Ohio Environmental Protection Agency

Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

July 30, 2021

Ms. Cheryl Newton
Acting Regional Administrator
U.S. EPA, Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604

Re: Ohio's Regional Haze State Implementation Plan (SIP) for the Second Implementation Period

Dear Administrator Newton:

I am writing to submit Ohio's Regional Haze State Implementation Plan (SIP) for the Second Implementation Period. This SIP demonstrates satisfactory progress toward the long-term visibility goals contained in the Regional Haze Rule, as revised in 2017, and the Clean Air Act. Ohio EPA has addressed all required elements of 40 CFR 51.308(f) in this Plan, including consultation with the Federal Land Managers (FLMs) and other states.

The public comment period for the draft SIP was held from May 10, 2021 through June 28, 2021. Ohio EPA has made revisions based on comments received during the comment period and a response to comments is included in the appendices.

U.S. EPA's Memorandum "Clarifications Regarding Regional Haze State Implementation Plans for the Second Implementation Period", issued July 8, 2021, is not addressed in this submittal. The SIP was developed using all regulations and guidance provided by U.S. EPA available during the extensive planning process, which involved multiple years of planning and consultation with affected parties. U.S. EPA's issuance of a clarification memorandum of this significance so late in the planning process – just over three weeks from the deadline for submittal of the SIP, and after the conclusion of the public comment period – is very concerning and leaves the states in a difficult position. In order to meet our mandatory Clean Air Act requirements, Ohio had no choice but to submit our SIP without taking into consideration this ill-timed clarification memo, which is described as non-binding. Ohio is continuing to review the July 8, 2021 clarification memo and anticipates further discussion and engagement with U.S. EPA and other affected parties on this issue.

This SIP does not include the relaxation of any existing requirements and therefore will not interfere with the attainment or maintenance of the NAAQS in accordance with section 110(l) of the CAA.

Ohio EPA requests U.S. EPA approve Ohio's Regional Haze SIP for the Second Implementation Period.

If you have questions, please contact Jennifer Van Vlerah in our Division of Air Pollution Control at (614) 644-3696.

Sincerely,

Laurie A. Stevenson
Director

Cc: Bob Hodanbosi, Chief, Division of Air Pollution Control, Ohio EPA

Enclosures

Regional Haze State Implementation Plan for the Second Implementation Period

Prepared by:
The Ohio Environmental Protection Agency
Division of Air Pollution Control

July 2021

Acknowledgement

The Ohio EPA Division of Air Pollution Control wishes to express their appreciation for the effort, expertise, and direction provided by the staff of the Lake Michigan Air Directors Consortium (LADCO). The assistance they have given in terms of development of modeling and overall technical guidance has been invaluable and essential to the successful completion of this project.

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I. Background

In the 1977 amendments to the Clean Air Act (CAA), Congress established the goal of restoring many national parks and wilderness areas[1] to the natural visibility condition of atmospheric clarity that would prevail in the absence of human impacts. Section 169 of the CAA calls for the prevention of any future, and the remedying of any existing, human-made visibility impairment in mandatory Class I areas. Over the following years modest steps were taken to address the visibility problems in Class I areas; however, these measures mainly addressed plume blight from specific sources and did little to address regional haze issues in the eastern United States.

When the CAA was amended in 1990, Section 169B (42 USC 7492) was incorporated. This section provided for further research and regular assessments of the progress made to date. In 1993, the National Academy of Sciences concluded that "current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility" (*Protecting Visibility in National Parks and Wilderness Areas*; National Research Council, Washington, DC: 1993). In addition to authorizing creation of visibility transport commissions and setting forth their duties, Section 169B(f) of the CAA mandated creation of the Grand Canyon Visibility Transport Commission (Commission) to make recommendations to the U.S. EPA for the region affecting the visibility of the Grand Canyon National Park. After four years of research and policy development, the Commission submitted its report to U.S. EPA in June 1996. The Commission report, as well as the many research reports prepared by the Commission, contributed invaluable information to the U.S. EPA in its development of the federal Regional Haze Rule.

U.S. EPA's Regional Haze Rule was adopted July 1, 1999 and went into effect on August 30, 1999 (64 FR 35714, July 1, 1999). The Regional Haze Rule aims at achieving natural visibility goals by 2064. This rulemaking addressed the combined visibility effects of various pollution sources over a wide geographic region. This wide-reaching effort means that many states, including those without Class I areas, must participate in haze reduction efforts. U.S. EPA designated five Regional Planning Organizations (RPOs) to assist with the coordination and cooperation needed to address the haze issue. Ohio participates in the Lake Michigan Air Directors Consortium (LADCO), which is comprised of the states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

In January 2017, U.S. EPA issued a final rule updating the regional haze program (82 FR 3078, January 10, 2017). The revised rule governs states' obligations and U.S. EPA's review of periodic State Implementation Plans (SIPs) developed for the second and subsequent implementation periods, among other requirements. Requirements for the second implementation period SIPs, due July 31, 2021 are contained in 40 CFR 51.308(f). On August 20, 2019, U.S. EPA issued a memorandum "Guidance on Regional Haze State Implementation Plans for the Second Implementation Period" (hereinafter referred to as

[1] Mandatory Class I Federal areas are composed of all international parks in the United States, all national wilderness areas and memorial parks larger than 5,000 acres, and all national parks larger than 6,000 acres in size that were in existence by 1977 (CAA Section 162, 42 USC 7472; 40 CFR 52.21(e)).

Regional Haze Guidance). This document will closely follow the key process steps outlined in U.S. EPA's Regional Haze Guidance.

II. Regional Planning

Since the atmospheric contaminants degrading the atmosphere in a given park or wilderness area may have been transported by winds over a great distance, U.S. EPA determined that control strategies to reduce those contaminants must involve participation by responsible parties on a region-wide basis, over a large area. Accordingly, U.S. EPA has designated five regional planning organizations (RPO's) to cover the entire country. The Lake Michigan Air Director's Consortium (LADCO) serves as the RPO for the States of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. This SIP utilizes data analysis, modeling results, and other technical support documents prepared by LADCO for its members.

Since the emissions of the LADCO region travel far outside the boundaries of those six States, LADCO's activities have included mutual consultation and sharing of information with other RPOs. LADCO works cooperatively with the RPOs representing other parts of the country. LADCO maintains regular contact with the RPOs on technical and policy matters. By coordinating with LADCO and other RPOs, Ohio has worked to ensure that its long-term strategy provide reasonable reductions to mitigate impacts of sources from Ohio on affected Class I areas.

III. Ohio's Regional Haze SIP – Second Implementation Period

U.S. EPA's Regional Haze Guidance outlines key process steps to help states develop approvable Regional Haze SIPs. Not all steps apply to a state such as Ohio which does not contain any Class I areas. Generally, for a state that does not contain Class I areas, the process involves determining which Class I areas may be impacted by the state, selecting sources (or groups of sources) for analysis of emission control measures, performing a four-factor analysis of emission control measures on those sources, and determining which control measures are necessary to make reasonable progress for incorporation into a Long-Term Strategy (LTS). The following discussion closely follows the key process steps outlined in U.S. EPA's Regional Haze Guidance.

1. Step 1: Ambient data analysis

40 CFR 51.308(f)(1) requires each state with a Class I area to calculate the baseline, current, and natural visibility conditions as well as to determine the visibility progress to date and the uniform rate of progress (URP). This step is not applicable to Ohio, which does not contain any Class I areas.

2. Step 2: Determination of affected Class I areas in other states

40 CFR 51.308(f)(2) requires each state to develop a Long Term Strategy (LTS) that includes the control measures necessary to make reasonable progress at each Class I area outside the state that may be affected by emissions from the state. U.S. EPA's

Regional Haze Guidance (p. 8) indicates that "since determinations of affected Class I areas were previously made for the first regional haze implementation period, states may consider retaining the same linkages and assumptions from those SIPs, but if states do so then they should consider whether the assumptions about source-receptor relationships have changed since those assessments."

Ohio's Regional Haze SIP for the first implementation period, submitted on December 2008, as revised in March 2011 and August 2015, identified the Class I areas shown in Table 1 below were impacted by Ohio. U.S. EPA published approvals for Ohio's first implementation period SIP on July 2, 2012 (77 FR 39177), March 4, 2016 (81 FR 11445) and May 10, 2018 (83 FR 21719). This assessment was based on back-trajectory analyses and source apportionment modeling performed by LADCO, as well as contribution assessments and area of influence analysis conducted by other RPOs. Ohio expects this to be a conservative assessment of current source-receptor relationships as emissions contributing to visibility impairment have decreased significantly since this analysis, as shown in the progress report in Section 8(b) below (see Figures 1 and 2 and Table 21).

Class I areas impacted by Ohio were also identified using source apportionment modeling conducted by LADCO (Appendix A). LADCO's source apportionment modeling used 2016-base year and projected 2028 future year inventories with tags by state/region. Ohio was assumed to affect visibility impairment in a Class I area if it contributes 2 percent or more to total light extinction (this is the same metric used during the first implementation period). Class I areas determined to be impacted by Ohio using the LADCO modeling are also shown in Table 1 below.

Table 1 also shows that visibility conditions in 2028 at each Class I area impacted by emissions from Ohio are projected to be below (or well below) the uniform rate of progress (URP) glidepath. On September 19, 2019, U.S. EPA issued a memorandum "Availability of Modeling Data and Associated Technical Support Document for EPA's Updated 2028 Regional Haze Modeling" (hereinafter referred to as U.S. EPA's Regional Haze Modeling)[2]. For each Class I area determined to be impacted by Ohio, Table 1 includes the 2028 adjusted glidepath[3] as referenced in U.S. EPA's Regional Haze Modeling. Table 1 also includes the 2028 projected 20% most impaired days from U.S. EPA's Regional Haze Modeling which used 2011-base year 2028 projections, and LADCO's Regional Haze glidepath modeling (Appendix A) which used 2016-base year 2028 projections. The Class I areas impacted by Ohio are projected to be 1.28 to 7.56 deciviews (dv) below the URP glidepath in 2028, and average approximately 4 dv below the glidepath. The Class I areas impacted most significantly by Ohio, Dolly Sods Wilderness and Otter Creek Wilderness, are projected to be approximately 5 dv below the glidepath in 2028.

[2] https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf

[3] Adjusted for international anthropogenic and prescribed fire impacts

Table 1. Class I areas impacted by Ohio, 2028 Adjusted Glidepath, and 2028 Projected Visibility

Class I Area	State	Impacted by Emissions from Ohio - Round 1 Determinations[1]	Impacted by Emissions from Ohio - Round 2 Determination[2]	LADCO 2028 Projected Total Light Extinction (Mm-1)[2]	LADCO 2028 Projected Ohio Contribution (Mm-1)[2]	LADCO 2028 Projected Ohio Contribution (%)[2]	2028 Adjusted Glidepath[3]	U.S. EPA 2028 Projected 20% most impaired days (dv)[3]	LADCO 2028 Projected 20% most impaired days (dv)[2]	Below Glidepath
Acadia NP	ME	Y	N	41.90	0.669695593	1.6%	18.45	13.90	13.95	Y
Brigantine	NJ	Y	Y	69.40	2.990697032	4.3%	21.55	18.45	18.58	Y
Caney Creek Wilderness	AR	Y	N	54.40	0.091461974	0.2%	18.88	16.97	16.67	Y
Cohutta Wilderness	GA	N	Y	51.80	1.102987728	2.1%	22.09	16.57	16.18	Y
Dolly Sods Wilderness	WV	Y	Y	54.03	7.090515068	13.1%	21.29	16.21	16.50	Y
Great Gulf Wilderness	NH	Y	Y	36.40	0.922406207	2.5%	18.22	12.17	12.37	Y
Great Smoky Mountains NP	TN	Y	Y	51.02	1.152088086	2.3%	22.17	16.08	15.98	Y
Hercules-Glades Wilderness	MO	Y	N	59.43	0.645405507	1.1%	19.63	17.44	17.48	Y
James River Face Wilderness	VA	Y	Y	53.42	3.477229369	6.5%	21.35	16.40	16.51	Y
Joyce-Kilmer-Slickrock Wilderness	TN	N	Y	51.02	1.152088086	2.3%	22.17	16.08	15.98	Y
Linville Gorge Wilderness	NC	N	Y	45.73	1.757926993	3.8%	21.29	15.15	14.99	Y
Lye Brook Wilderness	VT	Y	Y	42.86	1.433901835	3.3%	19.25	13.94	14.13	Y
Mammoth Cave NP	KY	Y	Y	74.18	4.40766853	5.9%	22.74	19.50	19.65	Y
Mingo	MO	Y	N	69.67	0.886236974	1.3%	20.22	18.88	18.94	Y
Moosehorn	ME	Y	N	37.33	0.422077842	1.1%	17.76	12.73	12.84	Y
Otter Creek Wilderness	WV	Y	Y	54.03	7.090515068	13.1%	21.29	16.21	16.50	Y
Presidential Range-Dry River Wilderness	NH	Y	Y	36.40	0.922406207	2.5%	18.22	12.17	12.37	Y
Seney	MI	Y	Y	57.36	1.150628133	2.0%	19.80	16.82	16.67	Y
Shenandoah NP	VA	Y	Y	50.63	5.321622537	10.5%	21.47	15.82	15.82	Y
Shining Rock Wilderness	NC	N	Y	41.42	1.173215905	2.8%	21.50	14.33	13.94	Y
Sipsey Wilderness	AL	N	Y	60.97	1.401809639	2.3%	21.16	18.00	17.75	Y
Swanquarter	NC	N	Y	48.52	1.756667177	3.6%	18.80	15.75	15.58	Y
Upper Buffalo Wilderness	AR	Y	N	54.35	0.589473529	1.1%	19.29	16.92	16.65	Y

Data Sources:

[1] Round 1 SIP (https://epa.ohio.gov/Portals/27/sip/regional/Regional_Haze_SIP_2015-FINAL.pdf)

[2] LADCO 2016 base year, 2028 modeling (Appendix A), specifically the "2016-based 2028 glidepaths and PSAT tracer contributions" spreadsheet posted specifically the “Control Sheet” tab, posted on LADCO’s electronic docket at https://www.ladco.org/reports/technical-support/ladco-regional-haze-tsd-second-implementation-period/.

[3] U.S. EPA Regional Haze Modeling TSD, Table 5-2 (https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf)

3. Step 3: Selection of sources for analysis

40 CFR 51.308(f)(2)(i) requires states to include a description of the criteria used to determine the sources or groups of sources evaluated for potential controls. The Regional Haze Rule does not explicitly list factors that a state must or may not consider. Rather, U.S. EPA's Regional Haze Guidance (p. 10) indicates that states are required to "reasonably choose factors and apply them in a reasonable way given the statutory requirement to make reasonable progress".

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. For this second implementation period, Ohio is focusing on major and minor stationary sources and groups of sources, as these sources are more controllable at the state level and are significant contributors to Regional Haze at Class I areas impacted by sources in Ohio.

U.S. EPA's 2028 Regional Haze Modeling included source apportionment modeling showing the contribution of different sectors at each Class I area. As shown in Table 2, an analysis of the point source contributions available in Appendix B of U.S. EPA's Regional Haze Modeling TSD shows that total electric generating unit (EGU) and non-EGU sectors contribute an average of 58 percent of the visibility impact at a Class I area impacted by sources in Ohio, ranging from 37 percent to 76 percent. While U.S. EPA's modeling pertains only to sector-based source apportionment and does not specifically provide the impact coming from Ohio sources, Ohio finds it reasonable to support a focus on point sources for the second implementation period.

In accordance with the flexibilities provided in the Regional Haze Guidance, Ohio will defer analysis of other sectors to future implementation periods. The Regional Haze Guidance (pp. 9-10) states "A key flexibility of the regional haze program is that **a state is not required to evaluate all sources of emissions in each implementation period**. Instead, a state may reasonably select a set of sources for an analysis of control measures. The guidance that an analysis of control measures is not required for every source in each implementation period is based on CAA section 169A(b)(2), which requires each SIP to contain emission limits, schedules of compliance, and other measures as may be necessary to make reasonable progress, but (in marked contrast to the statutory provision for BART) does not provide direction regarding the particular sources or source categories to which such emission limits, etc., must apply. Selecting a set of sources for analysis of control measures in each implementation period is also consistent with **the Regional Haze Rule, which sets up an iterative planning process and anticipates that a state may not need to analyze control measures for all its sources in a given SIP revision**. Specifically, section 51.308(f)(2)(i) of the Regional Haze Rule requires a SIP to include a description of the criteria the state has used to determine the sources or groups of sources it evaluated for potential controls. Accordingly, **it is reasonable and permissible for a state to distribute its own analytical work, and the compliance expenditures of source owners, over time by addressing some sources in the second implementation period and other sources in later periods**. For the sources that are not selected for an analysis of control measures

for purposes of the second implementation period, it may be appropriate for a state to consider whether measures for such sources are necessary to make reasonable progress in later implementation periods." (Emphasis added)

As shown in Table 2, the largest contribution to visibility impairment at Class 1 areas impacted by sources in Ohio outside of the point source sector is the nonpoint sector, with contributions ranging between 8 and 23 percent (average 14 percent) (Appendix B of U.S. EPA's Regional Haze Modeling TSD). Ohio EPA is exploring options for regulating the nonpoint category as a part of our strategy to attain the 2015 ozone standard. Based upon the results of this exploration, Ohio may look further at this category as a part of Regional Haze in future rounds.

Contributions from onroad emissions, which are difficult to control at the state level, range from only 4 to 11 percent (average 6 percent) (Appendix B of U.S. EPA's Regional Haze Modeling TSD). Oil and gas, residential wood combustion (RWC), and anthropogenic dust sectors each contribute on average less than 10 percent. Therefore, in order to direct limited analytical resources to those sources with a greater contribution, that are more easily controllable at the state level, Ohio finds it reasonable to support a focus on point sources for the second implementation period and defer analysis of other sectors to future implementation periods, consistent with the flexibilities provided in the Regional Haze Guidance.

Table 2. U.S. EPA 2028 modeling sector-based contribution (percent) at Class I areas impacted by sources in Ohio

Class I Area	State	EGU	Non-EGU	Total Point	Nonpoint	Onroad	Oil and Gas	RWC	Anthro Dust	Other Sectors
Acadia NP	ME	19	18	37	23	8	N/A	15	N/A	16
Brigantine	NJ	16	21	37	22	10	N/A	10	N/A	21
Caney Creek Wilderness	AR	45	23	68	8	5	7	N/A	N/A	13
Cohutta Wilderness	GA	42	26		14	6	N/A	N/A	3	10
Dolly Sods Wilderness	WV	54	22	76	8	4	4	N/A	N/A	8
Great Gulf Wilderness	NH	31	24	55	17	5	N/A	13	N/A	9
Great Smoky Mountains NP	TN	42	26	68	13	6	N/A	3	N/A	9
Hercules-Glades Wilderness	MO	42	18	60	8	8	7	N/A	N/A	18
James River Face Wilderness	VA	38	24	62	14	7	N/A	6	N/A	11
Joyce-Kilmer-Slickrock Wilderness	TN	42	26	68	13	6	N/A	3	N/A	9
Linville Gorge Wilderness	NC	45	28	73	13	4	N/A	N/A	N/A	9
Lye Brook Wilderness	VT	25	20	45	20	9	N/A	12	N/A	14
Mammoth Cave NP	KY	46	21	67	8	5	8	N/A	N/A	12
Mingo	MO	42	19	61	8	7	N/A	N/A	6	19
Moosehorn	ME	26	21	47	20	7	N/A	14	N/A	12
Okefenokee	GA	25	16	41	16	5	N/A	N/A	6	12
Otter Creek Wilderness	WV	54	22	76	8	4	4	N/A	N/A	8
Presidential Range-Dry River Wilderness	NH	31	24	55	17	5	N/A	13	N/A	9
Cape Romain	SC	29	34	63	13	N/A	N/A	N/A	5	19
Seney	MI	26	24	50	14	11	N/A	8	N/A	18
Shenandoah NP	VA	45	21	66	12	6	N/A	4	N/A	11
Sipsey Wilderness	AL	42	21	63	16	7	3	N/A	N/A	10
Swanquarter	NC	29	26	55	15	6	N/A	N/A	N/A	23
Upper Buffalo Wilderness	AR	44	19	63	8	6	7	N/A	N/A	15
Wolf Island	GA	25	16	41	16	5	N/A	N/A	6	12
Average		36	22	58	14	6	6	9	5	13
Maximum		54	34	76	23	11	8	15	6	23
Minimum		16	16	37	8	4	3	3	3	8

Source: Appendix B of U.S. EPA's Regional Haze Modeling TSD

Ohio EPA evaluated individual point sources for potential four-factor analysis, as described further below.

a) Determining which pollutants to consider

The direct and precursor pollutants that can impair visibility include sulfur dioxide (SO_2), nitrogen oxides (NOx), fine and coarse particulate matter (PM), volatile organic compounds (VOC), and ammonia. Ohio considered SO_2, NOx, $PM_{2.5}$, and ammonia. Consistent with the Regional Haze Guidance, Ohio did not consider VOC emissions based on the expectation that anthropogenic VOC emissions make only a small contribution to visibility impairment. The Regional Haze Guidance (p. 11) also indicates states can focus on the PM species that dominate visibility impairment at the Class I areas; Ohio focused on $PM_{2.5}$ rather than PM_{10} or any particular species of PM.

b) Estimating baseline visibility impacts for source selection

The Regional Haze Rule allows reasonable surrogate metrics of visibility impact for source selection. The Regional Haze Guidance (pp. 10, 13) describes the process for using surrogate metrics for visibilitiy impacts. Ohio is using the surrogate metric "emissions divided by distance" (Q/d). In this approach, a source's annual emissions in tons (Q) divided by distance in kilometers between the source and the nearest Class I area (d) is used as a surrogate for source visibility impacts.

LADCO prepared a Q/d analysis for sources in the LADCO region where the sum of SO_2, NOx, $PM_{2.5}$, and ammonia was greater than 0.1 tons per year (TPY). On October 14, 2020 LADCO issued a technical memorandum "Description of the Sources and Methods Used to Support Q/d Analysis for the 2nd Regional Haze Planning Period" which describes the data sources and methods used in the Q/d analysis (Appendix B[4]). For each source, Q was determined for the sum of SO_2, NOx, $PM_{2.5}$, and ammonia. U.S. EPA's Regional Haze Guidance (p. 13) states "In the most simple implementation of Q/d, metrics and thresholds can be defined on the basis of the sum of emissions of all visibility-impairing pollutants". While the Regional Haze Guidance (p. 13) also indicates "it may be best to evaluate Q/d metrics on an individual pollutant basis" and "appropriate pollutant-specific Q/d thresholds…may need to be considered", Ohio believes it is appropriate to define the Q/d metric and thresholds based on the sum of all emissions. Defining the metric and thresholds based on the sum of multiple pollutants has the advantage of capturing sources that may have a small amount of emissions for many pollutants, but which collectively have a large impact. Ohio has selected a threshold which captures both large sources of individual pollutants and sources with a cumulative impact from multiple pollutants.

2016 emissions were used for EGU and non-EGU sources; Ohio considers 2016 actual data to be a more accurate representation of emissions than the alternative available at

[4] Several iterations of the Q/d analysis were performed by LADCO due to adjustments and refinements during the process. Ohio's selection of sources in Step 3 relied on the "Process level report of Q/d sources (Haze_Control_Sheet_6.9.xlsx)", specifically the "Control Sheet" tab, posted on LADCO's electronic docket at https://www.ladco.org/reports/technical-support/ladco-regional-haze-tsd-second-implementation-period.

the time of this analysis – 2028 emissions projected from a 2011 base year – due to many shut downs and changes at EGUs and non-EGUs between 2011 and 2016. For point oil and gas sources, 2028 projected emissions from a 2011 base year were used. This was the best available data at the time Ohio began our analysis.

40 CFR 51.308(f)(2)(iii) requires that emissions information used in this analysis must include, but need not be limited to, information on emissions in a year at least as recent as the most recent National Emissions Inventory (NEI) year. At the time of submission, the most recent NEI year is 2017. However, the 2017 NEI inventory was not available at the time Ohio began our source selection process.

Acknowledging that in some cases states may have begun their process using emissions for an earlier year, the Regional Haze Guidance provides for an alternative to repeating the analysis with updated emissions. The Regional Haze Guidance (p. 18) states:

> "Another reasonable option for a state to satisfy the requirement in section 51.308(f)(2)(iii) of the Regional Haze Rule, when it is not possible to fully incorporate the more recent information in all the source selection analysis steps, may be to verify in a reasonable manner, for some or all of the state's sources, that there are no important differences between the older and new emissions information that can be expected to affect the selection of sources. In most cases, the state should focus on source sectors that may have experienced increased emissions in the most recent NEI or new sources that did not exist in the previous inventory.
>
> "For example, if a state has used 2014 information to select sources (directly, or as the starting point for a 2028 projection) and if for that state the most recent [National Emissions Inventory] NEI submission year is 2017, the state could compare the 2014 and 2017 emissions for some sources. If 2017 emissions from a source the state has not selected are lower than its 2014 emissions, the state could reasonably conclude that using the 2017 information would not have resulted in the source being selected if the analysis had been based only on 2017 emissions information. If 2017 emissions are higher than 2014 emissions, further consideration of that source may be appropriate."

Therefore, Ohio performed an additional analysis comparing point source inventories from the 2017 NEI[5], as well as 2018 emissions from Ohio's "Emissions Inventory System"[6] (EIS) with the inventory used for our source selection process. For sources included in the original Q/d analysis that were not previously selected for a 4-factor analysis, where the sum of SO_2, NOx, $PM_{2.5}$, and ammonia emissions (Q) was greater than 500 TPY in any of the three data sets (the 2016 actual data, 2017 NEI data, and 2018 Ohio EIS data) and showed an increase from the original Q/d analysis, Ohio calculated an updated Q/d value to determine if the thresholds established in Step 3(c) below were exceeded given the more recent emissions data from the 2017 NEI and 2018

[5] https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data
[6] https://epa.ohio.gov/dapc/aqmp/eiu/eis

Ohio EIS. These recent emissions data were also evaluated for any new sources not evaluated in the original Q/d analysis with a sum of SO_2, NOx, $PM_{2.5}$, and ammonia emissions (Q) greater than 500 TPY, and none were found. Ohio did not identify any increases in emissions or new sources that would have resulted in the source being selected if the analysis had been based on 2017 or 2018 emissions.

'd' was determined for each source as the distance from the source to the nearest Class I area in/near LADCO states (including Boundary Waters, Isle Royale, Seney, Voyagers, Mingo Junction, Mammoth Cave and Dolly Sods). By determining the "worst case Q/d" for each source (i.e. the closest Class I area to that source), Ohio will identify all sources that exceed the selected thresholds for one or more Class I areas. While the Regional Haze Guidance recommends that states "repeat the source selection step from the perspective of each Class I area", this exercise would not identify any additional sources than those identified using Ohio's "worst case Q/d" approach, as the Q/d determined for each area would never be higher than the worst case.

c) Using estimates of visibility impacts to select sources

U.S. EPA's Regional Haze Guidance (p. 19) indicates a state may establish a "reasonable value of its chosen metric to serve as a threshold, such that only sources with impacts above this threshold are selected for analysis of control measures." Ohio established as our primary selection criteria a Q/d threshold of greater than 5 as a starting point for evaluating sources that may be carried forward into a four-factor analysis. This primary selection criteria is determined considering each unit's separate contribution to visibility impairment. Sources meeting this primary selection criteria account for 36 units at 15 facilities. Ohio selected this primary selection criteria and finds it to be a reasonable approach because it captures a reasonable set of sources to carry forward for futher analysis.

On March 9, 2020 U.S. EPA Region 5 forwarded an informal list of recommended sources developed by the National Park Service (NPS)[7] which was based on a facility-wide contribution. In reviewing this list, Ohio found it appropriate to include facility-wide contribution as an additional consideration. Therefore, in addition to the primary selection criteria for individual units, Ohio added secondary selection criteria for a facility-wide Q/d greater than 10. Where a facility triggers the secondary criteria based on facility-wide contribution (facility Q/d greater than 10), the four-factor analysis will only be performed for any units with Q/d greater than 4. As part of this secondary criteria, Ohio believes it is reasonable to limit a potential four-factor analysis to only those units which had a larger contribution, for efficiency and effectiveness in allocating Ohio's resources as well as the expenditures of source owners. The secondary selection criteria resulted in the addition of two units at two facilities (Haverhill Coke Company unit P902 and Sammit unit B011) to the initial starting point for evaluating sources that may be carried forward into a four-factor analysis.

[7] See Section 8(a) below for a full discussion of the consultation process with FLMs and other parties. The NPS recommendations are noted in this section because they led Ohio to adjust our selection criteria with the addition of a secondary threshold based on facility-wide contribution.

Sources in Ohio meeting the primary and secondary selection criteria, combined, account for 38 units at 16 facilities. 73% of the total Q/d for all sources analyzed[8] was carried forward for further consideration. This captures 68% of total emissions analyzed, including 80% of SO_2 emissions, 57% of NOx emissions, 47% of $PM_{2.5}$ emissions and 23% of ammonia emissions. Ohio considers the combined primary and secondary selection criteria to capture a reasonable set of sources as an initial screening for potential four-factor analysis.

A full inventory for 2017, the most recent NEI year at the time of this SIP, is presented in in the progress report in Section 8(b), Table 20 below. As shown in this inventory, ammonia comprises just 7% of total emissions. Further, the Regional Haze Guidance (p. 12) states "In the first implementation period, many states eliminated VOC and ammonia emissions from consideration based on the expectation that anthropogenic VOC emissions make only a small contribution to visibility impairment and that formation of nitrate and sulfate PM is most effectively reduced by reducing emissions of NOx and SO_2 rather than by anthropogenic emissions of ammonia. EPA believes that, in general, this would also be a reasonable approach for the second implementation period." Thus, while it may have been reasonable to exclude ammonia entirely in our analysis, Ohio took a conservative approach by capturing 23% of ammonia emissions with the selection criteria selected.

d) Option to consider the four statutory factors when selecting sources

The Regional Haze Guidance allows states the option of considering any of the four statutory factors (i.e. cost of compliance, remaining useful life, time necessary for compliance, and energy and non-air quality environmental impacts) at the source-selection step (Step 3). Ohio has opted to consider the four factors during Step 4.

e) Option to consider the five additional factors when selecting sources

40 CFR 51.308(f)(2)(iv) requires that when developing its LTS, a state must consider five additional factors. The rule does not specify that these factors must be considered at any particular step, but U.S. EPA's Regional Haze Guidance allows states the option of considering any of the five additional factors at the source-selection step (Step 3). Ohio considers all five additional factors below:

1. *Emission reductions due to ongoing air pollution control programs, including measures to address reasonably attributable visibility impairment (RAVI)*

   Ohio considered this factor by excluding certain sources from four-factor analyses based on those sources already having effective emissions controls in place, as described further in Step 3(f) below.

[8] Recall, sources with a sum of SO_2, NOx, $PM_{2.5}$, and ammonia emissions greater than 0.1 TPY were included in this analysis.

In 2017, U.S. EPA simplified provisions for the 1980 Reasonably Attributable Visibility Impairment (RAVI) Rule and extended it to all states, not just those with Class I areas. 40 CFR 51.302 describes how a FLM may provide a state with a certification regarding a particular Class I area and an associated source responsible for visibility impairment. Ohio does not have any sources for which an FLM has provided a RAVI certification.

2. *Measures to mitigate the impacts of construction activities*

Ohio does not have any in-state Class I areas, and Ohio does not believe construction activities in Ohio are a significant contributor to visibility impairment in out-of-state Class I areas.

When U.S. EPA first promulgated the Regional Haze Rule in 1999, emissions related to construction activities such as windblown dust and nonroad diesel engines were a major concern. This was especially a problem in rapidly growing metropolitan areas such as Los Angeles and Phoenix. Construction activities are directly related to population growth. Ohio has not experienced rapid growth and is not forecasted to in the future, based on population projections from Ohio's Development Services Agency's "Population Projections by Age and Sex, 2015 to 2050 (April 2018)[9] . Between 2010 and 2020, Ohio's population grew from 11,536,504 to 11,574,870, a growth of just 0.3 percent. Ohio's population is projected to grow to 11,615,100 by 2030, a 0.3 percent increase over 2020.

Construction projects in Ohio that disturb one acre or more are required to obtain a general permit under the National Pollutant Discharge Elimination System (NPDES). The permitting program was implemented to protect the waters of the state from sediment and other contaminants, and may also reduce the amount of particulate matter emissions from these activities. The NPDES permits require permitted entities to develop a storm water pollution prevention plan containing best management practices to control erosion and runoff. Many of the best management practices employed to prevent erosion and runoff are also effective at preventing windblown dust. For example, the use of wind fences, sprinkling, or using vegetative cover such as geotextiles can reduce the amount of airborne particles.

3. *Source retirement and replacement schedules*

This factor was considered by not selecting sources that have permanently shut down, or that have an enforceable commitment to shut down by no later than 2028. When an owner or operator notifies[10] Ohio EPA of a permanent shut down, the facility cannot resume operations without being considered a new facility and being subject to the new source review (NSR) requirements. Ohio Administrative Code

[9] https://www.development.ohio.gov/files/research/P6001.pdf
[10] Notification may occur by official letter or electronically through the STARS2/Air Services tracking system.

(OAC) Chapter 3745-31[11] contains Ohio's Permits-to-Install New Sources and Permit-to-Install and Operate Program rules. OAC rule 3745-31-02 prevents installation or modification, and subsequent operation of new sources without properly obtaining appropriate permits. A new source is defined in OAC Chapter 3745-31 as any air contaminant source for which an owner or operator undertakes a continuing program of installation or modification, wherein a modification is defined as any physical change in, or change in the method of operation of any air contaminant source that results in an increase in the allowable emissions. In addition, it has been Ohio's longstanding policy and memorialized under OAC Chapter 3745-31 that for any emission unit that is permanently shut down (physically removed from service or altered in such a way that it can no longer operate without a subsequent "modification" or installation), authorization to operate the affected emissions unit shall cease upon the date certified by the authorized official that the emissions unit was permanently shut down. No emission unit certified by the authorized official as being permanently shut down may resume operation without first applying for and obtaining a permit pursuant to OAC Chapter 3745-31. Thus, the cessation of emissions from shut down facilities or units is permanent and enforceable.

In accordance with the Regional Haze Guidance, this factor was further considered by not selecting sources that have an enforceable commitment to be retired or replaced by 2028. On September 29, 2020, the owner of Miami Fort Power Station and Zimmer Power Station announced plans to permanently shut down these sources. On July 9, 2021, Ohio EPA issued Director's Final Findings and Orders (DFFOs) (Appendix C) which establish an enforceable commitment for the permanent shut down of the coal-fired operations at the boilers at Miami Fort Power Station and Zimmer Power Station by no later than January 1, 2028. Therefore, Ohio did not select these sources for four-factor analysis. The permanent shut down of the coal-fired boilers at Miami Fort Power Station (Unit IDs B015 and B016) and Zimmer Power Station (Unit ID B006) are being relied on to make reasonable progress as part of the LTS for the second implementation period. Therefore, Ohio is requesting the DFFOs be approved into Ohio's SIP.

4. *Basic smoke management practices for prescribed fire used for agricultural and wildland vegetation management purposes and smoke management programs*

This factor was considered in Step 3(g) below. Additionally, in Ohio, emissions from prescribed fires are managed and regulated through interrelated laws and regulations.

Chapter 1503.18[12] of the Revised Code gives the Ohio Department of Natural Resources (ODNR) Division of Forestry the authority to ban outdoor burning statewide in unincorporated areas during the months of March, April, May, October, and November in any year, between six A.M. and six P.M. ORC 1503.18

[11] http://epa.ohio.gov/dapc/regs/3745_31.aspx
[12] http://codes.ohio.gov/orc/1503.18 (included for reference; not intended to be incorporated into the SIP)

(C) allows the Chief of the ODNR Division of Forestry to waive the ban expanding the times and places for kindling fires. The Division of Forestry's policy waives the ban only for individuals that have been certified by the Division as a Certified Prescribed Fire Manager.

Ohio Administrative Code (OAC) Chapter 3745-19 "Open Burning Standards"[13], regulates the types of materials that can be burned, locations where they can be burned and determines that no open burning shall be conducted in an area where an air alert, warning, or emergency is in effect. Furthermore, to open burn in many areas, approval from Ohio EPA is required in the form of a written permission from Ohio EPA or submission of a written notification certifying that the party performing the fire will follow all Ohio EPA rules and regulations related to the planned fire. Open burning is defined as the burning of any material wherein air contaminants resulting from combustion are emitted directly into the ambient air without passing through a stack or chimney.

OAC Chapter 3745-19 allows specific open burning activities such as prescribed fires, for recognized horticultural, silvicultural, range, or wildfire management practices. OAC Chapter 3745-19 requires that an application for permission to open burn or notification of planned open burning activities shall be submitted in writing to the Ohio EPA at least ten working days before the fire is to be set. OAC 3745-19 determines that the application for permission to open burn or notification of planned open burning activities must contain the following minimal information:

- the purpose of the proposed burning;
- the quantity or acreage and the nature of material to be burned;
- the date or dates when such burning will take place;
- the location of the burning site, including a map showing distances to residences, populated areas, roadways, air fields, and other pertinent landmarks;
- the methods or actions which will be taken to reduce the emissions of air contaminants; and
- For notifications for prescribed fires, a certification that the person performing the fires recognizes the requirements for prescribed fires contained in OAC Chapter 3745-19 and will perform the fire according to those rules and regulations.

Persons caught performing fires outside the limits of the written permission or without permission are initially subject to the fines and penalties listed under OAC rule 3745-19-06. Repeat or persistent offenders may be subject to greater fines or penalties.

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

[13] Appendix D contains a copy of OAC Chapter 3745-19 as approved into Ohio's SIP

U.S. EPA's Regional Haze Guidance indicates that projected 2028 visibility conditions assuming only already adopted controls may be a consideration when determining which sources to include in the analysis of controls measures in the second implementation period. The Regional Haze Guidance further indicates that projected visibility conditions in 2028 below the uniform rate of progress (URP) glidepath may serve to demonstrate that, after a state has gone through its source selection and control measure analysis, it has no "robust demonstration" obligation per 40 CFR 51.308(f)(3)(ii)(A) and/or (B).

As shown in Table 1, U.S. EPA's Regional Haze modeling[14] and LADCO modeling (Appendix A) both show that visibility conditions in 2028 at each Class I area impacted by emissions from Ohio is projected to be below (or well below) the URP glidepath.

This modeling accounts for "on the books" controls adopted prior to and during the first implementation period. A full description of on-the-books control measures relied on for reasonable progress during the first implementation period are described in the progress report contained in Step 8(b) below. Additional on-the-books controls implemented since the time of the original SIP for the first implementation period as submitted in December 2008 and revised in March 2011 and August 2015, which are also accounted for in the modeling, include:

- Permanent Shutdown of Sources

  Several facilities permanently shutdown during the second implementation period, including but not limited to those included in Table 4 and the discussion following Table 4 (i.e. Conesville Power Plant units B004, B007 and B008; DP&L JM Stuart units B001-B004; DP&L JM Killen unit B001; and WH Sammis Plant B007-B010).

- Reciprocating Internal Combustion Engines (RICE) NESHAPs

  U.S. EPA has issued multiple regulations that cover different types of RICEs. U.S. EPA promulgated the NESHAP for existing, new, and reconstructed stationary RICE greater than 500 horsepower (HP) located at major sources on June 15, 2004 (69 FR 33474). U.S. EPA promulgated the NESHAP for new and reconstructed stationary RICE that are located at area sources of HAP emissions and for new and reconstructed stationary RICE that have a site rating of less than or equal to 500 HP that are located at major sources of HAP emissions on January 18, 2008 (73 FR 3568). On March 3, 2010, U.S EPA promulgated the NESHAP for existing stationary compression ignition (CI) RICE with a site rating of less than or equal to 500 HP located at

[14] TSD Appendix B (https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf)

major sources, existing nonemergency CI engines with a site rating greater than 500 HP at major sources, and existing stationary CI RICE of any site rating located at area sources (75 FR 9674). On August 20, 2010, U.S EPA promulgated the NESHAP for stationary spark ignition (SI) RICE that are located at area sources of HAP or have a site rating of less than or equal to 500 brake HP and are located at major sources of HAP (75 FR 51570).

On January 14, 2013, the rule was revised due to legal challenges and petitions for reconsideration. U.S. EPA estimated the revised rule would reduce PM by 2,800 TPY, NOx by 9,600 TPY and VOC by 36,000 TPY starting in 2013.

- Control of Hazardous Air Pollutants from Mobile Sources

  This rule, also known as the Mobile Source Air Toxics (MSAT2) rule, was published on February 26, 2007 (revised October 16, 2008), requiring refiners and importers produce gasoline that has an annual average benzene content of 0.62 volume percent or less beginning in 2011 [72 F.R. 8428, 73 F.R. 61358]. U.S. EPA estimates that in 2030 this rule would reduce total emissions of mobile source air toxics by 330,000 tons and VOC emissions by over 1 million tons.

- Mercury and Air Toxic Standards (MATS)

  This new standard, effective in April 2012, regulates emissions of mercury, acid gases, and non-mercury metallic toxic pollutants from new and existing coal and oil-fired EGUs. U.S. EPA estimated that this rule will apply to approximately 1,100 coal-fired and 300 oil-fired EGUs at 600 power plants in the U.S. According to U.S. EPA, most facilities comply with these standards through a range of strategies, including the use of existing emission controls, upgrades to existing emission controls, installation of new pollution controls, and fuel switching.

  Following promulgation of the rule, U.S. EPA received petitions for reconsideration of various provisions of the rule, including requests to reconsider the work practice standards applicable during startup periods and shutdown periods. U.S. EPA granted reconsideration of the startup and shutdown provisions as no opportunity to comment was provided to the public regarding the work practice requirements contained in the final rule. On November 30, 2012, U.S. EPA published a proposed rule reconsidering certain new source standards and startup and shutdown provisions in MATS. U.S. EPA proposed certain minor changes to the startup and shutdown provisions contained in the 2012 final rule based on information obtained in the petitions for reconsideration. On April 24, 2013, U.S. EPA took final action on the new source standards that were reconsidered and also the technical corrections contained in the November 30, 2012, proposed action. U.S. EPA did not take final action

on the startup and shutdown provisions and, on June 25, 2013, added new information and analysis to the docket and reopened the public comment period for the proposed revisions. U.S. EPA took final action on the remaining topics open for reconsideration on November 19, 2014. The compliance date for existing sources was April 16, 2015, while the compliance date for new sources was April 16, 2012.

On November 25, 2014, the U.S. Supreme Court accepted several challenges to the rules brought by the utility industry and a coalition of nearly two dozen states. On June 29, 2015, the U.S. Supreme Court ruled that U.S. EPA did not properly account for compliance costs when crafting the MATS rule and remanded the decision to the D.C. Circuit Court for reconsideration. On May 22, 2020, On May 22, 2020, U.S. EPA published in the Federal Register a reconsideration of the appropriate and necessary finding for the Mercury and Air Toxics Standards, correcting flaws in the 2016 supplemental cost finding while ensuring that power plants will emit no more mercury to the air than before. This action did not remove any coal- and oil-fired power plants from the list of affected source categories, so MATS remains in effect.

- Oil and Natural Gas Industry Standards

  This new standard, issued on April 17, 2012, regulates VOC and air toxic emissions from hydraulically fractured natural gas wells and also includes requirements for several other sources of pollution in the oil and natural gas industry that were previously unregulated in the United States. U.S. EPA estimates that these standards apply to approximately 11,400 new natural gas wells hydraulically fractured each year and an additional 1,400 existing natural gas wells refractured annually. U.S. EPA estimated that VOC and air toxic emissions in the U.S. are reduced by approximately 190,000 to 290,000 tpy and 12,000 to 20,000 tpy, respectively, beginning in 2015.

- NO_x Emission Standard for New Commercial Aircraft Engines

  On June 18, 2012, U.S. EPA finalized a rule to adopt NO_x emission standards for certain commercial passenger and freighter aircraft engines in common use at airports across the U.S. [77 F.R. 36342]. The rule contains six major provisions, two of which are new NO_x emission standards for newly certified-engine models. The first standards, Tier 6, took effect when the rule became effective and represents approximately a 12% reduction from current Tier 4 levels. The second standards, Tier 8, took effect in 2014 and represents approximately a 15% reduction from Tier 6 levels. Equipment turnover will ensure contined emissions reductions from this category for many years.

- Area Source Boilers, Major Source Boilers and Commercial/Industrial Solid Waste Incinerators (CISWI) NESHAPs

  On January 31, 2013, February 1, 2013 and February 7, 2013, U.S. EPA finalized revisions to the March 2011 Clean Air Act emissions standards for large boilers (commonly referred to as the Boiler MACT), small boilers and incinerators, respectively [78 F.R. 7138, 78 F.R. 7488, 78 F.R. 9112]. These standards cover more than 200,000 boilers and incinerators that emit harmful air pollution, including mercury, cadmium, and particle pollution.

  Boilers at large sources of air toxics emissions are known as major source boilers. They are located at large sources of air pollutants, including refineries, chemical plants, and other industrial facilities. Boilers located at small sources of air toxics emissions are known as area source boilers. These are located at universities, hospitals, hotels and commercial buildings. A CISWI unit is a device that is used to burn solid waste at a commercial or industrial facility. This includes units designed to discard solid waste; energy recovery units designed to recover heat that combust solid waste; and waste burning kilns that combust solid waste in the manufacturing of a product.

  In a separate but related action, U.S. EPA revised the non-hazardous secondary materials rule (NHSM). This rule defines which materials are, or are not, “solid waste” when burned in combustion units. The NHSM rule helps determine which standards, either boiler or CISWI, a unit that burns these materials will be required to meet. These combined rules will lead to additional NOx and VOC reductions. The compliance deadlines for area boilers, major boilers and CISWI units were 2014, 2016 and 2018, respectively.

- NSPS for Residential Wood Heaters

  On March 16, 2015, U.S. EPA finalized the residential wood heaters NSPS [80 F.R. 13672]. This rule does not affect existing woodstoves or other wood burning devices; however, it does provide more stringent emissions standards for new woodstoves, outdoor hydronic heaters and indoor wood-burning forced air furnaces. New “Phase 1” less-polluting heater standards began in 2015, with even more-stringent Phase 2 standards beginning in 2020. However, new units are assumed to replace retired units beginning in 2015. U.S. EPA estimates 9,265 tons of VOC emissions will occur annually.

- SO_2 Data Requirements Rule

  On August 21, 2015, U.S. EPA finalized the Data Requirements Rule for the 2010 1-hr Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS) [80 FR 51052]. This rule required characterization

of sources with actual SO_2 emissions greater than 2,000 tons per year (TPY) through modeling or monitoring. In response to this rule, several facilities accepted restrictions such that SO_2 emissions would be sufficiently below 2,000 TPY and further characterization of ambient air quality was unnecessary. NOx emissions reductions were also realized as a co-benefit due to these restrictions.

- Ohio's Beneficiary Mitigation Plan for the Volkswagen settlement

  In 2018, Ohio EPA developed a Beneficiary Mitigation Plan to accept and distribute funds allocated to Ohio from the Volkswagen settlement. Ohio's plan allocates $40 million to on-road fleets (school bus replacements, transit bus replacements, and class 4-8 local freight and port drayage trucks and shuttle buses), $19 million to off-road equipment (tugboats and ferries, switcher locomotives, and airport ground support and port cargo handling equipment), and $11.25 million for infrastructure to support light-duty Zero Emissions Vehicles. Funds are planned to be distributed over six to eight years. Ohio EPA estimates that applying the entire amount of funding allocated to Ohio ($75,302,522.67) to fund the Eligible Mitigation Actions will result in annual emission reductions of approximately 352 tons of NOx. Projects like these will also significantly reduce emissions of other pollutants of concern, such as $PM_{2.5}$, hydrocarbons, carbon monoxide and carbon dioxide. Actual emission reductions are dependent on the types of projects that are ultimately selected to receive funding. Benefits will compound over the lifetime of the equipment purchased or repowered.

These on the books controls have resulted in significant reduction in emissions of pollutants that contribute to regional haze. As described further in the progress report contained in Step 8(b) below, Ohio's SO_2 emissions decreased by 90% between 2005 and 2017. During the same time period, NOx emissions decreased by 57%, VOC emissions decreased by 33%, and ammonia emissions decreased by 26% (see Table 21 in progress report). SO_2 emission from EGUs in Ohio decreased by 94% between 2005 and 2019, while EGU NOx emissions decreased by 84% (see Figures 1 and 2 in progress report).

In addition to the on the books controls described above, additional emissions reductions are expected in the future due to several "on-the-way" controls, including:

- Revised CSAPR Update

  On April 30, 2021, U.S. EPA finalized the Revised Cross-State Air Pollution Rule (CSAPR) Update in order to fully address states' outstanding interstate pollution transport obligations for the 2008 ozone standard (86 FR 23054). Starting in 2021, the proposed rule will require additional reductions to Ohio's ozone season NOx allocations. The Revised CSAPR Update will provide for a

reduction of almost 10,000 tons of ozone season NOx in Ohio statewide, a reduction of over 50%.

- Miami Fort Power Station and Zimmer Power Station

  As discussed previously, the owner of Miami Fort Power Station and Zimmer Power Station announced plans on September 29, 2020 to permanently shut down these sources. On July 9, 2021, Ohio EPA issued Director's Final Findings and Orders (DFFOs) (Appendix C) which establish an enforceable commitment for the permanent shut down of the coal-fired operations at the boilers at Miami Fort Power Station and Zimmer Power Station by no later than January 1, 2028.

Changes in emissions due to on the books controls, including those adopted during the first implementation period, have resulted in significantly improved visibility at Class I areas impacted by emissions from Ohio. Additional reductions in emissions due to on the way controls such as the Revised CSAPR Update are expected to improve visibility even further. Thus, after fulfilling the source selection and control measure analysis requirements, Ohio has no "robust demonstration" obligation per 40 CFR 51.308(f)(3)(ii)(A) and/or (B).

f) Sources that already have effective emission control technology in place

U.S. EPA's Regional Haze Guidance (p. 23) indicates it may be reasonable not to select an effectively controlled source for four-factor analysis, as 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." The Regional Haze Guidance provides example scenarios in which U.S. EPA believes it may be reasonable for a state not to select a particular source for further analysis. These examples are meant to be illustrative but not exhaustive. As described further in Step 3(h) below, some sources were not selected by Ohio for four-factor analysis because they are effectively controlled.

g) Special considerations for wildland fires

U.S. EPA's Regional Haze Guidance indicates that emissions from wildland fires are considered to be natural emissions that do not contribute to visibility impairment; therefore, states are not required to select wildland wildfires for controls analysis.

Regarding wildland prescribed fires, U.S. EPA's Regional Haze Guidance indicates that states with no or little contribution to visibility impairment from prescribed fires may meet the fire-relevant requirements of the Regional Haze Rule by stating and supporting the following statement: "In-state prescribed fires do not contribute significantly to visibility impairment on the 20 percent most anthropogenically impaired days at any of the Class I areas to which the state's sources contribute". Ohio has very little prescribed fire activity.

As shown in Table 3 below, 2017 emissions obtained from the 2017 NEI[15] show prescribed fire activity in Ohio constitutes less than 1% of total U.S. prescribed fire emissions.

Table 3. 2017 NEI prescribed fire emissions (TPY)

Area	VOCs	NOx	PM25-PRI	PM10-PRI	NH3	SO2
OH	5,797	372	2,142	2,528	403	196
U.S. Total	2,042,075	164,697	805,307	948,309	144,913	78,190
% U.S. Total	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%

Further, U.S. EPA's 2028 Regional Haze Modeling included source apportionment modeling showing modeled prescribed fire contributions at each Class I area. Table 5-1 in the TSD[16] for this modeling shows the highest impact from prescribed fires at a Class I area impacted by sources in Ohio (as identified in Table 1 above) was 4.11 Mm-1 at the Mingo Wilderness Area in Missouri. While the 4.11 Mm-1 impact at Mingo Wilderness Area is from all sources impacting the area, not just from sources in Ohio, Table 3 above shows very low emissions from prescribed fires in Ohio. Figure 53 in the TSD shows that prescribed fires were a relatively minor contributor to overall visibility impairment at the Mingo Class I area.

In sum, Ohio has very low emissions from prescribed fire activity, and the worst case contribution from prescribed fires at a Class I area impacted by Ohio could have only a minor impact on visibility.

h) Documentation of the source selection process and result

40 CFR 51.308(f)(2)(i) requires a SIP to include a description of the criteria the state has used to determine the sources or groups of sources it evaluated for potential controls. As described in more detail above, Ohio used primary selection criteria to identify sources with a Q/d greater than 5 as a starting point, based on the sum of SO_2, NOx, $PM_{2.5}$, and ammonia emissions.

In addition to sources selected using the primary criteria identified above, two additional units (Haverhill Coke Company unit P902 and Sammit unit B011) were considered for four-factor analysis based on secondary selection criteria of a facility-wide Q/d greater than 10, with the four-factor analysis to be performed only for any units with Q/d greater than 4.

Ohio then refined the list by considering whether the source has permanently shut down, has an enforceable commitment to shut down by no later than 2028, converted to natural gas, converted to limited use, auxiliary boilers, or is already effectively controlled such that it is reasonable to assume that a full four-factor analysis would likely result in the

[15] https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data
[16] https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf

conclusion that no further controls are necessary. The results of this analysis are presented in Table 4 below.

During the source selection process for the second implementation period, Ohio did not categorically exclude any sources subject to Best Available Retrofit Technology (BART) requirements during the first implementation period.

Table 4. Sources considered for four-factor analysis[17]

Facility Name (Facility ID)	UnitID	Sector	Q/d	2016 Emissions (TPY)					Selection Criteria Triggered*	4-Factor Analysis?
				Total	SO2	NOx	PM25-PRI	NH3		
Avon Lake Power Plant (0247030013)	B012	EGU	32	11,134	8,863	2,031	240	0	Primary	Yes, for SO2 and NOx - Operational restrictions in 2016, but still a Q/d of 7 using 2019 emissions. SNCR (20% removal). Emission rates do not meet guidance for effectively controlled (0.7 lb SO2/mmBTU). Not a significant source of PM25 or NH3.
Cardinal Power Plant (Cardinal Operating Company) (0641050002)	B001	EGU	33	5,437	3,885	1,497	54	1	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Cardinal Power Plant (Cardinal Operating Company) (0641050002)	B002	EGU	32	5,206	3,986	1,146	73	1	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Cardinal Power Plant (Cardinal Operating Company) (0641050002)	B009	EGU	21	3,406	1,325	1,112	969	0	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Carmeuse Lime, Inc. - Maple Grove Operations (0374000010)	P003	NONEGU	10	3,794	2,503	1,280	11	0	Primary	Yes, for SO2 and NOx - does not have SO2 or NOx controls. Not a significant source of PM25 or NH3.
Carmeuse Lime, Inc. - Maple Grove Operations (0374000010)	P004	NONEGU	9	3,520	2,323	1,187	10	0	Primary	Yes, for SO2 and NOx - does not have SO2 or NOx controls. Not a significant source of PM25 or NH3.
Conesville Power Plant (0616000000)	B004	EGU	17	4,078	2,580	1,196	302	0	Primary	No - unit shut down 5/31/2020
Conesville Power Plant (0616000000)	B007	EGU	13	3,148	989	1,945	214	0	Primary	No - unit shut down 5/31/2019
Conesville Power Plant (0616000000)	B008	EGU	19	4,538	1,444	2,840	254	0	Primary	No - unit shut down 5/31/2020

[17] Additional information for each source not selected for four-factor analysis because they permanently shut down, converted to natural gas, converted to limited use, auxiliary boilers, or are already effectively controlled is described in further detail following Table 4.

Facility Name (Facility ID)	UnitID	Sector	Q/d	2016 Emissions (TPY)					Selection Criteria Triggered*	4-Factor Analysis?
				Total	SO2	NOx	PM25-PRI	NH3		
Department of Public Utilities, City of Orrville, Ohio (0285010188)	B001	EGU	17	4,733	3,846	647	240	0	Primary	No - converted to a limited use boiler 1/31/2017
Department of Public Utilities, City of Orrville, Ohio (0285010188)	B004	EGU	13	3,729	3,030	510	189	0	Primary	No - converted to natural gas 12/20/2016
Dover Municipal Light Plant (0679010146)	B004	EGU	7	1,536	1,348	172	16	0	Primary	Yes, for SO2 - does not have SO2 controls. Not a significant source of NOx, PM25 or NH3.
DP&L, J.M. Stuart Generating Station (0701000007)	B001	EGU	14	3,789	1,979	1,375	434	1	Primary	No - shut down 9/30/2017
DP&L, J.M. Stuart Generating Station (0701000007)	B002	EGU	14	3,953	2,223	1,372	357	1	Primary	No - shut down 6/1/2018
DP&L, J.M. Stuart Generating Station (0701000007)	B003	EGU	14	3,817	2,103	1,216	497	1	Primary	No - shut down 6/1/2018
DP&L, J.M. Stuart Generating Station (0701000007)	B004	EGU	17	4,558	2,700	1,503	354	1	Primary	No - shut down 6/1/2018
DP&L, Killen Generating Station (0701000060)	B001	EGU	57	16,655	10,130	6,057	468	0	Primary	No - shut down 6/1/2018
FirstEnergy Generation LLC, Bay Shore Plant (0448020006)	B006	EGU	6	2,764	2,100	364	209	91	Primary	No - process results in low pollutant formation/effectively controlled for SO2 and NOx. Not a significant source of PM25 or NH3.
General James M. Gavin Power Plant (0627010056)	B003	EGU	57	13,220	9,039	3,572	608	1	Primary	Yes, for SO2. Effectively controlled for NOx (SCR). Not a significant source of PM25 or NH3.
General James M. Gavin Power Plant (0627010056)	B004	EGU	67	15,755	10,990	3,757	1,007	1	Primary	Yes, for SO2. Effectively controlled for NOx (SCR). Not a significant source of PM25 or NH3.
Haverhill Coke Company LLC (0773000182)	P902	NONEGU	5	1,452	1,183	226	43	0	Secondary**	No - effectively controlled for SO2 (FGD). Not a significant source of NOx, PM25 or NH3.
Miami Fort Power Station (1431350093)	B015	EGU	34	8,503	5,610	2,281	386	226	Primary	No - enforceable commitment to permanently shut down no later than 2028.

Facility Name (Facility ID)	UnitID	Sector	Q/d	2016 Emissions (TPY)					Selection Criteria Triggered*	4-Factor Analysis?
				Total	SO2	NOx	PM25-PRI	NH3		
Miami Fort Power Station (1431350093)	B016	EGU	32	7,949	4,604	2,771	356	218	Primary	No - enforceable commitment to permanently shut down no later than 2028.
Ohio Valley Electric Corp., Kyger Creek Station (0627000003)	B001	EGU	9	2,064	755	1,197	112	0	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Ohio Valley Electric Corp., Kyger Creek Station (0627000003)	B002	EGU	8	1,913	700	1,109	104	0	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Ohio Valley Electric Corp., Kyger Creek Station (0627000003)	B003	EGU	12	2,821	853	1,848	120	0	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Ohio Valley Electric Corp., Kyger Creek Station (0627000003)	B004	EGU	12	2,738	828	1,793	117	0	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Ohio Valley Electric Corp., Kyger Creek Station (0627000003)	B005	EGU	12	2,796	845	1,831	120	0	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
P. H. Glatfelter Company - Chillicothe Facility (0671010028)	B002	NONEGU	11	3,311	2,873	412	26	0	Primary	No - converted to natural gas 5/31/2016
P. H. Glatfelter Company - Chillicothe Facility (0671010028)	B003	NONEGU	21	6,455	5,708	691	56	0	Primary	No - converted to natural gas 9/6/2016
W. H. SAMMIS PLANT (0641160017)	B007	EGU	9	1,624	848	459	317	0	Primary	No - shut down 5/31/20
W. H. SAMMIS PLANT (0641160017)	B008	EGU	8	1,444	668	357	419	0	Primary	No - shut down 5/31/20
W. H. SAMMIS PLANT (0641160017)	B009	EGU	8	1,544	840	459	245	0	Primary	No - shut down 5/31/20
W. H. SAMMIS PLANT (0641160017)	B010	EGU	6	1,228	640	359	229	0	Primary	No - shut down 5/31/20
W. H. SAMMIS PLANT (0641160017)	B011	EGU	5	893	326	531	36	0	Secondary***	No - effectively controlled (FGD/SCNR+LNB). Not a significant source of PM25 or NH3.

Facility Name (Facility ID)	UnitID	Sector	Q/d	2016 Emissions (TPY)					Selection Criteria Triggered*	4-Factor Analysis?
				Total	SO2	NOx	PM25-PRI	NH3		
W. H. SAMMIS PLANT (0641160017)	B012	EGU	17	3,162	1,354	1,651	155	2	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
W. H. SAMMIS PLANT (0641160017)	B013	EGU	12	2,333	1,038	1,178	116	1	Primary	No - effectively controlled (FGD/SCR). Not a significant source of PM25 or NH3.
Zimmer Power Station (1413090154)	B006	EGU	64	16,341	9,973	5,458	569	341	Primary	No - enforceable commitment to permanently shut down no later than 2028.
TOTAL Q/d > primary or secondary selection criteria			**754**	**187,341**	**117,032**	**59,390**	**10,032**	**887**		
TOTAL analyzed (> 0.1 TPY)			**1,035**	**275,870**	**145,925**	**104,509**	**21,559**	**3,876**		
% Q/d > primary or secondary selection criteria			**73%**	**68%**	**80%**	**57%**	**47%**	**23%**		

* Primary selection criteria is unit Q/d > 5; Secondary selection criteria is facility Q/d > 10 and unit Q/d > 4

** Facility Q/d is 12, consisting of contributions from 11 units. Only one unit (P902) had individual Q/d > 4.

*** Facility Q/d is 34 (excluding shutdown units); B011 individual Q/d is 5.

As noted in the above table, several sources were not selected for four-factor analysis because they have permanently shut down[18], have an enforceable commitment to shut down no later than 2028, have converted to natural gas, have converted to limited use, auxiliary boilers, or are already effectively controlled. Each of these is described in further detail below. Except where expressly noted below, Ohio is not relying on the existing measures at any of the sources not selected for four-factor analysis to make reasonable progress.

For this analysis, Ohio reviewed our records regarding existing controls, federally enforceable permits, consent decrees or other federally enforceable orders, and recent emissions data. For Bay Shore Plant, Ohio contacted the facility to confirm our records or to request additional information (see additional discussion below).

Emissions data referenced below was obtained from the following sources:

- 2016 emissions are the same as that used for the Q/d analysis.
- 2017 to 2019 SO_2 and NOx emissions were obtained from U.S. EPA's Clean Air Markets Database (CAMD)[19] for sources which report emissions data to CAMD; all other 2017 to 2019 emissions were obtained from Ohio EPA's Emission Inventory System (EIS)[20].
- 2016 to 2019 emission rates for SO_2 and NOx were obtained from CAMD for sources which report emissions data to CAMD.

Copies of permits referenced below can be found on Ohio EPA's website[21]. Permit information provided below is for reference and is not intended to be incorporated into Ohio's SIP. Permits issued under the Permit to Install (PTI) and Title V programs are federally enforceable and permanent. The rules governing the PTI program in OAC Chapter 3745-31 are incorporated into Ohio's SIP at 40 CFR 52.1870. Ohio's Title V program in OAC Chapter 3745-77 is approved in Appendix A of 40 CFR Part 70. Federally-enforceable terms and conditions are designated as such within the PTI or Title

[18] As noted previously, when an owner or operator notifies Ohio EPA of a permanent shut down, the facility cannot resume operations without being considered a new facility and being subject to the new source review (NSR) requirements. Ohio Administrative Code (OAC) Chapter 3745-31 contains Ohio's Permits-to-Install New Sources and Permit-to-Install and Operate Program rules. OAC rule 3745-31-02 prevents installation or modification, and subsequent operation of new sources without properly obtaining appropriate permits. A new source is defined in OAC Chapter 3745-31 as any air contaminant source for which an owner or operator undertakes a continuing program of installation or modification, wherein a modification is defined as any physical change in, or change in the method of operation of any air contaminant source that results in an increase in the allowable emissions. In addition, it has been Ohio's longstanding policy and memorialized under OAC Chapter 3745-31 that for any emission unit that is permanently shut down (physically removed from service or altered in such a way that it can no longer operate without a subsequent "modification" or installation), authorization to operate the affected emissions unit shall cease upon the date certified by the authorized official that the emissions unit was permanently shut down. No emission unit certified by the authorized official as being permanently shut down may resume operation without first applying for and obtaining a permit pursuant to OAC Chapter 3745-31. Thus, the cessation of emissions from shut down facilities or units is permanent and enforceable.

[19] https://ampd.epa.gov/ampd/

[20] https://epa.ohio.gov/dapc/aqmp/eiu/eis

[21] https://www.epa.ohio.gov/dapc/newpermits/issued#IssuedPermits

V permit. In addition, PTIs and Title V permits are considered permanent as that word would be considered in a federal context, in that modifications would not be allowed without review by U.S. EPA.

As noted previously, U.S. EPA's Regional Haze Guidance (pp. 23-24) provides example scenarios for sources that would be considered "effectively controlled" in which U.S. EPA believes it may be reasonable for a state not to select a particular source for further analysis. Two of the example scenarios provided by U.S. EPA which Ohio finds most pertinent include:

> "For the purpose of SO_2 control measures, an EGU that has add-on **flue gas desulfurization (FGD)** and that meets the applicable alternative SO_2 emission limit of the 2012 Mercury Air Toxics Standards (MATS) rule for power plants. The two limits in the rule (**0.2 lb/MMBtu for coal-fired EGUs** or 0.3 lb/MMBtu for EGUs fired with oil-derived solid fuel) are low enough that it is unlikely that an analysis of control measures for a source already equipped with a scrubber and meeting one of these limits would conclude that even more stringent control of SO_2 is necessary to make reasonable progress." (Emphasis added)
>
> "For the purposes of SO_2 and NOx control measures, a combustion source (e.g., an EGU or industrial boiler or process heater) that, during the first implementation period, installed a **FGD system that operates year-round with an effectiveness of at least 90 percent** or by the installation of a **selective catalytic reduction system that operates year-round with an overall effectiveness of at least 90 percent** (in both cases calculating the effectiveness as the total for the system, including any bypassed flue gas), on a pollutant-specific basis." A pair of footnotes add that "For purposes of this consideration, the first regional haze implementation period started when SIPs were due on December 17, 2007." and "While a 90 percent control effectiveness is used in this example, we expect that any FGD system installed to meet CAA requirements since 2007 would have an effectiveness of 95 percent or higher. This does not apply to a source that has recently achieved a higher level of control efficiency without the installation of a control system, for example if it has merely increased the flow rate of a reagent. In such a situation, the four factors should be fully considered. The outcome may still be that the current level of control is the measure that is necessary to make reasonable progress." (Emphasis added)

Where applicable, the specific example scenario applicable to a source is referenced. For ease of reference, these two examples will be referred to as "FGD that meets MATS limits" and "FGD/SCR with at least 90% effectiveness", respectively.

However, U.S. EPA's Regional Haze Guidance clearly indicates that the examples are meant to be illustrative but not exhaustive. Therefore, Ohio has also excluded below some sources which do not squarely fit the specific example scenarios included in the Regional Haze Guidance. For these sources, we have found based on a review of the specific details for each source that it satisfies U.S. EPA's general metric that it is "reasonable to assume for the purposes of efficiency and prioritization that a full four-factor analysis

would likely result in the conclusion that no further controls are necessary." (Regional Haze Guidance, p. 23)

Using that same general principle, Ohio interprets the "FGD/SCR with at least 90% effectiveness" example slightly broader than written in the Regional Haze Guidance. First, although the example only references controls installed in the first implementation period (i.e. after December 17, 2007), Ohio does not believe the installation date is pertinent to whether the source is effectively controlled, so long as the device is getting sufficient removal. Ohio believes that conducting a four-factor analysis on a source with an FGD or SCR with 90% control efficiency, regardless of the date installed, would likely result in the conclusion that no further controls are necessary. Therefore, Ohio considered control devices installed prior to the first implementation period to meet our interpretation of this example.

Second, although the footnote indicates any FGD system installed since 2007 would have an effectiveness of 95% or higher, Ohio believes the metric of 90% control efficiency noted in the main text of the example is controlling and most appropriate. Ohio believes that conducting a four-factor analysis on a source with an FGD system with 90% control efficiency or greater would likely result in the conclusion that no further controls are necessary.

In addition, many of these sources are subject to the Cross-State Air Pollution Rule (CSAPR). Although CSAPR is an emissions trading programs and individual unit allocations are not enforceable limitations for specific units or facilities, the programs serve to minimize SO_2 and NOx emissions. Sources must purchase allowances for any emissions that exceed their unit allocations, thereby creating a significant economic incentive for the operation and optimization of emissions controls. Current Ohio statewide budgets are 90,258 tons of annual NOx, 19,121 tons of ozone season NOx, and 142,240 tons of annual SO_2. This economic incentive will become stronger with additional reductions to ozone season NOx allocations to 9,385 tons beginning in 2021 with the U.S. EPA's Revised CSAPR Update (86 FR 23054, April 30, 2021). The Revised CSAPR Update will provide for a reduction of almost 10,000 tons statewide, amounting to a reduction of over 50% in ozone season NOx.

Cardinal Power Plant

Cardinal Power Plant (Facility ID 0641050002) operates three coal-fired boilers (B001, B002 and B009), each of which is considered effectively controlled for SO_2 and NOx in accordance with the "FGD/SCR with at least 90% effectiveness" example in the Regional Haze Guidance.

FGDs with approximately 95% control efficiency were installed March 1, 2008 on B001, December 1, 2007 on B002, and December 30, 2011 on B009. The FGDs must be continuously operated on and after December 31, 2008 for B001 and B002, and December 31, 2012 for B009, in accordance with the requirements of a federal Consent Decree in *United States, et al. v. American Electric Power Service Corp.*, et al., S.D. Ohio Civil Action Nos. C2-99-1250, C2-99-1182, C2-05-360, and C2-04-1098, entered on

December 10, 2007, as amended (AEP Consent Decree[22]). Pursuant to the AEP Consent Decree, "continuously operated" means that "when SCR, FGD and/or an electrostatic precipitator (ESP) is/are used at a unit, except during a malfunction, it/they shall be operated at all times such unit is in operation, consistent with the technological limitations, manufacturers' specifications, and good engineering and maintenance practices for such equipment and the unit so as to minimize emissions to the greatest extent practicable". While these requirements were originally established in the AEP Consent Decree, they were subsequently incorporated into Permits to Install (PTIs) on February 17, 2011 (PTI nos. P0104412 and P0104411) and are therefore federally enforceable and permanent (in that no modifications would be allowed unless it underwent review by U.S. EPA). B001 and B002 each have federally enforceable SO_2 emissions limits of 1.056 lb/MMBtu based on a rolling, 30-day average (PTI no. P0104412, effective February 17, 2011). B003 has a federally enforceable SO_2 emissions limit of 0.66 lb/MMBtu based on a rolling, 30-day average (PTI no. P0104411, effective February 17, 2011). As shown in Table 5, recent SO_2 emission rates are 0.27 lb/MMBtu or less.

SCRs with approximately 90% control efficiency were installed June 1, 2003 on B001, and May 1, 2003 on B002 and B009. The SCRs must be continuously operated on and after January 1, 2009 in accordance with the requirements of the AEP Consent Decree and federally-enforceable and permanent PTIs (PTI nos. P0104412 and P0104411). As shown in Table 5, recent NOx emission rates are below 0.1 lb/MMBtu.

Further, these units are each subject to CSAPR, which provides significant economic incentive to operate and optimize SO_2 and NOx emissions controls. This incentive will become stronger with additional reductions to NOx allocations with the Revised CSAPR Update.

Table 5. Cardinal Power Plant B001, B002 and B009 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B001	2016	3,885	0.22	1,497	0.09	54	1
	2017	3,796	0.24	1,166	0.08	50	1
	2018	3,794	0.22	1,348	0.08	74	1
	2019	3,685	0.18	1,479	0.08	92	1
B002	2016	3,986	0.27	1,146	0.08	73	1
	2017	5,205	0.25	1,446	0.07	247	0
	2018	3,103	0.22	1,024	0.08	38	1
	2019	3,714	0.23	1,242	0.08	43	1
B009	2016	1,325	0.10	1,112	0.09	969	1
	2017	2,256	0.13	1,272	0.08	88	1
	2018	2,807	0.14	1,468	0.08	166	1
	2019	2,053	0.15	1,157	0.09	118	1

[22] https://www.epa.gov/enforcement/consent-decree-and-modifications-american-electric-power-service-corporation

B001 and B002 are not significant sources of $PM_{2.5}$. Although B009 is reported to have emitted 969 tons of $PM_{2.5}$ in 2016, emissions have dropped substantially in more recent years. This decrease may likely be due in part to more recent stack testing, along with new requirements for condensable stack testing under U.S. EPA's Method 202 established in March 2016[23], which forms the basis of the emissions estimates for the condensable fraction of PM. Further, B009 is equipped with an Electrostatic Precipitator (ESP) with 99.5% control efficiency installed September 1, 1977.

None of the units are significant sources of ammonia.

Conesville Power Plant

Conesville Power Plant (Facility ID 0616000000) coal-fired boiler B007 permanently shut down on May 31, 2019. Coal-fired boilers B004 and B008 permanently shut down on May 31, 2020.

City of Orrville

City of Orrville (Facility ID 0285010188) converted unit B001 to a limited use boiler beginning January 31, 2017, and converted B004 to natural gas on December 20, 2016 as part of a strategy to comply with Boiler Maximum Achievable Control Technology (Boiler MACT) requirements and the Data Requirements Rule (DRR) for the SO_2 NAAQS designation process (PTI no. P0124959, effective December 24, 2018; and Title V no. P0125633, effective March 16, 2020). Conversion of these boilers back to full time use or to coal would require first applying for and obtaining modified, federally enforceable permits.

Further, in accordance with a Consent Agreement and Final Order (CAFO) issued by U.S. EPA Region 5 on September 16, 2015, as amended on September 28, 2018, Orrville must comply with plant-wide SO_2 and NOx limits of 1,475 TPY and 490 TPY, respectively, effective January 13, 2017. These emission limits were subsequently incorporated into the PTI and Title V permits and are therefore federally enforceable and permanent (PTI no. P0124959, effective December 24, 2018; and Title V no. P0125633, effective March 16, 2020).

B001 has a federally enforceable SO_2 emissions limit of 7.0 lbs/MMBtu. B004 has federally enforceable emissions limits of 0.1 lb/MMBtu of SO_2 on a monthly average emission rate basis, and 0.170 lb/MMBtu of NOx on a monthly average emission rate basis (PTI no. P0124959, effective 12/24/2018 and Title V permit no. P0125633, effective 03/16/2020). The NOx emission limitation is based on the Best Available Technology (BAT) analysis for natural gas burner emission rate that was not required under any law or regulation but conducted and approved by the Ohio EPA on May 22, 2015, in compliance with the CAFO settlement process.

As shown in Table 6, emissions substantially decreased following the conversion of B001 to limited use boiler and conversion of B004 to natural gas in 2017. These units are no longer significant sources of SO_2, NOx, $PM_{2.5}$ or ammonia.

[23] https://www.epa.gov/emc/method-202-condensable-particulate-matter

Table 6. City of Orrville B001 and B004 emissions[24] (2016 to 2019)

Unit ID	Year	SO_2 (tons)	NOx (tons)	PM25-PRI (tons)	NH3 (tons)
B001	2016	3,846	647	240	0
	2017	1,066	181	67	0
	2018	275	57	17	0
	2019	266	45	17	0
B004	2016	3,030	510	189	0
	2017	0	93	2	1
	2018	0	20	1	0
	2019	0	7	0	0

DP&L, J.M. Stuart Generating Station (0701000007)
DP&L, J.M. Stuart Generating Station (0701000007) coal-fired boiler B001 permanently shut down on September 30, 2017. Coal-fired boilers B002, B003 and B004 permanently shut down on June 1, 2008.

DP&L, Killen Generating Station (0701000060)
DP&L, Killen Generating Station (0701000060) coal-fired boiler B001 permanently shut down on June 1, 2008.

FirstEnergy Generation LLC, Bay Shore Plant
FirstEnergy Generation LLC, Bay Shore Plant (0448020006) operates a circulating fluidized bed (CFB) boiler (B006) with limestone injection and a baghouse. The operational nature of this process, whereby calcium sulfate is formed in the boiler and captured in the baghouse, results in approximately 94% removal of SO_2. B006 has federally enforceable SO_2 emissions limits of 0.73 lb/MMBtu on a 30-day rolling average basis, 90% reduction of SO_2 (except that 70% reduction is allowable for all heat inputs less than 0.60 lb SO_2/mmBtu), 1,897.6 lbs/hour as a rolling, 3-hour average and 5,541 tons/year (Title V permit no. P0125559, effective December 10, 2019). As shown in Table 7 below, recent SO_2 emission rates are 0.35 lb/MMBtu or less.

In addition, NOx is controlled by low combustion temperature, similar to a low NOx burner with overfire air technology in a pulverized solid fuel boiler, which along with very low nitrogen content in the petroleum coke that is used as fuel, results in a NOx emission rate of 0.08 lb/MMBtu or lower. B006 has federally enforceable NOx emissions limits of 0.20 lb/MMBtu on a 30-day rolling average basis, 529.3 lb/hr on a 30-day rolling average basis, and 1,546 tons/year as a rolling, 12-month summation of monthly emissions (Title V permit no. P0125559, effective December 10, 2019). As shown in Table 7 below, recent

[24] SO_2 and NOx emission rates are not provided as the City of Orrville does not report emission data to CAMD

NOx emission rates are less than 0.1 lb/MMBtu. See Appendix E for additional information on the process at this facility[25].

Table 7. Bay Shore Plant B006 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B006	2016	2,100	0.33	364	0.06	209	91
	2017	2,309	0.32	502	0.07	188	0
	2018	2,787	0.35	580	0.07	222	0
	2019	1,537	0.34	319	0.08	98	0

B006 is not a significant source of $PM_{2.5}$ or ammonia.

Given the operational nature of the process at this unit in which SO_2 and NOx are inherently controlled and/or there is low formation potential, resulting in 94% removal of SO_2 along with low SO_2 and NOx emissions rates, it is reasonable to assume for the purposes of efficiency and prioritization that a full four-factor analysis would result in the conclusion that no further controls are necessary.

General James M. Gavin Power Plant

General James M. Gavin Power Plant (Facility ID 0627010056) operates two coal-fired boilers (B003 and B004).

FGDs with 95% control efficiency were installed December 1, 1994 on B003 and March 1, 1995 on B004. The FGDs must be continuously operated in accordance with the requirements of the federal AEP Consent Decree[26]. While these requirements were originally established in the Consent Decree, they have since been incorporated into the Title V permit on April 15, 2020 (Title V permit no. P0089258) and are therefore federally enforceable and permanent (in that no modifications would be allowed unless it underwent review by U.S. EPA). The Title V permit defines "continuously operated" as "when an SCR, FGD, DSI, ESP or other NO_x pollution controls are used at an emissions unit, except during a malfunction, they shall be operated at all times such emissions unit is in operation, consistent with the technological limitations, manufacturers' specifications, and good engineering and maintenance practices for such equipment and the emissions unit so as to minimize emissions to the greatest extent practicable." B003 and B004 each have federally enforceable SO_2 emissions limits of 7.41 lb/MMBtu (permit no. P0089258, effective April 15, 2020). As shown in Table 8, recent SO_2 emissions rates are 0.39 lb/MMBtu or less. As these units each have FGDs with 95% control efficiency that operate year-round, these units could be considered effectively controlled for SO_2 in accordance with the "FGD/SCR with at least 90% effectiveness" example in the Regional Haze

[25] Ohio EPA initially requested the Bay Shore Plant perform a four-factor analysis. After consideration of additional information provided by the facility regarding the operational nature of the plant (as described above and in Appendix E), Ohio EPA agreed that a four-factor analysis is not warranted.

[26] https://www.epa.gov/enforcement/consent-decree-and-modifications-american-electric-power-service-corporation

Guidance. However, Ohio requested a four-factor analysis for SO_2 from Gavin Power Plant due primarily to the recent emission rates as well as relative impact of this source to visibility impairment. This is a conservative approach designed to ensure a thorough evaluation is performed. The four-factor analysis for SO_2 is discussed further in Step 4(d) below.

B003 and B004 are considered effectively controlled for NOx in accordance with the "FGD/SCR with at least 90% effectiveness" example in the Regional Haze Guidance. SCRs were installed May 1, 2001 on B003 and B004. Supplemental information provided by Gavin regarding their existing NOx controls is provided in Appendix L4, Attachment 2. The SCRs, together with low NOx burners, achieve 91% control efficiency. The SCRs must be continuously operated so as to minimize emissions to the greatest extent possible in accordance with the requirements of the AEP Consent Decree and federally-enforceable Title V permit (permit no. P0089258). As shown in Table 8, recent NOx emission rates are 0.11 lb/MMBtu or less.

The supplemental information provided by Gavin shows that the SCRs are well-maintained, including routine replacement of the catalyst layers. In addition, Gavin operates its control systems in concert to maximize the efficiencies in reducing all pollutants, and must maintain an operational balance between objectives. From 2009-2012, Gavin achieved slightly higher control efficiencies from its SCRs through injection of additional ammonia, but those marginal improvements in NOx emissions resulted in environmental disbenefits including higher mercury emissions jeopardizing MATS compliance, compromised ash quality rendering the ash unsuitable for beneficial reuse, and air heater pluggages that reduced plant output and efficiency, thereby increasing total emissions of all pollutants. Further, the supplemental information provided by Gavin shows the visibility impacts of NOx emissions at Gavin are minimal, as determined from CAMx modeling performed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS)/Southeastern States Air Resource Managers, Inc. (SESARM) Regional Planning Organization.

Further, these units are each subject to CSAPR, which provides significant economic incentive to operate and optimize SO_2 and NOx emissions controls. This incentive will become stronger with additional reductions to NOx allocations with the Revised CSAPR Update.

Table 8. Gavin Power Plant B003 and B004 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B003	2016	9,039	0.27	3,572	0.11	608	1
	2017	13,785	0.32	4,441	0.10	650	1
	2018	13,172	0.38	3,495	0.10	567	1
	2019	12,161	0.37	3,485	0.11	219	1
B004	2016	10,990	0.29	3,757	0.10	1,007	1
	2017	11,640	0.36	3,382	0.11	518	1
	2018	14,420	0.34	4,553	0.11	644	1
	2019	14,313	0.39	3,857	0.11	403	1

Although B003 and B004 are reported to have emitted higher emissions of $PM_{2.5}$ in 2016, as shown in Table 8, emissions have dropped substantially in more recent years. These differences are due to updated stack testing in 2017 which forms the basis of the emissions estimates for the condensable fraction of PM[27]. Thus, the recent emissions based on more recent data are expected to more accurately reflect current conditions. Ohio EPA does not consider B003 or B004 to be a significant source of $PM_{2.5}$ based on recent reported emissions.

In addition, B003 and B004 each are equipped with an Electrostatic Precipitator (ESP) for particulate control with greater than 99% control efficiency of particulates. B003 and B004 each have federally enforceable particulate emissions limits of 0.1 lb/MMBtu (permit no. P0089258, effective 04/15/2020).

Neither unit is a significant source of ammonia.

Haverhill Coke Company

Haverhill Coke Company (Facility ID 0773000182) operates a coke battery (P902)[28], which is considered effectively controlled for SO_2 in accordance with the "FGD/SCR with at least 90% effectiveness" example in the Regional Haze Guidance. In accordance with a federally enforceable permit requirement, the waste gas from coking shall be processed by a lime spray dryer (a type of dry FGD), installed February 1, 2007, with a manufacturer's design control efficiency of 92% for SO_2 control except during maintenance of the lime spray dryer and ancillary equipment (e.g. atomizer replacements)(Title V permit no. P0091350, effective 08/30/2019).

In addition, Haverhill Coke Company agreed to install redundant Heat Recovery Steam Generators ("HRSGs") to reduce the release of waste heat and associated emissions

[27] The 2016 and 2017 emissions are based on stack testing conducted 02/26/09, whereas the 2018 and 2019 emissions are based on a stack test conducted on 08/23/2017.

[28] Haverhill Coke Company was considered for a four-factor analysis due to exceeding the secondary selection criteria for a facility-wide Q/d greater than 10. However, where a facility triggers the secondary criteria based on facility-wide contribution (facility Q/d greater than 10), the four-factor analysis will only be performed for any units with Q/d greater than 4. Therefore, only unit P902 is evaluated here.

directly to the atmosphere from Bypass Vent Stacks, and thereby reduce SO_2 along with other pollutants, in accordance with the requirements of a federal Consent Decree in *United States of America, the State of Illinois and the State of Ohio v. Gateway Energy & Coke Company, LLC, Haverhill Coke Company, LLC and Suncoke Energy, Inc.* (S.D. Illinois Case No. 3:13-cv-00616-DH-SCW), entered on November 10, 2014, as amended on June 5, 2015 and July 10, 2018 (Haverhill Consent Decree). Bypass venting emission limits were also established in the Haverhill Consent Decree and subsequently incorporated into a PTI and are therefore federally enforceable and permanent (in that no modifications would be allowed unless it underwent review by U.S. EPA) (PTI No P0236298, effective 7/22/2019).

P902 has the following federally enforceable SO_2 emissions limits:

- 192.0 lb/hr as a 3-hour block average from the waste gas stack, except during maintenance of the lime spray dryer and ancillary equipment.
- 700.80 TPY as a rolling, 12-month summation from the waste gas stack except during maintenance of the lime spray dryer and ancillary equipment.
- 420 lb/hr, as a 3-hour block average, from a single HRSG bypass vent stack. For any bypass venting incident lasting 48 consecutive hours or longer, SO_2 emissions shall not exceed 323 lb/hr as a rolling, 48-hour average, from a single HRSG bypass vent stack.
- 384.0 tons per year from all HRSG bypass vent stacks combined for emissions units P901 and P902.
- 520.8 tons per 24 months from all HRSG bypass vent stacks combined for emissions units P901 and P902 as a rolling, 24-month total. The compliance period for this emission limit starts on February 7, 2019 but will not become enforceable until 24 months after the notification or on February 7, 2021.
- 1.6 pounds per ton of coal from the waste gas stack.
- 0.14 pound per hour from the charging baghouse.
- 0.13 ton per year as a rolling, 12-month summation from the charging baghouse.
- 0.0003 pound per ton of coal from the charging baghouse.
- 24 pounds per hour from the flat push hot car vented to the multiclone dust collector
- 21.90 tons per year as a rolling, 12-month summation from the flat push hot car vented to the multiclone dust collector.
- 0.05 pound per ton of coal from the flat push hot car vented to the multiclone dust collector.

(PTI No P0236298, effective 7/22/2019).

As shown in Table 9, SO_2 emissions have decreased significantly since 2016. This can be attributed to the redundant HRSGs project.

Table 9. Haverhill Coke Company P902 emissions[29] (2016 to 2019)

Unit ID	Year	SO_2 (tons)	NOx (tons)	PM25-PRI (tons)	NH3 (tons)
P902	2016	1,183	226	43	0
	2017	1,191	330	43	0
	2018	993	331	82	0
	2019	777	334	73	0

This unit is not a significant source of NOx, $PM_{2.5}$ or ammonia.

Miami Fort Power Station

On September 29, 2020, the owner of Miami Fort Power Station (Facility ID 1431350093) announced plans to permanently shut down. On July 9, 2021, Ohio EPA issued Director's Final Findings and Orders (DFFOs) (Appendix C) which establish an enforceable commitment for the permanent shut down of the coal-fired operation of the boilers at Miami Fort Power Station no later than January 1, 2028. Therefore, Ohio did not select this source for four-factor analysis[30]. As the permanent shut down of the coal-fired boilers at Miami Fort Power Station (Unit IDs B015 and B016) is being relied on to make reasonable progress as part of the LTS for the second implementation period, Ohio is requesting the DFFOs be approved into Ohio's SIP.

Kyger Creek Station

Kyger Creek Station (Facility ID 0627000003) operates five coal-fired boilers (B001, B002, B003, B004 and B005), which are considered effectively controlled for SO_2 in accordance with the "FGD/SCR with at least 90% effectiveness" example in the Regional Haze Guidance. Supplemental information provided by Kyger Creek Station regarding their existing SO_2 and NOx controls is provided in Appendix L4, Attachment 1.

FGDs with 97% control efficiency were installed March 19, 2012 on B001 and B002, and November 4, 2011 on B003, B004 and B005. Each of these controls operate year-round. Each of the five units have a federally enforceable SO_2 emissions limits of 1.2 lb/MMBtu based on a rolling, 30-day average (Title V permit no. P0089199, effective 1/1/2018). As shown in Table 10, recent SO_2 emission rates are 0.16 lb/MMBtu or less. In addition, these units are each subject to the federal Mercury and Air Toxics Standards (MATS) requirements under 40 CFR 63 Subpart UUUUU. While multiple options for demonstrating compliance with MATS are established in the Title V permit (Title V permit no. P0089199, effective 1/1/2018), Kyger Creek has chosen to demonstrate compliance through the alternative SO_2 emission limit of 0.2 lbs/MMbtu as a 30 day rolling average in

[29] SO_2 and NOx emission rates are not provided as Haverhill Coke Company does not report emission data to CAMD

[30] Ohio EPA initially requested the Miami Fort Power Station perform a four-factor analysis. After the planned shut down was announced and it was determined there would be an enforceable commitment for the permanent shut down no later than 2028 (Appendix C), Ohio EPA agreed that a four-factor analysis is not warranted.

accordance with Table 2(1)a of Subpart UUUUU. Thus, continued compliance with MATS serves as significant incentive for continued optimized operation of the FGDs with resultant low SO_2 emission rates.

SCRs with 70-90% control efficiency 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. As shown in Table 10, recent NOx emission rates are 0.24 lb/MMBtu or less. Kyger Creek operates the SCRs year-round, except for periods of repair and maintenance in part due to the co-benefit of mercury removal. In addition to NOx removal, the SCRs are used to oxidize mercury in order for the facility to demonstrate compliance with the MATS mercury emission limit. As a result, the facility needs to retain some operational balance between NO_x removal and mercury oxidation to effectively remove both pollutants at levels necessary to comply with both the annual and ozone season NO_x regulations applicable to this facility as well as the stack specific “not to exceed” Hg emission limits required under MATS regulations.

Kyger Creek has also recently enhanced its preventative maintenance and operator training programs and made process improvements to the urea injection system that are expected to improve year-round NO_x control urea injection reliability. Kyger Creek has improved seasonal NO_x removal efficiency since the CSAPR Update went into effect in 2017, and is working on system and process improvements to improve urea injection reliability year-round while balancing MATS compliance obligations.

Additional analysis of NOx emissions performed by AECOM can be found in Appendix P5. This additional analysis shows that the SCRs, together with overfire air systems, achieve an average 87% NOx control efficiency. The SCRs are well-maintained, including routine replacement of the catalyst layers. Kyger Creek operates its control systems in concert to maximize the efficiencies in reducing all pollutants, and must maintain an operational balance between objectives. NOx emission control is limited by acceptable ammonia slip and mercury oxidation. In addition to potentially jeopardizing MATS compliance as described above, excessive ammonia can affect air heater performance, causing fouling and pluggages that reduce plant output and efficiency, thereby increasing total emissions of all pollutants. High ammonia slip also adversely affects ash quality rendering the ash unsuitable for beneficial reuse. Further, the supplemental information in Appendix P5 shows the visibility impacts of NOx emissions at Kyger are minimal, as determined from CAMx modeling performed for the VISTAS/SESARM Regional Planning Organization.

Therefore, although the SCRs do not meet a strict interpretation of the “FGD/SCR with at least 90% effectiveness” example in the Regional Haze Guidance, Ohio EPA concludes based on a case-by-case evaluation of the control efficiency, emission rate, year-round control operation, operational improvements, and visibility impact that it is reasonable to assume for the purposes of efficiency and prioritization that a full four-factor analysis would result in the conclusion that no further controls are necessary.

Further, these units are each subject to CSAPR, which provides additional significant economic incentive to operate and optimize SO_2 and NOx emissions controls. This incentive will become stronger with additional reductions to NOx allocations with the Revised CSAPR Update.

Table 10. Kyger Creek B001, B002, B003, B004 and B005 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B001	2016	755	0.14	1,197	0.22	112	0
	2017	1,025	0.15	970	0.15	141	0
	2018	1,157	0.16	1,385	0.20	144	1
	2019	675	0.12	997	0.19	112	0
B002	2016	700	0.14	1,109	0.24	104	0
	2017	844	0.15	687	0.13	113	0
	2018	1,144	0.16	1,404	0.20	142	0
	2019	718	0.11	1,245	0.20	128	0
B003	2016	853	0.15	1,848	0.23	120	0
	2017	867	0.15	729	0.13	127	0
	2018	914	0.15	1,100	0.18	129	0
	2019	744	0.13	1,043	0.18	127	0
B004	2016	828	0.16	1,793	0.22	117	0
	2017	982	0.15	968	0.15	144	0
	2018	880	0.15	1,102	0.19	124	0
	2019	823	0.13	1,086	0.17	140	0
B005	2016	845	0.15	1,831	0.22	120	0
	2017	964	0.15	885	0.14	142	0
	2018	876	0.15	1,001	0.18	125	0
	2019	787	0.13	1,003	0.17	130	0

None of the units are significant sources of $PM_{2.5}$ or ammonia.

P. H. Glatfelter Company - Chillicothe Facility

P. H. Glatfelter Company - Chillicothe Facility (Facility ID 0671010028), now Pixelle Specialty Solutions LLC, converted units B002 and B003 to natural gas on May 31, 2016 and September 6, 2016, respectively, as part of a strategy that would address Best Available Retrofit Technology (BART) requirements under the first Regional Haze first implementation period SIP, as well as the Boiler MACT requirements (PTI number P0118906, effective 12/29/2016). Conversion of these boilers back to coal would require first applying for and obtaining a modified, federally enforceble permit.

Glatfelter has a federally enforceable SO_2 emissions limit for B002 and B003, combined, of 24,930 lb/calendar day, established to comply with the Round 1 Regional Haze BART requirements. In addition, Glatfelter has a federally enforceable facility-wide SO_2 emissions limit of 1,800 tons, based upon a rolling, 12-month summation, established as part of the DRR process (PTI number P0118906, effective December 29, 2016). As

shown in Table 11, SO_2 emissions decreased substantially following the conversion of these units to natural gas.

Neither of these units are significant sources of NOx, $PM_{2.5}$ or ammonia.

Table 11. P. H. Glatfelter Company - Chillicothe Facility B002 and B003 emissions[31] (2016 to 2019)

Unit ID	Year	SO_2 (tons)	NOx (tons)	PM25-PRI (tons)	NH3 (tons)
B002	2016	2,873	412	26	0
	2017	1	132	7	0
	2018	1	134	7	0
	2019	0	112	6	0
B003	2016	5,708	691	56	0
	2017	1	150	8	0
	2018	1	195	11	0
	2019	1	200	11	0

W. H. Sammis Plant

W. H. Sammis Plant (Facility ID 0641160017) permanently shut down coal-fired boilers B007, B008, B009 and B010 on May 31, 2020. Coal-fired boilers B012 and B013 are considered effectively controlled for SO_2 and NOx in accordance with the "FGD/SCR with at least 90% effectiveness" example in the Regional Haze Guidance. B011, B012 and B013 are also considered effectively controlled for SO_2 in accordance with the "FGD that meets MATS limits" example.

FGDs with 95% control efficiency were installed February 10, 2010 on B011, B012 and B013. Prior to installation of the FGD, data from CAMD indicates an average uncontrolled SO2 emission rate 1.30 lb/MMBtu for unit B011, of 1.52 lb/MMBtu for unit B012 and 1.46 lb/MMBtu for unit B013. Over 2016-2020, SO_2 emissions averaged 0.08 lb/MMBtu for each unit B011, B012 and B013, resulting in an average actual historical control efficiency of at least 94%. Please note that this is a conservative estimate because other contributing information, such as varying coal sulfur content, is not considered. The FGDs must be continuously operated to minimize SO_2 emissions to the extent practicable in accordance with the requirements of a federal Consent Decree in March 18, 2005 *United States of America, et al. v. Ohio Edison Company, et al.,* U.S. District Court for the Southern District of Ohio, Eastern Division, Civil Action No. C2-99-1181[32] (Ohio Edison Consent Decree). The Ohio Edison Consent Decree also establishes federally enforceable SO_2 emission limits for each B011, B012 and B013 of 0.130 lb/MMBtu based on a 30-day rolling average. While the emission limits were originally established in the Ohio Edison Consent Decree, they have since been incorporated into the Title V permit

[31] SO_2 and NOx emission rates are not provided as the P.H. Glatfelter Company – Chillicolte Facility does not report emission data to CAMD

[32] https://www.epa.gov/sites/production/files/documents/ohioedison-cd.pdf

(Title V permit no. P0089749, effective December 17, 2018) and are therefore federally enforceable and permanent (in that no modifications would be allowed unless it underwent review by U.S. EPA). To ensure the 0.13 lb/MMBtu 30-day rolling limitation is not exceeded, SO_2 is controlled to an lb/MMBtu set point with closed loop feedback from the continuous emissions monitoring system (CEMS). The typical set point is 0.09 lb/MMBtu. As shown in Table 12, recent SO_2 emission rates are 0.10 lb/MMBtu or less.

SCRs with at least 90% control efficiency were installed February 3, 2010 on B012 and April 24, 2010 on B013. Prior to installation of the SCR, additional NOx controls were implemented by the facility including low NOx burner technology with overfire air and selective non-catalytic reduction. Therefore, uncontrolled emissions data is not readily available. Over 2016-2020, NOx emissions averaged 0.10 lb/MMBtu for B012 and B013 and a manufacturer control efficiency guarantee is provided at 98%.

An SNCR was installed February 1, 2006 on B011. Prior to installation of the SNCR, data from CAMD indicates an average uncontrolled NOx emission rate 0.44 lb/MMBtu for unit B011. During this time, NOx was controlled with a low NOx burner. Over 2016-2020, NOx emissions averaged 0.14 lb/MMBtu resulting in an average actual historical control efficiency of approximately 68%.

The SCRs and SNCR must be continuously operated in accordance with the requirements of the Ohio Edison Consent Decree. The Ohio Edison Consent Decree also establishes federally enforceable and permanent NOx emission limits for B011 of 0.290 lb/mmBtu and for each B012 and B013 of 0.100 lb/MMBtu based on a 30-day rolling average which were incorporated into the federally enforceable Title V permit (Title V permit no. P0089749, effective December 17, 2018). To ensure the 0.100 lb\MMBtu 30-day rolling limitation for B012 and B013 is not exceeded, NOx is controlled to an lb\MMBtu set point with closed loop feedback from the CEMS. The typical set point is between 0.08 and 0.09 lb\MMBtu. As shown in Table 12, recent NOx emission rates are 0.15 lb/MMBtu or less for B011 and 0.12 lb/MMBtu or less for B012 and B013.

Therefore, although the SNCR (with low NOx burner) at B011 does not meet a strict interpretation of the “effectively controlled” examples in the Regional Haze Guidance, Ohio EPA concludes based on a case-by-case evaluation of the control efficiency, low emissions (762 tons in 2019), low emission rate (0.15 lb/MMBtu in 2019), and year-round control operation that it is reasonable to assume for the purposes of efficiency and prioritization that a full four-factor analysis would result in the conclusion that no further controls are necessary.

Further, these units are each subject to CSAPR, which provides significant economic incentive to operate and optimize SO_2 and NOx emissions controls. This incentive will become stronger with additional reductions to NOx allocations with the Revised CSAPR Update.

Table 12. W. H. Sammis Plant B012 and B013 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B011	2016	326	0.08	531	0.13	36	0
	2017	568	0.09	869	0.13	58	1
	2018	399	0.07	901	0.15	53	1
	2019	338	0.07	762	0.15	49	1
B012	2016	1,354	0.08	1,651	0.10	155	2
	2017	1,232	0.10	1,326	0.11	116	3
	2018	748	0.08	908	0.12	81	2
	2019	529	0.08	632	0.10	74	1
B013	2016	1,038	0.08	1,178	0.10	116	1
	2017	1,311	0.09	1,564	0.11	130	3
	2018	905	0.08	1,151	0.11	103	3
	2019	771	0.07	1,006	0.10	111	1

Neither of the units are significant sources of $PM_{2.5}$ or ammonia.

Zimmer Power Station

On September 29, 2020, the owner of Zimmer Power Station (Facility ID 1413090154) announced plans to permanently shut down. On July 9, 2021, Ohio EPA issued Director's Final Findings and Orders (DFFOs) (Appendix C) which establish an enforceable commitment for the permanent shut down of the coal-fired operations of the boilers at Zimmer Power Station no later than January 1, 2028. Therefore, Ohio did not select this source for four-factor analysis[33]. As the permanent shut down of the coal-fired boiler at Zimmer Power Station (Unit ID B006) is being relied on to make reasonable progress as part of the LTS for the second implementation period, Ohio is requesting the DFFOs be approved into Ohio's SIP.

4. Step 4: Characterization of factors for emission control measures

In Step 4, the four statutory factors and other considerations are characterized for each of the sources selected in Step 3. The four factors that must be considered include cost of compliance, time necessary for compliance, energy and non-air environmental impacts, and remaining useful life of the source. In addition, states may consider visibility benefits when it determines what emission control measures are required for a source to make reasonable progress. States have flexibility to decide how to characterize the factors, but a state's approaches must be reasonable, and the state must document how it has done its analysis.

[33] Ohio EPA initially determined Zimmer Power Station was effectively controlled for SO_2 and was in the process of evaluating whether to request a four-factor analysis for NOx when the planned shut down was announced. When it was determined there would be an enforceable commitment for the permanent shut down no later than 2028 (Appendix C), Ohio EPA agreed that a four-factor analysis is not warranted.

In addition to cost-effectiveness and visibility benefits, for some sources below Ohio has included analysis of the affordability of potential controls. Although the Regional Haze Guidance does not specifically address the consideration of affordability of a potential control measure during the second implementation period, affordability was a consideration during the first implementation period, specifically with regards to BART determinations. 40 CFR, Appendix Y to Part 51, Section IV.E.3 states:

> "In selecting a "best" alternative, should I consider the affordability of controls?
>
> 1. Even if the control technology is cost effective, there may be cases where the installation of controls would affect the viability of continued plant operations.
> 2. There may be unusual circumstances that justify taking into consideration the conditions of the plant and the economic effects of requiring the use of a given control technology. These effects would include effects on product prices, the market share, and profitability of the source. Where there are such unusual circumstances that are judged to affect plant operations, you may take into consideration the conditions of the plant and the economic effects of requiring the use of a control technology. Where these effects are judged to have a severe impact on plant operations you may consider them in the selection process, but you may wish to provide an economic analysis that demonstrates, in sufficient detail for public review, the specific economic effects, parameters, and reasoning. (We recognize that this review process must preserve the confidentiality of sensitive business information). Any analysis may also consider whether other competing plants in the same industry have been required to install BART controls if this information is available."

While this was originally intended for analysis of BART sources in the first implementation period, Ohio finds these general principles continue to be appropriate and relevant for reasonable progress determinations in the the second implementation period.

U.S. EPA's November 2006 "Final Guidance for EPA Rulewriters: Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA)[34]" indicates that U.S. EPA has often defined an upper threshold for the cost/sales ratio of 3% as representative of "a level of economic impact that would be unquestionably significant for a small entity" (p. 25). Ohio finds this threshold continues to be appropriate and relevant for reasonable progress determinations in the the second implementation period.

Except where otherwise specified, emissions data referenced below was obtained from the following sources:

- 2016 emissions are the same as that used for the Q/d analysis.

[34] https://www.epa.gov/sites/production/files/2015-06/documents/guidance-regflexact.pdf

- 2017 to 2019 SO_2 and NOx emissions were obtained from U.S. EPA's Clean Air Markets Database (CAMD)[35] for sources which report emissions data to CAMD; all other 2017 to 2019 emissions were obtained from Ohio EPA's Emission Inventory System (EIS)[36].
- 2016 to 2019 emission rates for SO_2 and NOx were obtained from CAMD for sources which report emissions data to CAMD.

Copies of permits referenced below can be found on Ohio EPA's website[37]. Permit information provided below is for reference and is not intended to be incorporated into Ohio's SIP.

a) Avon Lake Power Plant

Avon Lake Power Plant (Facility ID 0247030013) is a coal-fired electrical generating plant. SO_2 and NOx emissions from unit B012 (Unit 9), a 6,040 MMBtu/hour pulverized coal-fired boiler, is the major contributor to visibility impairment from this facility. This unit was installed on June 1, 1970 and is equipped with low-NOx cell burners and overfire air for NOx control, a dry sorbent injection (DSI) system for hydrochloric acid (HCl) emission control under the MATS Rule, and an ESP for PM control.

To satisfy requirements under the Data Requirements Rule (DRR) for the SO_2 NAAQS designation process, Avon Lake accepted a federally enforceable SO_2 emissions limit from all SO_2-emitting sources at the facility (i.e., emissions units B010, B012, B013, B015, and B016, combined) of 9,600 lbs/hr on a 1-hour average basis, effective January 13, 2017. In addition, SO_2 emissions from emissions units B010 and B012, combined, shall not exceed 1.59 lb/MMBtu as a rolling, 30-day average (Title V permit no. P0085253, effective April 18, 2017). In addition, the fuel was changed in 2016 to a Western Bituminous and Powder River Basin coal blend which resulted in reduced SO_2 emissions.

Table 13. Avon Lake B012 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B012	2016	8,863	1.60	2,031	0.33	240	0
	2017	1,922	0.72	918	0.30	118	0
	2018	3,693	0.72	1,670	0.29	238	0
	2019	1,597	0.70	608	0.24	103	0

B012 is not a significant source of $PM_{2.5}$ or ammonia.

A four-factor analysis for NOx and SO_2 emissions is available in Appendix F and summarized below.

[35] https://ampd.epa.gov/ampd/
[36] https://epa.ohio.gov/dapc/aqmp/eiu/eis
[37] https://www.epa.ohio.gov/dapc/newpermits/issued#IssuedPermits

For SO_2 control, Avon Lake evaluated dry FGD (specifically, a spray dryer absorber (SDA) and wet FGD. Cost-effectiveness was determined to be $22,600/ton SO_2 controlled and $19,500/ton for the wet FGD and SDA, respectively. Capital costs were estimated at $483,000,000 for the wet FGD and $417,000,000 for the SDA. Total annual costs were estimated at $51,600,000/yr for the wet FGD and $44,500,000/yr for the SDA. Either control option would require approximately 5 years to complete installation. Energy and solid waste impacts are associated with FGD, but are not considered unacceptable. The boiler's remaining useful life is assumed to be 20 years.

For NOx control, Avon Lake evaluated SNCR and SCR. Cost-effectiveness was determined to be $10,200/ton NOx controlled and $26,700/ton for the SNCR and SCR, respectively. Capital costs were estimated at $13,000,000 for the SNCR and $229,000,000 for the SCR. Total annual costs were estimated at $1,679,100/yr for the SNCR and $25,600,000/yr for the SCR. Approximately 2 years would be required to complete installation of an SNCR and approximately 5 years would be required to complete installation of an SCR system. There are energy impacts associated with the use of SCR and environmental impacts associated with the use of ammonia. The boiler's remaining useful life is assumed to be 20 years.

A firm-specific interest rate of 7% was used in the analysis. This was considered conservative as this facility is a privately held wholesale power generator and not a public utility or subsidiary thereof, and therefore the cost of capital is significantly higher than the bank prime rate and the default 7% rate. Benchmarking with other independent coal plant projects in the area showed financing ranged from 11.5 to 12.5%.

Although we believe a remaining useful life of 20 years and a retrofit factor of 1.2 (for all but SNCR) are appropriate and justified in this case, the costs were also calculated based on a remaining useful life of 30 years and a retrofit factor of 1 to show the sensitivity of costs to these parameters. In this analysis, the cost effectiveness of wet FGD ranged from $16,800/ton to $22,600/ton; SDA ranged from $14,500/ton to $19,500/ton; SNCR ranged from $9,100/ton to $10,200/ton; and SCR ranged from $20,000/ton to $26,700/ton.

Avon Lake also evaluated the optional 5th factor which involves consideration of visibility impacts of candidate control options. The closest Class I areas to Avon Lake Power Plant are Dolly Sods and Otter Creek Wilderness areas in West Virginia. Extrapolating from CAMx modeling performed for the VISTAS/SESARM Regional Planning Organization for the Cardinal and Conesville Power Plants, Avon Lake estimates that the maximum visibility benefit would be 0.17970 Mm^{-1} for wet FGD or SDA, and 0.00427 Mm^{-1} for SNCR or SCR. In addition, modeling indicates visibility conditions in 2028 at each Class I area impacted by emissions from Ohio is projected to be below (or well below) the uniform rate of progress (URP) glidepath.

b) Carmeuse Lime, Inc. - Maple Grove Operations

Carmeuse Lime, Inc. - Maple Grove Operations (Facility ID 0374000010) is a lime manufacturing plant. SO_2 and NOx emissions from units P003 and P004 (SCC 30501604) are the major contributors to visibility impairment from this facility:

- P003 - Rotary Kiln # 1 and cooler
- P004 - Rotary Kiln # 2 and cooler

Both units have baghouses for control of particulates and a shared stack. Inherent control of SO_2 is achieved due to chemical absorption of the SO_2 by the calcium-rich lime kiln dust (LKD) in the flue gas and in the baghouses and NOx emissions are limited by good combustion practices, but there are no add-on controls for NOx or SO_2 emissions. These units burn coal, petroleum coke, and/or natural gas. Permitted limits on the maximum sulfur content are 5.50 percent for coal and 6.50 percent for coke, by weight. P003 and P004 are each subject to federally enforceable SO_2 limits of 1,102.00 pounds SO_2/hour and 4,826.80 tons SO_2 per rolling, 12-month period. Each unit is also subject to federally enforceable NOx limits of 1,234.90 pounds NOx/hour and 5,408.90 tons NOx per rolling, 12-month period (Title V permit no. P0125171, effective January 2, 2019).

These emission units were subject to best available control technology (BACT) analysis following restarting of lime manufacturing operations. The results of the BACT evaluation were established in the PSD permit issued in 2002, where it was determined that there are no cost-effective control technologies for NOx or SO_2 (Title V permit no. P0125171, effective January 2, 2019).

Table 14. Carmeuse Lime, Inc., - Maple Grove Operations P003 and B004 emissions[38] (2016 to 2019)

Unit ID	Year	SO_2 (tons)[39]	NOx (tons)	PM25-PRI (tons)	NH3 (tons)
P003	2016	2,503	1,280	11	0
	2017	3,229	1,570	6	0
	2018	2,904	1,657	6	0
	2019	3,262	1,543	7	0
P004	2016	2,323	1,187	10	0
	2017	3,070	1,375	5	0
	2018	3,323	1,596	6	0
	2019	2,963	1,294	6	0

Neither of these units are significant sources $PM_{2.5}$ or ammonia.

A four-factor analysis for NOx and SO_2 emissions is available in Appendix G1 and summarized below.

[38] SO_2 and NOx emission rates are not provided as Carmeuse Lime – Maple Grove does not report emission data to CAMD

[39] 2017-2019 SO_2 emissions represent that used for periodic dispersion modeling, not the rate used for annual emissions (fee) reporting and provides a more accurate estimations of emissions. While the methodology used for modeling provides the most accurate estimations of emissions, this method is quite burdensome. Carmeuse uses a simplified process for estimating emissions for the purposes of the annual emissions report.

For SO_2 control, Carmeuse Lime – Maple Grove evaluated DSI, conditioning tower slurry injection, and wet scrubbing. As shown in Table 15, cost-effectiveness was determined to range from \$3,266/ton SO_2 controlled to \$5,862/ton. Capital costs ranged from \$14,437,782 to \$23,784,927 per kiln. Total annual costs ranged from \$3,989,617/yr to \$9,171,510/yr per kiln. An interest rate of 7.00% was used in this analysis, which is below the actual interest rate Carmeuse received for recent internal projects. Approximately 5 years would be needed to complete installation. Significant energy and solid waste impacts are associated with SO_2 controls. Operating the control devices would require increased electrical usage would decrease overall plant energy efficiency and increase emissions from nearby power stations. Environmental impacts include treating and disposing of large volumes of water and lime mud, and controls may negatively impact the beneficial use of the LKD resulting in sending it to a landfill. The remaining useful life of the kilns does not impact the annualized cost for the add-on control technology because the useful life is assumed to be at least as long as the capital cost recovery period, which is 20 years.

Table 15. Carmeuse Lime, Inc., - Maple Grove Operations: Estimated Costs (\$2019) of SO_2 Emissions Reduction

Source	SO_2 Control Option	Total Capital Investment (\$)	Annual Cost (\$/yr)	Cost Effectiveness (\$/ton SO_2)
Kiln #1	DSI	16,960,653	9,171,510	5,857
	Conditioning Tower Slurry Injection	14,437,782	3,989,617	3,266
	Wet Scrubber	23,784,927	6,352,197	4,056
Kiln #2	DSI	16,960,653	9,140,819	5,862
	Conditioning Tower Slurry Injection	14,437,783	3,982,597	3,274
	Wet Scrubber	23,784,927	6,305,184	4,043

Carmeuse Lime – Maple Grove evaluated several NOx control options and determined there are no technically feasible NOx control options for the kilns beyond current operation under good combustion practices. Despite concerns about technical feasibility, Carmeuse Lime – Maple Grove performed a four-factor analysis on the addition on tail-end SCR. This analysis included the installation of a wet scrubber to minimize SO_2 emissions upstream of the SCR to avoid conversion to SO_3, potential catalyst masking via formation of ammonium sulfate/bisulfate byproducts, downstream corrosion, and visible plume. The analysis also included installation of a stack gas reheat downstream of the wet scrubber to provide ensure proper operation of the SCR. Cost-effectiveness was determined to be \$10,419/ton NOx controlled for B001 and \$11,484/ton for B002. Approximately 4 to 5 years would be needed to complete installation. Increased energy use, upstream impacts related to production and transport of ammonia and downstream impacts in potential for ammonia slip (i.e., unreacted ammonia exiting stack) are associated with installation of an SCR. The remaining useful life is estimated to be 25 years for the SCR equipment.

In addition, Carmeuse Lime noted that the Maple Grove facility was not one of the four sources in Ohio identified by VISTAS as a source which strongly contributes to regional haze. Further, Carmeuse Lime noted that the closest Class I area to the Maple Grove facility, Dolly Sods, is well below the glidepath not only in 2028 but also in 2038, and that the Maple Grove facility is located outside of the area of influence for Dolly Sods as shown in Figure 2-2 of Ohio EPA's March 2011 revision to the Regional Haze SIP for the first implementation period[40]. Ohio finds it important to recognize that the Class I area is below the glidepath and therefore visibility targets are being met, while acknowledging that this is not a reason, on its own, to not consider additional controls.

Finally, Carmeuse Lime – Maple Grove submitted a supplemental affordability assessment (Appendix G2[41]) which shows the cost/sales ratio for each of the SO_2 control options evaluated is well above the 3% threshold typically considered by U.S. EPA to pose a potentially significant economic burden.

c) Dover Municipal Light

Dover Municipal Light (Facility ID 0679010146) is a coal-fired electrical generating plant. SO_2 and NOx emissions from unit B004, a 247 MMBtu/hour coal-fired spreader stoker boiler (SCC 10100204), is the major contributor to visibility impairment from this facility.

This unit was installed on 01/01/1962 and is controlled with a baghouse for particulate matter, activated carbon for mercury, and dry sorbent injection systems for hydrogen chloride; natural gas may be used as backup fuel. This unit is subject to a federally-enforcable SO_2 emissions limit of 4.60 lbs/MMBtu (Title V permit no. P0090801, effective November 29, 2016).

Table 16. Dover Municipal Light B004 emissions[42] (2016 to 2019)

Unit ID	Year	SO_2 (tons)	NOx (tons)	PM25-PRI (tons)	NH3 (tons)
B004	2016	1,348	172	16	0
	2017	967	188	19	0
	2018	1,067	212	21	0
	2019	902	191	18	0

B004 is not a significant source of NOx, $PM_{2.5}$ or ammonia.

A four-factor analysis for SO_2 emissions is available in Appendix H and summarized below.

[40] https://www.epa.ohio.gov/portals/27/SIP/regional/Regional_Haze_SIP_Revised_Final_3-11-11.pdf
[41] Carmeuse Lime – Maple Grove submitted a supplemental affordability analysis which contains information that Carmeuse holds as confidential and trade secret. Attached is a public copy where this confidential information has been redacted.
[42] SO_2 and NOx emission rates are not provided as Dover Municipal Light does not report emission data to CAMD

Dover Municipal Light evaluated DSI, Wet FGD, and semi-dry scrubbing (specifically, SDA). Cost-effectiveness was determined to be $2,985/ton SO_2 controlled for DSI, $5,016/ton for Wet FGD, and $4,402/ton for SDA. Capital costs were estimated to be $2,640,000 for DSI, $28,110,269 for Wet FGD, and $24,274,288 for SDA. Total annual costs were estimated to be $1,558,509/yr for DSI, $4,615,991/yr for Wet FGD, and $4,030,803/yr for SDA. An interest rate of 3.25% was used in this analysis. Approximately 5 years would be needed to complete installation. All options increase power usage and generate solid waste that must be managed; wet FGD and SDA also require increased freshwater usage, and wet FGD generates wastewater that must be managed/treated. The remaining useful life of 30 years is assumed, as the City of Dover has no plans to shut down or cease burning coal in this unit.

In addition, Dover noted that the plant was not one of the four sources in Ohio identified by VISTAS as a source which strongly contributes to regional haze. Further, Dover noted that the closest Class I area to the plant, Dolly Sods, is well below the glidepath not only in 2028 but also in 2038. Ohio finds it important to recognize that the Class I area is below the glidepath and therefore visibility targets are being met, while acknowledging that this is not a reason, on its own, to not consider additional controls.

Dover additionally noted that installation of additional controls would not be associtated with a capital improvement project for which increased revenue could be expected for the plant to recoup the added costs. Dover is a non-profit governmental organization, and the entirety of the costs would be passed on to the consumer. The cost/sales ratio for each of the control options evaluated is significant, ranging from 6.2% to 18.5%, well above the 3% threshold typically considered by U.S. EPA to pose a potentially significant economic burden.

d) General James M. Gavin Power Plant

General James M. Gavin Power Plant (Facility ID 0627010056) is a coal-fired electrical generating plant. SO_2 and NOx emissions from units B003 and B004, each 11,936 MMBtu/hour pulverized coal-fired, dry-bottom boilers (SCC 10100202), are the major contributors to visibility impairment from this facility. These units were installed on August 16, 1974 and are controlled with selective catalytic reduction system (SCR), electrostatic precipitator (ESP), wet FGD scrubber, and DSI for control of sulfur trioxide (SO_3) emissions.

FGDs with 95% control efficiency were installed December 1, 1994 on B003 and March 1, 1995 on B004. The FGDs must be continuously operated in accordance with the requirements of the federal AEP Consent Decree[43]. While these requirements were originally established in the Consent Decree, they have since been incorporated into the Title V permit on April 15, 2020 (Title V permit no. P0089258) and are therefore federally enforceable and permanent (in that no modifications would be allowed unless it underwent review by U.S. EPA). The Title V permit defines “continuously operated” as

[43] https://www.epa.gov/enforcement/consent-decree-and-modifications-american-electric-power-service-corporation

"when an SCR, FGD, DSI, ESP or other NO_x pollution controls are used at an emissions unit, except during a malfunction, they shall be operated at all times such emissions unit is in operation, consistent with the technological limitations, manufacturers' specifications, and good engineering and maintenance practices for such equipment and the emissions unit so as to minimize emissions to the greatest extent practicable." B003 and B004 each have federally enforceable SO_2 emissions limits of 7.41 lb/MMBtu (Title V permit no. P0089258, effective April 15, 2020). As shown in Table 17, recent SO_2 emissions rates are 0.39 lb/MMBtu or less. Further, these units are each subject to CSAPR, which provides significant economic incentive to operate and optimize SO_2 and NOx emissions controls. This incentive will become stronger with additional reductions to NOx allocations with the Revised CSAPR Update.

Table 17. Gavin Power Plant B003 and B004 emissions (2016 to 2019)

Unit ID	Year	SO_2 (tons)	SO_2 rate (lb/MMBtu)	NOx (tons)	NOx Rate (lb/MMBtu)	PM25-PRI (tons)	NH3 (tons)
B003	2016	9,039	0.27	3,572	0.11	608	1
	2017	13,785	0.32	4,441	0.10	650	1
	2018	13,172	0.38	3,495	0.10	567	1
	2019	12,161	0.37	3,485	0.11	219	1
B004	2016	10,990	0.29	3,757	0.10	1,007	1
	2017	11,640	0.36	3,382	0.11	518	1
	2018	14,420	0.34	4,553	0.11	644	1
	2019	14,313	0.39	3,857	0.11	403	1

As described in section 3(h) above, Ohio determined that these units are not significant sources of $PM_{2.5}$ or ammonia, and are effectively controlled for NOx and therefore did not request a four-factor analysis for NOx. A four-factor analysis for SO_2 emissions is available in Appendix I and summarized below.

Gavin evaluated fuel switching, retrofit new dry FGD, retrofit new wet FGD, and operational improvements to the existing wet FGD. No other technically feasible controls measures were identified that are more efficient at controlling SO_2 emissions than the currently installed wet FGD systems. The existing wet FGD systems were recently upgraded and are operating at just above 95% control efficiency. Further optimization is not technically feasible given the physical limitation of the systems.

Gavin also evaluated the optional 5th factor which involves consideration of visibility impacts of candidate control options. The closest Class I areas to Gavin Power Plant are Dolly Sods, James River Face, and Otter Creek Wilderness areas in West Virginia. By scaling CAMx modeling performed for the VISTAS/SESARM Regional Planning Organization which used 2011 actual emissions for the Gavin Power Plant, Gavin estimates that the visibility impact of current SO_2 emissions (based on an average of 2017 to 2019 emissions) is 1.1460 Mm^{-1}. In addition, modeling indicates visibility conditions in 2028 at each Class I area impacted by emissions from Ohio is projected to be below (or well below) the uniform rate of progress (URP) glidepath. Ohio finds it important to

recognize that the Class I areas are below the glidepath and therefore visibility targets are being met, while acknowledging that this is not a reason, on its own, to not consider additional controls.

5. Step 5: Decisions on what control measures are necessary to make reasonable progress

In Step 5, the four statutory factors characterized in Step 4 are considered to determine what emission control measures are necessary to make reasonable progress for the second implementation period. In addition, the optional 5th factor (visibility benefits) may be considered in light of the other factors as a balancing of outcomes.

a) Considering the cost of compliance and visibility benefits

The Regional Haze Guidance states "the outcome of the decision-making process by a state regarding a control measure may most often depend on how the state assesses the balance between the cost of compliance and the visibility benefits, with the other three statutory factors either being subsumed into the cost of compliance or not being major considerations."

A summary of cost-effectiveness for the various control options evaluated in the four-factor analyses conducted under Step 4 in shown in Table 18 below. Additional SO_2 or NOx controls are clearly not cost-effective for Avon Lake Power Plant. While the cost-effectiveness of SO_2 controls at Carmeuse Lime – Maple Grove and Dover Municipal Light are lower in comparison to Avon Lake Power Plant, these sources have both included an analysis showing the added costs of these controls are not affordable. In addition, significant energy and solid waste impacts are associated with SO_2 controls including increased power usage and increased generation of solid waste and waste water. No technically feasible control measures were identified for SO_2 control at Gavin Power Plant beyond existing wet FGD systems, or for NOx control at Carmeuse Lime – Maple Grove beyond current operation under good combustion practices.

In addition, Ohio estimated the visibility benefit of potential emissions reductions, following a similar but slightly expanded approach to that taken by AECOM on behalf of Avon Lake as part of an analysis for the optional 5th factor (see Appendix F). Ohio based this analysis on source apportionment modeling conducted by VISTAS[44]. VISTAS modeled the visibility impact at Class I areas in the eastern/central U.S. in 2028 (using 2011 base year and projected 2028 future year inventories) from many point sources across the U.S., including five point sources in Ohio (Cardinal Power Plant, Conesville Power Plant, Wm. H. Zimmer Station, Gavin Power Plant, and Kyger Creek Station). The methodology for the VISTAS source apportionment modeling can be found in the August 31, 2020 "Particulate Source Apportionment Technology Modeling Results Task 7" report[45]. The specific modeling data used in Ohio's analysis can be found in the "PSAT

[44] https://metro4-sesarm.org/content/vistas-regional-haze-program
[45] https://www.metro4-sesarm.org/content/task-7-source-apportionment-modelingtagging

Percent Contribution Rankings – April 2020" spreadsheet (specifically the "AOI and PSAT" tab).

To determine the estimated visibility benefit of a potential control, Ohio scaled the modeled visibility impacts from the modeled source to the expected emissions reductions from potential controls using the following equation:

$$Estimated\ visibility\ benefit\ of\ potential\ control = Modeled\ visibility\ impact * \left(\frac{Estimated\ emissions\ reductions}{Modeled\ emissions}\right)$$

The estimated visibity benefit of each potential control evaluated in Step 4 was calculated using the modeling results for each of the five modeled sources. For each potential control measure, Ohio then determined the maximum estimated visibility benefit at any Class I area from among all of the modeled sources. As recommended by the Regional Haze Guidance, Ohio also determined the cumulative visibility benefit of each potential control across all of the affected Class I areas (by summing the visibility benefit at each Class I area) for each modeled source, then determined which modeled source resulted in the highest cumulative visibility benefit.

While this approach is a rough estimate for those sources not directly modeled by VISTAS (all except Gavin Power Plant), it is a quite conservative estimate as in each case the source modeled was closer to the Class I area[46,47,48]. In addition, assessing the cumulative visibility benefit of the potential control across all of the affected Class I areas is extremely conservative as it sums the modeled visibility benefit at multiple locations at multiple times. However, the visibility benefit from a single source is not likely to be observed at all Class I areas at any given time.

In this analysis, visibility benefit is considered in terms of light extinction (with the units of Mm^{-1}), which is the "attenuation of light due to scattering and absorption as it passes through a medium. In the case of visibility, attenuation or extinction refers to the loss of image-forming light as it passes from an object to the observer"[49]. Visibility can also be measured in deciview (DV), a unitless metric of haze proportional to the logarithm of light extinction. The deciview is scaled such that a change of one deciview represents a constant change in visibility across the entire range of conditions, from pristine to very obscured. As recommended in the Regional Haze Guidance, the visibility benefit is

[46] For Avon Lake, the maximum estimated scaled SO_2 impact occurred at Dolly Sods, estimated from modeling conducted for the Cardinal Power Plant. Avon Lake is located 348 km from Dolly Sods, while Cardinal is only 164 km away. Similarly, the maximum estimated scaled NOx impact occurred at Mammoth Cave, estimated from modeling conducted for the Wm. H. Zimmer Station. Avon Lake is located 601 km from Mammoth Cave, while Zimmer is only 256 km away.
[47] For Carmeuse Lime – Maple Grove, the maximum estimated scaled SO_2 impact occurred at Dolly Sods, estimated from modeling conducted for the Cardinal Power Plant. The Maple Grove facility is located 399 km from Dolly Sods, while Cardinal is only 164 km away.
[48] For Dover Municipal Light, the maximum estimated scaled SO_2 impact occurred at Dolly Sods, estimated from modeling conducted for the Cardinal Power Plant. Dover Municipal Light is located 235 km from Dolly Sods, while Cardinal is only 164 km away.
[49] https://www.fs.fed.us/air/visibilityTerminology.htm

considered here in units of light extinction rather than deciviews, so as to avoid computational complexities that can make public understanding more difficult.

Ohio EPA is not establishing here a "bright-line" threshold for a significant visibility benefit, and is rather considering each on a case-by-case basis as part of a weight of evidence approach to considered alongside, not instead of, the four statutory factors.

This analysis is available in Appendix J and is summarized in Table 18. Ohio's analysis shows the maximum estimated visibility benefit at a Class I area for a controlled source is 0.246 Mm^{-1} (from Carmeuse Lime – Maple Grove at Dolly Sods). The maximum estimated cumulative visibility benefit across all Class I areas of any of the new additional controls evaluated is 1.391 Mm^{-1} (from Carmeuse Lime – Maple Grove). Even if the new additional controls with the greatest visibility benefit were required at all four of the sources evaluated under the 4-factor analysis[50], the sum of the cumulative visibility benefit at all affected Class I areas would be only 2.9 Mm^{-1}. Again, this is an extremely conservative estimate that likely overstates the visibility benefit of these potential controls.

Finally, although no technically feasible measures were identified for SO_2 control at Gavin Power Plant and therefore a visibility benefit for potential new controls is not included in Table 18, we note that scaling of the VISTAS modeling to recent actual emissions shows the maximum estimated visibility impact of these two units, as currently controlled, is 1.215 Mm^{-1} at the Otter Creek Wilderness Class I area. The estimated cumulative visibility impact at all Class I areas from these units, as currently controlled, is 9.126 Mm^{-1}.

[50] 1.107 Mm^{-1} for Wet FGD or SDA at Avon Lake; 1.391 Mm^{-1} for DSI or Wet Scrubber at Carmeuse Lime – Maple Grove; 0.410 Mm^{-1} for Wet FGD at Dover Municipal Light; and 0.026 Mm^{-1} for SCR at Avon Lake (note: no technically feasible measures were identified for SO_2 control at Gavin Power Plant or NOx control at Carmeuse Lime – Maple Grove)

Table 18. Summary of cost-effectiveness and estimated visibility benefit

Source	Control	Emissions Reduced (TPY)	Cost Effectiveness ($/ton)	Maximum Estimated Visibility Benefit at a Class I Area (Mm^{-1})	Cumulative Estimated Visibility Benefit at all Class I Areas (Mm^{-1})
SO_2					
Avon Lake Power Plant (B004)	Wet FGD	2,284	$22,600	0.180[a,b]	1.017[b]
	SDA	2,284	$19,500	0.180[a,b]	1.017[b]
Carmeuse Lime, Inc., - Maple Grove (P003 and P004)	DSI	3,125	$5,857 (P003) $5,862 (P004)	0.246[a,b]	1.391[b]
	Conditioning Tower Slurry Injection	2,437	$3,266 (P003) $3,274 (P004)	0.192[a,b]	1.085[b]
	Wet Scrubber	3,125	$4,056 (P003) $4,043 (P004)	0.246[a,b]	1.391[b]
Dover Municipal Light (B004)	DSI	522	$2,985	0.041[a,b]	0.232[b]
	Wet FGD	920	$5,016	0.072[a,b]	0.410[b]
	SDA	916	$4,402	0.072[a,b]	0.408[b]
Gavin Power Plant (B003 and B004)	N/A – no technically feasible SO_2 control measures were identified beyond existing wet FGD systems				
NOx					
Avon Lake Power Plant (B004)	SNCR	164	$10,200	0.001 [c,d]	0.004[e]
	SCR	959	$26,700	0.005[c,d]	0.026[e]
Carmeuse Lime, Inc., - Maple Grove (P003 and P004)	N/A – no technically feasible NOx control measures were identified beyond current operation under good combustion practices				

[a] at Dolly Sods
[b] estimated from Cardinal modeled impact
[c] at Mammoth Cave
[d] estimated from Zimmer modeled impact
[e] estimated from Conesville modeled impact

While Ohio is not establishing here a “bright-line” threshold for a significant visibility benefit, Ohio believes that the visibility benefit as estimated from this analysis would not be considered significant, whether considered for potential controls at one source at a single Class I area, for potential controls at one source at all Class I areas, or potential controls at all four sources at all Class I areas. Balancing cost-effectiveness, energy and non-air quality environmental impacts, affordability, and visibility benefits, Ohio does not find any of the potential controls evaluated to be necessary for reasonable progress.

Further, Ohio is not relying on the existing measures at sources selected for four-factor analysis, but where new additional measures were found not to be necessary, to make reasonable progress.

b) Time necessary for compliance

The time necessary for compliance ranged from approximately 2 to 5 years. In accordance with the Regional Haze Guidance, this is considered as part of what compliance deadlines for selected control measures are reasonable, rather than as part of a determination whether to adopt the control measures.

c) Energy impacts and non-air quality environmental impacts

While some energy and environmental impacts are associated with potential controls, these are not considered unacceptable.

d) Remaining useful life

As recommended by the Regional Haze Guidance, remaining useful life was considered by using it to calculate emission reductions, annualized compliance costs, and cost/ton values.

e) Long-Term Strategy (LTS) for second implementation period

50 CFR 51.308(f)(2) requires each state to develop a LTS that includes the control measures necessary to make reasonable progress at each Class I area outside the state that may be affected by emissions from the state. The Regional Haze Guidance (p. 36) states "the regional haze program is an iterative program that provides states with flexibility to develop a cohesive strategy that demonstrates reasonable progress over time … a state may be able to demonstrate, based on careful consideration of the relevant factors for its selected sources, that no additional measures are necessary to make reasonable progress in the second implementation period."

Ohio has carefully considered the four statutory factors and anticipated visibility benefits, along with the overall progress in the Regional Haze program. As described above, potential additional controls are not cost-effective or affordable, and the estimated visibility benefit is minimal. In addition, as described in Step 3(e) above, current visibility monitoring data shows steady and significant improvement, and modeling shows that all Class I areas impacted by sources in Ohio are below, or well below, their glidepaths. As shown in the progress report contained in Step 8(b) below, emission trends show huge reductions in both NOx and SO_2. Additional emissions reductions are expected from the Revised CSAPR Update and permanent shutdown of coal-fired boilers at Miami Fort Power Station and Zimmer Power Station. Given all of these factors, Ohio concludes that on-the-books and on-the-way controls are more than sufficient to achieve reasonable progress goals, and thus no additional measures are necessary to make reasonable progress in the second implementation period.

Ohio's LTS is relying on the following on-the-books and on-the-way controls as the control measures measures necessary to make reasonable progress during the second implementation period.

On-the-books controls

On-the-books controls implemented since the time of the original SIP for the first implementation period, as submitted in December 2008 and revised in March 2011 and August 2015 (each described in additional detail in Step 3(e)(5) above):

- Permanent shutdown of sources (including but not limited to Conesville Power Plant units B004, B007 and B008; DP&L JM Stuart units B001-B004; DP&L JM Killen unit B001; and WH Sammis Plant B007-B010)
- Reciprocating Internal Combustion Engines (RICE) NESHAPs
- Control of Hazardous Air Pollutants from Mobile Sources
- Mercury and Air Toxic Standards (MATS)
- Oil and Natural Gas Industry Standards
- NO_x Emission Standard for New Commercial Aircraft Engines
- Area Source Boilers, Major Source Boilers and Commercial/Industrial Solid Waste Incinerators (CISWI) NESHAPs
- NSPS for Residential Wood Heaters
- SO_2 Data Requirements Rule
- Ohio's Beneficiary Mitigation Plan for the Volkswagen settlement

On-the-way controls

Additional emissions reductions are expected in the future (each described in additional detail in in Step 3(e)(5) above):

- Revised CSAPR Update
- Permanent shutdown of coal-fired boilers at Miami Fort Power Station and Zimmer Power Station

Ohio is not relying on any existing measures for sources evaluated in Step 3 but not selected for four-factor analysis, or for sources selected for four-factor analysis but where new additional measures were found not to be necessary, as part of the LTS to make reasonable progress in the second implementation period.

f) Establishing emission limitations, compliance schedules, and other measures necessary to make reasonable progress

40 CFR 51.308(d)(3) states: "The long-term strategy must include enforceable emissions limitations, compliance schedules, and other measures *as necessary* to achieve the reasonable progress goals established by the States having mandatory Class I Federal areas." (emphasis added).

All of the on-the-books and on-the-way controls identified in Step 5(e) above as measures being relied on for Ohio's LTS for the second implementation period have existing

emissions limitations and compliance schedules as applicable to the measure, with the exception of the measures for Miami Fort Power Station and Zimmer Power Station. As such, Ohio is requesting the DFFOs issued on July 9, 2021 (Appendix C) which establish an enforceable commitment for the permanent shut down of the coal-fired operations at the boilers at Miami Fort Power Station and Zimmer Power Station by no later than January 1, 2028 be approved into Ohio's SIP. As Ohio has determined that no other additional measures are necessary to make reasonable progress in the second implementation period, no other additional emissions limitations and compliance schedules are applicable.

6. Step 6: Regional scale modeling of the LTS to set the RPGs for 2028

Step 6 involves states with Class I areas conducting modeling to determine the visibility conditions in 2028 that will result from implementation of the LTS, in order to set Reasonable Progress Goals (RPGs) for 2028. This step is not applicable to Ohio, which does not contain any Class I areas.

7. Step 7: Progress, degradation, and URP glidepath checks

a) Checking for improvement in visibility on the 20 percent most impaired days; and checking for no visibility degradation on the 20 percent clearest days

Step 7(a) requires a comparison of the RPGs to the baseline period visibility conditions. This Step is not applicable to Ohio, which does not contain any Class I areas.

b) URP glidepath check

40 CFR 51.308(f)(3)(ii)(A) and (B) requires a state with sources that contribute to visibility impairment in a Class I area in another state to compare the RPG for the 20 percent most anthropogenically impaired days to the 2028 point on the URP glidepath. As shown in Table 1, both U.S. EPA's Regional Haze modeling[51] and LADCO's modeling show that visibility conditions in 2028 at each Class I area impacted by emissions from Ohio is projected to be below (or well below) the uniform rate of progress (URP) glidepath. Therefore, Ohio is not subject to the "robust demonstration" requirements that apply when the 2028 RPG is above the URP glidepath.

8. Step 8: Additional requirements for regional haze SIPs

a) Consultation and discussions with other parties

i) FLM Consultation

Coordination between states and federal land managers (FLMs) is required by 40 CFR 51.308(f)(2)(ii) and 40 CFR 51.308(i). Opportunities have been provided by LADCO for FLMs to review and comment on each of the technical documents developed by LADCO

[51] TSD Appendix B (https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf)

and referenced in this submittal. Ohio has provided agency contacts to the FLMs as required.

In development of this plan submittal, Ohio participated in an early engagement review process with the FLMs, including reviewing information provided by the FLMs as well as sharing drafts of the SIP for their review. On March 9, 2020, Ohio received, via an email from U.S. EPA Region 5, a list of sources that NPS recommends that LADCO states consider in their source selection process for the Regional Haze 4-factor analysis (Appendix K1). Additionally, on May 12, 2020, Donna Kenski with LADCO forwarded an email to all contacts in the LADCO Regional Haze Workgroup from Don Shepherd at NPS. The subject heading was: "my 'homework' from today's call." In the May 12, 2020 email, Don Shepherd sent "the NPS workbook that contains the lists of LADCO facilities that we suggests for 4-factor analyses (that we sent about a year ago.)" (Appendix K2). On October 2, 2020, Ohio received a list of recommended sources for four-factor analysis from the Forest Service (Appendix K3). On October 8, 2020, Ohio's provided a draft SIP describing Ohio's methodology for selecting sources for four-factor analysis and the results of that process along with our analysis and response for each facility identified by NPS and the Forest Service (Appendix K4). The majority of the sources recommended by the FLMs were evaluated by Ohio during our own Q/d analysis, as described in Step 3(h) above, and were not selected because they did not meet Ohio's selected threshold, or they permanently shut down, converted to natural gas, converted to limited use, auxiliary boilers, or are already effectively controlled.

However, while Ohio's primary approach was to consider each unit's separate contribution to visibility impairment, review of the NPS list which is based on a facility-wide contribution prompted Ohio to consider facility-wide contribution as an additional factor. Therefore, Ohio established secondary selection criteria at a facility-wide Q/d greater than 10, with the four-factor analysis to be performed for any units with Q/d greater than 4. This identified two additional units for consideration (Haverhill Coke Company unit P902 and Sammis unit B011), which were determined upon further evaluation to be effectively controlled and therefore was not selected, as described in more detail in Step 3(h) above.

In addition to the early engagement process, the FLMs were consulted as required under 40 CFR 51.308(i)(2). Ohio provided FLMs an opportunity for consultation, in person and at least 60 days prior to holding a public hearing on this plan submittal. During the consultation process, the FLMs were given the opportunity to address their:

- Assessment of the impairment of visibility in any Class I areas;
- Recommendations on the development of reasonable progress goals; and
- Recommendations on the development and implementation of strategies to address visibility impairment.

Ohio sent the draft plan to the FLMs for formal consultation on January 6, 2021. On February 10, 2021, Ohio received comments from the Forest Service (Appendices L1 and L2). On February 17, 2021, Ohio received comments from the NPS (Appendix L3). A

response to the FLM comments is available in Appendix L4. Ohio notified the FLMs of the public comment period and opportunity to request a public hearing.

Ohio will continue to coordinate and consult with the FLMs during the development of future progress reports and revisions of this plan, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas. This includes coordination with the FLMs during new source review (NSR) of sources that may impact Class I areas.

ii. Consultation with Other States/Tribes

Ohio is required by 40 CFR 51.308(f)(2)(ii) to consult with other states/tribes to develop coordinated emission strategies. This requirement applies both where emissions from the state are reasonably anticipated to contribute to visibility impairment in Class I areas outside the state and when emissions from other states/tribes are reasonably anticipated to contribute to visibility impairment in Class I areas within the state. Ohio consulted with other states and tribes by participation in the LADCO and inter-RPO processes that developed technical information necessary for development of coordinated strategies.

Ohio does not contain any Class I areas. Ohio, through LADCO, has consulted with the other States/Tribes to which Ohio may reasonably be anticipated to cause or contribute to visibility impairment in a Class I areas. Ohio is involved with monthly consultation calls with LADCO states, FLMs, and Region 5 EPA. Minutes from these calls are available upon request.

Documentation of specific consultations with other states and tribes is provided below.

August 25, 2017 MANE-VU ASK

On August 25, 2017, Ohio EPA received a “Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) States Concerning a Course of Action in Contributing States Located Upwind of MANE-VU Toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028)” (herein “2017 MANE-VU Ask”, Appendix M1). The 2017 MANE-VU Ask requested upwind states to adopt and implement several “emissions management” strategies to meet reasonable progress goals. MANE-VU’s analysis supporting this Ask was based on actual 2015 emissions for EGUs and 2011 for other emission sources. On December 20, 2017, LADCO provided comments indicating that LADCO did not agree with the impact assessment results drawn by MANE-VU and recommending MANU-VU improve their analysis by using emissions estimates that reflect the current state of knowledge (Appendix M2). On December 29, 2017, Ohio EPA provided information to correct data inaccuracies regarding Ohio sources (Appendix M3).

The 2017 MANE-VU Ask recommended states outside of the MANE-VU area consider the following “emissions management” strategies:

1. EGUs with a nameplate capacity larger than or equal to 25MW with already installed NOx and/or SO_2 controls - ensure the most effective use of control technologies on a year-round basis to consistently minimize emissions of haze precursors, or obtain equivalent alternative emission reductions;

2. Emission sources modeled by MANE-VU that have the potential for 3.0 Mm^{-1} or greater visibility impacts at any MANE-VU Class I area, as identified by MANE-VU contribution analyses (see attached listing) - perform a four-factor analysis for reasonable installation or upgrade to emission controls;

3. States should pursue an ultra-low sulfur fuel oil standard similar to the one adopted by MANE-VU states in 2007 as expeditiously as possible and before 2028, depending on supply availability, where the standards are as follows:
    a. distillate oil to 0.0015% sulfur by weight (15 ppm),
    b. #4 residual oil to 0.5% sulfur by weight,
    c. #6 residual oil to 0.5% sulfur by weight.

4. EGUs and other large point emission sources larger than 250 MMBTU per hour heat input that have switched operations to lower emitting fuels - pursue updating permits, enforceable agreements, and/or rules to lock-in lower emission rates for SO_2, NOx and PM. The permit, enforcement agreement, and/or rule can allow for suspension of the lower emission rate during natural gas curtailment;

5. Each State should consider and report in their SIP measures or programs to: a) decrease energy demand through the use of energy efficiency, and b) increase the use within their state of Combined Heat and Power (CHP) and other clean Distributed Generation technologies including fuel cells, wind, and solar.

Ohio's process for source selection and four-factor analyses essentially follows MANE-VU's first and second requests. As part of Ohio's process, described in Steps 3 and 4 above, larger sources with NOx and/or SO_2 controls were evaluated and determined to already be effectively controlled on a year-round basis, or four-factor analyses were performed to evaluate whether the existing controls could be upgraded or optimized. Four-factor analyses were performed for all of the specific sources in MANE-VU's second request (i.e. Avon Lake Power Plant and General James M. Gavin Power Plant), except for Muskingum River Power Plant which permanently shutdown in 2015.

Ohio considered MANE-VU's third request for an ultra-low sulfur fuel oil standard and does not find it necessary or appropriate at this time. Ohio does not believe that use of distillate oil, #4 residual oil or #6 residual oil comprise a significant portion of fuel usage in Ohio. Thus, establishing an ultra-low sulfur fuel standard would have little impact on visibility and further evaluating this potential control would not be an efficient use of state resources.

Regarding MANE-VU's fourth request for sources that have switched to lower emitting fuels, in most cases the fuel switch is already incorporated into federally-enforceable permits. However, Ohio does not agree that establishing lower emission rates commensurate with the fuel switch is either required or appropriate.

Regarding MANE-VU's fifth request for energy efficiency, CHP and other Distributed Generation technologies, Ohio is a fully deregulated energy market and relies on PJM Interconnection, LLC (PJM), the regional transmission organization (RTO) established by the Federal Energy Regulatory Commission (FERC), to ensure the adequate and efficient distribution of power in Ohio. Ohio EPA lacks the legislative authority to dictate energy policy, including the type of fuel used by a source and the order of distribution of electricity. Even if such measures were possible to be implemented by Ohio EPA, making such measures federally enforceable would severely limit the flexibility necessary to maintain electric reliability. Lastly, incorporating such measures into a SIP would severely and senselessly limit the ability of generators to apply emerging technologies in energy efficiency and renewable energy. While Ohio EPA lacks regulatory authority to establish federally enforceable measures in response to this Ask, Ohio EPA does encourage and promote energy efficiency, for example, through our Encouraging Environmental Excellence (E_3)[52] Program which recognizes organizations achievements in environmental stewardship.

June 22, 2020 VISTAS ASK

On June 22, 2020, VISTAS, on behalf of Alabama, Georgia, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia, requested that Ohio conduct a reasonable progress analysis for four Ohio sources that were identified by VISTAS to have an impact on visibility in Class I areas located in VISTAS states (Appendix N1). In this letter, it was also requested that if it is determined that a four-factor analysis is not warranted for one or more of the identified sources, rationale for this determination be provided. On October 29, 2020, Ohio responded indicating that each of the four sources meets U.S. EPA's guidance for effectively controlled, and therefore Ohio believes it is reasonable not to perform a four-factor analysis on these sources (Appendix N2).

iii. Consideration of Emissions Reductions Identified by Other States

40 CFR 51.308(f)(2)(ii)(B) requires the state to consider the emission reduction measures identified by other states for their sources as being necessary to make reasonable progress in the Class I area. The Regional Haze Guidance indicates "To give adequate consideration to this factor, a state must (1) consult with other contributing states to learn what measures they have identified as being necessary to make reasonable progress and then (2) consider those measures for any similar instate sources that it has already selected for analysis of control measures. This provision of the rule does not require the state to select additional sources for analysis of control measures if its source selection process is otherwise reasonable; however, a state should explain why its source selection process arrived at a different result. A state that has determined that certain measures

[52] https://www.epa.state.oh.us/ocapp/ohioe3

for its sources are or are not necessary to make reasonable progress will have developed technical analyses on costs and other factors that may be informative to other states. Such analyses could be shared and discussed during interstate consultation."

Review of currently available LADCO source apportionment modeling (Appendix A) shows that the other states with at least 2 percent contribution to Class I areas impacted by Ohio include: Indiana, Illinois, Michigan, Minnesota, Wisconsin, Iowa, and Missouri. In addition, the following regional areas were found to contribute at least 2 percent to Class I areas impacted by Ohio[53]: Northeast (MANE-VU: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland and Washington DC), Southeast (VISTAS: West Virginia, Kentucky, Virginia, North Carolina, South Carolina, Tennessee, Georgia, Alabama, Mississippi and Florida), CENSARA (Louisiana, Oklahoma, Kansas, Nebraska and Arkansas – not including Texas) and West (WRAP: New Mexico, Arizona, Colorado, Utah, Wyoming, Montana, Idaho, Washington, Oregon, California, Nevada, North Dakota and South Dakota).

Ohio reviewed the SIPs for these states and regions, where currently available, to ensure appropriate consideration was given to measures determined necessary by other states for similar types of sources as those selected by Ohio for four-factor analysis (that is, for EGUs and lime manufacturing plants). Final determinations were not yet available for most states and regions.

The states included in the "Northeast" group tagged by LADCO are represented by the MANE-VU[54] RPO. The control measures determined necessary by the MANE-VU states are detailed in the August 25, 2017 "Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action Within MANE-VU Toward Assuring Reasonable Progress for the Second Implementation Period (2018-2028)" (Appendix O). These measures include:

1. EGUs with a nameplate capacity larger than or equal to 25MW with already installed NOx and/or SO_2 controls: ensure the most effective use of control technologies on a year-round basis to consistently minimize emissions of haze precursors, or obtain equivalent alternative emission reductions;

2. Emission sources modeled by MANE-VU that have the potential for 3.0 Mm^{-1} or greater visibility impacts at any MANE-VU mandatory Class I Federal area, as identified by MANE-VU contribution analyses (see attached listing): perform a four-factor analysis for reasonable installation or upgrade to emission controls;

3. Each MANE-VU State that has not yet fully adopted an ultra-low sulfur fuel oil standard as requested by MANE-VU in 2007: pursue this standard as

[53] the LADCO source-apportionment modeling did not tag individual states in these regional areas, so the regional area as a whole is considered in this analysis
[54] https://otcair.org/manevu/index.asp

expeditiously as possible and before 2028, depending on supply availability, where the standards are as follows:

a. distillate oil to 0.0015% sulfur by weight (15 ppm),
b. #4 residual oil within a range of 0.25 to 0.5% sulfur by weight,
c. #6 residual oil within a range of 0.3 to 0.5% sulfur by weight.

4. EGUs and other large point emission sources larger than 250 MMBTU per hour heat input that have switched operations to lower emitting fuels: pursue updating permits, enforceable agreements, and/or rules to lock-in lower emission rates for SO_2, NOx and PM. The permit, enforcement agreement, and/or rule can allow for suspension of the lower emission rate during natural gas curtailment;

5. Where emission rules have not been adopted, control NOx emissions for peaking combustion turbines that have the potential to operate on high electric demand days by:
   a. Striving to meet NOx emissions standard of no greater than 25 ppm at 15% O_2 for natural gas and 42 ppm at 15% O_2 for fuel oil, but at a minimum meeting NOx emissions standard of no greater than 42 ppm at 15% O_2 for natural gas and 96 ppm at 15% O_2 for fuel oil; or,
   b. Performing a four-factor analysis for reasonable installation or upgrade to emission controls; or,
   c. Obtaining equivalent alternative emission reductions on high electric demand days.

6. Each State should consider and report in their SIP measures or programs to: a) decrease energy demand through the use of energy efficiency, and b) increase the use within their state of Combined Heat and Power (CHP) and other clean Distributed Generation technologies including fuel cells, wind, and solar.

All of these measures except number 5 are similar or identical to the requests included in the 2017 MANE-VU Ask for states outside of MANE-VU discussed in Step 8(a)(ii) above, and therefore have already been considered.

MANE-VU's necessary measure 5 for peaking combustion turbines is not applicable to the types of sources selected by Ohio for four-factor analysis. Through the Q/d process described in Step 3 above, Ohio focused on the sources with the greatest contribution to visibility impairment. While the process followed by Ohio did not result in the selection of peaking combustion turbines for four-factor analysis, Ohio considers our process to be reasonable and appropriate as described in Step 3. Nevertheless, Ohio has considered this measure and does not find it necessary for Ohio sources at this time.

<u>b) Progress report elements</u>

40 CFR 51.308(f)(5) requires the SIP for the second implementation period to address the requirements of 40 CFR 51.308 (g)(1) through (5), so that it will serve also as a

progress report addressing the period since submission of the progress report for the first implementation period. Ohio's first progress report for the first implementation period was submitted on March 11, 2016 and included inventories through 2011 for all sectors, and through 2014 for EGUs. Ohio also commits to submit a progress report for the second implementation period by January 31, 2025 in accordance with 40 CFR 51.308(f).

i. 40 CFR 51.308(g)(1) - Status of Control Strategies in the Regional Haze SIP

Ohio's Regional Haze SIP for the first implementation period concluded that "on-the-books" controls were sufficient to decrease the emissions of visibility-impairing pollutants and address Ohio's impact. As noted in the original SIP, the majority of visibility-impairing point source emissions in Ohio come from EGUs, and as a result the projected emissions developed for 2018 in the original SIP showed dramatic reductions due to the Clean Air Interstate Rule (CAIR). As such this rule and its successor, the Cross-State Air Pollution Rule (CSAPR), are discussed in the following section at length, with other on-the-books controls listed with some brief updates.

1. Clean Air Interstate Rule (CAIR) and the Cross-State Air Pollution Rule (CSAPR)

On March 10, 2005, the U.S. EPA announced CAIR, a rule that addresses the interstate transport of air pollution to downwind states. On February 1, 2008, U.S. EPA approved Ohio's CAIR program. Revisions to the CAIR SIP were again submitted by Ohio EPA on July 15, 2009. The revised CAIR SIP was approved as a direct final action on September 25, 2009 (74 FR 48857).

On July 11, 2008, the U.S. Court of Appeals for the D.C. Circuit vacated U.S. EPA's CAIR rule. However, on December 23, 2008, the U.S. Court of Appeals for D.C. Circuit issued a mandate deciding to remand CAIR back to U.S. EPA without vacatur. This decision allowed implementation of CAIR, and the benefit of CAIR emission reductions, while U.S. EPA worked to address the Court's prior opinions contained in the original vacatur and promulgate a replacement to the CAIR program.

On July 6, 2010, U.S. EPA proposed a replacement to the CAIR program (75 FR 45210). On July 6, 2011, CSAPR was finalized as this replacement to the CAIR program, requiring states to significantly improve air quality by reducing power plant emissions. On December 30, 2011, the U.S. Court of Appeals for the D.C. Circuit issued a decision staying CSAPR prior to its implementation. On August 21, 2012, the D.C. Circuit court decided to vacate CSAPR, but on April 29, 2014, the U.S. Supreme Court reversed this vacatur. Following this remand, U.S. EPA requested the CSAPR stay be lifted with the CSAPR compliance deadlines being extended by three years. This request was granted by the D.C. Circuit Court on October 23, 2014 with CSAPR Phase 1 implementation now scheduled for 2015 and Phase 2 beginning in 2017. With CAIR remaining in effect throughout this process, Ohio acted in accordance with the CAIR program, as determined by the Ohio Regional Haze SIP to produce reasonable progress in emissions reductions. Now, with CSAPR being implemented, Ohio has benefitted from even further reductions than those it would achieve under the CAIR program.

On November 16, 2015, U.S. EPA proposed an update to CSAPR that bring even greater reductions in NOx emissions (80 FR 75706, December 3, 2015). On September 7, 2016, the CSAPR Update was finalized (81 FR 74504). Implementation began in May 2017 and additional emissions reductions from EGUs continue.

2. Additional Control Strategies

Additional on-the-books control strategies identified in the Ohio Regional Haze SIP have further generated emissions reductions. These included:

On-Highway Mobile Sources

- Federal Motor Vehicle Emission Control Program, low-sulfur gasoline and ultra-low sulfur diesel fuel

  In February 2000, U.S. EPA finalized a federal rule to significantly reduce emissions from cars and light trucks, including sport utility vehicles (SUVs), referred to as the Tier II vehicle emission and fuel standards. Under this proposal, automakers will be required to sell cleaner cars, and refineries will be required to make cleaner, lower sulfur gasoline. This rule applied nationwide. The federal rules were phased in between 2004 and 2009. U.S. EPA has estimated that NO_x emission reductions were approximately 77% for passenger cars, 86% for smaller SUVs, light trucks, and minivans, and 65 to 95% reductions for larger SUVs, vans, and heavier trucks. Volatile organic compound (VOC) emission reductions were approximately 12% for passenger cars, 18% for smaller SUVs, light trucks, and minivans, and 15% for larger SUVs, vans, and heavier trucks.

  In March 2014, U.S. EPA finalized a federal rule to further strengthen Tier II vehicle emission and fuel standards. This rule will require automakers to produce cleaner vehicles and refineries to make cleaner, lower sulfur gasoline. This rule will be phased in between 2017 and 2025. Tier III requires all passenger vehicles to meet an average standard of 0.03 gram/mile of NOx. Compared to Tier II, the Tier III tailpipe standards for light-duty vehicles are expected to reduce NOx and VOC emissions by approximately 80%. Tier III vehicle standards also include evaporative standards using onboard diagnostics that will result in a 50% reduction in VOC emissions compared to Tier II reductions. The rule reduces the sulfur content of gasoline to 10 parts per million (ppm), beginning in January 2017.

- Inspection - maintenance (I/M) programs, including Ohio’s E-check program in northeast Ohio

  The U.S. EPA's final I/M regulations in 40 CFR Part 85 require the states to submit a fully adopted I/M program by November 15, 1993. U.S. EPA approved Ohio's enhanced I/M program (E-Check), on April 4, 1995 (60 FR 16989) and

January 6, 1997 (62 FR 646). Ohio's E-Check program has been implemented since 1996 and reduces VOCs that form ground-level ozone.

Off-Highway Mobile Sources

- Federal control programs (e.g., nonroad diesel rule), plus the evaporative Large Spark Ignition and Recreational Vehicle standards

  In May 2004, U.S. EPA issued the Clean Air Non-road Diesel Rule. This rule applies to diesel engines used in industries such as construction, agriculture, and mining. It also contains a cleaner fuel standard similar to the highway diesel program. The new standards cut emissions from non-road diesel engines by more than 90%. Non-road diesel equipment, as described in this rule, accounted for 47% of diesel particulate matter (PM) and 25% of NO_x from mobile sources nationwide. Sulfur levels were reduced in non-road diesel fuel by 99% from previous levels, from approximately 3,000 ppm to 15 ppm in 2009. New engine standards took effect, based on engine horsepower, starting in 2008.

  Effective in January 2003, the Non-road Spark-Ignition Engines and Recreational Engine Standards standard regulates NOx, VOCs, and carbon monoxide (CO) for groups of previously unregulated non-road engines. This standard applies to all new engines sold in the United States and imported after the standards went into effect. The standard applies to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain vehicles), and recreational marine diesel engines. When all of the non-road spark-ignition engines and recreational engine standards are fully implemented, an overall 80% reduction in NOx, 72% reduction in VOC, and 56% reduction in CO emissions are expected by 2020.

  On October 8, 2008, U.S. EPA set emission standards for new nonroad spark ignition engines. The exhaust emission standards applied starting in 2010 for new marine spark ignition engines, including first-time U.S. EPA standards for sterndrive and inboard engines. Exhaust emission standards also applied starting in 2011 and 2012 for different sizes of new land-based, spark-ignition engines at or below 19 kilowatts (kW). These small engines are used primarily in lawn and garden applications. U.S. EPA also adopted evaporative emission standards for vessels and equipment using any of these engines. U.S. EPA estimates that by 2030, this rule will reduce annual nationwide VOCs by 604,000 tons, NOx by 132,200 tons, and $PM_{2.5}$ by 5,500 tons.

- Heavy-duty diesel (2007) engine standard/Low sulfur fuel

  In July 2000, U.S. EPA issued a final rule for Highway Heavy Duty Engines, a program which includes low-sulfur diesel fuel standards, which was phased in

from 2004 through 2007. This rule applies to heavy-duty gasoline and diesel trucks and buses. This rule resulted in a 40% reduction in NO_x from diesel trucks and buses, a large sector of the mobile sources NO_x inventory.

- Federal railroad/locomotive standards

  In March 2008, U.S. EPA finalized a three part program that will dramatically reduce emissions from diesel locomotives of all types -- line-haul, switch, and passenger rail. The rule will cut PM emissions from these engines by as much as 90% and NOx emissions by as much as 80% when fully implemented. The standards are based on the application of high-efficiency catalytic after treatment technology for freshly manufactured engines built in 2015 and later.

  U.S. EPA standards also apply for existing locomotives when they are remanufactured. Requirements are also in place to reduce idling for new and remanufactured locomotives

  Emission standards and other requirements began reducing idle emissions as early as 2000. However, because it is common for locomotives to remain in service for as long as 50 years, the number of new ultralow-emission locomotives in a railroad's fleet will be small during the start of this program.

- Federal commercial marine vessel engine standards

  This new standard, effective in June 2010, promulgated more stringent exhaust emission standards for new large marine diesel engines with per-cylinder displacement at or above 30 liters (commonly referred to as Category 3 compression-ignition marine engines) as part of a coordinated strategy to address emissions from all ships that affect U.S. air quality. These emission standards are equivalent to those adopted in the amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL Annex VI). The emission standards apply in two stages: near-term standards, for newly built engines, which took effect in 2011 and long-term standards requiring an 80% reduction in NOx emissions that will begin in 2016.

  U.S. EPA is adopting changes to the diesel fuel program to allow for the production and sale of diesel fuel with up to 1,000 ppm sulfur for use in Category 3 marine vessels. The regulations generally forbid production and sale of fuels with more than 1,000 ppm sulfur for use in most U.S. waters unless operators achieve equivalent emission reductions in other ways.

  U.S. EPA is also adopting provisions to apply some emission and fuel standards to foreign flagged and in-use vessels that are covered by MARPOL Annex VI. When this strategy is fully implemented in 2030, U.S. EPA estimates that NOx and $PM_{2.5}$ emissions in the U.S. will be reduced by approximately 1.2 million tpy and 143,000 tpy, respectively.

Area Sources

- Consumer solvents

  Ohio's consumer products rules[55] became effective September 15, 2007. The rules specify reductions in VOCs required for any person who sells, supplies, offers for sale, or manufactures consumer products on or after January 1, 2009, for use in the state of Ohio.

- AIM coatings

  Ohio's Architectural and Industrial Maintenance coatings rules[56] became effective September 21, 2007. The rules specify reductions in VOCs required for any person who supplies, sells, offers for sale, or manufacturers any AIM coating for use within the state of Ohio, as well as any person who applies or solicits the application of any AIM coating within the state of Ohio, on or after January 1, 2009.

- Aerosol coatings

  On March 24, 2008 (73 FR 15604) U.S. EPA promulgated national emission standards for the aerosol coatings (aerosol spray paints) category under CAA section 183(e). This regulation established nationwide reactivity-based standards for aerosol coatings controlling contributions to ozone formation by encouraging the use of less reactive VOC ingredients. U.S. EPA estimates that this rule will reduce nationwide emissions of VOC by 19.4% from the 1990 baseline level.

  On November 7, 2008 (73 FR 66184), U.S. EPA promulgated regulations moving the compliance date from January 1, 2009 to July 1, 2009.

- Portable fuel containers

  Ohio's portable fuel container rules[57] became effective February 10, 2006[58]. This rule reduces VOC emissions by requiring any portable fuel containers or spouts sold, supplied, offered for sale, or manufactured for sale in Ohio on or after July 1, 2007 to be certified by the California air resources board (CARB) (or equivalent).

Power Plants

- Title IV (Phases I and II)

[55] http://www.epa.ohio.gov/dapc/regs/3745_112.aspx
[56] http://www.epa.ohio.gov/dapc/regs/3745_113.aspx
[57] http://www.epa.ohio.gov/dapc/regs/3745_113.aspx
[58] http://www.epa.ohio.gov/portals/27/regs/3745-21/3745-21-17_Final.pdf

The Acid Rain Program (ARP), established under Title IV of the 1990 CAA Amendments[59] requires major emission reductions of SO_2 and NO_x, the primary precursors of acid rain, from the power sector. The SO_2 program sets a permanent cap on the total amount of SO_2 that may be emitted by electric generating units (EGUs). The program was phased in, with the final 2010 SO_2 cap set at 8.95 million tons, a level of about one-half of the emissions from the power sector in 1980. NO_x reductions under the ARP are achieved through a program that applies to a subset of coal-fired EGUs and is closer to a traditional, rate-based regulatory system. Since the program began in 1995, the ARP has achieved significant emission reductions and continues to limit emissions of NOx and SO_2.

- NOx SIP Call

  On October 27, 1998, U.S. EPA promulgated the NO_x SIP Call requiring 22 states to pass rules that would result in significant emission reductions from large EGUs, industrial boilers, and cement kilns in the eastern United States. Ohio promulgated this rule in 2001. NOx SIP Call requirements are incorporated into permits along with monitoring, recordkeeping, and reporting necessary to ensure ongoing compliance. Compliance is tracked through the Clean Air Markets data monitoring program. Beginning in 2004, this rule accounts for a reduction of approximately 31% of all NO_x emissions statewide compared to previous uncontrolled years. The other 21 states also have adopted these rules. As discussed in detail below, U.S. EPA subsequently replaced the NOx SIP Call with CAIR and CSAPR. CSAPR continue to be implemented and amounts to even further reductions than that realized under the NOx SIP Call.

- CAIR and CSAPR

  CAIR and CSAPR are discussed at length above, and any changes in implementation and promulgation of rules related to emissions from power plants will continue to produce further reductions in emissions, as discussed previously.

Other Point Sources

- VOC 2-, 4-, 7-, and 10-year MACT standards

  U.S. EPA has promulgated and revised numerous Maximum Achievable Control Technology (MACT) standards that reduce VOC emissions and continue to be implemented.[60]

[59] http://www.epa.gov/airmarkets/acid-rain-program-laws-and-regulations
[60] http://www3.epa.gov/ttn/atw/eparules.html

- Combustion turbine MACT

  On March 5, 2004, U.S. EPA issued requirements to reduce VOC emissions from stationary combustion turbines. These requirements apply to turbines used at facilities such as power plants, chemical and manufacturing plants, and pipeline compressor stations. This rule limits the amount of air pollution that may be released from exhaust stacks of any new stationary combustion turbine (built after January 14, 2003).

  On April 7, 2004 (68 FR 18338), U.S. EPA proposed a rule to amend the list of categories of sources that was developed pursuant to CAA section 112(c)(1) (69 FR 18327). U.S. EPA proposed to delete four subcategories from the Stationary Combustion Turbines source category. The subcategories proposed for delisting, as defined in 40 CFR 63.6175, are: (1) lean premix gas-fired stationary combustion turbines (also referred to herein as ‘‘lean premix gas-fired turbines’’), (2) diffusion flame gas-fired stationary combustion turbines (also referred to herein as ‘‘diffusion flame gas-fired turbines’’), (3) emergency stationary combustion turbines, and 4) stationary combustion turbines located on the North Slope of Alaska.

  Effective August 18, 2004 (80 FR 51184), U.S. EPA stayed the effectiveness of two subcategories of stationary combustion turbines: lean premix gas-fired turbines and diffusion flame gas-fired turbines. Pending the outcome of U.S. EPA's proposal to delete these subcategories from the source category list, U.S. EPA stayed the effectiveness of the emissions and operating limitations in the stationary combustion turbines NESHAP for new sources in the lean premix gas-fired turbines and diffusion flame gas-fired turbines subcategories. This action was necessary to avoid wasteful and unwarranted expenditures on installation of emission controls which will not be required if the subcategories are delisted. Without a stay, all turbines in the lean premix gas-fired turbine and the diffusion flame gas-fired turbine subcategories which were constructed or reconstructed after January 14, 2003, would have been required to comply immediately with the emission standards for new sources.

3. Review of BART Determination

It was shown in the Ohio Regional Haze SIP for the first implementation period, that one facility, P.H. Glatfelter Company in Chillicothe, had two boilers which were the only non-EGU “subject-to-BART” sources in Ohio. This analysis and determination is discussed at length in the Ohio Regional Haze SIP as revised August 2015, section 8.2[61]. As discussed in the SIP, Glatfelter elected to implement an alternative program to BART as allowed under 40 CFR 51.308(e)(2). It was decided that these alternative measures would achieve greater emissions reductions than would be achieved through the installation and operation of BART. As Glatfelter was also subject to Industrial Boiler Maximum Achievable Control Technology (MACT) requirements, the two compliance dates were

[61] https://epa.ohio.gov/Portals/27/sip/regional/Regional_Haze_SIP_2015-FINAL.pdf

intentionally coordinated in order that Glatfelter would be able to select and implement a control strategy that would address both the MACT and BART together. As such, Glatfelter's compliance date for BART implementation was extended to be no later than January 31, 2017, which was still within the appropriate range of 5 years after approval of the implementation plan revision (July 2, 2017), as allowed by U.S. EPA's regulations (40 CFR 51.308(308)(1)(iv)). In November 2016, Glatfelter (now Pixelle Specialty Solutions) converted its two coal-fired boilers to natural gas. This change brings even further reductions than required as part of the BART compliance.

4. Reasonable Progress Determination for First Implementation Period

Ohio does not have any Class I areas for which to assess reasonable progress. However, Ohio is required to address Regional Haze in each mandatory Class I federal area located outside Ohio which may be affected by emissions from within Ohio. The following Class I areas were identified in the original SIP as being impacted by Ohio:

- Caney Creek Wilderness Area (Arkansas)
- Upper Buffalo Wilderness Area (Arkansas)
- Great Gulf Wilderness Area (New Hampshire)
- Pres. Range-Dry River Wilderness Area (New Hampshire)
- Brigantine Wilderness Area (New Jersey)
- Great Smoky Mountains National Park (North Carolina, Tennessee)
- Mammoth Cave National Park (Kentucky)
- Acadia National Park (Maine)
- Moosehorn Wilderness Area (Maine)
- Seney Wilderness Area (Michigan)
- Hercules-Glades Wilderness Area (Missouri)
- Mingo Wilderness Area (Missouri)
- Lye Brook Wilderness (Vermont)
- James River Face Wilderness (Virginia)
- Shenandoah National Park (Virginia)
- Dolly Sods/Otter Creek Wilderness (West Virginia)

Ohio determined in its original SIP, based on modeling assessments performed by LADCO and in consultation with other states and RPOs, that on-the-books controls by Ohio constitute Ohio's fair share of emission reductions at all Class I areas at which emissions from Ohio contribute. Ohio maintains that complying with these on-the-books controls constitutes Ohio's fair share towards reasonable progress in Class I areas at present. In addition, Ohio implementation of stricter controls than were in existence at the time of the original SIP led to greater emissions reductions than anticipated, including the greater-than BART reductions at Glatfelter (now Pixelle Specialty Solutions), as well as the implementation of CSAPR. Furthermore, Ohio anticipates implementation of the Revised CSAPR Update will lead to even greater emissions reductions in the future.

As part of Ohio's consultation with the Mid-Atlantic/Northeast Visibility Union (MANE-VU), MANE-VU requested that states outside of the MANE-VU area examine controls for

specific types of sources and suggested various control strategies to be adopted and implemented, as detailed in the Ohio Regional Haze SIP. As indicated in the SIP, MANE-VU identified sources which contributed to visibility impairment based on 2002 emissions and plans were outlined for many Ohio units identified that already had, or were planning to, implement controls. Presently, all but one source have post-combustion emission control for SO_2 emissions. As a result of this progress in SO_2 control implementation, and the findings in this progress report, Ohio reiterates its belief that on-the-books controls represent reasonable progress in regards to the requests of MANE-VU. Consultation with all other RPOs in the original SIP resulted in agreement that on-the-books controls constitute reasonable progress for Ohio's fair share of emission reductions.

Ohio did receive one request from a state or Regional Planning Organization for Ohio emissions reductions to improve visibility. MANE-VU's document entitled "Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas - Methodology for Source Selection, Evaluation of Control Options, and Four Factor Analysis, July 2007[62]" requests states outside of the MANE-VU area to examine controls for specific types of sources (i.e., "2007 MANE-VU Ask"). MANE-VU suggested the following control strategies be adopted and implemented:

- Application of BART.
- 90% (or greater) reduction in SO_2 emissions from each of the EGU stacks on MANE-VU's list of 167 stacks (located in 19 states), which reflect those stacks determined to be reasonably anticipated to cause or contribute to visibility impairment in the MANE-VU Class I areas.
- 28% reduction in non-EGU (point, area, on-road, and off-road) SO_2 emissions relative to on-the-books, on-the-way 2018 projections.
- Continued evaluation of other measures, including measures to reduce SO_2 and NO_x emissions from coal-burning facilities and promulgation of new source performance standards for wood combustion.
- Further reduction in power plant SO_2 (and NOx) emissions beyond CAIR

Ohio's Regional Haze SIP stated of the 167 stacks identified by MANE-VU based on 2002 emissions, 28 were from 14 sources in Ohio. Ohio noted that most of these stacks had or would have post-combustion emission controls for SO_2 emissions (i.e., scrubbers) that would provide for further reductions in emissions from these Ohio sources compared to the 2002 emissions used by MANE-VU to develop this list.

Ohio's Regional Haze SIP provided additional information relevant since the 2002 inventory:

[62] http://www.marama.org/technical-center/regional-haze-planning/reasonable-progress-analysis, under "Work Products." The resulting request is referred to as the "MANE-VU Ask."

- The seven units (4 -185 MW; 300 MW; 2-600 MW) (identified as five stacks by MANE-VU) at First Energy W. H. Sammis facility began continuous operation of scrubbers in 2010.

- Two (600 MW each) of the three units at AEP Cardinal were operating scrubbers by the end of 2007 or early 2008. The third unit's (630 MW) scrubber is currently under construction but required by Consent Decree to continuously operate by 2012

- AEP Muskingum currently has five units identified as two stacks by MANE-VU. The largest of five units (2-205 MW; 2-250 MW; 600 MW) at AEP Muskingum is required by Consent Decree to install and continuously operate a scrubber by 2016.

- The four units (573 MW each) at the Dayton P&L JM Stuart facility have installed and operated scrubbers continuously since spring of 2008.

- The unit (587 MW) at Dayton P&L Killen facility has installed and operated its scrubber since June 2007.

- In 2006, two of the units (each 125 MW) at AEP Conesville, and identified on MANE-VU's list, shut down (they comprised one stack). The second stack, comprised of one unit (800 MW), completed construction and began operating its scrubber in June 2009.

- Duke Miami Fort had five units in operation. In 2007, two of these units shut down. Of the remaining three units, two units (490 MW each) began operating scrubbers in 2007; and for the third (smallest at163 MW), Duke has indicated no immediate plans to install a scrubber.

- First Energy Burger has three units. Two units (156 MW each) will shut down by no later than 2012. For the third (smallest at 94 MW), First Energy has indicated no immediate plans to install a scrubber.

- OVEC Kyger Creek has five units (217 MW each)(identified as one stack by MANE-VU). All units are planned to have scrubbers installed and operating by mid-2012.

Since Ohio's Regional Haze SIP submittal for the first implementation period, the following are additional updates relevant to these sources:

- The third AEP Cardinal unit began operating its scrubber in December of 2012.

- AEP Muskingum permanently shut down all units by June of 2015.

- The only unit remaining at the Duke Miami Fort facility that did not have a scrubber permanently shut down in June of 2015.

- The two units planned for shut down by 2012 at the First Energy Burger facility (by 2012) permanently shut down in December of 2010. The facility permanently shut down on January 31, 2016.

- The five units at OVEC Kyger Creek began operating scrubbers by February 2012.

- All units at the Richard Gorsuch facility permanently shut down in November of 2010.

- All units at the Walter C. Beckjord facility permanently shut down in October of 2014.

- All units at the Eastlake facility permanently shut down in April of 2015.

- Four units at W. H. Sammis permanently shut down on May 31, 2020.

- All units at the J.M. Stuart and Killen facilities permanently shut down on June 1, 2018.

- One unit at the Conesville Power Plant permanently shut down on May 31, 2019 and the remaining two units permanently shut down on May 31, 2020.

- Miami Fort and Zimmer Power Station are planning to permanently shut down in 2027.

Therefore, Ohio continues to believe our utilities have made significant progress in installing SO_2 controls as requested under MANE-VU's Ask.

ii. 40 CFR 51.308(g)(2) - Emissions Reductions from Regional Haze SIP Strategies

The most significant emissions reductions from SIP strategies are reductions in NOx and SO_2 from EGUs as a result of CAIR/CSAPR. As can be seen in Figure 1, SO_2 has dramatically decreased from 1,085,485 TPY in 2005 to 68,905 TPY in 2019 as a result of CAIR/CSAPR and other control strategies implemented. This represents a 94% decrease in SO_2 emissions from EGUs over that time period. As shown in Figure 2, NOx emissions have also decreased substantially from the EGU sector, falling from 255,000 TPY in 2005 to 40,493 TPY in 2019. This represents an 84% decrease. Data for the SO_2 and NOx emissions from 2005 to 2019 were obtained from the U.S. EPA Clean Air Markets Division (CAMD)[63].

[63] https://ampd.epa.gov/ampd/

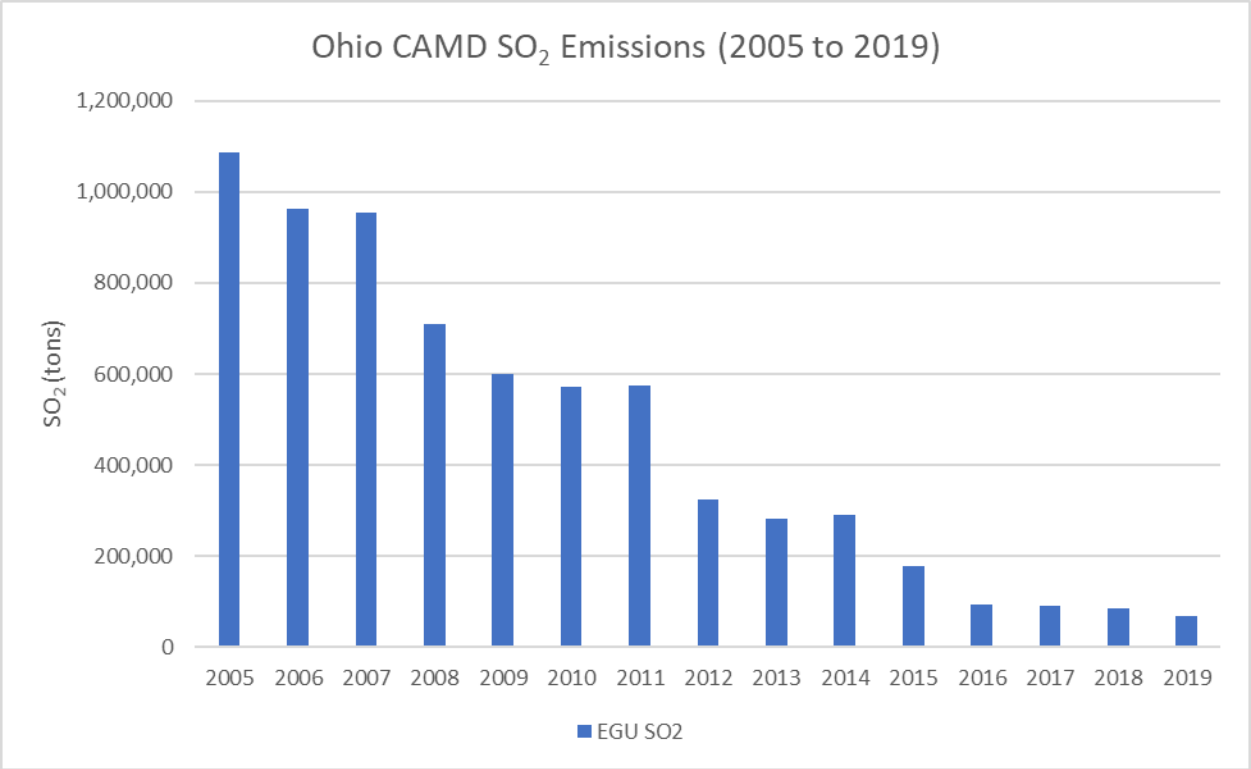

Figure 1. Ohio CAMD SO_2 Emissions (2005 to 2019)

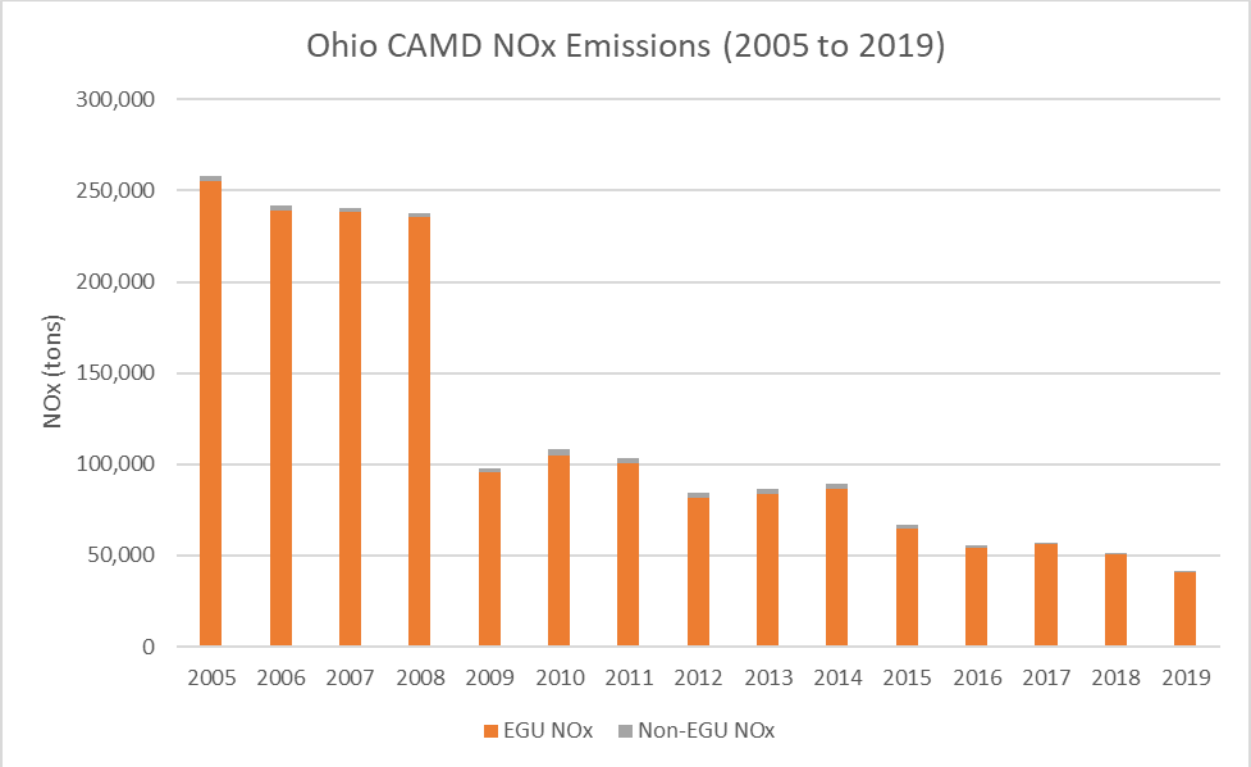

Figure 2. Ohio CAMD NOx Emissions (2005 to 2019)

The EGU sector was the highest contributor of SO_2 in the 2005 base year inventory by at least an order of magnitude, comprising 89% of total SO_2 emissions. The EGU sector was the second highest contributor in the 2005 inventory, comprising 34% of total NOx emissions. Given the magnitude of the emissions of these pollutants and their substantial contribution to visibility impairment, these reductions from EGUs represent large decreases in Ohio's contribution to visibility impairment at the Class I areas it affects.

iii. 40 CFR 51.308(g)(3) - Visibility Progress

There are no Class I areas within the State of Ohio; therefore, the Ohio Regional Haze SIP is concerned only with the contribution of Ohio's emissions to Class I areas in other states and has no assessment of visibility conditions and changes in Class I areas.

iv. 40 CFR 51.308(g)(4) - Emissions Progress

40 CFR 51.308(g)(4) requires the progress report to include an analysis tracking the change in emissions since the period addressed in the most recent plan. In the Ohio Regional Haze SIP for the first implementation period, Ohio presented its 2005 "Base M" inventory developed by LADCO. This inventory is presented here in Table 19.

Table 19. Ohio 2005 emissions inventory (first implementation period)

Ohio 2005 Emissions Summary, by Source Category and Pollutant (TPY)						
Source Category	VOC	NOX	PM25-PRI	PM10-PRI	NH3	SO2
EGU Point	1,354	255,556	9,158	17,324	107	1,100,511
Non-EGU Point	27,848	66,229	9,920	15,012	3,175	115,547
Non-Road	89,584	85,887	7,384	7,719	77	8,747
Other	226,910	39,582	16,708	16,764	109,047	5,632
MAR	2,706	47,021	1,452	1,634	27	4,687
On-Road	171,331	259,299	4,735	6,797	11,381	6,290
Total	519,733	753,574	49,357	65,250	123,814	1,241,414

40 CFR 51.308(g)(4) requires that the analysis must extend at least through the most recent NEI year. Therefore, 2017 emissions obtained from the 2017 NEI[64] are provided in Table 20 below. 40 CFR 51.308(g)(4) further requires for sources that directly report to a centralized emissions data system operated by U.S. EPA, the analysis extend through the most recent year available. Data through 2019 from CAMD is available in Figures 1 and 2 above.

[64] https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data

Table 20. Ohio 2017 emissions inventory

Ohio 2017 Emissions Summary, by Source Category and Pollutant (TPY)						
Source Category	VOC	NOX	PM25-PRI	PM10-PRI	NH3	SO2
EGU Point	1,029	58,124	7,358	8,845	572	93,106
Non-EGU Point	28,883	44,976	11,109	13,652	2,771	26,085
Non-Road	35,981	38,824	3,536	3,715	71	97
Other	215,808	22,111	28,814	36,500	84,747	3,613
MAR	2,296	29,007	988	1,062	16	358
On-Road	64,888	133,353	4,447	9,570	3,606	794
Total	348,885	326,395	56,252	73,344	91,783	124,053
Dust			*30,309*	*190,886*		
Total including Dust	*348,885*	*326,395*	*86,561*	*264,230*	*91,783*	*124,053*

The 2005 inventory provided in the SIP during the first implementation period did not include fugitive dust. For the purposes of providing a complete inventory for 2017 while maintaining consistency between sources categories included in the 2005 inventory, dust has been included in the 2017 inventory as a separate source category.

In addition, there were several important changes in methodologies for estimating emissions between the 2005 and 2017 inventories, and therefore these inventories aren't readily comparable. 40 CFR 51.308(g)(4) states that "the State is not required to backcast previously reported emissions to be consistent with more recent emissions estimation procedures, and may draw attention to actual or possible inconsistencies created by changes in estimation procedures". Specifically, these inconsistencies include changes in the reporting of the condensable portion of PM emissions, changes in the model used for onroad and nonroad emissions, and other changes in methodologies.

Concerning PM emissions, the $PM_{2.5}$ and PM_{10} values presented in the 2005 inventory represent only the filterable portion of PM emissions as submitted by Ohio. Ohio EPA did not have a consistent reporting requirement at that time, so data from years such as 2005 generally contain only particulate fraction emissions for PM, but likely a slightly inflated value of particulate fraction emissions which includes some amount of condensable particulate emissions that couldn't be properly distinguished at that time. The 2017 inventory was developed using improved methodologies which more accurately account for condensable PM emissions. Thus, the apparent increase in PM emissions between 2005 and 2017 is not a true representation of the change in emissions.

Concerning on-road emissions, U.S. EPA has replaced the MOBILE6 model with the MOVES model as its official model for estimating emissions from cars, trucks and motorcycles. The 2005 inventory was constructed when MOBILE6 was still the official model for on-road emissions, but the 2017 on-road emissions have been calculated using MOVES2014b. As such, the results are not directly comparable for the purpose of tracking emissions changes.

U.S. EPA's TSD for the 2017 NEI[65] states "The current version of MOVES also calculates nonroad equipment emissions, adding VOCs and toxics, updating the gasoline fuels used for nonroad equipment to be consistent with those used for onroad vehicles. These changes in MOVES lead to a small increase in nonroad NOx emissions in some locations, introducing additional uncertainty when comparing 2017 NEI to past inventories. Other significant emissions sectors have also had improvements and, therefore, trends are also impacted by inconsistent methods. Examples include paved and unpaved road PM emissions, ammonia fertilizer and animal waste emissions, oil and gas production, residential wood combustion, solvents, industrial and commercial/institutional fuel combustion and commercial marine vessel emissions."

While comparisons between 2005 and 2017 emissions are presented in Table 21 below for the purpose of showing a general picture of the changes in emissions which impact visibility, care should be taken to understand that these specific inventories are not directly comparable due to changes and improvements in methodologies for estimating emissions over time.

[65] https://www.epa.gov/sites/production/files/2020-04/documents/nei2017_tsd_full_30apr2020.pdf

Table 21. Changes in Ohio Emissions by Source Category and Pollutant, 2005 to 2017 (top to bottom: VOC, NOx, $PM_{2.5}$, PM_{10}, NH_3, SO_2)

VOC Emissions Comparison (2005 to 2017)				
	Emissions (TPY)		Change 2005 to 2017	
Source Category	2005	2017	TPY	%
EGU Point	1,354	1,029	-325	-24%
Non-EGU Point	27,848	28,883	1,035	4%
Non-Road	89,584	35,981	-53,603	-60%
Other	226,910	215,808	-11,102	-5%
MAR	2,706	2,296	-410	-15%
On-Road	171,331	64,888	-106,443	-62%
Total	519,733	348,885	-170,848	-33%

NOx Emissions Comparison (2005 to 2017)				
	Emissions (TPY)		Change 2005 to 2017	
Source Category	2005	2017	TPY	%
EGU Point	255,556	58,124	-197,432	-77%
Non-EGU Point	66,229	44,976	-21,253	-32%
Non-Road	85,887	38,824	-47,063	-55%
Other	39,582	22,111	-17,471	-44%
MAR	47,021	29,007	-18,014	-38%
On-Road	259,299	133,353	-125,946	-49%
Total	753,574	326,395	-427,179	-57%

PM25-PRI Emissions Comparison (2005 to 2017)				
	Emissions (TPY)		Change 2005 to 2017	
Source Category	2005	2017	TPY	%
EGU Point	9,158	7,358	-1,800	-20%
Non-EGU Point	9,920	11,109	1,189	12%
Non-Road	7,384	3,536	-3,848	-52%
Other	16,708	28,814	12,106	72%
MAR	1,452	988	-464	-32%
On-Road	4,735	4,447	-288	-6%
Total	49,357	56,252	6,895	14%

PM10-PRI Emissions Comparison (2005 to 2017)				
	Emissions (TPY)		Change 2005 to 2017	
Source Category	2005	2017	TPY	%
EGU Point	17,324	8,845	-8,479	-49%
Non-EGU Point	15,012	13,652	-1,360	-9%
Non-Road	7,719	3,715	-4,004	-52%
Other	16,764	36,500	19,736	118%
MAR	1,634	1,062	-572	-35%
On-Road	6,797	9,570	2,773	41%
Total	65,250	73,344	8,094	12%

NH3 Emissions Comparison (2005 to 2017)				
	Emissions (TPY)		Change 2005 to 2017	
Source Category	2005	2017	TPY	%
EGU Point	107	572	465	435%
Non-EGU Point	3,175	2,771	-404	-13%
Non-Road	77	71	-6	-8%
Other	109,047	84,747	-24,300	-22%
MAR	27	16	-11	-41%
On-Road	11,381	3,606	-7,775	-68%
Total	123,814	91,783	-32,031	-26%

SO2 Emissions Comparison (2005 to 2017)				
	Emissions (TPY)		Change 2005 to 2017	
Source Category	2005	2017	TPY	%
EGU Point	1,100,511	93,106	-1,007,405	-92%
Non-EGU Point	115,547	26,085	-89,462	-77%
Non-Road	8,747	97	-8,650	-99%
Other	5,632	3,613	-2,019	-36%
MAR	4,687	358	-4,329	-92%
On-Road	6,290	794	-5,496	-87%
Total	1,241,414	124,053	-1,117,361	-90%

Significant reductions have been made especially for SO_2 and NOx emissions, which are the most important when considering visibility impairment, with an overall reduction of 90% and 57%, respectively. Reductions in VOC and ammonia emissions, which are less impactful on visibility, are at 33% and 26% and represent significant progress. As discussed above, inconsistencies in PM reporting and changes in modeling of mobile emissions make a direct comparison between 2005 and 2017 inaccurate; therefore, the apparent increase in $PM_{2.5}$ and PM_{10} emissions is likely due to changes in the methodologies.

Finally, while EGU ammonia emissions appear to have increased significantly, these increases are due to changes in estimation methodologies at a few select facilities which

Ohio expects may be erroneous and is investigating further. Regardless, while these changes appear to be significant from a relative standpoint, the overall magnitude of the emissions and the contribution of EGU ammonia emissions to visibility impairment is low. Therefore, this change even if accurate is not significant.

iv. 40 CFR 51.308(g)(5) Assessment of Changes Impeding Visibility Progress

Ohio EPA believes that no changes in anthropogenic emissions within or outside Ohio have occurred since 2005 to limit or impede progress in reducing pollutant emissions in Ohio. As previously discussed, many changes occurred in the process of CSAPR replacing CAIR. However, these changes, as well as additional legislation and measures not directly for the purpose of improving visibility impairment, will only act as an additional benefit by producing even more reductions on visibility impairing pollutants than previously anticipated. As shown above, good progress is being made in reducing emissions of visibility-impairing pollutants and changes that are being made or have been made should only serve to reduce emissions even further than anticipated.

c) Monitoring strategy and other elements

i. Monitoring strategy

40 CFR 51.308(f)(6) requires a monitoring strategy for measuring, characterizing, and reporting regional haze visibility impairment that is representative of all mandatory Class I areas within the State. Ohio does not have any mandatory Class I areas.

Ohio is required by 40 CFR 51.308(f)(6)(iii) to identify procedures by which monitoring data and other information are used in determining the contribution of emissions from within Ohio to visibility impairment at Class I areas in other states.

The monitoring strategy relies in part upon participation in the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. The IMPROVE website is located at http://vista.cira.colostate.edu/improve/. Ohio also runs a large monitoring network of U.S. EPA-approved monitors for ozone and $PM_{2.5}$. Data from these monitors is used for a variety of reasons, including SIP development. Ohio is continually reviewing monitoring data as part of the SIP process.

For regional haze, monitoring data were analyzed to produce a conceptual understanding of the air quality problems and were used in the LADCO modeling (Appendix A) and U.S. EPA Regional Haze modeling[66] to project visibility conditions in 2028 at each Class I area.

ii. Preparation of emission inventories

The Regional Haze Guidance indicates that the requirement in 40 CFR 51.308(f)(6)(v) is to provide for the preparation of emission inventories, but the inventories themselves are not required to be submitted and are not subject to U.S. EPA review. In addition, the

[66] https://www.epa.gov/sites/production/files/2019-10/documents/updated_2028_regional_haze_modeling-tsd-2019_0.pdf

Regional Haze Guidance notes that SIPs for the second (and later) implementation period do not need to provide for a statewide inventory for a baseline year, because SIPs for the first implementation period provided for that one-time inventory.

Ohio complies with the Air Emissions Reporting Requirements in 40 CFR Part 51 Subpart A, which satisfies the requirement to provide for an emissions inventory for the most recent year for which data are available. Estimates of future projected emissions are developed through the LADCO regional planning process for use in establishing RPGs for Class I areas in the LADCO region.

IV. Public Participation

Ohio published notification for the public comment period and public hearing concerning the Regional Haze SIP for the second implementation period on Ohio EPA's website on May 10, 2021. The comment period and public hearing was also noticed in Ohio's Weekly Review and interested parties were notified via electronic mailing lists. On May 21, 2021, Ohio EPA extended the comment period by two weeks to June 28, 2021.

No comments were received during the public hearing, which was held on June 14, 2021. The public comment period closed on June 28, 2021. Appendix P includes a copy of the public notice, records from the public hearing, and a response to comments document.

V. Conclusion

Ohio has carefully considered the four statutory factors and anticipated visibility benefits, along with the overall progress in the Regional Haze program.

Using Q/d analysis as our source selection methodology, Ohio selected 38 units at 16 facilities sources for initial screening. This represents 73% of the total Q/d for all sources analyzed and 68% of total emissions analyzed. Ohio then refined the list by considering whether the source has permanently shut down, has an enforceable commitment to shut down by no later than 2028, converted to natural gas, converted to limited use, auxiliary boilers, or is already effectively controlled such that it is reasonable to assume that a full four-factor analysis would likely result in the conclusion that no further controls are necessary.

Four sources were selected for four-factor analysis: Avon Lake Power Plant, Carmeuse Lime - Maple Grove, Dover Municipal Light, and Gavin Power Plant. The cost effectiveness for additional controls considered ranges from $2,985 to $26,700, and the cost/sales ratio is well above the 3% threshold typically considered by U.S. EPA to pose a potentially significant economic burden. In addition, significant energy and solid waste impacts are associated with controls including increased power usage and increased generation of solid waste and waste water. Ohio also considered the potential visibility benefits. Ohio's analysis shows the maximum estimated visibility benefit at a Class I area of any of the new additional controls evaluated under the four-factor analysis is 0.246 Mm^{-1}, and the maximum estimated cumulative visibility benefit when considering the benefit

across all Class I areas is 1.391 Mm^{-1}. Ohio found that potential additional controls are not cost-effective or affordable, have significant energy and non-air quality environmental impacts, and provide minimal estimated visibility benefit.

All Class I areas impacted by sources in Ohio have made steady and significant improvement in visibility, and modeling shows they are projected to be below, or well below, their URP glidepaths in 2028. Trends show huge reductions in both NOx and SO_2 emissions. Additional emissions reductions are expected from the Revised CSAPR Update and permanent shutdown of coal-fired boilers at Miami Fort Power Station and Zimmer Power Station. Given all of these factors, Ohio concludes that on-the-books and on-the-way controls are more than sufficient to achieve reasonable progress goals, and no additional measures are necessary to make reasonable progress in the second implementation period.

Ohio's LTS is relying on the following on-the-books and on-the-way controls as the control measures measures necessary to make reasonable progress during the second implementation period.

<u>On-the-books controls</u>

On-the-books controls implemented since the time of the original SIP for the first implementation period, as submitted in December 2008 and revised in March 2011 and August 2015 (each described in additional detail in Step 3(e)(5) above):

- Permanent shutdown of sources (including but not limited to Conesville Power Plant units B004, B007 and B008; DP&L JM Stuart units B001-B004; DP&L JM Killen unit B001; and WH Sammis Plant B007-B010)
- Reciprocating Internal Combustion Engines (RICE) NESHAPs
- Control of Hazardous Air Pollutants from Mobile Sources
- Mercury and Air Toxic Standards (MATS)
- Oil and Natural Gas Industry Standards
- NO_x Emission Standard for New Commercial Aircraft Engines
- Area Source Boilers, Major Source Boilers and Commercial/Industrial Solid Waste Incinerators (CISWI) NESHAPs
- NSPS for Residential Wood Heaters
- SO_2 Data Requirements Rule
- Ohio's Beneficiary Mitigation Plan for the Volkswagen settlement

<u>On-the-way controls</u>

Additional emissions reductions are expected in the future (each described in additional detail in in Step 3(e)(5) above):

- Revised CSAPR Update
- Permanent shutdown of coal-fired boilers at Miami Fort Power Station and Zimmer Power Station

Ohio is not relying on any existing measures for sources evaluated but not selected for four-factor analysis, or for sources selected for four-factor analysis but where new additional measures were found not to be necessary, as part of the LTS to make reasonable progress in the second implementation period.