OVEC/IKEC

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June 18, 2021

Electronic Submittal

Ms. Holly Kaloz
Ohio Environmental Protection Agency, DAPC
Lazarus Government Center
P.O. Box 1049
Columbus, Ohio 43216-1049

Re: Ohio Valley Electric Corporation, Kyger Creek Station
Comments on Regional Haze State Implementation Plan
Second Implementation Period

Dear Ms. Kaloz:

In response to feedback from the Ohio Environmental Protection Agency (OEPA) following their receipt of comments from the National Park Service and Federal Land Managers (NPS/FLM) during the development of the OEPA Regional Haze SIP, Ohio Valley Electric Corporation (OVEC) provided information supporting OEPA's independent conclusion that a four-factor analysis for NOx was not needed for the Kyger Creek Station. Independent from the initial comments provided, OVEC also secured the services of a consultant (AECOM) to perform a more thorough evaluation of the facility NOx emissions with respect to the Regional Haze Rules' NOx four-factor analysis requested within NPS/FLM comments. The results of that evaluation confirm OVEC's previous comments that a NOx four-factor analysis is not necessary for the Kyger Creek Station. The myriad details supporting this conclusion are contained in AECOM's attached report.

OVEC is providing this report in support of OEPA's own independent evaluation resulting in the same conclusion. Specifically, the draft Regional Haze SIP within Table 4 (pages 23-24) and the Kyger Creek Station discussion on pages 35 and 36 of the draft SIP outline OEPA's rationale as to why no 4-Factor analysis is needed for the Kyger Creek Station. Specifically, these units are already effectively controlled, and any analysis would result in the conclusion that no further controls are necessary.

OVEC appreciates the opportunity to provide these comments in support of OEPA's evaluation of the Kyger Creek Station as the agency fulfills its obligations under the Clean Air Act with respect to Regional Haze.

If you have any questions, please contact me at (740) 289-7299.

Sincerely,

J. Michael Brown

J. Michael Brown
Environmental, Safety & Health Director

JMB:klr

Attachment

cc: Robert Hodanbosi - OEPA
Jennifer VanVlerah – OEPA
G. A. Hope – Kyger Creek Station
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G. S. Coriell - System
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AECOM

NOx Emissions and Visibility Analysis

Kyger Creek Station

AECOM Project Number: 60658179

June 18, 2021

Prepared for:

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Delivering a better world

1. Introduction

Ohio Valley Electric Corporation (OVEC) owns and operates the Kyger Creek Station (the Station). The Station operates five coal-fired boilers (B001, B002, B003, B004 and B005) that were installed in 1955. Flue gas desulfurization systems (FGDs) were installed March 19, 2012 on B001 and B002, and November 4, 2011 on B003, B004 and B005. The FGDs operate year-round. Selective catalytic reduction systems (SCRs) were installed October 1, 2002 on B001, December 1, 2002 on B002, February 1, 2003 on B003, April 1, 2003 on B004 and June 1, 2003 on B005. Initially, the SCRs operated only during the ozone season; however, because of changes in federal regulations impacting SO_2, NOx and mercury emissions from the utility industry discussed in greater detail below, the Station now operates the SCRs year-round, except for periods of repair and maintenance This Station has two flues in a common concrete stack. One flue exhausts the combined scrubbed flue gas from Units 1 and 2 and the second flue exhausts the combined scrubbed flue gas from Units 3, 4 and 5.

These units are each subject to the U.S. Environmental Protection Agency (USEPA) Cross-State Air Pollution Rule (CSAPR), promulgated on July 6, 2011, and implemented on January 1, 2015, which provides significant economic incentive to operate and optimize SO_2 and NOx emissions controls throughout the year. In addition, USEPA promulgated the CSAPR Update, that provided additional regional NOx reduction incentives during the ozone season beginning May 1, 2017. This incentive will become stronger with additional reductions in NOx allocations associated with USEPA's implementation of the final Revised CSAPR Update Rule, which goes into effect on June 29, 2021. This new rule requires additional seasonal NOx emission reductions from power plants in a 12-state region, including Ohio, beginning with the 2021 ozone season. In addition, the Kyger Creek units are each subject to the federal Mercury and Air Toxics Standards (MATS) requirements under 40 CFR 63 Subpart UUUUU, and the SCRs provide a co-benefit of oxidizing elemental mercury which aids in mercury removal from the flue gas. As a result, the Kyger Creek Station operates the SCRs holistically to achieve compliance with multiple regulatory obligations.

The National Park Service and Federal Land Managers (NPS/FLM) have commented to Ohio EPA that a NOx four-factor analysis is warranted for the coal units at the Kyger Creek Station, notwithstanding the fact that the Station already operates the best technology available for the control of NOx emissions – SCR, in conjunction with overfire air. Due to the timing of installation of those state-of-the-art NOx controls and because the NPS/FLM alleges that the Station does not achieve a 90% NOx control efficiency, the NPS/FLM asked that a four-factor analysis be submitted for the Station. The Station is hereby providing additional technical information on the Station's existing NOx controls on Units 1 through 5, their current actual emission rates and visibility impacts to support Ohio EPA's initial decision of not requiring a four-factor analysis for NOx.

As discussed further below, we believe a NOx four-factor analysis is not required for the Kyger Creek Station units because the units meet USEPA's criterion of a "well-controlled source".[1] Although the NPS/FLM claim that the units' NOx control efficiency ranges from 77% – 83%, the available emissions information supports the conclusion that overfire and the SCRs together achieve greater than 87% NOx removal efficiency (See **Table 2-1**). The actual NOx control efficiency is close to 90% and with the consideration of other factors, most importantly visibility/haze analysis, a four-factor analysis is not needed to support a conclusion that no NOx control efficiency enhancements are required.

The closest Class I areas to the Station (Dolly Sods, James River Face, and Otter Creek Wilderness Areas in West Virginia) are more than 200 km from the plant. Additionally, the available data for those Class I areas demonstrate that they are each significantly *ahead* of the USEPA-established glide path for

[1] US EPA; "Guidance on Regional Haze State Implementation Plans for the Second Implementation Period" in August 2019. Available at https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf.

achieving the nation's visibility goals and that additional NOx reductions at the Station will result in negligible visibility improvement at those areas.

While the NPS/FLM have the option of evaluating air pollutants and their impacts in isolation, focusing only on visibility at Class I areas, Ohio EPA is obligated to look holistically at all the environmental impacts associated with the plant's operations, including the adverse impacts that would result from increased ammonia injection. The Station needs to operate its control systems to optimize efficiencies in reducing ***all*** pollutants, not just NOx. Although the Station typically operates at lower NOx emissions during the ozone season, it is challenging to maintain that same low NOx emission rate year-round for the reasons discussed in Section 3. Given the imperceptible impacts on visibility that would result from slight reductions in annual NOx emission rates (see Section 4.0), it is clear that Ohio EPA should not be required to mandate further NOx reductions from the Kyger Creek Station, making a four-factor analysis unnecessary.

2. NOx Emissions

USEPA RHR guidance[2] states that a source may already have effective controls in place as a result of a previous regional haze SIP or to meet another Clean Air Act requirement. In addition, for well-controlled sources, the USEPA guidance indicates that it may be reasonable to assume for the purposes of efficiency and prioritization that a full four-factor analysis would likely result in the conclusion that no further controls are necessary. For a source meeting the specific USEPA examples for well-controlled sources, the practice widely accepted by states, USEPA, and other interested parties has been to not require a four-factor analysis.

Emissions of NOx at the Kyger Creek Station Units 1 through 5 are controlled by overfire air and SCR systems. The overfire air systems were installed in 1998 and 1999 and have resulted in a 40% reduction in NOx emission rates. The SCR systems were installed in 2003 and 2004. Emissions of NOx were originally subject to the Transport Rule (TR) NOx Annual Trading and the TR NOx Ozone Season Trading Program. These units are now each subject to the annual CSAPR regulations, which provide a significant year-round economic incentive to optimize NOx emissions controls. This incentive will increase during the 2021 ozone season with additional reductions to NOx allocations outlined in USEPA's Revised CSAPR Update rule that goes into effect June 29, 2021.

The NPS/FLM claim that those state-of-the-art controls should be disregarded because they were installed prior to 2007. We disagree. The Kyger Creek Station should not be penalized for being an early adopter of SCR technology, so long as those state-of-the-art controls are well-maintained and operated, as they demonstrably are, and are required to be. This conclusion is especially valid for sources using SCR to control NOx because the catalyst layers are routinely replaced with layers that may have updated catalyst types that provide for lower SO_2 oxidation as well as better mercury oxidation and NOx control.

Units 1 through 5 are wall-fired, wet-bottom boilers that were designed and constructed to burn Northern Appalachian bituminous coal. The boilers were installed in 1955, many years prior to any NOx emission standard. Pre- and post-control emissions of NOx are affected by various boiler design features and fuel type. Emission controls for NOx and SO_2 on the Station units were installed in the 2002 to 2012 time period and were specifically designed for the Station's unit type/fuel combination. The effect of boiler design and fuel on NOx emissions before add-on emission controls is evident in AP-42 Table 1.1-3 and summarized in **Table 2-1**.[3]

[2] US EPA; "Guidance on Regional Haze State Implementation Plans for the Second Implementation Period" in August 2019, Pages 22 and 23. Available at https://www.epa.gov/sites/production/files/2019-08/documents/8-20-2019_-_regional_haze_guidance_final_guidance.pdf.
[3] https://www.epa.gov/sites/production/files/2020-09/documents/1.1_bituminous_and_subbituminous_coal_combustion.pdf

Table 2-1 Typical NOx Emission Rates before Add-on Emission Controls[3]

Bolier Type	NOx Emissions lb/ton	NOx Emissions lb/MMBtu (1)
PC, wall fired wet bottom, sub-bituminous	24	1.41
Cyclone Furnace, bituminous	33	1.32
PC, cell burner dry bottom, bituminous	31	1.24
PC, wall fired wet bottom, bituminous, Pre-NSPS	31	1.24
Cyclone Furnace, sub-bituminous	17	1.00
PC, wall fired dry bottom, bituminous, Pre-NSPS	22	0.88
PC, cell burner dry bottom, sub-bituminous	14	0.82
PC, wall fired dry bottom, sub-bituminous, Pre-NSPS	12	0.71
PC, tangentially fired dry bottom, bituminous, Pre-NSPS	15	0.6
PC, tangentially fired wet bottom, bituminous, NSPS	14	0.56
PC, tangentially fired dry bottom, sub-bituminous, Pre-NSPS	8.4	0.49
PC, wall fired dry bottom, bituminous, NSPS	12	0.48
PC, tangentially fired dry bottom, sub-bituminous, NSPS	7.2	0.42
PC, wall fired dry bottom, sub-bituminous, NSPS	7.4	0.30
PC, tangentially fired dry bottom, bituminous, NSPS	7	0.28

(1) Based on 25 MMBtu/ton for bituminous coal and 17 MMBtu/ton for sub-bituminous coal.

As presented in **Table 2-1**, even with effective NOx controls in place, the Station is expected to have higher NOx emissions than post-NSPS units (units installed after August 17, 1971) as well as boilers burning sub-bituminous coal. In addition, the Station can be expected to have incrementally higher NOx emissions with effective NOx controls in place when compared to the more common dry-bottom boilers that comprise more than 80% of coal-fired boilers in the United States. Therefore, it is expected that the Kyger Creek Station units will have higher post control NOx emission rates than other Ohio boilers because there are no other currently operating wet-bottom boilers in Ohio. Therefore, any comparisons of Kyger Creek Station's post-control emission rates should be to other wall-fired, wet-bottom boilers rather than to the controlled emission rates of electric generating units with the same controls but a different boiler configuration/fuel mix within the state.

Actual emissions and annual capacity factors for Units 1 through 5 for the 1995 – 1997 period (pre-overfire air and SCR) and the 2017 through 2019 period (post-overfire air and SCR) are summarized in **Table 2-2**. Based on USEPA Air Markets Program Data[4], overall average emissions during this 3-year

[4] EPA Air Markets Program Data (https://ampd.epa.gov/ampd/)

period were 1.339 lb/MMBtu. In 1998 and 1999 overfire air systems were placed in service, and in 2003 and 2004, SCR systems were placed in service on all 5 units. Average NOx emissions during the 2016 through 2019 period were at 0.168 lb/MMBtu, which is an 87% reduction from the pre-control emission rate of 1.339 lb/MMBtu. In addition, total annual emissions have been reduced from 51,715 ton/yr to 5,218 ton/yr, a 90% reduction.

Table 2-2 Kyger Creek Station – Units 1 through 5 Actual Annual Operation and NOx Emissions

Time Period	Unit	Annual Operating Hours[(a)]	Power Output[(a)]	Capacity Factor based on MW[(b)]	Annual Fuel Use[(a)]	NOx Emissions[(a)]	
		(hr/yr)	(MWh)	%	(MMBtu/yr)	(ton/yr)	(lb/MMBtu)
1995 through 1997	1	8,107	1,703,042	80.0%	15,292,481	10,225	1.337
	2	8,236	1,740,792	77.9%	15,604,984	10,466	1.341
	3	8,197	1,746,261	77.2%	15,643,947	10,459	1.337
	4	8,131	1,660,724	82.9%	14,856,228	10,005	1.347
	5	8,267	1,766,556	80.4%	15,836,138	10,559	1.334
	Average	8,187	1,723,475	79.7%	15,446,755	10,343	1.339
	Total		8,617,375		77,233,777	51,715	1.339
2017 through 2019	1	7,180	1,350,200	71.0%	13,122,352	1,118	0.170
	2	6,947	1,285,856	67.6%	12,637,414	1,112	0.176
	3	6,760	1,218,602	64.1%	11,754,700	957	0.163
	4	7,136	1,306,505	68.7%	12,620,881	1,052	0.167
	5	7,035	1,225,554	64.5%	11,889,090	979	0.165
	Average	7,012	1,277,343	67.2%	12,404,887	1,044	0.168
	Total		6,386,716		62,024,437	5,218	
Emission Reduction						89.9%	87.4%

(a) EPA Air Markets Program Data (https://ampd.epa.gov/ampd/)

(b) Rated capacity for each unit 217 MW, gross.

3. SCR Systems on Units 1 through 5

Units 1 through 5 each have their own SCR system for control of NOx emissions. Each SCR unit has 4 catalyst layers. Catalyst activity is monitored by periodic sampling and analyses by Cormetech. Catalyst sampling occurs every 2 years. Each catalyst layer change-out requires a 10-day outage of the affected unit. On each unit, one layer of catalyst is changed during that unit's scheduled major outage. Typically, one major scheduled outage occurs for each unit every 2 years.

The SCR systems are operated year-round except for periods of repair and maintenance. The Station manages operation and maintenance of the boilers and the NOx emission control system to minimize emissions during the ozone season. Maintenance and repair activities that are scheduled during the non-ozone season, when possible, include air heater washes, catalyst cleanings, replacement of catalyst layers, electrostatic precipitator cleaning, and air heater basket change outs. Prior to the ozone season, the operation of the SCR system is optimized to minimize emissions during the ozone season.

Ammonia (NH_3) slip is monitored in the JBR via wet chemistry methods. NOx emission control is limited by acceptable NH_3 slip and mercury oxidation. SCR catalyst chemistry and operation are balanced to both reduce NOx to N_2, and oxidize mercury to form water-soluble mercury compounds. Oxidized mercury is well-controlled by wet FGD systems like the ones in place at the Kyger Creek Station. Non-oxidized (i.e., elemental) mercury essentially passes through the scrubber with minimal capture. High levels of ammonia, which is a reducing agent, reduce mercury oxidation, returning it to its elemental state. High levels of ammonia can therefore adversely affect the ability of the wet FGD system to capture and control the mercury, in turn jeopardizing the Station's MATS[5] compliance. Therefore, the facility needs to retain some operational balance between NOx removal and mercury oxidation to effectively remove both pollutants at levels necessary to comply with both the annual and ozone season NOx regulations applicable to this facility as well as the stack specific "not to exceed" mercury emission limits required under the MATS regulation. Lower NOx emission rate targets may then require installation of an activated carbon injection system to comply with the MATS rule.

Excessive ammonia (NH_3) slip can also adversely affect Kyger Creek Station's compliance with the MATS PM limit established on each stack at the facility. Excessive ammonia slip will be observed in the form of elevated PM on the continuous PM CEMs installed on each stack and the plant can adjust injection rates accordingly. The PM CEMS are used to demonstrate compliance with the "not to exceed" PM emission limits required under the MATS regulation and within the facility Title V permit, and the plant needs to have the compliance flexibility of adjusting ammonia injection rates as necessary to holistically balance its overall air emissions compliance obligations. The PM limits included in the Station's Title V permit also satisfy Ohio Revised Code (ORC) 3704.03(I) and 40 CFR Part 51 compliance obligations as an alternate for opacity monitoring, further supporting the argument that the Station must continue to manage its other air compliance obligations when operating NOx pollution control equipment throughout the year.

In addition, higher ammonia slip adversely affects air heater performance. Unreacted ammonia reacts with the sulfur oxides resulting in the formation of ammonium sulfate and ammonium bisulfate. Deposition of ammonium sulfate and ammonium bisulfate causes air heater fouling and eventually pluggage. Even low levels of ammonia slip for short periods of time are sufficient to result in ammonium sulfate and bisulfate formation, causing heater fouling and pluggage. The pluggage is typically detected by fan or duct back-pressure. Pluggage can result in plant derating until a major outage can be scheduled with the system operator to allow for a complete cleaning of the air heaters. This reduction in plant output and efficiency in turn increases all air emissions, including greenhouse gases, as more fuel is needed to generate the same amount of electricity.

Lastly, high NH_3 slip adversely affects ash quality which renders the ash unsuitable for future beneficial reuse.[6] The facility is in the process of constructing a dry fly ash handling system that is currently scheduled to be completed by mid- to late-2022. Once converted, the Station plans to beneficially reuse the fly ash. If unacceptable ammonia slip prevents the planned beneficial reuse of some or all of the fly ash, the Station will incur additional disposal costs for the landfilling of the ash. In the interim, the ash is wet-sluiced to an NPDES-permitted surface impoundment that is currently subject to routine ammonia monitoring requirements, and may become subject to an ammonia limit when the permit is renewed. NPDES permit renewal is imminent for this facility, and high ammonia slip resulting from focusing exclusively on NOx reductions could create near-term adverse water quality impacts and potential compliance risks with any new NPDES permit limit(s) established on the facility's ash pond discharge.

Lower non-ozone season NOx emissions could adversely affect the ability of the plant to limit ozone season emissions while significantly impacting plant operations. The Station has recently enhanced its preventative maintenance and operator training programs, and has also made process improvements to the urea injection system that are expected to improve the reliability of year-round NOx controls.

[5] Mercury and Air Toxics Standards (40 CFR 63, Subpart UUUUU)
[6] Fly ash is combined with the wet FGD sludge prior to landfilling. Beneficial reuse of the fly ash is its use in concrete.

In addition, as discussed in Section 4, lower annual NOx emissions, which could only be achieved by lowering non-ozone season NOx emissions, would not significantly improve visibility in nearby Class I areas. The technological and economic impacts of lower non-ozone season NOx emissions include:

- Increased urea and steam use;
- Additional hydrolyzer preventative maintenance;
- Additional air heater washes requiring a 48-hour unit outage for each wash:
- Additional catalyst cleanings requiring a 9-day unit outage for each cleaning;
- More frequent replacement of catalyst layers;
- More frequent electrostatic precipitator cleaning;
- More frequent air heater basket change outs;
- More frequent catalyst testing; and
- Possible additional mercury controls (activated carbon injection) to address decreased mercury oxidation rates as flue gas passes through the catalyst.

4. NOx Visibility Impacts

The goal of the RHR is to improve visibility in federal Class I areas. Accordingly, when evaluating possible emissions reduction projects or programs, it is appropriate to consider the degree to which control projects might contribute towards that goal. As explained below, because the visibility impacts attributable to NOx emissions at the Kyger Creek Station are low, further NOx controls and/or lower emission limits, even if technically and economically feasible, would yield negligible visibility benefits at any of the regional Class I areas.

Class I areas in the eastern United States within approximately 400 km of the Kyger Creek Station are shown in **Figure 4-1**. The closest Class I areas to the Kyger Creek Station are Dolly Sods, James River Face, and Otter Creek Wilderness Areas in West Virginia which are more than 200 km but less than 300 km from the plant. Other Class I areas within 400 km of the Kyger Creek Station are also shown in the figure.

The state of Ohio is a member of the Lake Michigan Air Directors Consortium (LADCO) Regional Planning Organization. LADCO assists its member states by conducting modeling analyses, including photochemical grid modeling, to assess visibility impacts from emission sources. This is especially helpful in determining the haze impact of the current emissions from sources being considered for SO_2 and NOx controls. A modeling result for this assessment is best obtained for a photochemical grid modeling analysis for which the source's emissions are "tagged" for purposes of determining the source's sulfate and nitrate haze contributions at each Class I area under consideration.

LADCO is currently conducting photochemical grid modeling that will assist member states to assess impacts from industry sectors (e.g., electric generating stations). However, the LADCO modeling had not been completed as of the time of this report. It is expected that when the modeling results are available, they will be consistent with independent modeling assessments that have already been completed by other Regional Planning Organizations (RPOs), as discussed below.

The next sub-section discusses available CAMx modeling for some Ohio EGUs conducted by the southeastern states Regional Planning Organization, VISTAS / SESARM.[7]

7 "VISTAS" is an acronym for Visibility Improvement-State and Tribal Association of the Southeast and "SESARM" stands for Southeastern States Air Resource Managers, Inc. Their web site for Regional Haze Rule modeling results is https://www.metro4-sesarm.org/content/vistas-regional-haze-program.

The impact of NOx emissions to Class I area visibility can be determined by analyzing the results of visibility modeling conducted by the VISTAS / SESARM Regional Planning Organization that included emissions for some Ohio power plants. The VISTAS modeling was conducted by Alpine Geophysics and utilized advanced CAMx modeling including modeling particulate matter simulations and source apportionment studies. Determinations of the haze contributions of specified large sources was accomplished by "tagging" the selected sources for determining their contribution to impairment at each Class I area of interest. Kyger Creek Station is a tagged source in the VISTAS analysis.
Visibility impairment is commonly expressed using two parameters to characterize the visibility impairment:

- **Light Extinction (b_{ext})** is the reduction in light due to scattering and absorption as it passes through the atmosphere. Light extinction is directly proportional to pollutant particulate and aerosol concentrations in the air and is expressed in units of inverse megameters or Mm-1.

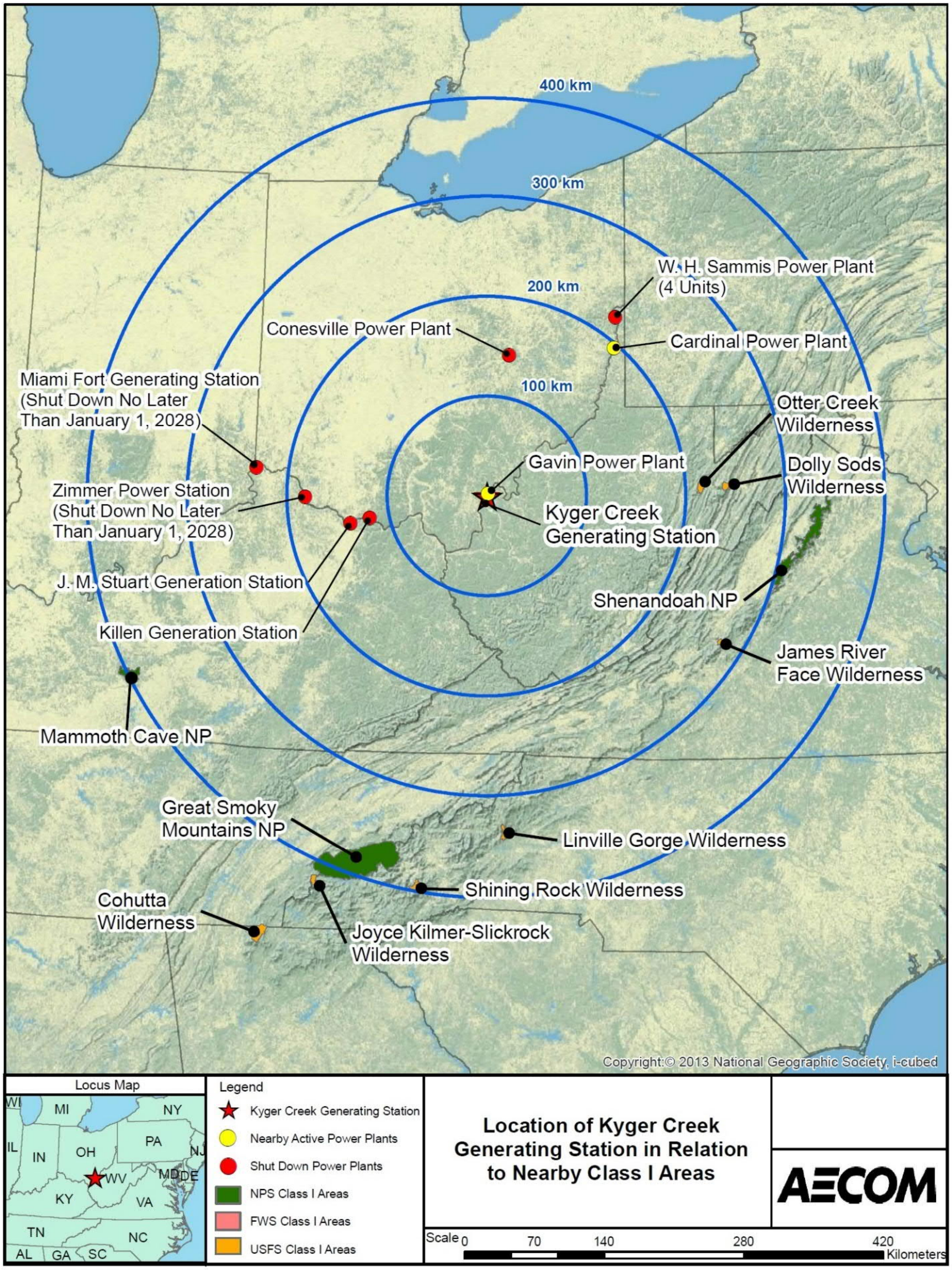
- **Deciview (DV)** is a unitless metric of haze which is proportional to the logarithm of the light extinction. Deciview correlates to a person's perception of a visibility change, with a change of 1 deciview being barely perceptible. The "no degradation" value of 0.1 DV stated in the 1999 Regional Haze Rule is only 10% of this perceptibility threshold.

Both metrics are helpful in understanding changes to visibility impairment. While the deciview is the best parameter to relate the significance of a perceived visibility change, modeling produces results in the form of light extinction using the new IMPROVE equation that converts particulate concentrations to visibility impairment.

In response to comments received from the Federal Land Managers for Ohio's draft State Implementation Plan submittal earlier in 2021, the Ohio EPA requested that the conversion between deciviews and extinction should reference the natural conditions endpoint visibility conditions. Ohio has indicated that it is permissible to reference the natural conditions endpoint adjusted for international haze contributions. These adjusted endpoints are available from USEPA's 2019 visibility modeling document[8], Appendix E.

8 Available at https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf.

Figure 4-1 Class I Areas in the Vicinity of Kyger Creek Station



A review of the natural conditions endpoint deciviews published by USEPA, adjusted for the influence of international contributions to haze, indicates that the cleanest background is at Dolly Sods and Otter Creek Wilderness Areas, with a deciview value of 11.07. The visibility metrics converter available at https://vista.cira.colostate.edu/Improve/haze-metrics-converter/ can be used to determine the extinction in inverse megameters for a deciview value of 11.07, as well as 10.97 and 11.17 (0.1 dv increments). At that deciview level, a change of 0.1 dv is equivalent to an extinction change of 0.3 Mm^{-1}. This conversion is used in the discussion provided below.

Charts shown in **Figures 4-2** and **4-3** are taken from the VISTAS Regional Haze modeling project webinar updated on September 10, 2020 (after being originally presented on May 20, 2020). They show, in units of deciview, the actual visibility measurements and projected modeling results of visibility for most impaired days at the Shenandoah National Park and the James River Face Wilderness Area where the Kyger Creek Station's NOx emissions have the greatest nearby visibility impacts.

Figure 4-2 Visibility Trends at Shenandoah National Park

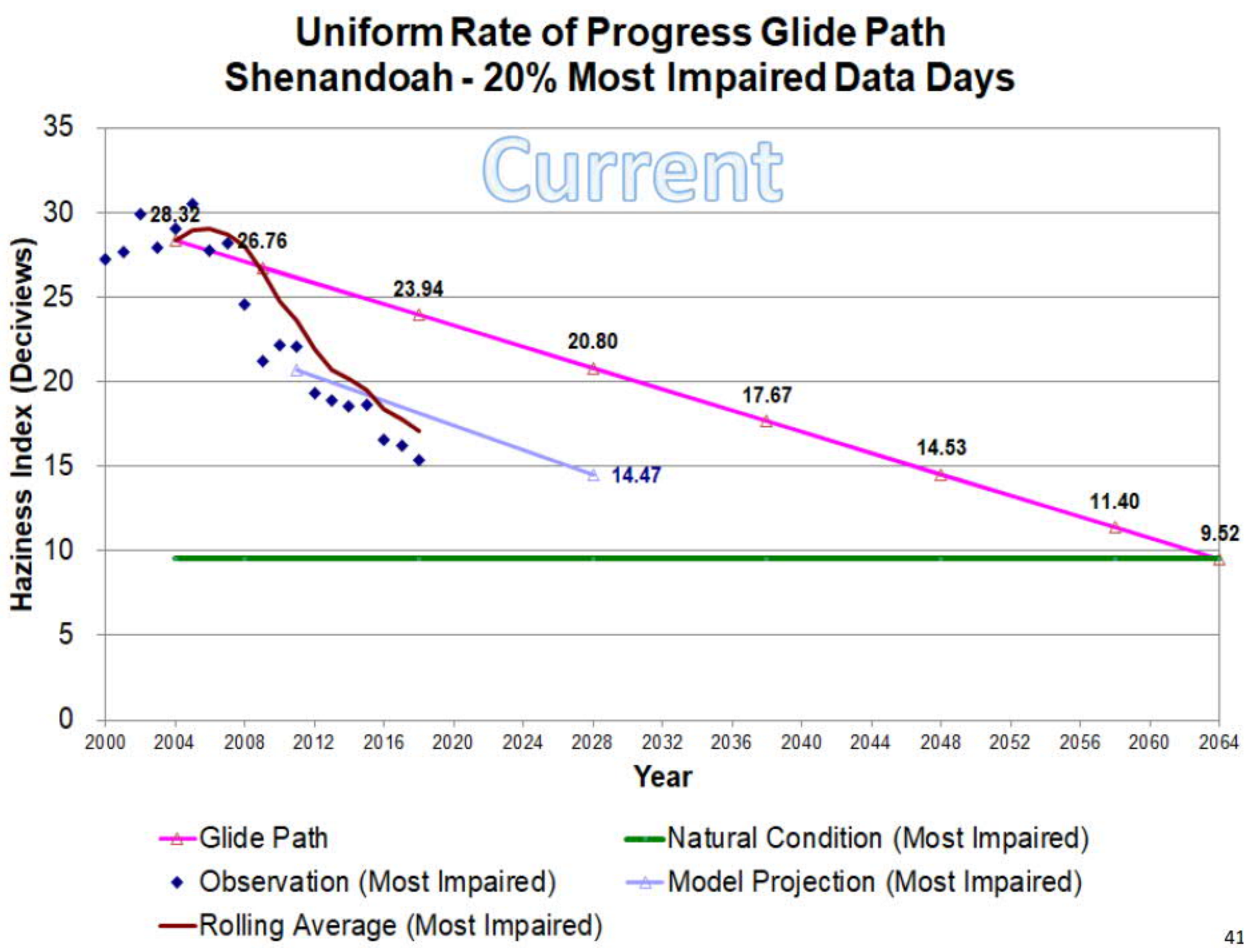
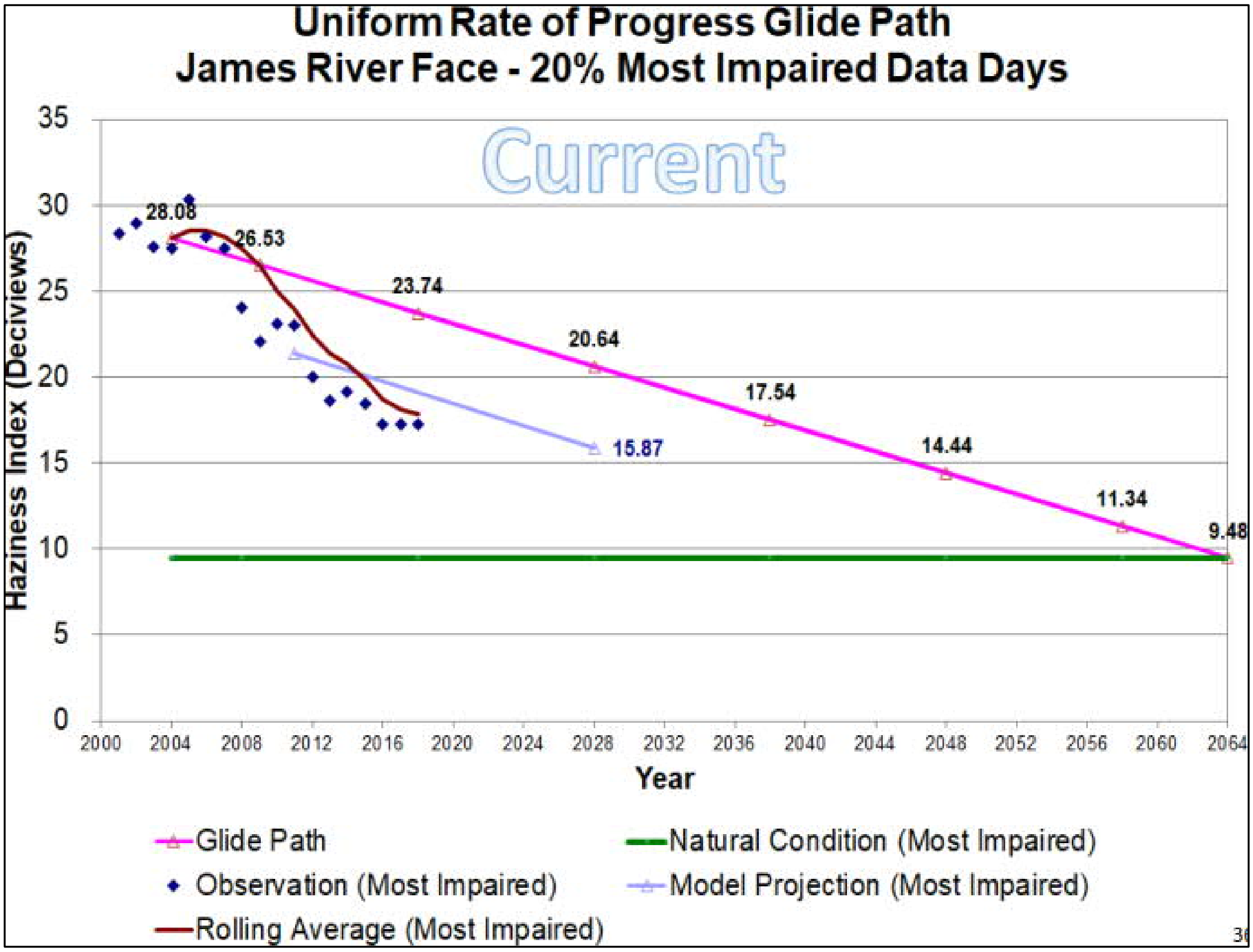


Figure 4-3 Visibility Trends at James River Face Wilderness Area



Figures 4-2 and **4-3** show that actual visibility measurements (the diamonds) confirm a strong trend of improved visibility in the past 10 years from about approximately 27 DV to 17 DV in both Shenandoah NP James River Face WA. These rates of actual improvement are much faster than the RHR target to maintain a "uniform rate of progress" or "glide path" (the pink line), which could be revised to a less-steep revised glide path to account for internationally-caused haze. However, VISTAS believes that since the Class I areas in this region are so far ahead of projections, that refinement is not necessary at this time.[9] Additionally, VISTAS modeling of the expected emissions reductions in the coming years (on-the-books / on-the-way controls) projects (the blue line) that visibility should continue to significantly improve, reaching 14.5 DV and 15.9 DV by the next RHR milestone year of 2028 for Shenandoah NP and James River Face WA, respectively. These charts show that visibility in these Class I areas is currently running ***at least 10 to 20 years ahead of the RHR targets*** and is expected to continue to do so. VISTAS modeling of other regional Class I areas shows very similar trends and all areas are far ahead of their glide path targets. Therefore, no additional emissions reductions at any regional facilities, beyond those already planned, are needed to continue to meet the RHR interim goals.

4.1 Impact of Kyger Creek Station's NOx Emissions

The VISTAS modeling used 2011 actual annual emissions to estimate the projected 2028 emissions for modeling, and these values can be scaled to current representative NOx emissions for the Kyger Creek

[9] VISTAS/SESARM response during Q&A of VISTAS Regional Haze modeling webinar presented on May 20, 2020.

Station. Ohio EPA has stipulated that 2017 through 2019 average emissions should be considered as a representative baseline for this analysis. The Kyger Creek Station's current emissions of NOx (5,218 ton/yr) can be compared to its modeled emissions (6,267 ton/yr) to develop, with linear scaling, estimates of visibility impacts of the current NOx emissions. **Table 4-1** presents the visibility impacts of the Kyger Creek Station's current NOx emissions.

Table 4-1 Visibility Impact of Current NOx Emissions

Class I Areas Nearest to the Kyger Creek Station	Total Haze Impacts of Current NOx Emissions	
	Mm^{-1}	DV*
Shenandoah NP	**0.0089**	**0.0074**
James River Face WA	0.0062	0.0051
Lye Brook WA	0.0062	0.0051
Otter Creek WA	0.0041	0.0034
Dolly Sods WA	0.0034	0.0029
Mammoth Cave NP	0.0034	0.0029

** Potential Improvement in DV is listed for the 20% most impaired days for each Class I area. Conversion between deciviews and extinction is based upon the discussion in Section 3.0: 0.1 dv is equivalent to 0.3 Mm^{-1} for extinction.*

The Station's current actual annual emissions of NOx result in estimated visibility impacts that are less than 0.02% of the projected 2028 visibility at the Shenandoah NP and James River Face. In addition, both these Class I areas are currently running at least 10 to 20 years ahead of the RHR glide path targets and are expected to continue to do so. Therefore, no further NOx reductions at the Station are required for Ohio EPA to meet its regional haze reasonable progress goals. Moreover, visibility improvements from any additional NOx reductions are likely to be imperceptible given that the impact of the total current NOx emissions is small.

5. Conclusion

In conclusion, a NOx four-factor analysis is unnecessary for the Kyger Creek Station. The Station currently operates the best available retrofit technology available for the control of NOx emissions – overfire air with SCRs, a system that together achieves almost 90% NOx removal efficiency. Mandating additional NOx reductions would upset the Station's concerted efforts in reducing emissions of all pollutants and in preventing other corollary environmental disbenefits, including higher mercury emissions, compromised ash quality, reduced plant output and efficiency (thereby increasing total emissions of other pollutants) and air heater pluggage resulting in major outages and/or significant plant capacity derating. Additionally, the closest Class 1 areas are more than 200 km away ***and*** are already well ahead of the USEPA-established glide path for achieving the nation's visibility goals. Moreover, the impact of the Station's current NOx emissions on the closest Class I area is 0.0074 DV, and any additional NOx reductions at the Kyger Creek Station would result in an imperceptible incremental improvement in visibility in those areas. Under these circumstances, it is entirely appropriate for Ohio EPA to conclude that the Kyger Creek Station is a well-controlled source for NOx and nothing further should be required to meet its regional haze obligations.