Ohio Regional Haze 5-year Progress Report

The Ohio Environmental Protection Agency
Division of Air Pollution Control

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Contents:

I. Introduction

The Clean Air Act (CAA) mandates the protection of visibility in Class I Federal areas. In 1999, the U.S. Environmental Protection Agency (U.S. EPA) finalized the Regional Haze Rule (RHR) (64 FR 35714), which calls for state and federal agencies to work together to improve visibility in 156 national parks and Wilderness areas, including the 21 Class I Wilderness areas.

The primary cause of regional haze in many parts of the country is light scattering resulting from fine particles (i.e., particulate matter less than 2.5 microns in diameter, referred to as PM2.5) in the atmosphere. These fine particles can contain a variety of chemical species including carbonaceous species (i.e., organics and elemental carbon), as well as ammonium nitrate, sulfates, and soil. Additionally, coarse particles between 2.5 and 10 microns in diameter can contribute to light extinction. Each of these components can be naturally occurring or the result of human activity. The natural levels of these species result in some level of visibility impairment in the absence of any human influences and will vary with season, daily meteorology, and geography.

The RHR included the requirement of states to develop control strategy plans (State Implementation Plans, or SIPs) detailing long-term strategies to reduce emissions of air pollutants that cause visibility impairment and should address contributions to visibility impairment at Class I areas both within and without the state. Ohio's Regional Haze SIP was submitted to U.S. EPA on March 11, 2011 and approved by U.S. EPA effective August 1, 2012 (77 FR 39177). Subsequently, Ohio EPA submitted a revision to U.S. EPA on April 14, 2014. On December 9, 2015, U.S. EPA proposed to approve this revision (80 FR 76403).

The U.S. EPA's RHR includes provisions for 5-year progress reports. The requirements for these reports are included for most states in 40 CFR 51.308 (g) and (h). The 5-year review is intended to provide a progress report on, and, if necessary, mid-course corrections to, the Regional Haze SIP. The progress report provides an opportunity for public input on the state's (and the U.S. EPA's) assessment of whether the approved Regional Haze SIP is being implemented appropriately and whether reasonable visibility progress is being achieved consistent with the projected visibility improvement in the SIP. The progress reports are due within 5-years of the state's Regional Haze SIP submittal, or specifically, March 11, 2016 for Ohio.

This document serves to satisfy the requirements of the 5-year progress report, as outlined in Section 51.308(g) of the RHR, on the "Regional Haze State Implementation Plan for Ohio". In accordance with U.S. EPA's April 2013 guidance document entitled "General Principles for the 5-Year Regional Haze Progress Reports for the Initial Regional Haze State Implementation Plans" , this progress report evaluates the "on-the-books" control strategies the original SIP

deemed adequate for addressing and sufficiently reducing Ohio's contributions to visibility-impairing pollutants in the Class I areas that Ohio's emissions affect. Furthermore, it includes the necessary emissions inventories and trajectories to evaluate progress in reducing emissions and determination of the sufficiency of the original Regional Haze SIP.

II. Progress Report Elements

A. Status of Control Strategies in the Regional Haze SIP. Sections 51.308(g)(1) and 51.309(d)(10)(i)(A).

> *A description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for mandatory Class I Federal areas both within and outside the State.*

It was concluded, in the Ohio Regional Haze SIP, that "on-the-books" controls were sufficient to decrease the emissions of visibility-impairing pollutants and address Ohio's impact. It was determined that Ohio's fair share of emission reductions would be met by these on-the-books controls for each Class I area for which Ohio was determined to have emissions impacting visibility. 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.

<u>Clean Air Interstate Rule (CAIR) and the Cross State Air Pollution Rule (CSAPR)</u>

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 will benefit from even further reductions than those it would achieve under the CAIR program.

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). 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.

- 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 PM2.5 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[1] 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[2] 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.

[1] http://www.epa.ohio.gov/dapc/regs/3745_112.aspx
[2] http://www.epa.ohio.gov/dapc/regs/3745_113.aspx

- Portable fuel containers

  Ohio's portable fuel container rules[3] became effective February 10, 2006[4]. 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)

  The Acid Rain Program (ARP), established under Title IV of the 1990 CAA Amendments requires major emission reductions of SO_2 and NO_x, the primary precursors of acid rain, from the power sector. The SO2 program sets a permanent cap on the total amount of SO2 that may be emitted by electric generating units (EGUs). The program was phased in, with the final 2010 SO2 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 SO2.

- 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

[3] http://www.epa.ohio.gov/dapc/regs/3745_113.aspx
[4] http://www.epa.ohio.gov/portals/27/regs/3745-21/3745-21-17_Final.pdf

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.[5]

- 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

[5] http://www3.epa.gov/ttn/atw/eparules.html

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.

Review of BART Determination

It was shown in the Ohio Regional Haze SIP, 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, section 8.2. 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. The alternative approach was to be detailed in a compliance plan by December 13, 2013, with the requirements incorporated into the federally enforceable permit by no later than December 31, 2014.

However, that compliance date was aligned with Glatfelter's expected compliance date for the Industrial Boiler Maximum Achievable Control Technology (MACT) requirements, which have been extended. These two compliance dates were 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 is now expected to be no later than January 31, 2017, which is still within the appropriate range of 5 years after approval of the implementation plan revision (which would be July 2, 2017), as allowed by U.S. EPA's regulations (40 CFR 51.308(308)(1)(iv)). Once implemented, Glatfelter will be complying with its BART limits. In fact, Glatfetler is currently pursuing conversion to natural gas in order to comply with U.S. EPA's Boiler MACT. In the end, this change will bring even further reductions than required as part of the BART compliance.

Reasonable Progress Determination

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 Midwest Regional Planning Organization (MRPO) 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. Furthermore, Ohio continues to anticipate implementation of stricter controls than were in existence at the time of the original SIP for meeting new pollutant standards, including the greater-than BART reductions anticipated at Glatfelter, as well as the implementation of CSAPR, which is more stringent, and will result in further emission reductions, than CAIR.

As part of Ohio's consultation with the Mid-Atlantic/Northeast Visibility Union (MANE-VU), MANE-VU requested that states outside of the MANE0VU 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 SO2 emissions. As a result of this progress in SO2 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[6]" requests states outside of the MANE-VU area to examine controls for specific types of sources (i.e., "MANE-VU Ask"). MANE-VU suggested the following control strategies be adopted and implemented:

- Application of BART.

- 90% (or greater) reduction in SO2 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) SO2 emissions relative to on-the-books, on-the-way 2018 projections.

- Continued evaluation of other measures, including measures to reduce SO2 and NO_x emissions from coal-burning facilities and promulgation of new source performance standards for wood combustion.

- Further reduction in power plant SO2 (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 SO2 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:

- 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

[6] 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."

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, 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 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.

Therefore, Ohio continues to believe our utilities have made significant progress in installing SO2 controls as requested under MANE-VU's Ask.

B. Emissions Reductions from Regional Haze SIP Strategies. Sections 51.308(g)(2) and 51.309(d)(10)(i)(B).

A summary of the emissions reductions achieved throughout the State through implementation of the measures described in paragraph (g)(1) of this section.

The most significant emissions reductions from SIP strategies are those of reductions in NOx and SO2 from EGUs as a result of CAIR/CSAPR. The overall trend from 2002 until the present is that of decreasing emissions from EGUs, and as can be seen in Figure 1, SO2 has dramatically decreased from 1,132,069 TPY in 2002 to 290,352 TPY in 2014 as a result of CAIR and other control strategies implemented. This represents a 74% decrease in SO2 emissions from EGUs over that time period.

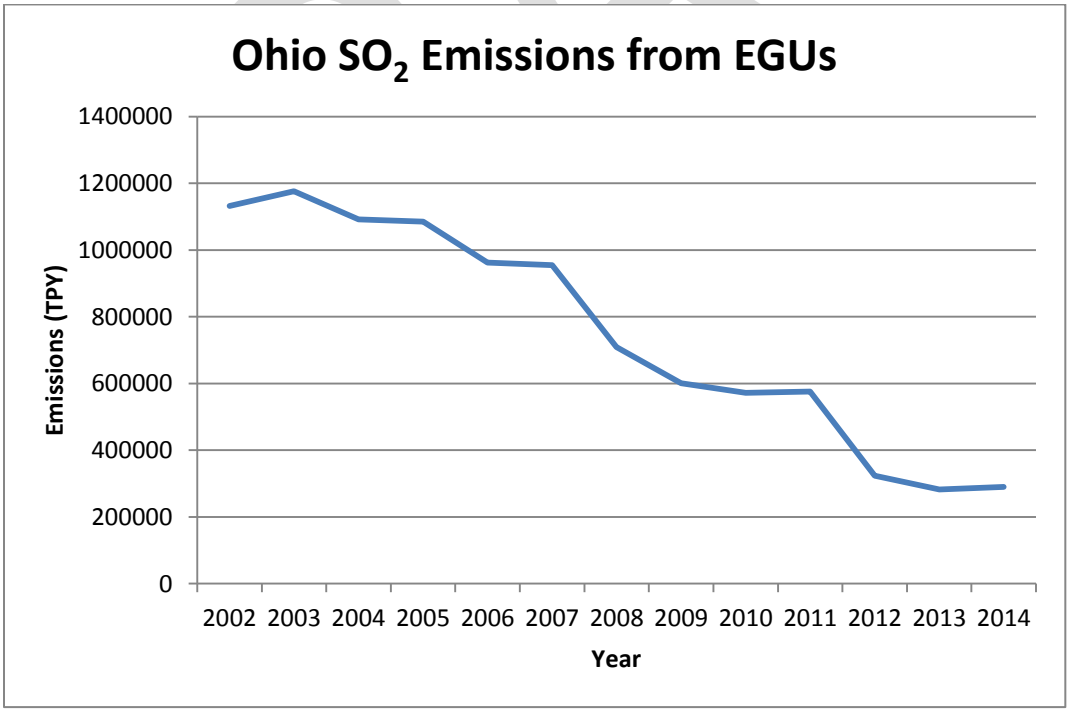

Figure 1: SO2 Emissions from Ohio EGUs 2002-2014
Data Source: U.S. EPA Clean Air Markets Division (CAMD)

Furthermore, NOx emissions have also decreased substantially from the EGU sector, falling from 370,497 TPY in 2002 to 86,262 TPY in 2014, as shown in Figure 2. This represents a 77% decrease. For emissions of SO2, the EGU sector was the highest contributor in both the 2002 and 2005 base year inventories by at least an order of magnitude, comprising 88% and 89% of total SO2 emissions, respectively. The EGU sector was the highest contributor to total NOx in the 2002 inventory and the second highest contributor in the 2005 inventory, comprising 37% and 34% of total NOx emissions, respectively. 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. Ohio expects implementation of CSAPR as well as other regulations and control strategies to generate even further reductions in emissions as the requirements are phased in over the next several years. Data for the SO2 and NOx emissions from 2002 to 2014 were obtained from the U.S. EPA Clean Air Markets Division (CAMD).

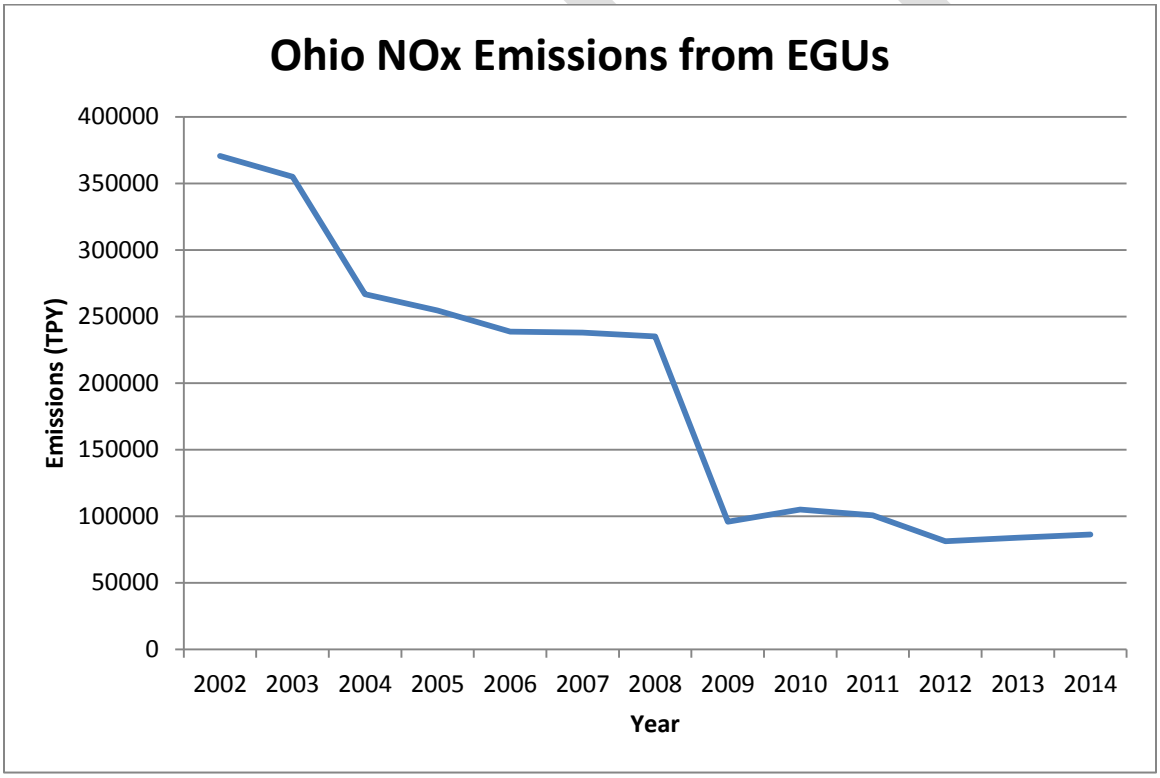

Figure 2: NOx Emissions from Ohio EGUs 2002-2012
Data Source: U.S. EPA Clean Air Markets Division (CAMD)

Although U.S. EPA's combustion turbine MACT has not been implemented fully, the emissions from its lack of implementation that could now impact visibility is likely very minimal. Further, reductions beyond on-the-books controls that Ohio has achieved due to CSAPR and EGU shutdowns (discussed above) would more

than offset those reductions not achieved under this rule. Regardless, Ohio EPA is also providing an additional analysis of the potential effect of the lack of implementation of U.S. EPA's combustion turbine MACT discussed above. This was the only on-the-books control strategy that was not implemented in Ohio.

The reductions assumed to be achieved from implementation of the combustion turbine MACT included a 13% reduction in VOC and 17% reduction in NOx[7]. As required under the combustion turbine MACT, Ohio EPA received notification from 20 facilities that they were subject to this MACT. Ohio EPA analyzed base year emissions (2002) and current emissions (2014) reported to Ohio EPA from each of these facilities for VOC and NOx. (Appendix A[8]) Based upon those emissions, even without implementation of the combustion turbine MACT, these facilities collectively reduced VOC emissions by 45% and NOx emissions by 77%. Therefore, the lack of implementation of the combustion turbine MACT has not affected emissions reductions achieved by these facilities in Ohio.

C. Visibility Progress.
Sections 51.308(g)(3) and 51.309(d)(10)(i)(C).

> *For each mandatory Class I Federal area within the State, the State must assess the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of 5-year averages of these annual values.*
>
> *(i) The current visibility conditions for the most impaired and least impaired days;*
>
> *(ii) The difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions;*
>
> *(iii) The change in visibility impairment for the most impaired and least impaired days over the past 5 years.*

There are no Class I Federal 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.

[7] Table III-2, E. H. Pechan, 2007, "Development of 2005 Base Year Growth and Control Factors for Lake Michigan Air Directors Consortium (LADCO)", Final Report, September 2007." http://www.ladco.org/reports/technical_support_document/references/ladco_2005_base_yr_growth_and_controls_report_final.pdf

[8] Base year emissions were substituted with another year according to the notes in Appendix A for certain facilities that either erroneously reported VOC emissions or failed to report VOC emissions in 2002.

D. Emissions Progress.
Sections 51.308(g)(4) and 51.309(d)(10)(i)(D).

An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.

In the Ohio Regional Haze SIP, Ohio presented its 2005 "Base M" inventory, developed by LADCO, as well as the projected 2018 inventory, grown from the 2005 emissions using the Economic Growth Analysis System (EGAS5), MOBILE 6.2, vehicle emission modeling software, and the Integrated Planning Model (IPM) version 3.0 for electric generating units (EGUs). This projection was used in the determination that on-the-books control strategies would sufficiently reduce emissions of visibility-impairing pollutants. These inventories are presented here in Table 1 and Table 2.

Data sources For Table 1 and Table 2:
On-Road data for 2005: 2005 National Emissions Inventory System http://www.epa.gov/air/data/neidb.html

All other data: Midwest Regional Planning Organization (MRPO) and Lake Michigan Air Directors Consortium (LADCO) Web site: http://www.ladco.org/tech/emis/round5/index.php

Table 1: LADCO-generated 2005 Ohio emissions inventory summary from SIP

Ohio 2005 Emissions Summary, by Source Category and Pollutant (TPY)						
Source Category	VOC	NOx	PM2.5	PM10	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
Totals	519,733	753,574	49,357	65,250	123,814	1,241,414

Table 2: LADCO-generated 2018 Ohio projected emissions inventory summary from SIP

Ohio 2018 Emissions Summary, by Source Category and Pollutant (TPY)						
Source Category	VOC	NOx	PM2.5	PM10	NH3	SO2
EGU Point	1,352	95,678	9,154	17,311	107	315,560
Non-EGU Point	34,651	66,696	11,776	18,161	4,300	117,018
Non-Road	60,461	37,691	3,526	3,728	86	100
Other	182,075	38,441	18,359	18,409	117,264	4,957
MAR	1,146	22,018	538	615	18	2,494
On-Road	88,526	100,056	2,483	2,529	12,067	1,455
Totals	368,211	360,580	45,836	60,753	133,842	441,584

The Ohio Regional Haze SIP predicted reductions in all pollutants except for Ammonia, for which a slight increase in emissions was predicted. In order to "track the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State", an emissions inventory summary for 2011 – the most recent year for which a complete inventory could be constructed – is presented in Table 3.

Data sources For Table 3:
EGU and Non-EGU Point source data for PM2.5 and PM10: 2011 National Emissions Inventory System http://www3.epa.gov/ttnchie1/net/2011inventory.html

All other data: 2011 Inventory constructed by LADCO based on the 2011 NEI version 2 data.

Table 3: 2011 Ohio emissions inventory summary for tracking emissions changes

Ohio 2011 Emissions Summary, by Source Category and Pollutant (TPY)						
Source Category	VOC	NOx	PM2.5	PM10	NH3	SO2
EGU Point	1,503	103,184	3,660	7,053	331	592,313
Non-EGU Point	30,187	58,583	7,853	11,227	3,805	79,473
Non-Road	69,465	61,641	5,620	5,903	80	170
Other	124,573	37,193	12,581	14,383	95,432	4,104
MAR	1,672	33,160	1,032	1,153	15	741
On-Road	205,383	192,844	3,615	6,317	4,375	1,090
Totals	432,783	486,605	34,361	46,036	104,039	677,891

In order to construct an emissions summary suitable for comparison to the emissions summaries for 2005 and 2018 it was necessary to make a few changes to the 2011 inventory obtained from LADCO due to methodological changes in emissions reporting and model utilization that took place in between the development of the 2005 and 2011 inventories. Specifically, the reporting of the condensable portion of PM emissions from point sources for the 2011 inventory as compared to the 2005 inventory necessitated a change in those portions of the inventory, and the use of the MOVES2014 model for the 2011 on-

road emissions as compared to the use of the MOBILE6.2 model for on-road emissions in the 2005 inventory required special consideration for comparing on-road emissions.

Concerning PM emissions, the PM2.5 and PM10 values presented in the 2005 inventory for EGU point and Non-EGU point sources actually 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 or 2008 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. As such, in order to accurately track changes in emissions compared to that submitted in Ohio's original SIP, it makes sense to only consider the filterable portion of PM emissions from EGU Point and Non-EGU Point sources for comparison, which is what is shown for 2011 in Table 3. This is the best possible comparison that can be made, but is still imperfect because of the possibility for some unidentifiable component of the 2005 reported particulate emissions being condensable PM that could not be eliminated from the reported emissions. This will likely lead to a slight overestimation of the reductions since 2005, but is still the best comparison that can be made.

A further complication in attempting to assess reductions in PM comes from the use of the U.S. EPA IPM model in projecting the trajectory of PM emissions from 2005 to 2018. As stated, the 2005 value for PM emissions essentially represents only the filterable portion. IPM, however, adds PM condensable emissions into future years, which leads to a false perception of PM growth, or at least a lesser reduction than would be expected in reality. Comparing Table 1 and Table 2, emissions predicted in this way for 2005 to 2018 were minimal for PM. These inconsistencies likely lead to the appearance of achieving more reductions than predicted. Ohio EPA is confident in steady reductions in PM emissions, though some of the figures presented here may overestimate reductions. In the future, much more confidence will be able to be placed in PM emissions tracking as a result of the improvements in PM emissions reporting, and the ability to achieve consistency in comparison of actual emissions with past actual emissions, as well as actual emissions with modeling.

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 2011 on-road emissions have been calculated using MOVES2014. As such, the results are not directly comparable for the purpose of tracking emissions changes. U.S. EPA has noted from comparative studies they have performed of the two models that mobile source VOC emissions tended to be lower using MOVES than using

MOBILE6, whereas NOx emissions tended to be higher using MOVES than MOBILE6, and PM2.5 emissions tended to be significantly higher using MOVES as compared to MOBILE6.2[9]. Using the results from a three-city comparison of the two models performed by U.S. EPA[10], the 2011 mobile source emissions presented here for VOC, NOx, PM2.5 and PM10 have been adjusted according to the mean ratios of MOBILE6 to MOVES2010 predictions for the three cities in the study, for each of these pollutants. These ratios of MOBILE6 to MOVES2010 predictions are 1.317 for VOC, 0.7745 for NOx, and 0.409 for PM. The On-Road emissions presented in this report for 2011 were developed using MOVES2014 not MOVES2010, which is the version used for the comparative study. However, no such comparative study is available for comparing MOVES2014 and MOBILE6.2. A comparative study of MOVES2014 to MOVES2010[11] does reveal some differences in predicted emissions, but these were less than the changes from MOBILE6.2 to MOVES2010, and incorporating them would not significantly change the results. Therefore, so as not to be overcomplicated, just the ratios mentioned previously were used.

Given the nature of this progress report, and that it is not expected to involve detailed new emissions inventory activities, Ohio did not deem it necessary to perform the modeling necessary to compare on-road emissions from 2005 and 2011 produced by the same model, but rather used these ratios for an estimate. However, in performance checks Ohio EPA anticipates we will be able to compare inventory years based on consistent MOVES model runs. With these changes made, Table 4 shows a comparison of the 2005 inventory with the 2011 inventory, demonstrating reductions in emissions for each pollutant.

[9] http://www3.epa.gov/otaq/models/moves/420f09073.pdf
[10] http://www.healtheffects.org/Slides/AnnConf2011/Somers-MonPM.pdf
[11] http://www3.epa.gov/ttn/chief/conference/ei21/session7/enam_pres.pdf

Table 4: 2005 to 2011 Emissions Inventory Summary comparison and reductions

2005 Inventory to 2011 Inventory Comparison						
	VOC (TPY)		NOx (TPY)		PM2.5 (TPY)	
Source Category	2005	2011	2005	2011	2005	2011
EGU Point	1,354	1,503	255,556	103,184	9,158	3,660
Non-EGU Point	27,848	30,187	66,229	58,583	9,920	7,853
Non-Road	89,584	69,465	85,887	61,641	7,384	5,620
Other	226,910	124,573	39,582	37,193	16,708	12,581
MAR	2,706	1,672	47,021	33,160	1,452	1,032
On-Road	171,331	205,383	259,299	192,844	4,735	3,615
Totals	519,733	432,783	753,574	486,605	49,357	34,361
Emissions Reduction	86,950		266,969		14,996	

2005 Inventory to 2011 Inventory Comparison (con't)						
	PM10 (TPY)		NH3 (TPY)		SO2 (TPY)	
Source Category	2005	2011	2005	2011	2005	2011
EGU Point	17,324	7,053	107	331	1,100,511	592,313
Non-EGU Point	15,012	11,227	3,175	3,805	115,547	79,473
Non-Road	7,719	5,903	77	80	8,747	170
Other	16,764	14,383	109,047	95,432	5,632	4,104
MAR	1,634	1,153	27	15	4,687	741
On-Road	6,797	6,317	11,381	4,375	6,290	1,090
Totals	65,250	46,036	123,814	104,039	1,241,414	677,891
Emissions Reduction	19,214		19,775		563,523	

As demonstrated here, significant reductions have been made especially for SO2, NOx and PM emissions, which are the most important when considering visibility impairment. Good and sufficient progress is being made to reduce emissions for all visibility-impairing pollutants and Ohio is well on its way to the reductions predicted for 2018, as shown in Table 5.

Table 5: Progress toward predicted reductions from 2005 to 2018

Emission Reductions: 2005 to 2011 vs Projected 2018 Reductions (TPY)						
	VOC	NOx	PM2.5	PM10	NH3	SO2
2005 to 2018 expected reduction	151,522	392,994	3,521	4,497	-10,028	799,830
2005 to 2011 reduction	86,950	266,969	14,996	19,214	19,775	563,523
% of reductions achieved	57%	68%	426%	427%	N/A	70%

It is clearly demonstrated in these tables that as a result of the control measures in place for these pollutants, emissions across the board are on a

substantial downward trend. Ohio is on track to meet or exceed projected 2018 goals for emissions reductions for all pollutants. As discussed above, the inconsistencies in PM reporting from the past to present, as well as in modeling, lead to the likely overestimation of reduction progress for PM seen in Table 5. Though not at the level shown there, Ohio is confident of good progress being made in PM emissions reductions, and believes that the reduction shown from 2005 to 2011 as shown in Table 4 is as accurate as possible, and likely only slightly inflated by the undetected condensable portion from 2005.

The changes identified, and made, above for PM emissions and for on-road emissions were important for comparison with previous base year and projection year emissions. However, moving forward, Ohio hopes to be able to compare emissions inventories taking current methodologies into account, including MOVES model predictions for mobile sources and primary PM including condensable and filterable portions. Table 6 shows the 2011 emissions inventory summary from LADCO, without these adjustments, that may be used for accurate comparisons in the future using these more current methodologies. Emissions that were changed for the previous tables are in bold.

Data source For Table 6:
All Data: 2011 Inventory constructed by LADCO based on the 2011 NEI version 2 data.

Table 6: 2011 Emissions Inventory Summary without modifications for comparison

Ohio 2011 Emissions Summary, by Source Category and Pollutant (TPY)						
Source Category	VOC	NOx	PM2.5	PM10	NH3	SO2
EGU Point	1,503	103,184	**33,741**	**37,140**	331	592,313
Non-EGU Point	30,187	58,583	**14,958**	**18,287**	3,805	79,473
Non-Road	69,465	61,641	5,620	5,903	80	170
Other	124,573	37,193	12,581	14,383	95,432	4,104
MAR	1,672	33,160	1,032	1,153	15	741
On-Road	**155,948**	**248,831**	**8,860**	**15,484**	4,375	1,090
Totals	383,348	542,592	76,793	92,350	104,039	677,891

E. Assessment of Changes Impeding Visibility Progress. Sections 51.308(g)(5) and 51.309(d)(10)(i)(E).

An assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

Ohio EPA believes that no changes in anthropogenic emissions within or outside Ohio have occurred in the past 5 years to limit or impede progress in reducing pollutant emissions in Ohio. As previously discussed, many changes

have 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 in section D, good progress is being made in reducing emissions of visibility-impairing pollutants and changes that are being made or have been made in the past five years should only serve to reduce emissions even further than anticipated.

F. Assessment of Current Strategy. Sections 51.308(g)(6) and 51.309(d)(10)(i)(F).

> *An assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Federal Class I areas affected by emissions from the State, to meet all established reasonable progress goals.*

Ohio believes that the current SIP, including the control strategies discussed in section A, is sufficient to achieve the emissions reductions that will constitute Ohio's fair share toward meeting the reasonable progress goals at all federal Class I areas to which Ohio's emissions contribute to the visibility impairment. The figures in section B and tables in section D demonstrate the progress Ohio is making in reducing emissions, and these reductions are expected to continue at an even quicker pace than originally predicted in the Ohio Regional Haze SIP due to the implementation of stricter controls than originally expected at the time of the SIP.

Furthermore, the States of Kentucky[12], Maine[13], North Carolina[14], Virginia[15], and West Virginia[16] prepared progress reports demonstrating that visibility is improving at Class I areas and Ohio is not interfering with the ability of these states to meet reasonable progress goals for their Class I areas.

G. Review of Visibility Monitoring Strategy. Sections 51.308(g)(7) and 51.309(d)(10)(i)(G).

> *A review of the State's visibility monitoring strategy and any modifications to the strategy as necessary.*

[12] http://air.ky.gov/Pages/SIPRevisionsandSubmittals,EmissionAllocations.aspx
[13] http://www.maine.gov/dep/ftp/AIR/SIP/Regional_Haze_Progress_Report_Draft.pdf
[14] http://daq.state.nc.us/planning/haze/regional_haze_sip.shtml
[15] https://www.federalregister.gov/articles/2014/05/02/2014-10110/approval-and-promulgation-of-implementation-plans-virginia-regional-haze-five-year-progress-report
[16] https://www.federalregister.gov/articles/2015/06/05/2015-13801/approval-and-promulgation-of-implementation-plans-west-virginia-regional-haze-five-year-progress

There are no Class I Federal areas within the State of Ohio and so Ohio's SIP is concerned only with the contribution of Ohio's emissions to Class I areas in other states and has no visibility monitoring strategy to review.

H. Determination of Adequacy. Sections 51.308(h) and 51.309(d)(10)(ii).

(h) Determination of the adequacy of existing implementation plan. At the same time the State is required to submit any 5-year progress report to the EPA in accordance with paragraph (g) of this section, the State must also take one of the following actions based upon the information presented in the progress report:

(1) If the State determines that the existing implementation plan requires no further substantive revision at this time in order to achieve established goals for visibility improvement and emissions reductions, the State must provide to the Administrator a negative declaration that further revision of the existing implementation plan is not needed at this time.

(2) If the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another State(s) which participated in a regional planning process, the State must provide notification to the Administrator and to the other State(s) which participated in the regional planning process with the States. The State must also collaborate with the other State(s) through the regional planning process for the purpose of developing additional strategies to address the plan's deficiencies.

(3) Where the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another country, the State shall provide notification, along with available information, to the Administrator.

(4) Where the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources within the State, the State shall revise its implementation plan to address the plan's deficiencies within one year.

Based on the information presented in this progress report, Ohio EPA submits a negative declaration to U.S. EPA that further revision of the existing implementation plan is not needed at this time and that the original SIP is sufficient for meeting the goals outlined in the RHR. This progress report shows that no revisions to the Ohio Regional Haze SIP are needed and that the on-the-books controls deemed sufficient in the original SIP, along with additional controls implemented since, remain the only controls needed. As such, no additional controls are necessary at this time, and Ohio submits the following language as required by the RHR:

(1) If the State determines that the existing implementation plan requires no further substantive revision at this time in order to achieve established goals for visibility improvement and emissions reductions, the State must provide to the Administrator a negative declaration that further revision of the existing implementation plan is not needed at this time.

III. Public Participation

Ohio EPA provided an opportunity for Federal Land Manager review on December 14, 2015. Comments were received and Ohio EPA has attempted to address those comments prior to full public participation. Appendix B contains a record of the opportunity for comment and comments received.

Ohio published notification for a public hearing and solicitation for full public comment concerning the draft 5-year progress report in the widely distributed county publications.

The public hearing to receive comments on the 5-year progress report was held on_____, 2017 at _____. The public comment period closed on_____, 2017. _____ testimony was provided at the public hearing and _____ comments were received during the public comment period. Appendix C includes a copy of the public notice and transcript from the public hearing and comment period.