section 1, Chapter 2 Cost Estimation: Concepts and Methodology, November 2017, which is the part of the Control Cost Manual where the subject is discussed. What appears is this statement, intended to be an example of how a retrofit factor is calculated: "The retrofit factor is calculated as a multiplier applied to the TCI. For instance, if a retrofit factor of as much as 50 percent can be justified, then the retrofit factor in the cost estimate is 1.5."

More specifically, Domtar believes the higher retrofit factor could be justified in order to (1) cover the potential additional cost of an Induced Draft (ID) fan over and above the $3,000,000 cost Domtar has allowed in its cost analysis, and (2) unanticipated delays.

First, a retrofit factor is a direct multiplier to capital and fixed operating costs and so has a large impact on the total annualized cost. Therefore, it must be well justified. The retrofit factor value assumed in almost all control cost estimating in the first round of regional haze SIP development was 1.0, which represents a retrofit of average difficulty. Almost every control system installation involves replacement of existing structures and involves some demolition of existing structures and construction of new structures. Thus, the potential events described by Domtar are not unusual.

Second, it is important to distinguish between issues that relate to a retrofit factor and those that relate to a contingencies fee. As the Control Cost Manual indicates, "[c]ontingencies is a catch-all category that covers unforeseen costs that may arise, such as '… possible redesign and modification of equipment, escalation increases in cost of equipment, increases in field labor costs, and delays encountered in start-up.'"[53] The Control Cost Manual also states, "[a] contingency factor should be reserved (and applied to) only those items that could incur a reasonable but unanticipated increase but are not directly related to the demolition, fabrication, and installation of the system."[54] Domtar's stated justification—unanticipated costs and unanticipated delays—should therefore be included in a contingency fee, which it already includes as 10% of (direct costs + indirect costs). The unremarkable issues described by Domtar aside, the addition of a retrofit factor greater than 1.0 would consequently be double counting. Therefore, NC DEQ should require that Domtar's wet scrubber cost analysis be revised to use a retrofit factor of 1.0.

5.5.2 Aside from the vendor quote, no documentation is provided by Domtar to cover many of the other charges included in its cost analysis. NC DEQ should require this documentation.

5.5.3 Domtar assumes a sales tax of $95,610. Under North Carolina law, pollution control equipment is exempt from sales tax.[55] The quote from the vendor in Appendix B of Domtar's four-factor analysis is from a sales manager who appears to be located in North Carolina. Therefore, if the sale of the wet scrubber takes place in North Carolina, this charge should be struck.

5.5.4 Domtar assumes a freight charge of $159,350. However, the quote from the vendor lists the estimated freight charge to be $125,000. NC DEQ therefore should correct this charge.

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[53] Control Cost Manual, Section 1, Chapter 2 Cost Estimation: Concepts and Methodology. Page 9.
[54] *Id.*, page 28.
[55] See https://www.nccommerce.com/grants-incentives/tax-other-cost-savings#pollution-abatement-equipment-&-recycling.

5.5.5 Domtar assumes a construction management charge of $344,196, however, the quote from the vendor lists the "construction supervision, on-site services, and training" charge to be $125,000. NC DEQ therefore should require this charge to be corrected.

5.5.6 As indicated earlier, Domtar has assumed the need for a new Induced Draft (ID) fan. However, the vendor states that its quote was based on the use of the existing upstream dry ESP fan and its supplied pressure drop requirements should be confirmed with Domtar's existing fan manufacturer. Domtar, has assumed an additional $3,000,000 charge for a new ID fan but has not provided any documentation that such a fan is needed. NC DEQ should require this documentation, since it is a large capital cost item.

Adjusting Domtar's cost analysis based on the above points yields the following:

Table 11. Revised Domtar Wet Scrubber Cost-Effectiveness

Cost Item	Domtar	Revised	Revised without new ID fan
Direct Costs			
Purchased equipment costs			
Equipment costs - wet scrubber	$3,187,000	$3,187,000	$3,187,000
Sales Tax	$95,610	$0	$0
Freight	$159,350	$125,000	$125,000
Total Purchased Equipment Costs	$3,441,960	$3,407,610	$3,407,610
Direct Installation Costs			
Direct Installation Cost	$2,925,666	$2,925,666	$2,925,666
Installed cost for new fan	$3,000,000	$3,000,000	$0
Total Direct Costs	$9,367,626	$9,333,276	$6,333,276
Indirect Costs			
Construction management	$344,196	$125,000	$125,000
Contractor fees	$344,196	$344,196	$344,196
Start-up	$34,420	$34,420	$34,420
Performance test	$34,420	$34,420	$34,420
Monitor re-certification	$34,420	$34,420	$34,420
Total indirect costs	$791,652	$572,456	$572,456
Contingencies (0.1 x DC + IC)	$1,015,928	$990,573	$690,573
Retrofit factor (0.3 x DC + IC +Cont.)	$3,352,562	$0	$0
Total Capital Investment (TCI)	$14,527,768	$10,896,305	$7,596,305
Total Direct Annual Costs	$2,241,505	$2,241,505	$2,241,505

Indirect Annual Costs			
Overhead	$67,260	$67,260	$67,260
General and admin (2% of TCI)	$290,555	$217,926	$151,926
Insurance (1% of TCI)	$145,278	$108,963	$75,963
Capital recovery (0.0527 x TCI)	$765,613	$574,235	$400,325
Total Indirect Annual Costs	$1,268,706	$968,384	$695,474
Total Annual Costs	$3,510,211	$3,209,889	$2,936,979
Cost-effectiveness			
2028 SO_2 Emissions (tons)	1,009.6	1,009.6	1,009.6
Removal efficiency	95.0%	98.0%	98.0%
Controlled SO_2 Emissions (tons)	959.1	989.4	989.4
Cost-effectiveness ($/ton)	$3,660	$3,244	$2,968

Two revised cost-effectiveness variations are presented: one with a new ID fan and one without a new ID fan. In both revisions, revised values for the sales tax, freight, construction management, retrofit factor, and removal efficiencies were entered. As can be seen, keeping the undocumented ID fan resulted in a cost-effectiveness reduction from Domtar's $3,660/ton to $3,244/ton. Removing the undocumented ID fan further reduced the cost-effectiveness to $2,968/ton. Therefore, NC DEQ's improper rejection of Domtar's wet scrubber aside, Domtar's cost-effectiveness calculation is demonstrably high.

6 Review of the PCS Phosphate Aurora Plant

In this section, the four-factor analyses for the PCS Phosphate Aurora Plant are reviewed.[56] The Title V permit for this facility was also reviewed,[57] as was the consent decree.[58] PCS Phosphate focuses on Sulfuric Acid Plants 5, 6, and 7.

6.1 NC DEQ Should not Assume Unsecured SO_2 Reductions

Information from NC DEQ, obtained from North Carolina's public records request process, indicates that the SO_2 emissions from Acid Plants 5, 6, and 7 were 701 tons, 565 tons, and 852 tons, respectively for a total of 2,118 tons. On page 295 of its SIP, NC DEQ projects the revised 2028 SO_2 emissions for Sulfuric Acid Plants 5, 6, and 7 as 792 tons, 852 tons, and 1,232 tons, respectively for a total of 2,876 tons. These projections were discussed by PSC Phosphate in a

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[56] These analyses are located in Appendices G3.
[57] Permit No 04176T62, effective 4/1/2021, and expires 12/31/2022. It is assumed this short period reflects a reassessment following a number of performance testing requirements discussed in the permit.
[58] See https://www.epa.gov/sites/default/files/2014-11/documents/pcsnitrogenfertilizer-cd.pdf.

letter to NC DEQ.[59] In that letter, PCS Phosphate explained that following upgrades (at least in part required to meet emission restrictions in its consent decree), it reduced its emissions to below the limits required by the consent decree. The consent decree required that Sulfuric Acid Plants 5, 6, and 7 meet annual emissions of 2.5, 2.5, and 1.75 lbs SO_2/ton sulfuric acid, respectively. However, PCS Phosphate indicates in Table 2 of that letter that the actual emission rates were 1.4, 1.3, and 1.3 lbs/ton sulfuric acid. It adds that catalyst is replaced every three years to ensure these emission rates. Therefore, PCS reasons it is proper to project 2028 emissions on the basis of a 1.4 lbs SO_2/ton sulfuric acid multiplied by the maximum annual acid production rate (from previous five years) in tons and converted to tons of SO_2 emitted.[60] NC DEQ accepted this reasoning and the resulting figures are its 2028 SO_2 projections noted above. The following comments pertain to this issue:

- No calculations were presented to verify PCS Phosphate's 2028 projections.
- There is no permit condition requiring that the acid plants replace their catalyst every three years in order to meet PCS Phosphate's cited emission rates.
- PCS Phosphate's Title V permit does not limit the emissions to the cited 1.4 lbs SO_2/ton sulfuric acid figure. Instead, that permits limits the acid plants to the consent decree requirements.
- The only annual SO_2 limitations for the acid plants in the Title V permit are the result of the facility apparently having used projected actual emissions to avoid applicability of Prevention of Significant Deterioration requirements for two different projects.[61] In those instances, PCS Phosphate projected SO_2 totals for the three acid plants to be 5,307 tons and 5,101 tons.

PCS Phosphate's four-factor analysis concludes that following its consent decree upgrades to Sulfuric Acid Plants 5, 6, and 7, no additional controls are technically feasible. This report concludes that is likely the case. However, as indicated above, PCS Phosphate has presented evidence that the three acid plants are capable of operating significantly below their current permitted limits. NC DEQ has accepted this information and in fact conducted its four-factor analyses on the basis of it. However, there is no enforceable commitment that the plant will meet its 2028 SO_2 projections. EPA discusses this situation in its Clarification Memo:[62]

> The existence of an enforceable emission limit or other enforceable requirement (e.g., a work practice standard or operational limit) reflecting a source's existing measures may also be evidence that the source will continue implementing those

[59] Letter from Mark Johnson to Michael Abraczinskas, dated 5/14/2020, in Appendix G-3.
[60] NC DEQ states on page 297 of its SIP that in fact emission rates following the upgrades were 1.1, 1.2, and 1.2 lbs SO_2/ton sulfuric acid, based on 180 day averages. However, it does not appear these figure were used in constructing the 2028 SO_2 projections.
[61] See pages 130 – 131 of the PCS Phosphate Aurora Title V Permit.
[62] Clarification Memo, page 9.

measures. A federally enforceable and permanent requirement provides the greatest certainty and, therefore, is the preferred and best evidence. EPA will consider these and other types of limits and operational requirements as part of its weight-of-evidence evaluation. To be relevant, the limit should reflect the emission rate the source is actually achieving with its existing measures. A limit that is significantly higher than the emission rate a source is actually achieving does not keep the source from increasing its rate in the future. States should provide information on any enforceable emission limits associated with sources' existing measures. States should also clearly identify the instrument in which the relevant limit(s) exist (by providing, e.g., the applicable permit number and where it can be found) and provide information on the specific permit provision(s) on which they are relying. If the instrument is not publicly available or readily accessible, a state should provide a copy of the instrument to EPA with its SIP submission.

This exactly describes the PCS Phosphate situation. Therefore, if it is to rely on and accept PCS Phosphate's emissions estimates, NC DEQ should commit in its SIP that it will incorporate significantly lower SO_2 limits for the three acid plants into PCS's Phosphate's permit, either through modification or a prompt renewal.

7 Apparent Errata

- Many internal references to tables and figures in the SIP appear to be in error.

- Figures 1-2 and 1-3 depict light extinction by species on the 20% most impaired and the 20% clearest days, respectively for GRSM, LIGO, SHRO, and SWAN. However, these figures do not include the JOYC. Since this appears near the beginning of the SIP, NC DEQ should indicate that JOYC assumes the monitored data from GRSM.

- On page 231, NC DEQ states, "The NCDAQ reviewed the 37 facilities identified in Table 7-19 through Table 7-23 with an AoI contribution of ≥1% for sulfate and nitrate combined for one or more of the Class I areas in North Carolina." The intended table citation appears to be Tables 7-20 to 7-24, inclusive. Also, it appears there are 69 facilities with an Area of Influence (AoI) contribution of ≥1% for sulfate and nitrate combined for one or more of the Class I areas in North Carolina.

- In Table 7-31, it appears that the "Final Revised EGU+NEG (Mm-1)" column is presented twice and all cells have the same value of 13.2255 Mm-1. Similar issues exist in Tables 7-32 through 7-35.

- On page 266, it appears that the last sentence in the next to the last paragraph should read, "Of this total point source facility impact, ~~the~~ seven (7) facilities have a sulfate contribution ≥1.00% and account for 11.3% of the point source sulfate plus nitrate visibility impact in 2028." Sentences in successive paragraphs should similarly be revised, table references should be revised, and the number of facilities with an impact of at least 1% at Joyce Kilmer-Slickrock Wilderness Area should be "8".

Enclosure 2

Technical Review of North Carolina Regional Haze State Implementation Plan
Second Round of Regional Haze State Implementation Plans
Supplemental Report

By: D. Howard Gebhart, October 2021

This report provides technical comments on the draft State Implementation Plan (SIP) for Regional Haze in the State of North Carolina, with a focus on air quality modeling and how the modeling results were applied by North Carolina, e.g. the selection of emissions sources for consideration of additional emission controls through the so-called "four factor" analysis.

This report is supplemental to a separate technical report that has been prepared with respect to modeling performed by VISTAS (Visibility Improvement - State and Tribal Association of the Southeast). The VISTAS modeling effort relied mainly upon the Comprehensive Air Quality Model with Extensions (CAMx) and was jointly conducted by Eastern Research Group and Alpine Geophysics. CAMx modeling was conducted for a 2011 baseline period plus a future-year emission projection representing 2028. The supplemental report provided here is intended to address issues specific to how the VISTAS modeling was used and applied in the development of the proposed North Carolina Regional Haze SIP.

Because North Carolina relied on the VISTAS visibility modeling in preparing the current draft of the Regional Haze SIP, the technical comments provided in the separate VISTAS modeling report are also applicable to the proposed North Carolina Regional Haze SIP.

The North Carolina Regional Haze SIP fails to address important contributors to visibility impairment at North Carolina's Class I areas and as such, fails to generate "reasonable progress" toward the national goal of achieving natural visibility conditions.

Following the general modeling approach outlined by VISTAS, North Carolina has used a two-step process in its attempt to identify potential sources contributing to existing visibility impairment at North Carolina's Class I areas. The first step, known as the "area of influence" (AOI) analysis, was used as an initial screen to select sources which would then be subject to more detailed modeling via CAMx and the Particulate Matter Source Apportioning Technology (PSAT) module. Some general comments on the flaws of this two-step modeling approach have been discussed in the separate report providing comments on the VISTAS modeling.

In general, the overall modeling approach developed under VISTAS and then applied by North Carolina was overly restrictive. As such, the modeling failed to identify many of the point sources that significantly contributed to visibility impairment at North Carolina's Class I areas.

Specifically, the VISTAS modeling appeared to have been developed as an attempt to eliminate all but the most significant contributing sources from conducting the "four factor" analysis. However, a major goal of the second-round regional haze SIP planning effort was to assess the feasibility of emission controls designed to reduce visibility precursors emissions and achieve "reasonable progress" at reducing visibility impairment. North Carolina's modeling approach should have been designed to be more inclusive, which in turn would have designated many more emission sources for evaluation of possible emission controls.

The actual outcome presented in the draft Regional Haze SIP itself was the evidence that North Carolina's process was not properly inclusive at identifying emission sources contributing to ongoing visibility impairment. In the draft Regional Haze SIP, North Carolina presented various statistics for the sources identified in the SIP for further evaluation via the "four factor" analysis.[1]

Using Great Smoky Mountains National Park (GRSM) as an example, the draft SIP stated that the two-step modeling approach identified seven (7) individual facilities where the modeled PSAT contribution was greater than the selected threshold of visibility impairment, i.e., 1% of the overall sulfate/nitrate contribution. Furthermore, the draft SIP stated that the seven identified facilities represented 11.3% of the point source sulfate/nitrate and that point source sulfate/nitrate represented 28.9% of the modeled visibility impairment. Combining these statistics, the emission sources identified by North Carolina for evaluation of possible emission controls via the "four-factor" analysis represented only 3.2% of the overall visibility impairment at GRSM on the 20% most-impaired days.[2]

Following the same approach, the fraction of the visibility impairment contributed by emission sources identified by North Carolina for evaluation of emission controls via the "four-factor" analysis was calculated below for each Class I area.

North Carolina Class I Area	Number of Sources (includes out-of-state emission sources)	Fraction of Existing Visibility Impairment based on PSAT Modeling
Great Smoky Mountains NP	7	3.2%
Joyce Kilmer-Slickrock	7	3.5%
Linville Gorge	11	5.8%
Shining Rock	13	5.0%
Swanquarter	10	4.9%

A more inclusive process could have been achieved by North Carolina by following one or more of the approaches selected below:

- North Carolina should have selected a lower threshold (e.g., lower than 1% contribution for sulfate/nitrate via PSAT) in order to identify more contributing sources and capture a larger fraction of the existing of the visibility impairment. The selected threshold should have been reduced by North Carolina as needed in order to capture a significant number of contributing emission sources, thereby assuring "reasonable progress" during the second SIP planning period.

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[1] North Carolina Draft Regional Haze SIP, Pages 266-2679

[2] (0.113) * (0.289) = 0.032 = 3.2%

- North Carolina should have placed more reliance on the initial AOI analysis to select the sources contributing to visibility impairment, which could have avoided the need to conduct the second-step PSAT modeling. The AOI modeling provided useful information by identifying those sources whose emissions would be transported to nearby Class I areas. A finding that a source's emissions impacted a Class I area via the AOI modeling should have been sufficient for North Carolina to designate the source as a significant contributor to visibility impairment. North Carolina's reliance on the VISTAS PSAT modeling as the sole source of data to define contributing sources was misguided and overly restrictive.

Similar comments that North Carolina should have relied more heavily on the AOI modeling analysis were also presented by the National Park Service, which presented its own evaluation of the North Carolina AOI modeling results.[3] Based on the NPS AOI analysis, all of Duke Energy's coal-fired electrical generating units (EGUs) located in North Carolina would have been selected for the four-factor emissions control analysis.

Also, it should be noted that the VISTAS modeling relied upon by North Carolina only identified facilities designated as "contributing sources". Once designated, the "contributing sources" were evaluated for possible installation of new/improved emission controls via the "four-factor" analysis. However, designating a "contributing source" via modeling did not automatically mean that new/improved emission controls would be required via the SIP.

Only a small number of facilities were identified by North Carolina for evaluation of new/improved emission controls via the "four-factor" analysis. Furthermore, the draft Regional Haze SIP as proposed by North Carolina did not require new/improved emission controls at most of the designated contributing sources. As a result, the second round Regional Haze SIP did not provide for any significant reductions of visibility precursor emissions. Because the second-round Regional Haze SIP failed to require installation of new/improved emission controls at the majority of sources identified as contributing to existing visibility impairment, the draft SIP by default failed to achieve "reasonable progress" toward improving visibility. As such, the North Carolina Regional Haze SIP in its present form would not conform with the underlying federal regulations and cannot be approved.

The Fractional Bias Analysis presented by North Carolina was flawed as it was predicated on the unsubstantiated assumption that the PSAT modeling results were a true and accurate representation of the existing visibility impairment at North Carolina's Class I areas.

In the draft Regional Haze SIP, North Carolina presented a comparison of the modeling results between the AOI and PSAT analysis and charted the comparisons as a function of downwind distance between the facility of interest and the Class I area, e.g., the so-called Fractional Bias Analysis[4]. Based on this flawed analysis, North Carolina made the claim that the AOI modeling overestimated the contribution of sources to Class I visibility impairment, especially in cases where the source was close to the Class I area of interest; i.e, less than100 kilometers (km).

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[3] NPS Response to VISTAS Source Selection and Technical Analysis for Regional Haze SIP Development, May 14, 2021

[4] Draft North Carolina Regional Haze SIP, Page 262

The Fractional Bias Analysis was flawed because the comparisons made by North Carolina were nothing more than a comparison of the AOI and PSAT modeling results. The North Carolina claim that the AOI analysis overestimated visibility impacts was predicated on the unsubstantiated assumption that the PSAT results were somehow a true and accurate representation of the real-world visibility impacts.

As such, the North Carolina Fractional Bias Analysis did not follow proper scientific principles. It would be wholly improper to compare two different modeling results and then make statements about the alleged accuracy of one of those modeling results. Based on the information provided, one would be equally justified to claim instead that the PSAT modeling results were underestimated at close-in distances. The Fractional Bias Analysis as presented by North Carolina had no valid scientific basis and as such should be deleted from the SIP.

There are also serious technical concerns about whether the PSAT modeling results were an accurate representation of visibility impacts from the individual emission sources. These concerns are especially pronounced for facilities located in close proximity to the Class I areas. In some cases, the separation distance between facilities of interest and the closest Class I area was as small at 16 km. Other sources of interest were located at distances of 32 km and 52 km from the nearby Class I area.

- Based on the Federal Land Managers' Air Quality Values Workgroup (FLAG) guidance[5], regional grid models like CAMx are not the preferred model where the Class I separation distance is less than 50 km. Inside 50 km, the FLAG-recommended visibility models address direct plume impacts and not contributions to light extinction from sulfate and nitrate. By relying only on CAMx/PSAT, the selection of contributing sources in the draft SIP did not consider direct visibility impacts to Class I areas closer than 50 km.[6]

- The CAMx grid size used in the VISTAS visibility modeling was 12 km[7]. For emission sources located as close as 16 km to the Class I area, a 12 km grid size is insufficient to resolve the details of emissions plume and generate accurate concentration estimates for the source in question. For any emission source within 50 km of the Class I area, the Class I areas are only 1-3 grid cells away from the source of interest. The CAMx model performance degrades substantially at these close-in distances. North Carolina erred by relying solely on the CAMx PSAT results for sources within 50 km of a Class I area.

- The VISTAS CAMx model performance evaluation[8] documented that sulfate concentrations were substantially underpredicted vs. actual measurements. The sulfate underprediction in CAMx would also carry over to the PSAT modeling.

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5 Federal Land Managers' Air Quality Values Workgroup Guidance (FLAG), Phase I Report, December 2000.

6 Based on the Draft SIP (Tables 7-20 through 7-24), eight facilities are located closer than 50 km to one or more North Carolina Class I area (four in NC and four in TN): SGL Carbon, Blue Ridge Paper – Canton Mill, Asheville Plant, PCS Phosphate – Aurora, McGhee Tyson, Cemex – Knoxville, Tate & Lyle, and Alcoa South Plant

7 Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project – Final Modeling Protocol, June 27, 2018.

8 Model Performance Evaluation for Particulate Matter and Regional Haze of the CAMx 6.40 Modeling System and VISTAS II 2011 Updated Modeling Platform for Task 8.0, Final Report October 29, 2020.

In summary, North Carolina's attempt to use the flawed Fractional Bias Analysis and ignore the findings of the AOI modeling was misguided. The PSAT model results are themselves model estimates and North Carolina's claim that the PSAT results were an accurate measurement of source-specific visibility impacts was inappropriate. Furthermore, the PSAT results were very suspect at close-in distances. North Carolina should have recognized that the AOI modeling provided useful information to aid in the identification of emission sources that contributed to visibility impairment at North Carolina's Class I area, i.e., the AOI analysis identified those sources whose emissions would be transported to nearby Class I areas. A finding that a source's emissions impacted a Class I area via the AOI modeling should have been sufficient for North Carolina to designate sources identified via this analysis as significant contributors to visibility impairment.

At many larger emission sources in North Carolina, the draft Regional Haze SIP listed 2028 emissions projections where the emissions were substantially less than current emission estimates. The basis for these emission reductions was not adequately explained by North Carolina, nor did the draft SIP contain enforceable limits which would have restricted source emissions to the levels used in the 2028 emission projections.

As reported by the technical analysis presented by Mr. Joe Kordzi,[9] the future emission projections used in the VISTAS modeling relied upon by North Carolina for the draft Regional Haze SIP listed 2028 emissions data where the emissions were substantially less than current emissions.

The technical basis for the 2028 emissions data used by North Carolina was not fully documented, especially given that substantial emission reductions were noted at many large sources, but no analysis of new/improved emission controls was ever conducted. In the absence of new/improved emission controls or facility retirements, the 2028 projections listing a substantial reduction in emissions from current levels were unjustified and suspect. Furthermore, any such emission reduction relied upon by North Carolina in developing the draft Regional Haze SIP needed to be made federally-enforceable via the SIP and/or modified permits. No enforceable commitments related to the claimed emission reductions appeared in the draft SIP.

Furthermore, there is concern that some or all of the emission reductions inferred by the 2028 projections resulted from assumed changes in load and/or utilization at the underlying emission unit. If the 2028 emission reductions relied upon by North Carolina were tied to reductions in load/utilization, such changes were not properly reflected in the VISTAS modeling. In the real-world, baseline hourly emissions would likely remain unchanged, although emissions might occur at a reduced frequency if the source load were reduced. However, the VISTAS CAMx modeling erroneously treated any and all 2028 emissions reductions as a percent reduction in baseline emissions across all hours of operation. Given these errors, the 2028 visibility modeling projections presented in the North Carolina Regional Haze SIP are inherently unreliable because the projections are based on suspect emissions data and also rely on emission reductions that have not been made federally-enforceable.

Please refer to the technical report specific to the VISTAS modeling for further discussion of this issue.

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[9] Technical comments from Mr. Joseph Kordzi

D HOWARD GEBHART

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EDUCATION

M.S. Meteorology, University of Utah 1979
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MEMBERSHIPS

Air & Waste Management Association
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EXPERIENCE SUMMARY

Mr. Gebhart has over 39 years' experience in air quality permitting and compliance specializing in issues technical and regulatory affecting regulated industries. Howard manages the environmental compliance section at ARS, where he provides technical studies and evaluations; and prepares models, client permit applications, air emission calculations, and performs multi-discipline environmental audits. He is very experienced in working with the federal Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act (RCRA), and similar programs enacted in states throughout the U.S.

Howard also acts as an Expert Witness in legal proceedings involving the Clean Air Act and is a recognized technical expert in air dispersion modeling.

PROJECT EXPERIENCE

- Manages the Environmental Compliance Section team.
- Produces and manages quality assurance documents including quality management plans and quality assurance project plans.
- Provides technical studies and evaluations, including air dispersion modeling, permit application preparation, emissions inventories, regulatory analysis and interpretation, and environmental audits.
- Prepares applications for new source permits under federal Prevention of Significant Deterioration (PSD) and state construction and operating permit programs.
- Provides technical studies supporting Environmental Impact Statements (EISs) and Environmental Assessments (EAs) under the National Environmental Policy Act (NEPA).
- Performs air pathway evaluations for releases of hazardous air pollutants from Superfund sites, hazardous waste sites, and incinerators. Models the potential consequences of accidental releases of hazardous materials.
- Performs multi-discipline environmental audits at regulated industrial facilities.
- Manages air quality and environmental permitting studies for biofuel (ethanol and biodiesel), oil & gas exploration and production, mining and minerals, general manufacturing, and a variety of other industries with experience representing both government and private-sector clients.

Enclosure 3

Technical Review of VISTAS Visibility Modeling for the Second Round of Regional Haze State Implementation Plans

By: D. Howard Gebhart, May 2021

Introduction and Background

This report provides a technical review of the VISTAS (Visibility Improvement - State and Tribal Association of the Southeast) visibility modeling effort, which has been conducted to assist in development of the second round of regional haze State Implementation Plans (SIPs) for ten states in the southeastern United States.

The visibility modeling effort relied mainly upon the Comprehensive Air Quality Model with Extensions (CAMx). The VISTAS CAMx modeling effort was jointly conducted by Eastern Research Group and Alpine Geophysics. CAMx modeling was conducted for a 2011 baseline period and also for a future year emission projection representing 2028.

Technical documents reviewed were those posted to the VISTAS website[1] along with associated guidance provided by VISTAS to member states (also found at the VISTAS website). Consistent with the terminology developed by the VISTAS group, the second round of visibility modeling is described using the name "VISTAS II".

Executive Summary

This section provides a brief overview of technical comments regarding the VISTAS II modeling studies. Additional detail on the topics identified in this section has been provided in the "Technical Discussion" sections later in this report.

1. The Model Performance Evaluation (MPE) conducted by VISTAS as part of the 2011 baseline CAMx modeling effort showed a large and significant underprediction for sulfate and organic carbon. In particular, the sulfate errors were outside of the modeling error boundaries established by VISTAS for its own CAMx modeling efforts[2]. The sulfate errors were also larger during the summer, when the sulfate extinction is known to be the greatest contributor to visibility impairment. The large sulfate underprediction clearly means that the VISTAS II CAMx results should not be used without properly accounting for the known bias in the sulfate predictions. The known sulfate underprediction in the VISTAS II CAMx modeling results also has repercussions in other areas of the modeling analysis.

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[1] https://www.metro4-sesarm.org/content/vistas-regional-haze-program

[2] VISTAS Model Performance Evaluation Report, Table 2-1 (Page 6)

2. VISTAS needs to reexamine whether the 2028 emission projection provides an accurate portrayal of the hourly/daily/seasonal Electric Generating Unit (EGU) emission profiles. The 2028 CAMx modeling inputs should be adjusted as necessary to capture the expected 2028 EGU utilization. The VISTAS II assumption that EGUs will operate in 2028 as they did in 2011 is simply not accurate.

3. In the VISTAS II modeling, the 20% most-impaired days were determined using the 2009-2013 IMPROVE measurements. This improper baseline was then erroneously carried forward to the 2028 modeling projection. As such, the VISTAS II 2028 modeling projection was not calculated using the 20% most-impaired days expected to be present in 2028, days that would be more impacted by nitrates based on changes in regional emissions since the baseline period. A better approach would have been to establish the 20% most-impaired days using more current IMPROVE measurements, e.g., 2014-2018 or later. Because the 20% most-impaired days were not accurately defined in the 2028 model projection, the VISTAS II modeling was biased in that it did not assess visibility impacts on days with elevated nitrate concentrations. In turn, the VISTAS II modeling failed to properly identify EGU and point sources with large NOx emissions as contributing to visibility impairment and also failed to address potential visibility benefit of NOx emission controls at these sources.

4. The Area of Influence (AOI) analysis was overly restrictive and failed to properly identify all sources contributing to adverse visibility conditions at VISTAS Class I areas. Most VISTAS states selected an AOI threshold in the range of 2-5% of the overall sulfate and/or nitrate impacts to identify emission sources contributing to visibility impairment. As a result, most states identified six or fewer contributing emission sources through the AOI analysis. Where a lower and more appropriate AOI threshold was selected, i.e., West Virginia, the number of emission sources captured by the AOI analysis was more reasonable.

5. The VISTAS II CAMx modeling also relied on a flawed PSAT modeling analysis that applied an outdated 2028 emissions inventory, provided incomplete information on source-specific contributions to visibility impairment, and carried forward known deficiencies in the modeled sulfate projections (see Item #1 above). VISTAS has coupled this flawed PSAT modeling analysis with a recommendation that only those sources which contribute 1% or greater to either the modeled sulfate or nitrate concentrations would be recommended for the "four-factor" emissions control analysis. As a result, VISTAS has concluded that only a relatively small group of emission sources would be considered for the "four-factor" analysis[3].

   One solution to this problem would have been to use an alternative method to screen emission sources for the "four-factor" analysis. For example, a simple emissions-to-distance (Q/D) ratio could have been applied or VISTAS could have placed a greater reliance on its initial "area of influence" (AOI) modeling (after addressing the AOI shortcomings discussed above). Relying on other modeling instead of the PSAT modeling would have generated a more realistic number of sources potentially subject to the "four-factor" analysis. The current approach that relied on the PSAT modeling (and also used an unacceptably high source contribution threshold) unduly limited the number of emissions sources subject to the "four-factor" analysis. The current

[3] VISTAS Regional Haze Project Update, May 20, 2020

VISTAS modeling approach was fundamentally flawed and contrary to the intent of the EPA Regional Haze regulations.

6. Despite visibility improvements at Class I areas in the VISTAS states, current IMPROVE data continue to show that the remaining visibility impairment is largely dominated by sulfate and nitrate. As such, further sulfur dioxide (SO_2) and nitrogen oxides (NOx) emissions reductions at EGUs and other point sources will be required to reach the national visibility goal. As per EPA's 2017 Regional Haze regulations, the state is required to look beyond the uniform rate of progress (URP) "glide path" in the current SIP planning period to judge success of the regional haze program. Compliance with the applicable EPA Regional Haze regulations stipulates that any emissions reduction measures meeting the "four-factor" emissions control criteria stated in the regulations should be implemented in the current SIP planning period, whether or not a given Class I area has met the URP visibility goals.

Technical Discussion

The Technical Discussion covers several individual items, as summarized below:

- CAMx Model Performance Evaluation
- Hourly/Daily/Seasonal Emissions Profile assumed in CAMx Modeling Input
- 20% Most-Impaired Days assumed for 2028 CAMx Modeling Projections
- Source Attribution and Selection of Sources for the Four-Factor Analysis
- CAMx Model Results vs. Visibility Glide Path

CAMx Model Performance Evaluation

All CAMx modeling studies are generally accompanied by a Model Performance Evaluation (MPE) under which statistics are developed that describe the accuracy of the model projections. In this instance, the VISTAS II MPE was developed using the CAMx 2011 base case modeling platform. The 2011 CAMx baseline scenario results were compared against IMPROVE (Interagency Monitoring of Protected Visual Environments) measurements from the same time period along with other available air quality monitoring data. In this report, the focus is on the CAMx MPE vs. IMPROVE measurements as the IMPROVE data are the primary measurement tool for assessing visibility trends.

The MPE compared the CAMx modeling results from the 2011 VISTAS platform against actual IMPROVE measurements. The statistical comparisons reported in the MPE used CAMx modeling projections paired in time and space with the IMPROVE measurements.

This discussion focusses on modeled sulfate impacts which are generally traceable to SO_2 emissions from point sources such as EGUs. Other emitting sources are also of interest because an important objective of the second-round regional haze SIPs is to identify sources which emit to visibility impairing pollutants affecting Class I areas and as such might be subject to a "four-factor" analysis which would review the feasibility of additional emissions controls.

Based on the VISTAS II MPE, the CAMx model results for the 20% most impaired days showed that the model results were biased low for two important visibility components: sulfate and organic carbon. The reported sulfate Normalized Mean Bias (NMB) for the VISTAS II CAMx MPE are listed below for the 20% most impaired days vs. measured IMPROVE data[4].

- Sulfate NMB (All Seasons) -19.13%
- Sulfate NMB (Summer) -32.81%
- Sulfate NMB (VISTAS II Goal) +/- 10%
- Sulfate NMB (VISTAS II Criteria) +/- 30%

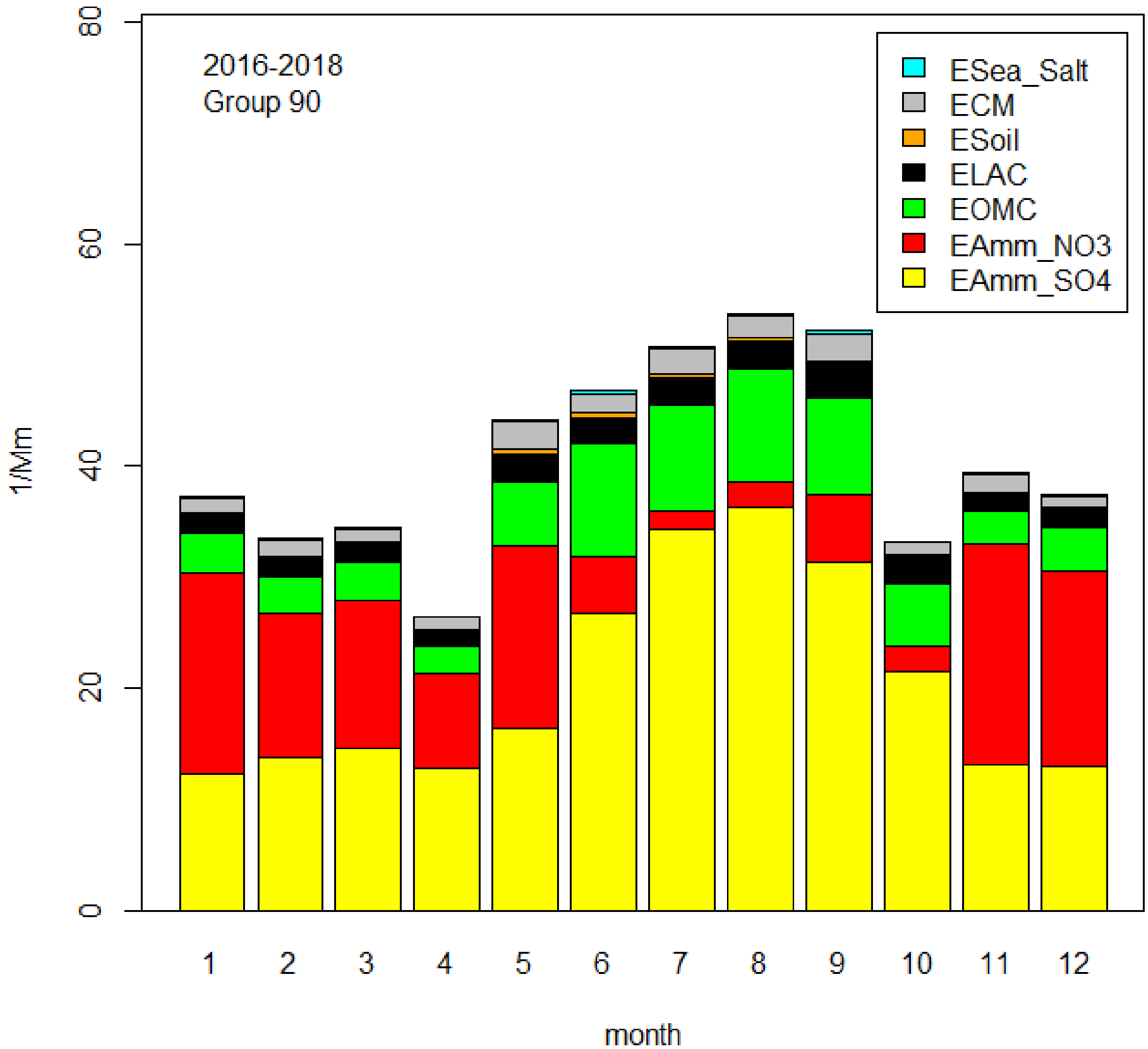
As reported above, the VISTAS II CAMx modeling using the 2011 emissions platform reported a significant underprediction for sulfate vs. the IMPROVE measurements on the 20% most impaired days for the same time period. The degree of the underprediction was also alarming as the sulfate error was outside of the CAMx model performance criterion selected by VISTAS (also listed above).

The negative sulfate bias occurred across all seasons but was larger during the summer months. This bias was also present across the entirety of the VISTAS modeling domain. For those Class I areas in the VISTAS domain, the occurrence of the 20% most impaired days was more frequent during the summertime and sulfate was also a major contributor to visibility impairment in the summer months. As an example, Figure 1 presents a monthly distribution for IMPROVE visibility data collected at Shenandoah National Park (SHEN) for the 20% most impaired visibility days (2016-18). Figure 1 shows that reconstructed extinction (a measure of impaired visibility) is largest at SHEN in the summer and that sulfate is the largest contributor to the measured summertime visibility impairment.

While no air quality model is perfect, the large and significant sulfate underprediction calls into question how one should best apply the VISTAS II CAMx model results. As Figure 1 demonstrates, the modeling errors are largest for the same period when the sulfate concentrations make the largest contribution to visibility impairment. The large sulfate underprediction means that the VISTAS II CAMx results should not be used directly without properly accounting for the known sulfate bias. The known sulfate underprediction in the VISTAS II CAMx modeling results also has repercussions in other areas. These issues are addressed in other sections of my report.

[4] VISTAS Model Performance Evaluation Report, Table 2-1 and Table 3-1.

Figure 1: IMPROVE Visibility Reconstructed Extinction by Month (2016-18)
Shenandoah National Park VA (SHEN): 20% Most Impaired Days
From Gebhart 2020



Hourly/Daily/Seasonal Emissions Profile

For EGUs, the VISTAS II CAMX modeling includes an hourly/daily/seasonal emissions profile derived mainly from continuous emissions monitoring (CEMS) data which EGUs are required to collect under various regulations. This information was created using the Sparse Matrix Operator Kernel Emissions (SMOKE) processing system within CAMx. The hourly emissions data from 2011 CEMS measurements were used to create hourly profiles at EGUs for SO_2 and NOx emissions. For other pollutants (which typically lack CEMS measurements), the hourly EGU emissions profiles were based on load data.

For non-EGU point sources, an hourly emissions profile was not created, and the annual emissions were assumed to occur at a uniform emission rate over the year.

In the VISTAS II CAMx modeling, the same hourly/daily/seasonal emissions profiles used in the 2011 modeling were also used for the 2028 emissions projections, e.g., at any given hour of the year being modeled, the 2028 emissions were at the same relative emissions in the 2011 data, adjusting for changes in the annual emissions total where necessary. Under the above approach, the implicit assumption was that the 2028 hourly/daily/seasonal EGU emissions profile would be unchanged from the 2011 data.

It is highly questionable whether the hourly/daily/seasonal EGU emissions profile for the 2028 projection would remain unchanged from the 2011 baseline, as assumed by the VISTAS II modeling. Since 2011, the electric utility industry has undergone dramatic shifts, influenced by numerous factors designed to increase reliance on alternative energy sources such as renewables and/or natural gas. For example, renewable energy mandates or goals have been established in VISTAS states such as North Carolina, South Carolina, and Virginia.[5] Also, a major utility operating in the VISTAS region (Southern Company) has publicly announced a company-wide goal of reducing greenhouse gas (GHG) emissions by 50 percent before 2030.[6]

In response to the above and other initiatives, a number of electric utilities in the VISTAS region are in the process of moving away from coal-fired EGUs as their primary baseline generation assets. Moving forward, an increasing number of coal-fired units may be used to balance peak seasonal loads as opposed to meeting the normal baseline electric load on the grid. The 2028 VISTAS II modeling failed to account for the dramatic shift in how coal-fired EGU are expected to be utilized. By 2028, many EGUs are expected to have a dramatically different hourly/daily/seasonal emissions profile.

For example, if the EGU load were to shift such that the unit utilization increased during the winter, the SO_2 and NOx emissions (as a percentage of total annual emissions) will be skewed toward the winter months. This change in utilization would not be reflected in the 2011 CEMS data. IMPROVE data at VISTAS Class I areas also show that nitrate extinction (as the resulting visibility degradation) is much greater during the winter period. Under such a scenario, the VISTAS II CAMx modeling could be underestimating the winter-time visibility impacts associated with EGUs.

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[5] Source: National Conference of State Legislatures website, www.ncsl.com

[6] Source: Southern Companies website, www.southerncompany.com

VISTAS needs to reexamine whether the future EGU emission projections based on 2011 CEMS data provided for an accurate portrayal of the expected 2028 hourly/daily/seasonal emissions profiles. The 2028 CAMx modeling inputs should be adjusted as necessary to capture the expected 2028 EGU utilization. The assumption that EGUs will operate in 2028 as they did in 2011 is simply not accurate.

Selection of 20% Most-Impaired Days

The VISTAS II modeling used 2009-2013 as the baseline period. In addition, IMPROVE monitoring data from that same period were used to select the 20% most impaired days for analyzing future visibility impacts for the 2028 projection. This approach was flawed as the 20% most impaired days have shifted since the 2009-13 baseline period due to the imposition of emission controls and other actions that occurred as a result of the first-round of Regional Haze SIPs and other factors. Instead, as required under the federal Regional Haze regulations, the selection of the 20% most-impaired days for the 2028 projection should have been based on more current IMPROVE measurements. The current IMPROVE data (2014-18) are the most accurate projection available at this time for the future 2028 visibility conditions.

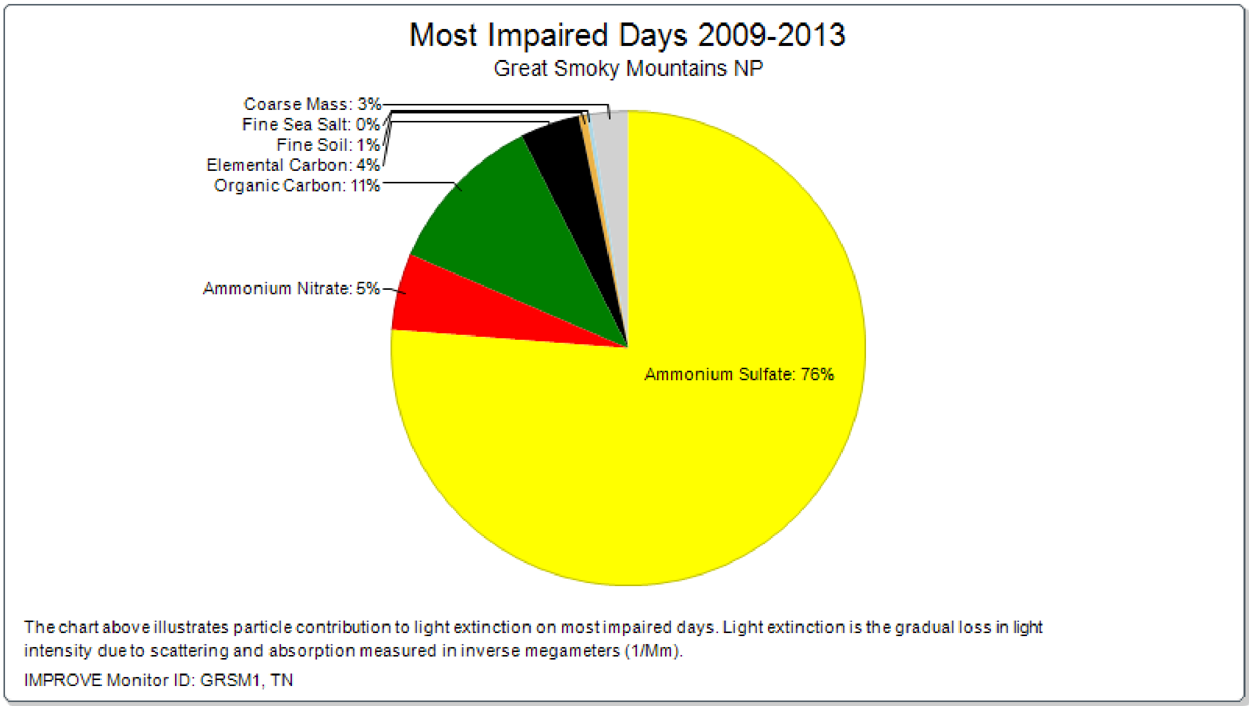
As an example which illustrates the changes described above, Figure 2 presents the reconstructed extinction for the 20% most-impaired days at Great Smoky Mountains National Park (GRSM). The data in Figure 2 compare the reconstructed extinction for the 20% most-impaired days covering the 2009-13 baseline period against the 2014-18 period. The 2014-18 time period would have been the most recent IMPROVE data available at the of the VISTAS II modeling effort.

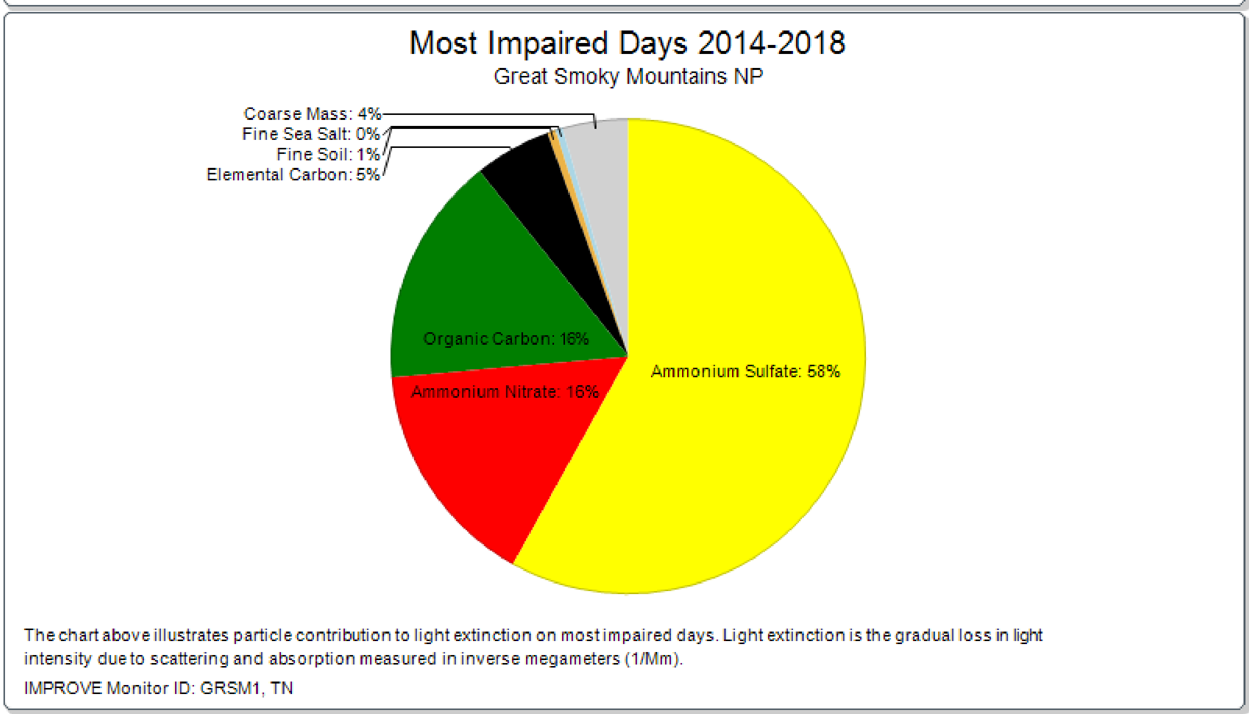
The reconstructed extinction on the 20% most-impaired days in Figure 2 shows a dramatic trend toward less sulfate extinction and greater nitrate extinction. The decrease in sulfate likely represents the effect of SO_2 emission controls and other regulatory actions including those that were imposed in the first round of regional haze SIPs. In turn, nitrate has become an increasingly important contributor to current visibility impairment. For example, at GRSM, the nitrate extinction budget has roughly tripled since the 2009-13 baseline period, increasing from 5 percent to 16 percent. The temporal trends showing increased nitrate extinction for the 20% most-impaired days are also repeated at other Class I areas in the VISTAS domain.

Nitrate is also a seasonal pollutant with a tendency for significantly higher concentrations during the wintertime period (See Figure 1 above). Consistent with the observed increases in the nitrate extinction budget, occurrences of the 20% most-impaired days would have also shifted since the 2009-13 baseline period with more of these days also occurring during the winter months. Nitrate levels are typucally higher during the winter due to the colder average temperatures.

In the VISTAS II visibility modeling, the 20% most-impaired days were determined using the 2009-2013 IMPROVE measurements and the same data were erroneously carried forward to the 2028 modeling projection. As such, the VISTAS II 2028 modeling projection was not calculated using the 20% most-impaired days that would be expected to be present in 2028. A better approach would have been to establish the 2028 20% most-impaired days using more current IMPROVE measurements, e.g., 2014-2018 as these data more accurately reflect the shift/increase in nitrate extinction levels.

Figure 2
Temporal Trends in Reconstructed Extinction
Great Smoky Mountains National Park[7]





[7] Data source: [Improve – Interagency Monitoring of Protected Visual Environments (colostate.edu)]

In summary, the 20% most-impaired days were not properly captured for the 2028 VISTAS II model projection. The 20% most impaired days selected by VISTAS for 2028 were in error as these days did not properly reflect the substantial increases in nitrate extinction contributions that were evident using more recent IMPROVE monitoring data. As a result, large NOx emission sources contributing to adverse visibility impairment were not properly identified by VISTAS and the potential visibility benefits of emission controls at large NOx emission sources were not properly analyzed.

Source Attribution

The VISTAS II modeling effort included information on source attribution to the visibility impairment. In this report, my focus is on the visibility source attribution analysis for individual point sources as it is the individual point sources (both EGUs and non-EGUs) which would be potentially subject to the so called "four-factor" emissions control analysis. The "four-factor" analysis evaluates whether additional controls to reduce visibility impairment might be required under the second-round regional haze SIPs in each state.

In the VISTAS II modeling, the source attribution analysis used a two-step process:

1. An "Area of Influence" (AOI) analysis was conducted to identify potential sources of visibility impairment impacting Class I areas within the VISTAS domain.
2. For individual point sources identified using the AOI approach, the emissions were "tagged" and the source contributions to visibility impairment were calculated within CAMx using the Particulate Matter Source Apportionment Technology (PSAT) option within CAMx.

The VISTAS source attribution analysis has two significant issues. First, the AOI analysis itself was overly restrictive in that the thresholds used to identify qualifying sources was too high, resulting in too few sources being identified. Second, the PSAT "tagging" approach introduced additional errors into the analysis. Also, the PSAT modeling itself was unnecessary given that AOI analysis already had the goal of identifying sources with the potential to contribute to adverse visibility conditions in VISTAS Class I areas.

The initial AOI evaluation utilized the HYSPLIT model. HYSPLIT allows calculation of "back-trajectories" that define the path taken by an air parcel before arriving at any given point. The various steps in the AOI analysis conducted by VISTAS II can be summarized as follows:

- The 20% most impaired days for a given Class I area/IMPROVE site were identified.
- HYPLIT trajectories were calculated for each of the 20% most impaired days at all Class I areas in the VISTAS domain.
- Based on the HYPLIT trajectories, the residence time in each grid cell was calculated. The residence time was also weighted by the extinction, creating the "extinction-weighted residence time" (EWRT).
- The EWRT was overlayed with emissions information from individual point source emissions, using the Q/D (emissions over distance) ratio between the point source of interest and the Class I area.

Table 1 below summarizes the findings from the AOI analysis as reported by VISTAS in a May 20, 2020 briefing to stakeholders. Table 1 shows the criteria adopted by each state in applying the AOI analysis as well as the number of qualifying sources based on these criteria.

Table 1

Summary of VISTAS AOI Analyses[8]

State	Threshold	Notes	# of Qualifying Sources
AL	2%	Sulfate only	9
FL	5%	Sulfate or nitrate + 4 additional sources	13 (AOI) + 4 = 17
GA	2% for GA facilities, 4% for non-GA facilities	Sulfate or nitrate,	5
KY	2%	Sulfate or nitrate	4
MS	2%	Sulfate or nitrate	2
NC	3%	Sulfate + nitrate	5
SC	2% for sulfate 5% for nitrate	+ 3 additional sources	3 (AOI) + 3 = 6
TN	3%	Sulfate + nitrate + 1 additional source	5 (AOI) + 1 = 6
VA	2%	Sulfate + nitrate	3
WV	0.2%	Sulfate or nitrate	13

Except for West Virginia, VISTAS states adopted AOI impact thresholds generally in the range of 2-5% to identify sources that are believed to contribute to existing visibility impairment in Class I areas. The lower threshold used by West Virginia (0.2%) resulted in the identification of the greatest number of emission sources (13). Otherwise, the AOI analysis for the most part generated only a handful of emission sources for further consideration as contributing to Class I visibility impairment. In seven of the ten VISTAS states, the unrealistically high AOI thresholds generated only six or fewer qualifying sources[9].

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[8] Data Source: VISTAS Regional Haze Project Update, Powerpoint Presentation dated May 20, 2020

[9] Florida had 13 sources identified through the AOI analysis despite having one of the higher thresholds. The VISTAS AOI report does not discuss this anomaly, but one possible explanation is that Class I areas are scattered across all areas of Florida (north, central, and south). As such the distance from a given source in Florida to the nearest Class I area may less than the distance to the nearest Class I areas in other states.

Despite the problems in selecting a specific threshold, the use of a percentage impact to screen sources in the AOI analysis is itself flawed. By using a percentage, the calculated threshold in absolute terms was actually higher for Class I areas where the visibility impacts were more severe. This approach generated the opposite of what is necessary to achieve real-world improvements in visibility conditions. Where the current visibility impacts are known to be more severe, the need for emission reductions is greater and the criteria for selecting contributing emission sources should reflect that need. The current VISTAS AOI approach based on meeting a minimum percentage of the total impact failed in that regard.

Also, in some cases (e.g., NC, TN, and VA), states considered the combined impacts of sulfate and nitrate, while the other states evaluated sulfate and nitrate impacts separately. The approach used by NC, TN, and VA that considered the combined sulfate and nitrate impact would be preferred as real-world visibility impacts result from the combined effects of all visibility precursor pollutants.

The reader is encouraged to review the appropriate VISTAS technical report for additional details about the AOI analysis. As mentioned previously, the VISTAS II modeling addressed source attribution for more than just individual point sources such as emissions on a state-wide or industry-wide level. However, my comments address only the source attribution analysis for individual point sources.

Based on the documentation in the VISTAS technical reports, those point sources identified through the AOI analysis or otherwise selected by a particular state were subject to additional modeling using the CAMx PSAT source "tagging" procedure. The VISTAS II PSAT "tagging" was applied only to the 2028 emission projections and not the 2011 baseline emissions inventory. The PSAT "tagging" was also limited to sulfate and nitrate.

Although the VISTAS II documentation notes that the initial 2028 emission inventory projections were updated for the final CAMx modeling, the associated AOI and PSAT modeling did not use the final 2028 inventory. In the case of the PSAT modeling, model projections using the outdated inventory were adjusted based on source-specific changes in the SO_2 and NOx emissions.

In the end, the VISTAS II PSAT modeling concluded that 33 emission sources remained with a modeled sulfate and/or nitrate contribution at or above 1% at any VISTAS Class I area[10]. As such, these 33 emissions sources were recommended for consideration by VISTAS states for the "four-factor" emissions control analysis; however, individual states had the option to further reduce the number of "four-factor" sources by establishing a required contribution threshold above 1%. Table 2 summarizes the state-by-state distribution of the 33 sources identified using the VISTAS II PSAT modeling.

[10] VISTAS Regional Haze Project Update, Powerpoint Presentation dated May 20, 2020, Slide 122

Table 2

Summary of VISTAS PSAT Modeling Analyses

State	# of Qualifying Sources
AL	1
FL	10
GA	3
KY	2
MS	0
NC	3
SC	5
TN	2
VA	2
WV	5

In addition, the PSAT modeling returned 13 facilities located in non-VISTAS states that had modeled sulfate or nitrate impacts above the 1% threshold at Class I areas within VISTAS[11].

The 1% threshold criteria used by VISTAS for selecting emission sources for possible application of emission controls is by itself questionable. As noted above, by establishing the contribution threshold strictly on a percentage basis, the source-selection approach used by VISTAS for a more highly polluted Class I areas in essence would require that an individual point source have a larger absolute contribution to sulfate and/or nitrate concentrations before triggering the 1% threshold. Limiting the number of facilities subject to the "four-factor" emissions control analysis in this manner is contrary to the Regional Haze regulatory program objectives. Also, where the Class I area is more highly polluted, the future need for emissions controls will be greater. The source-selection procedure employed by VISTAS has resulted in fewer emission controls at sources impacting those Class I areas in the VISTAS domain which are more highly polluted.

[11] VISTAS Regional Haze Project Update, Powerpoint Presentation dated May 20, 2020, Slide 123

In addition, the 1% threshold selected by VISTAS was based on the modeled PSAT contribution to sulfate and nitrate concentrations individually. However, in the atmosphere, sulfate and nitrate act in combination to contribute to the reconstructed extinction and visibility impairment. The combined sulfate and nitrate impact on visibility from any individual point source was not calculated or evaluated by VISTAS. The VISTAS modeling should have instead considered all precursor emissions that contribute to visibility impairment and not just sulfate or nitrate. As a result, the overall contribution to visibility impairment from any individual point source was consistently underestimated in the VISTAS modeling approach.

Furthermore, the VISTAS II PSAT analysis itself contains significant uncertainties in describing the source attribution of individual sources to existing visibility impairment, as summarized below:

- The PSAT modeling was limited to "tagging" of sulfate and nitrate and did not address the source attribution from other visibility precursor pollutants. Any source-specific visibility attribution based solely on the sulfate or nitrate modeling projections would underestimate the overall visibility impact of an individual source. An accurate assessment of the source-specific visibility impact must be based on the source attribution considering all visibility impairing pollutants.

- As noted above, the PSAT projections applied in the VISTAS II modeling analysis were not calculated using the most recent 2028 emissions inventory update. Instead, PSAT data from an outdated 2028 emissions inventory were used. VISTAS II attempted to compensate for this shortcoming and adjusted the outdated PSAT projections by scaling the predicted sulfate and nitrate by the corresponding change in SO_2 and NOx emissions. However, this approach carried an implicit assumption that the resulting sulfate and nitrate would be proportional to any change in emissions. It is known that sulfate and nitrate formation in the atmosphere has many complex elements which would be non-linear vs. emissions. As such, the PSAT modeling using an outdated 2028 emissions inventory introduced unknown errors into the modeling.

- As reported previously, the CAMx MPE revealed a significant underprediction for sulfate across the VISTAS modeling domain. Any errors described by the MPE for sulfate would also be carried over into the PSAT modeling results. The PSAT results for sulfate and the resulting source attribution were likely underestimated by the same ratios as described in the MPE.

Instead of relying on a flawed PSAT modeling analysis that applied an outdated 2028 emissions inventory, provided incomplete information on source-specific contributions to visibility impairment, and carried forward known deficiencies in the modeled sulfate projections, the VISTAS states should have instead relied on other approaches to screen emission sources for applicability of potential emission controls in the second-round Regional Haze SIPs. For example, a simple emissions-to-distance (Q/D) ratio has been used in other states to provide an initial screen for sources subject to the "four-factor" emissions control analysis. Using the AOI and PSAT modeling results to limit the field to only 33 emission sources for possible application of the "four-factor" analysis generated an approach that was overly restrictive.

As required under the 2017 Regional Haze regulations, the "four-factor" emissions control analysis should have been broadly applied to emission sources contributing to visibility impairment. Furthermore, the VISTAS II AOI and PSAT projections also underestimated the source-specific attribution to visibility impairment and as such should not have been relied upon in selecting the appropriate list of emission sources for the "four-factor" emissions control analysis.

Visibility Glide Path

Based on the VISTAS II modeling results, it was reported that the 2028 visibility projections for all VISTAS Class I areas except Everglades National Park (EVER) would be below the so-called "glide path", which is also known as the Uniform Rate of Progress (URP). Also, after the visibility projections were adjusted for non-US emissions, the 2028 EVER visibility projection was also below the URP "glide path". The URP "glide path" represents a linear reduction in visibility between the original baseline visibility conditions and the 2064 goal of "natural background" visibility.

The VISTAS II 2028 modeling projection showing that visibility conditions would be below the URP "glide path" are not disputed. In fact, modeling results showing that visibility improvements were below the URP "glide path" were not unexpected given that the regional haze program has resulted in significant emission reductions that were front-loaded to the early planning periods.

Nevertheless, whether the 2028 visibility projections were above or below the URP glide path should not have influenced the adoption of second-round regional haze SIP strategies that applied additional emission controls on visibility precursor pollutants. Although visibility improvements have occurred with "on-the-books" emission controls, current IMPROVE measurements also continue to show that the remaining visibility impairment on the 20% most impaired days is largely dominated by sulfate and nitrate extinction (See Figure 1 above showing the 2016-18 reconstructed extinction budget at SHEN). Sulfate and nitrate extinction is an indicator that SO_2 and NOx emissions from EGUs and other point sources still contribute to present-day visibility impairment. So, sulfate and nitrate are expected to remain a substantial contributor to post-2028 visibility impairment on the 20% most impaired days and further improvements in visibility would require additional SO_2 and NOx emission controls at EGUs and other point sources that go beyond current "on-the-books" controls. Consistent with current EPA policy, such emission controls would presumably yield visibility conditions that are even further below the URP "glide path" and would place the VISTAS Class I areas even closer to the national visibility goal.

The United States Environmental Protection Agency (EPA) concurs with the above position that the URP glide path does not present a "safe harbor" from the need to address EGUs and other point sources through the required four-factor emissions control analysis. In the Preamble to the USEPA 2017 Regional Haze Rule[12], EPA includes the following instructions:

> *"The EPA is clarifying the relationship between long-term strategies and RPGs in state plans and the long-term strategy obligations of all states. We are reiterating that the CAA requires states to consider the four statutory factors (costs of compliance, time necessary for compliance, energy and non-air quality environmental impacts and remaining useful life) in each implementation period to determine the rate of progress towards natural visibility conditions that is reasonable for each Class I area. The rate of progress in some Class I areas may be meeting or exceeding the uniform rate of progress (URP) that would lead to natural visibility conditions by 2064, but this does not excuse states from conducting the required analysis and determining whether additional progress would be reasonable based on the four factors."*

SO_2 and NOx emissions reductions at EGUs and other point sources in the VISTAS domain will be necessary to reach the national visibility goal of no anthropogenic visibility impairment. There is no environmental benefit in waiting until future SIP planning periods to implement additional emission controls at EGUs and other point sources, especially where the "four-factor" analysis concludes that such controls would already be reasonable and cost-effective.

Most importantly, the current EPA Regional Haze regulations require imposition of emissions controls where such controls may be deemed appropriate using the "four-factor" criteria set forth in the applicable regulations. The EPA Regional Haze regulations also require that current SIP planning period look beyond the URP "glide path" as the sole indicator of success. The SIP planning process and associated VISTAS II CAMx modeling should not be an attempt to limit the number of EGUs and other point sources subject to the required "four-factor" emissions control analysis.

References

Gebhart, K.A., 2020. Shenandoah Residence Time Analyses. Internal National Park Service PowerPoint Presentation, updated September 22, 2020.

[12] Federal Register, January 10, 2017