Indiana Regional Haze State Implementation Plan

Developed By:
The Indiana Department of Environmental Management

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Table of Contents

List of Tables

List of Figures

Appendices

1.0 Introduction and Background

This document constitutes the Indiana Department of Environmental Management (IDEM) Regional Haze State Implementation Plan (SIP). The federal Regional Haze Rule requires Indiana to submit a SIP to the United States Environmental Protection Agency (U.S. EPA). Indiana does not have any Class 1 areas; however, Indiana sources have been determined to impact visibility in Class 1 areas in other states. The Clean Air Act requires Indiana to develop a strategy to mitigate visibility impairment in those areas. The strategy has been developed in consultation with the Midwest Regional Planning Organization (MRPO) and affected states using data and tools, including emissions inventories and modeling analyses taking into consideration factors such as existing pollution control programs, emissions reduction needs, compliance schedules, and smoke management techniques. This document describes Indiana's consultation process, technical analyses, and actions to be pursued to reduce visibility impairment in other Class 1 areas.

In amendments to the Clean Air Act in 1977, Congress added Section 169 (42 U.S.C. 7491) setting forth the following national visibility goal:

> *Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class 1 Federal areas which impairment results from manmade air pollution.*

When the Clean Air Act was amended in 1990, Congress added Section 169B (42 U.S.C. 7492), authorizing further research and regular assessments of the progress made so far. 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."[1]

In addition to authorizing creation of visibility transport commissions and setting forth their duties, Section 169B(f) of the Clean Air Act mandated creation of the Grand Canyon Visibility Transport Commission (Commission) to make recommendations to U.S. EPA for the region affecting the visibility of Grand Canyon National Park. The Commission submitted its report to U.S. EPA in June 1996, following four years of research and policy development. That report, as well as the many research reports prepared by the Commission, contributed invaluable information to U.S. EPA in its development of the federal Regional Haze Rule.

U.S. EPA's Regional Haze Rule (RH Rule) was adopted July 1, 1999, and went into effect on August 30, 1999 (64 FR 35714). The RH Rule is aimed at achieving national visibility goals by 2064. This rulemaking addressed the combined visibility effects of various pollution sources over a wide geographic region. This wide reaching pollution net means that many states, even those without Class 1 areas, are required to participate in haze reduction efforts. U.S. EPA designated five Regional Planning Organizations (RPO) to assist with the coordination and cooperation needed to address the haze issue.

U.S. EPA's Regional Haze rulemaking process was controversial. On May 24, 2002, the U.S. Court of Appeals, DC District Court, ruled on the challenge brought by the American Corn Growers Association against the RH Rule. The Court remanded to U.S. EPA the Best Available Retrofit Technology (BART) provisions of the rule, and denied industry's challenge to the haze rule goals of natural visibility and no degradation requirements. U.S. EPA issued revisions to the RH Rule pursuant to the remand.

[1] *Protecting Visibility in National Parks and Wilderness Areas*, National Research Council. Washington, DC: 1993.

Regional haze is caused by tiny particles that absorb and scatter sunlight, creating white and brown haze. The RH Rule requires States to submit SIPs to address regional haze visibility impairment in 156 federally protected parks and wilderness areas. These 156 scenic areas are called "mandatory Class 1 Federal areas" in the Clean Air Act but are generally referred to as "Class 1 areas." As required by the Clean Air Act, U.S. EPA included in the final RH Rule a requirement for BART for certain large stationary sources. The RH Rule uses the term "BART-eligible source" to describe these sources. Under the Clean Air Act, BART is required for any BART-eligible source that a state determines "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area." Accordingly, for stationary sources meeting these criteria, states must address the BART requirement when they develop their Regional Haze SIPs.

On July 6, 2005, U.S. EPA published the Best Available Retrofit Technology Guidelines (BART Guidelines) in the Federal Register (70 FR 39104). These guidelines are a component of the July 1, 1999 Regional Haze regulations.

Though States have some discretion on the use of the BART Guidelines for most sources, Section 169A(b) of the Clean Air Act and 40 CFR 51.308(e)(1)(ii)(B) require that states follow the BART Guidelines for fossil-fuel fired generating power plants having a capacity in excess of 750 megawatts.

All Regional Haze SIPs are due three years after U.S. EPA designated $PM_{2.5}$ attainment and nonattainment areas. The FY 2004 Omnibus Appropriations Bill effectively addressed 40 CFR 51.308(b) and (c). The Appropriations Bill said that all Regional Haze SIPs would be due three years after the $PM_{2.5}$ designation dates regardless of attainment status. The U.S. EPA approved $PM_{2.5}$ designations for all areas of each state on December 17, 2004. All Regional Haze SIPs were therefore due December 17, 2007.

The RH Rule requires states to set reasonable progress goals toward meeting a national goal of natural visibility conditions in Class 1 areas by the year 2064. The first reasonable progress goals will be established for the planning period 2008 to 2018.

Even though Indiana has no Class 1 areas, U.S. EPA's Regional Haze Rule requires a state to address regional haze in each Class 1 area outside the state which may be affected by emissions from within the state. Indiana has participated in extensive technical analyses conducted by the MRPO to determine if any Class 1 areas have visibility impairment that may be caused by sources within the state.

This Regional Haze SIP will address the initial 10-year implementation period (i.e., reasonable progress by the year 2018). SIP requirements (pursuant to 40 CFR 51.308(d)) include establishing reasonable progress goals, determining baseline conditions, determining natural conditions, providing a long-term control strategy, providing a monitoring strategy (air quality and emissions), and establishing BART emissions limitations and an associated compliance schedule.

Pursuant to the requirements of 40 CFR 51.308(a) and (b), Indiana submits this SIP to meet the requirements of the RH Rule that was adopted to comply with requirements set forth in the Clean Air Act. Elements of this SIP address the core requirements pursuant to 40 CFR 51.308(d) and the BART components of 40 CFR 50.308(e). In addition, this SIP describes Indiana's consultation process, technical analyses, and actions to be pursued to reduce visibility impairment in Class 1 areas.

Indiana has developed this SIP in accordance with Indiana laws and rules and has the authority to implement the SIP in accordance with those laws and rules.

Indiana will provide public notice of the opportunity to comment on the SIP and of the public hearing that will be held regarding the SIP. Public comments will be addressed and summarized in the final version of the SIP.

2.0 Regional Planning

The MRPO was formed to facilitate regional planning to address the regional haze regulations adopted by U.S. EPA in 1999. The primary objective of the MRPO is to assess both visibility impairment due to regional haze in the mandatory Federal Class 1 areas located inside the borders of the five States of Illinois, Indiana, Michigan, Ohio, and Wisconsin, and to assess the impact of emissions from the five states on visibility impairment due to regional haze in the mandatory Federal Class 1 areas located outside the borders of the five States. Members of the MRPO include the five states, tribes located within the five states, Federal Land Managers (U.S. National Park Service, U.S. Fish & Wildlife Service, and U.S. Forest Service), and U.S. EPA. The Lake Michigan Air Directors Consortium (LADCO) has been designated as the agency to receive federal grant funds on behalf of the MRPO.

This SIP uses data analyses, modeling results and other technical support documents prepared for MRPO members. By coordinating with the MRPO and other Regional Planning Organizations (RPOs), Indiana has worked to ensure that its long term strategy provides sufficient reductions to mitigate impacts of sources from Indiana on affected Class 1 areas.

The other RPOs are Mid-Atlantic / Northeast Visibility Union (MANE-VU), Central Regional Air Planning Association (CENRAP), Visibility Improvement State and Tribal Association of the Southeast (VISTAS), and Western Regional Air Partnership (WRAP). Figure 1 shows a map of the regional planning organization boundaries.

Figure 1 Regional Planning Organizations

Indiana does not have any Class 1 areas. However, emissions from Indiana sources have been determined to impact Class 1 areas in other states. Table 1, taken from Appendix 1 contains a list of these Class 1 areas for all the LADCO states, and the analyses performed to assess the impact from Indiana that were compiled by the MRPO.

Table 1 (This is Table 1 from Appendix 1 Showing Impacts of LADCO States upon Class I Areas)

AREA NAME	IL	IN	MI	OH	WI
81.401 Alabama.					
Sipsey Wilderness Area	(1)	(1)			
81.404 Arkansas.					
Caney Creek National Wilderness Area	(2), (4)	(2), (4)		(2), (4)	
Upper Buffalo National Wilderness Area	(1),(2),(4),(5)	(2), (4)		(2), (4)	(2)
81.408 Georgia.					
Cohotta Wilderness Area					
Okefenokee Wilderness Area					
Wolf Island Wilderness Area					
81.411 Kentucky.					
Mammoth Cave National Park	(1), (2), (5)	(1), (2), (5)	(1), (2)	(1), (2), (5)	
81.412 Louisiana.					
Breton Wilderness Area					
81.413 Maine.					
Acadia National Park	(3)	(3)	(3)	(3)	
Moosehorn Wilderness Area	(3)	(3)	(3)	(3)	
81.414 Michigan.					
Isle Royale National Park	(1), (2)	(1), (2)	(1), (2)		(1), (2)
Seney National Wilderness Area	(1), (2)	(1), (2)	(1), (2)	(1), (2)	(1), (2)
81.415 Minnesota.					
Boundary Waters Canoe Area National Wilderness Area	(2)	(2)	(2)		(1), (2)
Voyageurs National Park	(2)	(2)			(1), (2)
81.416 Missouri.					
Hercules-Glades National Wilderness Area	(2), (4), (5)	(2), (4), (5)		(2), (4)	(2)
Mingo National Wilderness Area	(2), (4), (5)	(2), (4), (5)	(2)	(2), (4)	(2)
81.419 New Hampshire.					
Great Gulf National Wilderness Area	(3)	(3)	(3)	(1), (3)	
Pres. Range-Dry River National Wilderness Area					

AREA NAME	IL	IN	MI	OH	WI
81.42 New Jersey.					
Brigantine National Wilderness Area	(3)	(3)	(1), (3)	(1), (3)	
81.422 North Carolina.					
Great Smoky Mountains NP{1}	(1)	(1)		(1)	
Joyce Kilmer-Slickrock Wilderness Area {2}					
Linville Gorge Wilderness Area					
Shining Rock Wilderness Area					
Swanquarter Wilderness Area					
81.426 South Carolina.					
Cape Romain Wilderness					
81.428 Tennessee.					
Great Smoky Mountains NP{1}	(1)	(1)		(1)	
Joyce Kilmer-Slickrock Wilderness Area {2}					
81.431 Vermont.					
Lye Brook National Wilderness Area	(2), (3)	(2), (3)	(2), (3)	(1), (2), (3)	
81.433 Virginia.					
James River Face National Wilderness Area	(2)	(2)	(2)	(2), (5)	
Shanandoah National Park	(2), (3)	(1), (2), (3)	(2), (3)	(1),(2),(3),(5)	
81.435 West Virginia.					
Dolly Sods/Other Creek National Wilderness Area	(2), (3)	(1), (2), (3)	(1), (2), (3)	(1),(2),(3),(5)	

Key

(1) MRPO Back Trajectory Analyses
(2) MRPO PSAT Modeling
(3) MANE-VU Contribution Assessment
(4) Missouri-Arkansas Contribution
(5) VISTAS Areas of Influence

The following areas are listed as possibly being impacted by Indiana sources:

Southeastern U.S. (VISTAS) - Sipsey Wilderness Area, AL; Mammoth Cave National Park, KY; Great Smoky Mountains National Park, NC and TN; James River Face Wilderness Area, VA; Shenandoah National Park, VA; and Dolly Sods / Otter Creek Wilderness Areas, WV

Eastern U.S. (MANE-VU) - Acadia National Park, ME; Moosehorn Wilderness Area, ME; Great Gulf Wilderness Area, NH; Brigantine Wilderness Area, NJ; and Lye Brook Wilderness Area, VT

Northern U.S. (MRPO and CENRAP) - Isle Royale National Park, MI; Seney National Wildlife Refuge, MI; Boundary Waters Canoe Area Wilderness Area, MN; and Voyageurs National Park, MN

South Central U.S. (CENRAP) - Hercules-Glades Wilderness Area, MO; Mingo Wilderness Area, MO; Caney Creek Wilderness Area, AR; and Upper Buffalo Wilderness Area, AR

Class I areas outside the areas listed above were not analyzed further, as there was no impact from Indiana sources shown. Further, no impacts from Indiana were noted in the WRAP states and no requests for controls were initiated by those states.

Indiana has participated in meetings and conference calls with states within the MRPO and the RPOs outside the Midwest to discuss their assessments of visibility conditions, analyses of culpability, and possible measures that could be taken to meet visibility goals for 2018. The sections later in this document provide that information on a state-by-state basis. Table 2 shows the calls and meetings held with states and RPOs with Class 1 areas in which Indiana participated.

Table 2 Calls and Meetings Regarding Class 1 Areas

Date	Group
March 12, 2007	Northern States (Michigan and Minnesota) call
April 3, 2007	CENRAP call
April 17, 2007	Northern States meeting
April 25 - 26, 2007	Denver RPO - Federal Land Manager meeting
May 11, 2007	CENRAP call
May 17, 2007	Northern States call
June 7, 2007	CENRAP call
June 18, 2007	Northern States call
July 10 - 11, 2007	MANE-VU Science meeting (covered by MRPO)
July 19, 2007	MANE-VU call
July 30, 2007	Northern States call
August 6, 2007	MANE-VU meeting
August 23, 2007	Northern States call
February 7, 2008	Northern States call
June 25, 2008	Northern States call

3.0 Indiana and Federal Land Manager Coordination

The provision at 40 CFR 51.308(i) requires coordination between Indiana and the Federal Land Managers (FLMs). Opportunities have been provided by the MRPO for FLMs to review and comment on each of the technical documents developed by the MRPO and included in this SIP. Indiana has provided agency contacts to the FLMs as required. In development of this plan, the FLMs were consulted in accordance with the provisions of 40 CFR 51.308(i)(2).

During the consultation process, the FLMs were given the opportunity to address the following:

· Assessment of the impairment of visibility in any Class 1 areas
· Recommendations on the development of reasonable progress goals
· Recommendations on the development and implementation of strategies to address visibility impairment.

Indiana has consulted directly with the FLMs by email and phone, during periodic MRPO calls and meetings, at the FLM-RPO meeting in Denver on April 25 and 26, 2007, and during discussions with other states and RPOs with Class 1 areas (for example, the MANE-VU meeting August 6, 2007 in Chicago). Indiana will provide the FLMs an opportunity for review of the SIP, at least 60 days prior to holding the public hearing for the SIP. Comments received from the FLMs on this plan will be summarized and responses will be included in the final version.

Indiana will continue to coordinate and consult with the FLMs during the development of future progress reports and plan revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in the Class 1 areas. The FLMs will be consulted during the development and review of implementation plan revisions and during the review of 5-year progress reports

4.0 Development of Reasonable Progress Goals

The following maps show the locations of Class 1 areas in the central, eastern, and northeastern portions of the U.S. Modeling indicated that Indiana sources had no measurable impact on Class I areas in the Western Regional Air Partnership (WRAP). Therefore, Class I areas in that region are not addressed in this SIP.

Figure 2 Map Showing Locations of South Central and Southeastern Class 1 Areas

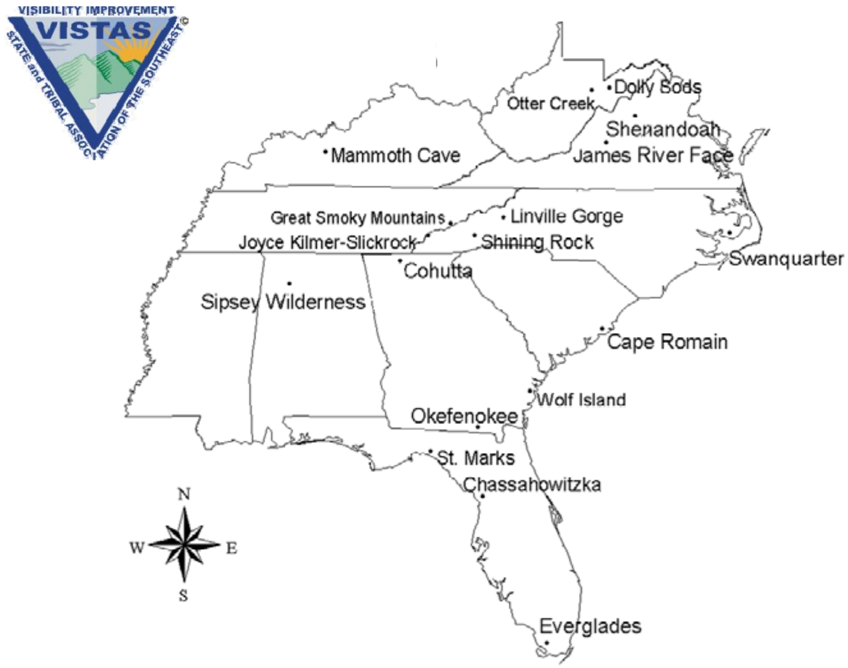


Figure 3 Map Showing Locations of Class 1 Areas in Northeastern U.S.

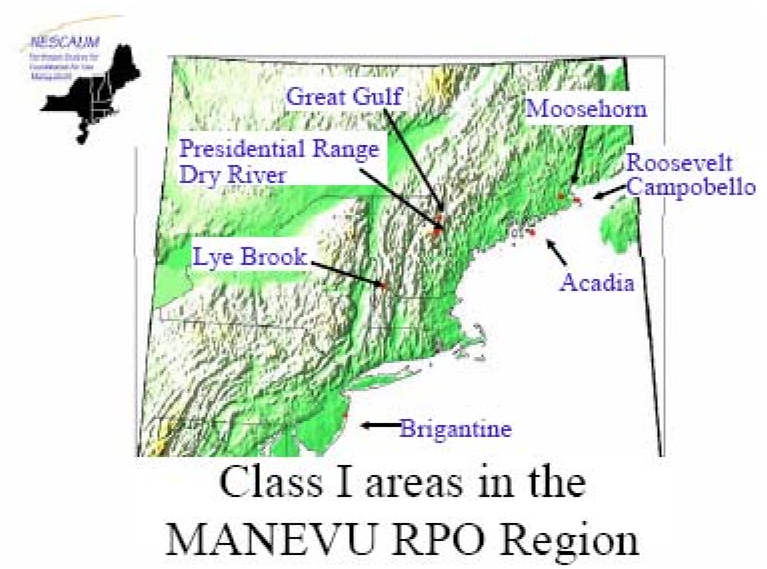


Figure 4 Map Showing Locations of Class 1 Areas in Northern U.S.

4.1 Assessment of Baseline (or Current) Conditions and Estimate of Natural Conditions (in Class 1 Areas)

The RH Rule requires states with Class 1 areas to establish reasonable progress goals, expressed in deciviews (dv), for visibility improvement at each affected Class 1 area. The goals must provide for reasonable progress toward achieving natural visibility conditions, provide for improvement in visibility for the most impaired days over the period of the implementation plan, and ensure no degradation in visibility for the least impaired days over the same period, (40 CFR 51.308(d)(1)).

An evaluation of the chemical composition of the light extinction for 20 % best visibility days and 20% worst visibility days was performed for the northern Class 1 areas. The results are shown in Appendix 9a, Figure 1 of the National Park Service response to comments document attached. For the 20% worst visibility days, the pollutants that contribute to visibility impairment are sulfates, which represent 35-55% impairment, nitrates are 25-30% of the pollutant contribution, and organic carbon contributes 12-22% to visibility impairment.

In addition, sulfates represent the highest contributing pollutant to light extinction with nitrates and organic carbon providing seasonal contributions. Nitrates have higher contributions during the late fall, winter and early spring while organic carbon has higher contributions to light extinction during the summer. Elemental carbon and coarse mass are fairly consistent throughout the year at all northern Class 1 areas. Monthly average light extinction values for the northern Class 1 areas are shown in Appendix 9a, Figure 2 of the National Park Service response to comments document attached.

LADCO conducted photochemical modeling for baseline and future year light extinction. This source apportionment modeling analyzed regional, source, and pollutant impacts on visibility at northern, south central, southeastern, and northeastern Class 1 Areas as shown in Appendix 1, Figure 3 through Figure 8. Indiana's contributions to visibility impairment at each of these Class 1 areas comprises mainly of sulfates from EGU emissions. Indiana contributions to visibility impairment at all the Class 1 areas analyzed were less than 5 Mm^{-1} with the exception of Indiana's contribution to visibility at Mammoth Cave National Park in Kentucky. The future year modeling shows that Indiana is projected to have reduced its contribution on Mammoth Caves' visibility impairment by approximately 50% by 2018.

Back trajectory analyses to determine which states were culpable during bad visibility days at each of the northern Class 1 areas analyzed were also conducted by LADCO. Table 1 in Appendix 1, shows the percentage of light extinction culpability from states in the eastern United States at the northern Class 1 areas. Indiana is shown to contribute less than 3 % light extinction at Boundary Waters Canoe Area, MN and Seney Wilderness, MI and no appreciable contribution to light extinction at Voyageurs National Park, MN. LADCO summarized its back trajectory, Round 4 and Round 5 PSAT analyses along with the CENRAP and MPCA PSAT modeling results to show the state culpabilities on the northern Class 1 areas. As can be seen in Appendix 1, Table 2, Indiana's impacts on the Boundary Waters, Voyageurs, and Isle Royale Class 1 areas are less than 6% of the total visibility impairment. Indiana is modeled to have a slightly higher impact at Seney, with modeled results less than 12% of total visibility impairment. Emission reductions that are projected through future year 2018 PSAT modeling show Indiana's impact will be reduced approximately 20% or more, decreasing Indiana's impact on future year visibility at Seney.

Baseline visibility conditions for the northern Class 1 areas, taken from 2000 through 2004, established the baseline values at the northern Class 1 areas between 18.5 and 23.5 deciviews for the 20% worst days using the old IMPROVE equation and baseline values at the northern Class 1 areas between 19.5 and 24.5 deciviews using the new IMPROVE equation. This information is used to establish the uniform rate of improvement (URI) for 2018. Appendix 9a, Table 3 shows the visibility values for the northern Class 1 area using the old and new IMPROVE equations.

4.2 Glidepaths to Natural Conditions in 2064

The states and RPOs with Class 1 areas performed their analyses to determine baseline conditions and natural conditions for 2064. The Regional Haze Rule directs states to graphically show what would be a "uniform rate of progress" toward natural conditions for each Class 1 area within their state, as well as Class 1 areas outside the state which may be affected by emissions from sources within the state. The uniform rate of progress is also known as the "glidepath." The glidepath is a straight line drawn from the baseline level of visibility impairment for 2000 - 2004 to the level representing no manmade impairment in 2064.

Glidepaths were developed by the states and RPOs for their own Class 1 areas using their available information. The MRPO also developed glidepaths for the Class 1 areas impacted by states within the RPO. The glidepath is one of the indicators used in setting reasonable progress goals.

The glide paths, as determined by LADCO's Base M modeling, show the different emission scenarios meeting the glide paths for most Class 1 areas by 2018. The different emission scenarios include:

- **R5S1a scenario** - EGU emissions as assumed by the EPA's IPM3.0 model
- **R5S1b scenario** – EPA's IPM3.0 model emissions for EGUs along with several "will do" adjustments identified by states (legally binding agreements such as consent degrees, operating permits, signed contracts, etc).

Modeling results show the deciview values resulting from the different emission rates fall in line with the glide path for each Class 1 area for the 20% worst days. Further explanation of the glide path results can be found in the "Regional Air Quality Analyses for Ozone, $PM_{2.5}$ and Regional Haze: Final Technical Support Document, April 25, 2008" page 96-100. The glide paths for several Class 1 areas are found in Figure 10 on page 27.

4.3 Letters Requesting Participation in Consultation Process from States with Class 1 Areas

As a result of the various analyses performed by the MRPO and other RPOs, Indiana was invited to participate in a number of consultations regarding contributions to Class 1 areas. These include Arkansas, Missouri, Minnesota, and Michigan. Also included were New Jersey, New Hampshire, and Vermont - each individually and together as part of the MANE-VU letter. Copies of these letters are found in Appendix 2.

5.0 Emissions Inventory

A great deal of technical information must be assembled to determine the causes of impaired visibility in the Class 1 areas. Required in 40 CFR 51.308(d)(4)(v) is a statewide emissions inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class 1 area. The pollutants inventoried by Indiana for this purpose include volatile organic compounds (VOCs), nitrogen oxides (NO_x), fine particulate ($PM_{2.5}$), coarse particulate (PM_{10}), and sulfur dioxide (SO_2). An inventory was developed for the baseline year 2005. In addition, projections of future emissions have been made for 2009 and 2018. Indiana will update this inventory on a periodic basis, every three years. A summary of the inventory results follows; the complete emission inventory is available at: http://www.ladco.org/tech/emis/current/. The following information is taken from Section 3.6 of the MRPO document, "Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze: Final Technical Support Document, April 25, 2008, States of Illinois, Indiana, Michigan, Ohio, and Wisconsin." This document is available at the MRPO website:
http://www.ladco.org/reports/technical_support_document/tsd/tsd_version_iv_april_25_2008_final.pdf

5.1 Base Year Emissions

Through coordination with the MRPO and other states, a base year inventory was prepared for regional modeling analysis. The states reviewed methodologies and assisted in the preparation of key segments of the emissions inventory that was eventually submitted to the MRPO.

For on-road, nonroad, ammonia, and biogenic sources, the 2005 emissions were estimated by models. For the other sectors, point sources, area sources, and MAR (commercial marine, aircraft, and railroads), the 2005 emissions were prepared using data supplied by the MRPO States and, for non-MRPO states, data developed by other RPOs. In particular, for the non-MRPO states, a contractor (Alpine, with assistance from MACTEC) obtained the latest base (2002) and future year emission files (2009 and 2018) from the other RPOs. Specifically, the following versions of these emissions files were used here:

- MANE-VU: Version 3.1
- WRAP: Pre2002d
- CENRAP: Base F
- VISTAS: Base F

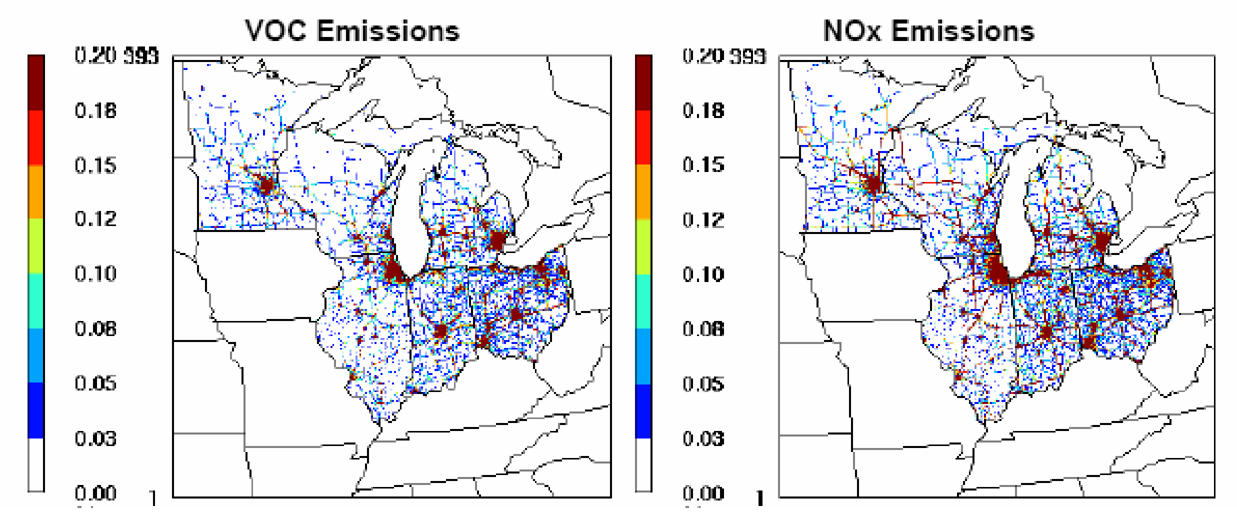
Emissions for 2005 were then estimated by linearly interpolating between the 2002 and 2009 emissions.[2]

Further discussion of the development of the 2005 base year emissions is provided below.

5.2 On-road Mobile

The CONsolidated Community Emissions Processing Tool (CONCEPT)[3] was run by a contractor (Environ) using transportation data (e.g., VMT and vehicle speeds) supplied by the state and local planning agencies in the MRPO States and Minnesota for 24 networks. These data were first processed with T3 (Travel Demand Modeling [TDM] Transformation Tool) to provide input files for CONCEPT to calculate link specific, hourly emission estimates. CONCEPT was run with meteorological data for a July and January weekday, Saturday, and Sunday (July 15 – 17 and January 16 – 18). Spatial plots of emissions for July 15 are provided in the following figure.

Figure 5 July 15, 2005 Motor Vehicle Emissions for VOC and NO_x (Tons Per Day)



[2] Emissions Inventory Assistance: 2005 Base Year Biogenic and Other (non-MRPO) State Emissions", March 12, 2007
[3] CONCEPT was developed as joint project between Alpine Geophysics, LLC and ENVIRON Corporation, with Midwest RPO and joint RPO funding, the CONCEPT model combines the best attributes of current emissions modeling systems into an open source model.

For the non-MRPO states, CONCEPT was run by Environ using RPO-based HPMS county-level data (2002 and 2009) and MOBILE6 inputs (2002) compiled by another contractor for VISTAS. HPMS VMT for 2005 was generated by linearly interpolating between the 2002 and 2009 data. The 2002 MOBILE6 inputs were used for the 2005 modeling, with a few adjustments (e.g., fuel sulfur content was set to 30 ppm, as required by the Tier 2/low sulfur regulations).

5.3 Nonroad Mobile

NMIM2005[4] was run by Grant Hetherington (Wisconsin Department of Natural Resources). The following are the NMIM2005 model runs prepared for the emissions inventory.

- Phase 1: Run NMIM2005 for the MRPO states plus Minnesota plus Iowa and Missouri agriculture with Pechan's modifications only[5]. The Pechan modifications that were not incorporated in the default NMIM2005 inputs and need to be incorporated are BSFC emission factor data, Michigan population data, Missouri seasonality data and revised countynrfile, countyyear, countyyearmonth, datasource and gasoline NCD tables that assimilate fuel changes and file references.

- Phase 2: Run NMIM2005 for the MRPO states plus Minnesota plus Iowa and Missouri agriculture with Pechan's modifications, revised 2005 MRPO gasoline parameters and a modified SCC table containing $PM_{2.5}$ corrections for diesel equipment.

- Phase 3: Run NMIM2005 for the MRPO states plus Minnesota plus Iowa and Missouri agriculture with Pechan's modifications, revised 2005 MRPO gasoline parameters, a modified SCC table containing $PM_{2.5}$ corrections for diesel equipment and AIR's NONROAD.EXE. (Note: it is not clear if Phase 3 was used.)

Not all sectors of the nonroad inventory are calculated by NMIM2005 (i.e., commercial marine, aircraft, and railroads) and those were handled separately. Aircraft emissions were supplied by the states. Updated information for railroads and commercial marine was prepared by a contractor (Environ).[6] For the non-MRPO states, Alpine developed appropriate emissions files based on data from the other RPOs, as noted above.

5.4 Area Sources

EMS (Emissions Modeling System) was run by the MRPO using 2005 data supplied by the MRPO states and, for the non-MRPO states, using emission files supplied by Alpine based on data from the other RPOs to produce weekday, Saturday, and Sunday emissions for each month. Upon reviewing the

[4] The National Mobile Inventory Model (NMIM) is a free, desktop computer application developed by EPA to help develop estimates of current and future emission inventories for on-road motor vehicles and nonroad equipment. NMIM uses current versions of MOBILE6 and NONROAD to calculate emission inventories, based on multiple input scenarios entered into the system. NMIM is used to calculate national, state or county inventories.
[5] "LADCO Nonroad Emissions Inventory Project – Development of Local Data for Construction and Agricultural Equipment", Final Report, September 10, 2004
[6] "LADCO 2005 Locomotive Emissions", Environ, February 2007, and "LADCO 2005 Commercial Marine Emissions", Environ, March 2, 2007

data, further attention was given to two source categories, industrial adhesives and sealants and outdoor wood boilers, in order to provide updated emissions estimates. These activities are described below.

Industrial Adhesives and Sealants: The National Emissions Inventory shows this to be a large VOC emissions category in the MRPO States (i.e.., 50,000 TPY). U.S. EPA subsequently determined that "(f)or the Region V states, we no longer believe that there are any activities in the Industrial Adhesives and Sealants category (SCC 2440020000) that have not been inventoried either in the point source Industrial Adhesives and Sealants category or under the Consumer and Commercial Adhesives and Sealants nonpoint category (SCC 2460600000 - all adhesives and sealants)." Consequently, this category was omitted from the 2005 regional emissions inventory.

Outdoor Wood Boilers: Over the past several years, the installation and operation of outdoor wood boilers for residential use has increased dramatically in many northern states. Relying on an emission estimation methodology prepared by Bart Sponseller (Wisconsin Department of Natural Resources), emissions were calculated by the other states for this category.

For the non-MRPO states, a contractor (Alpine, with assistance from MACTEC) estimated 2005 emissions by linearly interpolating between the 2002 and 2009 emissions developed by the other RPOs.

5.5 Point Sources – Electric Generating Units (EGUs)

EMS was run by the MRPO using 2005 data supplied by the MRPO states and, for the non-MRPO states, using emission files supplied by Alpine based on data from the other RPOs to produce weekday, Saturday, and Sunday emissions for each month.

The annual and summer season EGU emissions were temporalized for modeling purposes using profiles prepared by Scott Edick (Michigan Department of Environmental Quality) based on CEM data for the period 2002 – 2005. Since the CEM data was the source of the emissions data, EGUs were removed from the general point source files provided by the states.

5.6 Point Sources – Non-EGU

EMS was run by the MRPO using 2005 data supplied by the MRPO states and, for the non-MRPO states, using emission files supplied by Alpine based on data from the other RPOs, to produce weekday, Saturday, and Sunday emissions for each month.

5.7 Other Improvements

Canadian Emissions: Previous modeling inventories for Canadian sources were flawed due to problems with emissions (e.g., MRPO inventories omitted ammonia emissions) or stack parameters (e.g., VISTAS inventories failed to include proper stack parameters, resulting in emissions getting dumped in the surface layer of the model). Scott Edick of the Michigan DEQ processed the 2005 Canadian National Pollutant Release Inventory (NPRI). Specifically, a subset of the NPRI data which is relevant to the air quality modeling was reformatted. Circle plots of point source emissions are presented in the following figures.

Figure 6 Base Year Emission Plots for Canada

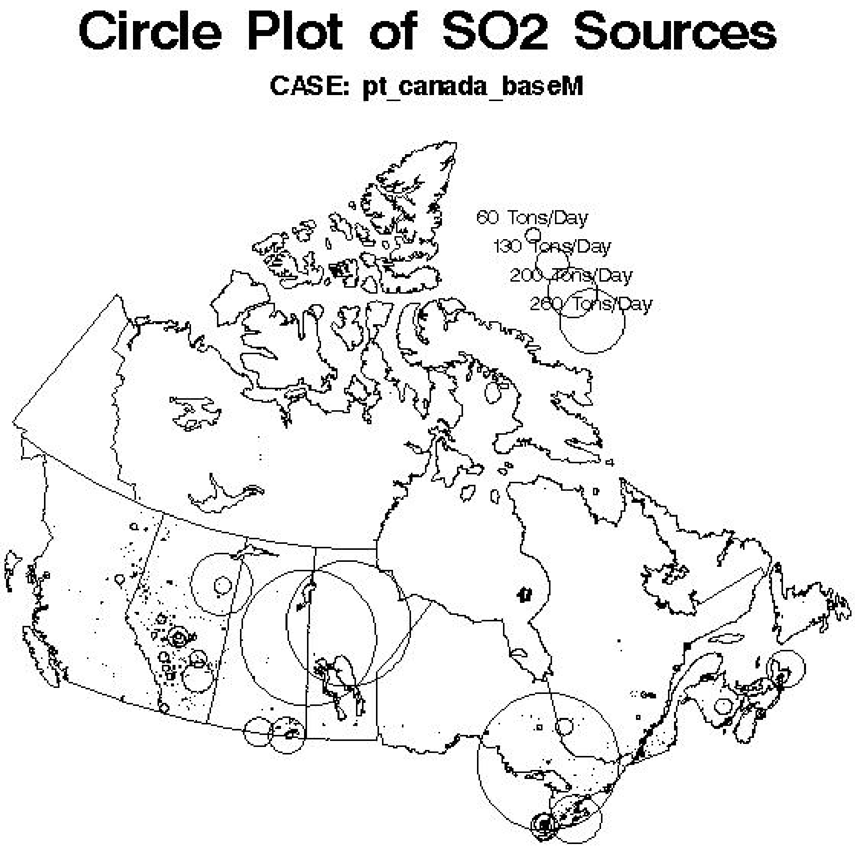
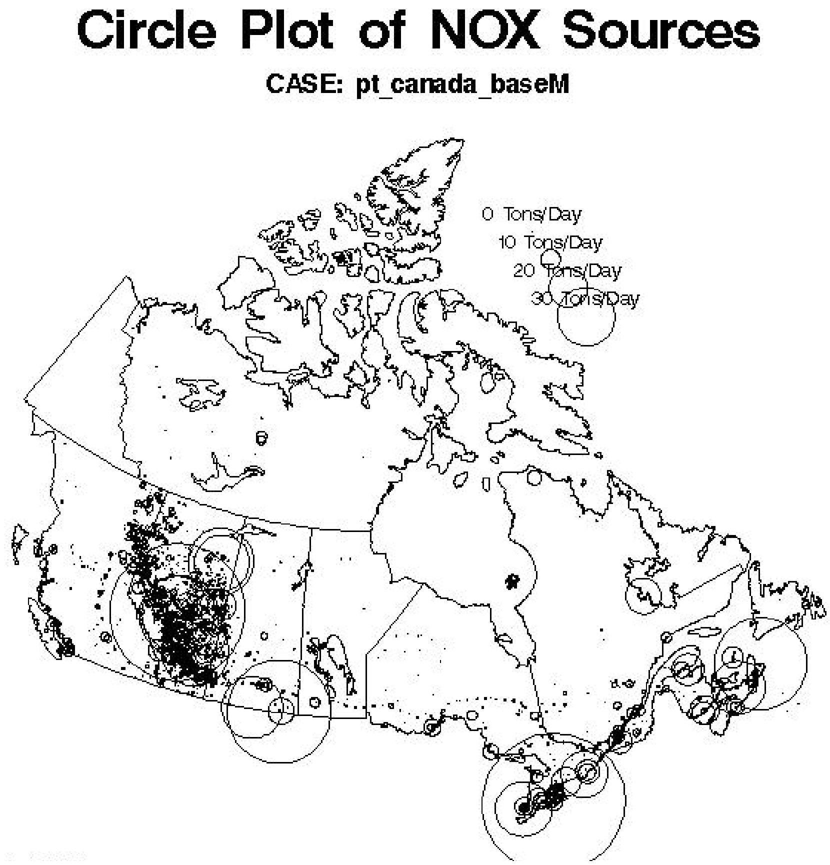


Figure 7 Base Year Emission Plots for Canada



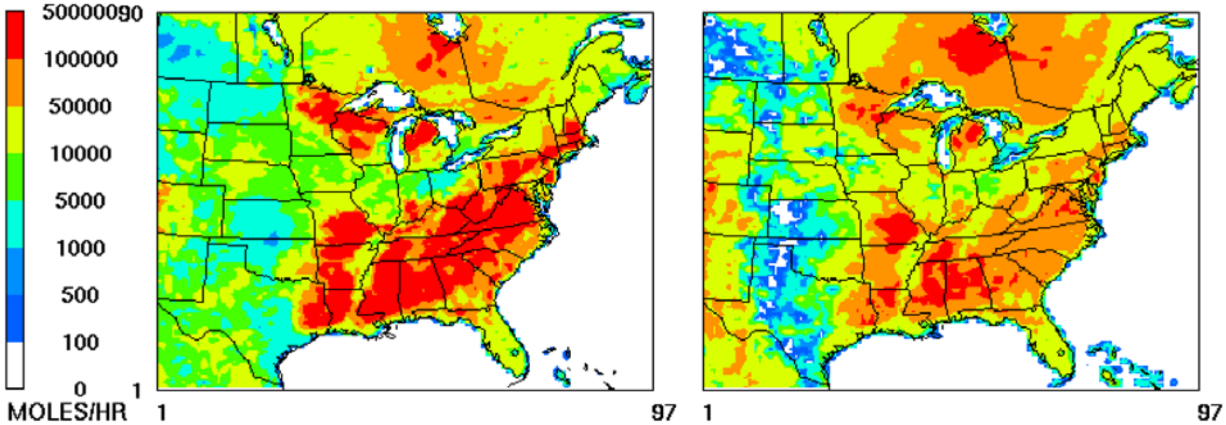
Biogenic Emissions: A contractor (Alpine) provided an updated version of the CONCEPT/MEGAN[7] (Model of Emissions of Gases and Aerosols from Nature) biogenics model, which was used to produce base year biogenic emission estimates. Model improvements included: (a) reduced model run times, (b) improved ability to run successive days, and (c) enhanced meteorological input processing[8].

As a result of the model improvements and more recent data sets, there is more regional isoprene using MEGAN compared to the BIOME estimates used for Base K (see Figure 8). Also, with the secondary organic aerosol updates to the CAMx air quality model, Base M includes emissions for monoterpenes and sesquiterpenes, which are precursors of secondary $PM_{2.5}$ organic carbon mass.

[7] See http://bai.acd.ucar.edu/Megan/

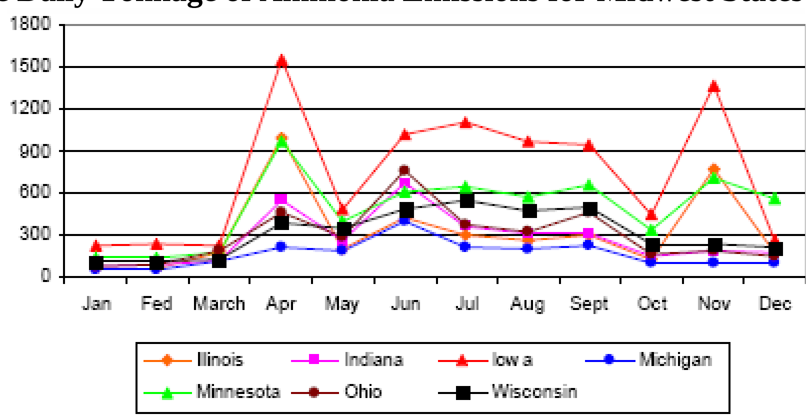
[8] Subsequent to delivery of the updated CONCEPT/MEGAN model, it was found that more recent data sets and model formulations were available. Consequently, additional model improvements were undertaken. Compared to the initial updated model, the revised model reflects lower emissions for several organic aerosol species and NOx.

Figure 8 Isoprene Emissions for Current Inventory (left) v. Previous Inventory (right)



Ammonia Emissions: The CMU-based 2002 ammonia emissions were projected to 2005 using growth factors from the Round 4 emissions modeling. These emissions were then adjusted by applying temporal factors by month based on the process-based ammonia emissions model. A plot of the average daily emissions by state and month is provided in Figure 9.

Figure 9 Average Daily Tonnage of Ammonia Emissions for Midwest States by Month (2005)



5.8 Future Year Emissions

Emission inventories were developed for two future years: 2009 and 2018. For on-road, nonroad, and EGU sources, the future year emissions were estimated by models (i.e., CONCEPT, NMIM2005, and IPM, respectively) and then processed by the MRPO with EMS.

For other sectors (area, commercial marine, aircraft, and railroads, and non-EGU point sources) the future year emissions for the MRPO States were derived by applying growth and control factors to the base year inventory. These factors were developed by a contractor (E.H. Pechan).[9] For the non-MRPO states, future year emission files were supplied by Alpine based on data from the other RPOs. Growth factors were based initially on EGAS (version 5.0), and were subsequently modified (for select, priority categories) by examining emissions activity data.

[9] "Development of 2005 Base Year Growth and Control Factors for Lake Michigan Air Directors Consortium", Final Report, September 2007

Control factors were prepared for the following area, commercial marine, aircraft, railroad, and non-EGU point source existing ("on the books") controls:

On-Highway Mobile Sources
- Tier II/low sulfur fuel
- Inspection/maintenance programs (nonattainment areas)
- Reformulated gasoline (nonattainment areas)

Off-Highway Mobile Sources
- Federal control programs incorporated into NONROAD model (e.g., nonroad diesel rule), plus the evaporative Large Spark Ignition and Recreational Vehicle standards
- Heavy-duty diesel (2007) engine standard/low sulfur fuel
- Federal railroad/locomotive standards
- Federal commercial marine vessel engine standards

Area Sources
- Consumer solvents
- AIM coatings
- Aerosol coatings
- Portable fuel containers
- Woodstoves
- Stage II Vapor Recovery

Point Sources - EGUs
- Title IV (Phases I and II)
- NO_x SIP Call
- Clean Air Interstate Rule (CAIR)
- Clean Air Mercury Rule

Other Point Sources
- VOC 2-, 4-, 7-, and 10-year MACT standards
- Combustion turbine MACT
- Industrial boiler/process heater/RICE MACT
- Consent decrees (refineries, ethanol plants, and ALCOA)[10]
- Other (Illinois and Ohio NO_x RACT[11], and BART in IN and WI)
- MACT[12]

Further discussion of the development of the future year emissions is provided below:

On-road: Similar to the base year modeling, CONCEPT was run using transportation data (e.g., VMT and vehicle speeds) supplied by the state and local planning agencies for 2009 and 2018. CONCEPT was only run with meteorological data for the July weekday. The emissions for Saturday and Sunday

[10] E.H. Pechan's original control file included control factors for three sources in Wayne County, MI. These control factors were not applied in the regional-scale modeling to avoid double-counting with the state's local-scale analysis for $PM_{2.5}$

[11] WI believes that NOx RACT for their sources is already included in the 2005 basecase and EGU "will do" scenario, and IN provided NOx RACT information for inclusion as a non-EGU "may do" scenario.

[12] E.H. Pechan's original control file included EPA-default control factor information. Alternative control factors were developed by Wisconsin for a few MACT categories, and were also applied to the other four MRPO States.

were derived by using scaling factors based on the 2005 emissions. The state-level emissions for the five MRPO States plus Minnesota are summarized in the following table[13].

Table 3 Summary of On-road Emissions (Tons Per Day – July 15, 2005)

Year	State	CO	VOC	NO_x	$PM_{2.5}$	SO_2	NH3	Sum of VMT
2005	IL	3,684	342	748	13	10	36	344,087,820
	IN	3,385	282	541	9	11	26	245,537,232
	MI	4,210	352	722	12	14	35	340,834,026
	MN	2,569	219	381	6	8	18	170,024,600
	OH	6,113	680	934	16	19	37	360,521,069
	WI	2,206	175	458	8	9	20	189,123,964
	Total	22,168	2,049	3,783	65	70	171	1,650,128,710
2009	IL	2,824	268	528	10	4	39	372,132,591
	IN	2,840	235	402	7	3	26	249,817,026
	MI	3,172	269	501	9	4	37	356,347,011
	MN	2,257	206	308	5	2	22	204,443,018
	OH	4,619	424	694	12	5	40	387,428,127
	WI	1,673	119	322	6	2	21	197,729,965
	Total	17,385	1,522	2,754	49	20	184	1,767,897,738
2018	IL	2,085	152	201	6	4	43	413,887,887
	IN	2,217	138	173	4	3	30	288,042,232
	MI	2,434	164	204	6	4	41	388,128,432
	MN	1,800	123	137	4	2	25	237,022,214
	OH	3,362	243	274	7	4	43	421,694,093
	WI	1,256	68	139	4	2	22	218,277,168
	Total	13,153	888	1,128	31	18	204	1,967,052,026

For the non-MRPO states, CONCEPT was run by Environ using HPMS county-level data and MOBILE6 inputs compiled by another contractor for VISTAS. The emissions modeling for Iowa, Missouri, and Oklahoma was redone for 2009 to reflect the state-developed registration distribution data. (The initial modeling for 2009 used national default values for registration distribution assumed by VISTAS' contractor. CENRAP's contractor developed emissions inventories for 2002 and 2018 using the state developed data. For consistency, Environ's remodeling for these three states for 2009 also used the state-developed data.)

Off-road: Similar to the base year inventory, NMIM2005 was run by Grant Hetherington (Wisconsin Department of Natural Resources) to produce the future year inventories, with updated growth factors by E.H. Pechan.

Point Source - EGU: Future year emissions were based on U.S. EPA's IPM3.0 modeling. Two additional scenarios were addressed to analyze actual implementation of controls in each state to meet CAIR requirements:

- 5a: U.S. EPA's IPM3.0 was assumed as the CAIR future year base for EGUs.

[13] For northeastern IL (CATS region), 2009 and 2018 emissions were increased by 9% and 8%, respectively, to reflect newer transportation modeling by CATS.

- 5b: U.S. EPA's IPM3.0 CAIR run, with several "will do" adjustments identified by the States. These adjustments should reflect a legally binding commitment (e.g., signed contract, consent decree, or operating permit).
- 5c: U.S. EPA's IPM3.0 CAIR run, with several "may do" adjustments identified by the States. These adjustments reflect less rigorous criteria, but should still be some type of public reality (e.g., BART determination or press announcement).

Table 4 summarizes the SO_2 and NO_x emissions for the three scenarios. The EGU emissions were the only changes in scenarios 5b and 5c. The net effect is a small change (increase) in regional SO_2 and NO_x emissions. SO_2 emissions increase from scenario 5a to scenarios 5b and 5c by 28% while NO_x emissions increase only 1% for Indiana in 2009. These increases are 15% for SO_2 in 2018 and 4% for NO_x in 2018. Emissions differed from the IPM predicted runs because the CAIR rule included a wide-spread trading program and use of banked allowances. Therefore, some companies could attain their CAIR budget through means other than installation of advanced control devices. Also, there were several facilities identified in the LADCO states that would likely not complete scrubber projects as originally predicted by the IPM 3.0 runs. Emissions for 2005 were then substituted for 2009 LADCO runs. For Indiana, 2005 "unscrubbed" data was substituted for all the Clifty Creek units. This information is found at the LADCO website; ladco.org/tech/Emis/round5/index.php, "Current Inventory – LADCO's Round 5, 2009/2018 Inventory (August 2007)", under "State Total Reports". Emission projections from 2009 to 2018 show significant decreases in NO_x emissions for scenario 5a of 31% and NO_x emissions decreases for scenarios 5b and 5c of 29%, each. Emission projections from 2009 to 2018 show decreases in SO_2 emissions for scenarios 5b and 5c of 9% each.

Table 4 EGU Emissions for Base (5a), Will Do (5b), and May Do (5c) Scenarios

	2009 (Tons per Day)			2018 (Tons per Day)		
SO_2	**5a**	**5b**	**5c**	**5a**	**5b**	**5c**
IL	958	881	881	869	433	433
IN	1033	1318	1318	1036	1194	1194
MI	667	667	667	725	725	725
OH	1326	1410	1410	983	1127	1127
WI	460	460	421	435	499	235
Total	4444	4736	4697	4048	3978	3714
MN	162	148	148	187	167	157
NO_x	**5a**	**5b**	**5c**	**5a**	**5b**	**5c**
IL	275	247	247	224	195	195
IN	370	372	372	255	266	266
MI	242	242	242	243	243	243
OH	281	305	305	285	310	310
WI	165	164	155	176	172	145
Total	1333	1330	1321	1183	1186	1159
MN	116	142	142	132	157	125

Table 5 shows the emissions for various pollutants from emission sectors used in the Round 5 runs. This table illustrates the amount of reductions in each sector from controls in place and projected over the years, including those listed on page 15. Overall, emissions from Indiana and the Midwest, as a whole, are reduced significantly over this time, illustrating that Indiana is making reasonable progress toward reducing emissions.

Table 5 Emissions Summaries

	VOC			NO_x			SO_2			**$PM_{2.5}$**		
July	2005	2009	2018	2005	2009	2018	2005	2009	2018	2005	2009	2018
Nonroad												
IL	321	257	213	333	275	155	33	5	0	30	24	14
IN	195	160	128	191	158	89	19	3	0	17	13	7
MI	414	350	271	239	197	112	22	3	0	22	18	11
OH	356	294	238	304	246	135	29	5	0	27	22	13
WI	238	203	157	157	129	77	15	2	0	14	12	7
5-StateTotal	1,524	1,264	1,007	1,224	1,005	568	118	18	2	110	89	52
Commercial marine, aircraft, and railroad												
IL	11	10	6	246	228	165	22	19	17	7	6	4
IN	5	5	3	93	87	65	8	7	6	2	2	2
MI	7	7	7	87	82	65	21	14	8	3	3	2
OH	7	7	5	134	126	94	14	12	10	4	4	2
WI	4	4	3	58	54	41	8	6	5	2	2	1
5-StateTotal	34	33	24	618	577	430	73	58	46	18	17	11
Other Area												
IL	675	594	582	48	48	49	11	16	16	40	64	69
IN	391	358	384	56	58	59	32	32	32	2	2	2
MI	652	562	549	49	50	51	29	29	28	111	114	120
OH	604	506	487	93	108	108	6	15	14	19	35	34
WI	315	290	293	37	37	37	17	13	13	11	12	12
5-StateTotal	2,637	2,310	2,295	283	301	304	95	105	103	183	227	237
On-Road												
IL	341	268	151	748	528	201	9	4	3	13	10	6
IN	282	235	138	541	402	173	11	3	2	9	7	2
MI	351	269	163	722	501	204	14	4	3	12	9	3
OH	680	424	242	934	693	274	18	4	4	16	12	4
WI	175	119	68	457	322	138	9	2	2	8	6	2
5-StateTotal	1,829	1,315	762	3,402	2,446	990	61	17	14	58	44	17
EGU												
IL	7	6	7	305	275	224	1,158	958	869	13	34	77
IN	6	6	6	393	370	255	2,614	1,033	1,036	16	73	74
MI	6	4	4	393	242	243	1,251	667	725	15	25	29
OH	4	5	6	408	280	285	3,405	1,326	983	28	94	80
WI	5	2	3	213	165	177	545	460	435	-	22	25
5-StateTotal	28	23	26	1,712	1,332	1,184	8,973	4,444	4,048	72	248	285
Non-EGU												
IL	221	218	258	330	218	235	423	335	346	16	17	19
IN	130	137	167	179	175	178	218	216	180	35	36	44
MI	116	119	140	240	242	271	158	148	163	20	21	25
OH	84	87	104	175	166	178	289	288	293	27	28	33
WI	84	87	106	97	93	81	156	152	85	-	0	0
5-StateTotal	635	648	775	1,021	894	943	1,244	1,139	1,067	98	102	121

July Total	VOC 2005	2009	2018	NO_x 2005	2009	2018	SO_2 2005	2009	2018	$PM_{2.5}$ 2005	2009	2018
IL	1,576	1,353	1,217	2,010	1,572	1,029	1,656	1,337	1,251	119	155	189
IN	1,009	901	826	1,453	1,250	819	2,902	1,294	1,256	81	133	131
MI	1,546	1,311	1,134	1,730	1,314	946	1,495	865	927	183	190	190
OH	1,735	1,323	1,082	2,048	1,619	1,074	3,761	1,650	1,304	121	195	166
WI	821	705	630	1,019	800	551	750	563	540	35	54	47
5-StateTotal	6,687	5,593	4,889	8,260	6,555	4,419	10,564	5,781	5,280	539	727	723

6.0 Modeling Assessment

Provided in 40 CFR Part 51, Appendix W are guidelines for conducting regional-scale modeling to simulate pollutants impairing visibility. The U.S. EPA recommends the use of one of three models and the MRPO chose the Comprehensive Air Quality Model with extensions (CAMx).

The air quality analysis conducted by the MRPO includes weight of evidence approaches which rely on extensive data analysis and modeling. Given uncertainties in emissions inventories and modeling, these data analyses are a necessary part of the overall technical support.

Modeling includes base year analyses for 2005 to evaluate model performance and strategy analyses to assess candidate control strategies. The analyses were conducted in accordance with the U.S. EPA's "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze", EPA-454/B-07-002, April 2007 (Modeling Guidance). The regional haze modeling covers the full calendar year of 2005 for the eastern U.S. and uses 36 kilometer meteorology and modeling domains using CAMx.

The Clean Air Act sets as a national goal, "the prevention of any future, and the remedying of any existing, impairment of visibility in Class 1 areas which impairment results from manmade air pollution"[14] for regional haze. In the 5-state MRPO region, there are two Class 1 areas: Isle Royale National Park, MI and Seney National Wildlife Refuge, MI. The U.S. EPA visibility rules (64 FR 35714, July 1, 1999) require reasonable progress toward achieving "natural conditions" by the year 2064. Table 6 lists the areas that were modeled.

Table 6 Class 1 Areas Modeled by the MRPO

Class 1 Area	Identifier	State
Acadia National Park	ACAD1	Maine
Boundary Waters Canoe Area Wilderness Area	BOWA1	Minnesota
Brigantine Wilderness Area	BRIG1	New Jersey
Caney Creek Wilderness Area	CACR1	Arkansas
Dolly Sods Wilderness Area	DOSO1	West Virginia
Hercules-Glades Wilderness Area	HEGL1	Missouri
Isle Royale National Park	ISLE1	Michigan
James River Face Wilderness Area	JARI1	Virginia
Lye Brook Wilderness Area	LYBR1	Vermont

[14] Section 169A of the Clean Air Act

Class 1 Area	Identifier	State
Mammoth Cave National Park	MACA1	Kentucky
Mingo Wilderness Area	MING1	Missouri
Seney National Wildlife Refuge	SENE1	Michigan
Shenandoah National Park	SHEN1	Virginia
Upper Buffalo Wilderness Area	UPBU1	Arkansas
Voyageurs National Park	VOYA2	Minnesota

The primary source of modeling used in this document is from "Regional Air Quality Analyses for Ozone, $PM_{2.5}$ and Regional Haze: Technical Support Document", April 25, 2008, States of Illinois, Indiana, Michigan, Ohio, and Wisconsin.

6.1 Regional Haze/Visibility

The components of the visibility equation match up very closely to the prominent chemical forms of $PM_{2.5}$: nitrate ion, sulfate ion, ammonium ion, organic carbon, elemental carbon, and soil (U.S. EPA, 2007). Since these modeling applications will support $PM_{2.5}$ and Regional Haze rules, model performance will be most rigorous for each of these $PM_{2.5}$ species and coarse mass.

One of the problems related to PM model performance evaluation involves matching inconsistent monitor methodologies and model specie definition. Additionally, speciated measurements rarely add up to measurements of total fine mass. This unexplained fraction is usually attributed to the retention of water on the weighed samples (Timin, 2002). Other problems with comparing speciation samples and Federal Reference Method (FRM) measurements include volatilization of nitrate and positive and negative organic carbon artifacts (Timin, 2002).

Organic material is typically estimated from organic carbon using a factor of 1.4, which is based on the assumption that carbon accounts for 70% of the organic mass. Recent literature recommends a factor of 1.6 ± 0.2 for urban aerosol and 2.1 ± 0.2 for non-urban areas that see more aged aerosols (Turpin and Lim, 2001; “Interagency Monitoring of Protected Visual Environments (IMPROVE)”, 2006). These factors are applied to observation data based on land use type before being compared to model output. These factors may also be used to reduce modeled estimates of organic material to organic carbon.

Performance metrics used to describe model performance for $PM_{2.5}$ species include mean bias, gross error, fractional bias, and fractional error (U.S. EPA, 2007). The bias and error metrics are used to describe performance in terms of the measured concentration units (µg/m3). Even though the distribution of $PM_{2.5}$ is log-normal, the data is not transformed for this analysis. The model attainment tests outlined by U.S. EPA for the $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) and RH Rule require relative response factors to be applied to actual concentrations and not transformed concentrations. No minimum value is used to eliminate data points for the purposes of this analysis.

Visibility may be estimated by two similar methods that relate light extinction to ambient $PM_{2.5}$ concentrations (FLAG, 2000; U.S. EPA, 2007). Visibility will be estimated using the new equation recommended by the IMPROVE steering committee (IMPROVE, 2006). The new and old equations produce very similar estimates of light extinction in the upper Midwest. The new equation will be emphasized for the SIP modeling demonstration due to its more up-to-date science.

The equation shown below relates $PM_{2.5}$ specie concentrations to light extinction. Additional factors of relative humidity adjustment factor (fRH) are included that change the light scattering of sulfate and nitrate based on climatologically averaged relative humidity.

βext = 2.2*fSRH*[small sulfate] + 2.4*fS(RH)*[small nitrate] + 4.8*fLRH*[large sulfate] + 5.1*fL(RH)*[large nitrate]+ 2.8*[small OCM] + 6.1*[large OCM] + 10*EC + 1*SOIL + 0.6*CM + 1.7*fSS(RH)*SS + βrayleigh

βext - Estimated extinction coefficient (Mm-1)
Sulfate - Sulfate associated with ammonium (SO4*1.375)
Nitrate - Nitrate associated with ammonium (NO3*1.29)
OCM - Organic carbon Mass
EC - Elemental carbon
SOIL - Inorganic primary $PM_{2.5}$ (soil, crustal, other)
CM - Coarse fraction particulate matter
SS - Sea salt
βrayleigh Light scattering due to Rayleigh scattering (site specific)
fRH - Relative humidity adjustment factor

The apportionment of sulfate, nitrate, and organic carbon mass into small and large size fractions is shown below using 'X' as a placeholder for these species.

Large X = ([Total X] / [20 µg/m3]) * [Total X], where [Total X] < 20 µg/m3
Large X = [Total X], where [Total X] ≥ 20 µg/m3
Small X = [Total X] – [Large X]

The fRH values are long-term averages that are site and month specific (U.S. EPA, 2003a; U.S. EPA 2003b; FLAG, 2000). The light scattering due to Rayleigh is site specific (IMPROVE, 2006). The NO_2 component to the light extinction equation is not included since it is not measured at Class 1 areas in the upper Midwest. The visibility equation is expressed as an extinction coefficient (βext) and is converted to deciviews using the equation below.

Deciview = 10ln(βext/ βrayleigh)

The reasonable progress test to determine the relationship between current and future year visibility is expressed in deciview units. The changes in deciviews between the current and future year strategy is the reasonable progress test and is shown below.

Change in Deciview = 10ln[(βext)future / (βext)base]
- or -
Change in Deciview = Deciviewbase – Deciviewfuture

Visibility will be estimated for key Class 1 areas in the Midwest for the base year and various future year scenarios. The changes in visibility between the baseline and future year will be assessed using procedures in U.S. EPA's modeling guidance document (U.S. EPA, 2007).

1. The visibility in deciviews (dv) will be ranked from high to low at each Class 1 area for the calendar years 2000-2004 using the monthly and site specific fRH values and the more recent IMPROVE light extinction equation.
2. The mean dv for the 20% days with the best and the 20% days with the worst visibility are estimated for each Class 1 area for each year of the 2000-2004 baseline period.

3. The mean observed extinction coefficient for the days during the modeling period (2005) with the 20% best and 20% worst visibility will be calculated.
4. The mean predicted extinction coefficient for the corresponding 20% best and 20% worst days of the modeling period of the base case and future year strategy will be calculated using monthly site specific fRH values.
5. The relative response factor for the 20% best and 20% worst group of days for each site for each of the particulate matter species in the light extinction equation is estimated.
6. The relative response factors are multiplied by daily measured PM data during the 2000-2004 baseline to estimate future daily values of these species.
7. These future daily PM estimates are used to estimate light extinction for each of the previously identified 20% best and 20% worst days of monitored data. Light extinction is converted to dv and the mean value for the best and worst days for each year of the baseline period is estimated.
8. The 5 mean dv values for the worst and best days (one from each of the 5 years) are averaged together for a mean value for the best and worst days.
9. The future year mean dv values in step 8 are compared to the observed values from step 2. The differences are compared to established goals for reasonable progress to determine if reasonable progress is demonstrated.

6.2 Regional Haze Modeling Results

For regional haze, the calculation of future year conditions assumed: (a) baseline concentrations based on 2000-2004 IMPROVE data, with updated (substituted) data for Mingo, Boundary Waters, Voyageurs, Isle Royale, and Seney (see “Impact of Missing Data on Worst Days at Midwest Northern Class 1 Areas”, March 12, 2007 (revised 6/19/07)), (b) use of the new IMPROVE light extinction equation, and (c) use of U.S. EPA default values for natural conditions, based on the new IMPROVE light extinction equation.

Pursuant to the RH Rule, states must consider several factors in establishing reasonable progress goals for their Class 1 areas, including the uniform rate of visibility improvement. The uniform rate of visibility improvement values for the 2018 planning year were derived (for the 20% worst visibility days) based on a straight line between the baseline concentration value (plotted in the year 2004, end year of the 5-year baseline period) and the natural condition value (plotted in the year 2064, the date for achieving natural conditions). Plots of these “glidepaths” for Class 1 areas in the eastern U.S. showing the worst 20% days and best 20% days are presented in Figure . A tabular summary of measured baseline and modeled future year dv values for these Class 1 areas are provided in Tables 7 and 8. These values are based upon the emissions shown in Section 5, Tables 4 and 5. Note that column headings, on-the-books controls, "OTB," is equal to scenario 5a and on-the-books controls plus adjustments for controls from states commitments, "OTB+Will Do," is equivalent to scenario 5b. Only emissions from EGUs are changed when moving from 5a to 5b. This information was taken from the MRPO Technical Support Document (TSD). Data for Smoky Mountains and Sipsey were not included in that report. Caney Creek was not plotted in the MRPO TSD. These are addressed individually in later portions of this section.

The visibility modeling results show that the rates of visibility improvement in several Class 1 areas in the eastern U.S. are expected to be greater than the glidepath (i.e. further improvement needed), in 2018, including those in northern Michigan and several in the northeastern U.S. The rates of visibility improvement in many other Class 1 areas in the eastern U.S. are expected to be better than the glidepath, e.g. Mammoth Cave and Dolly Sods, in 2018.

Figure 10 Visibility Modeling Results for Class 1 Areas in Eastern U.S.

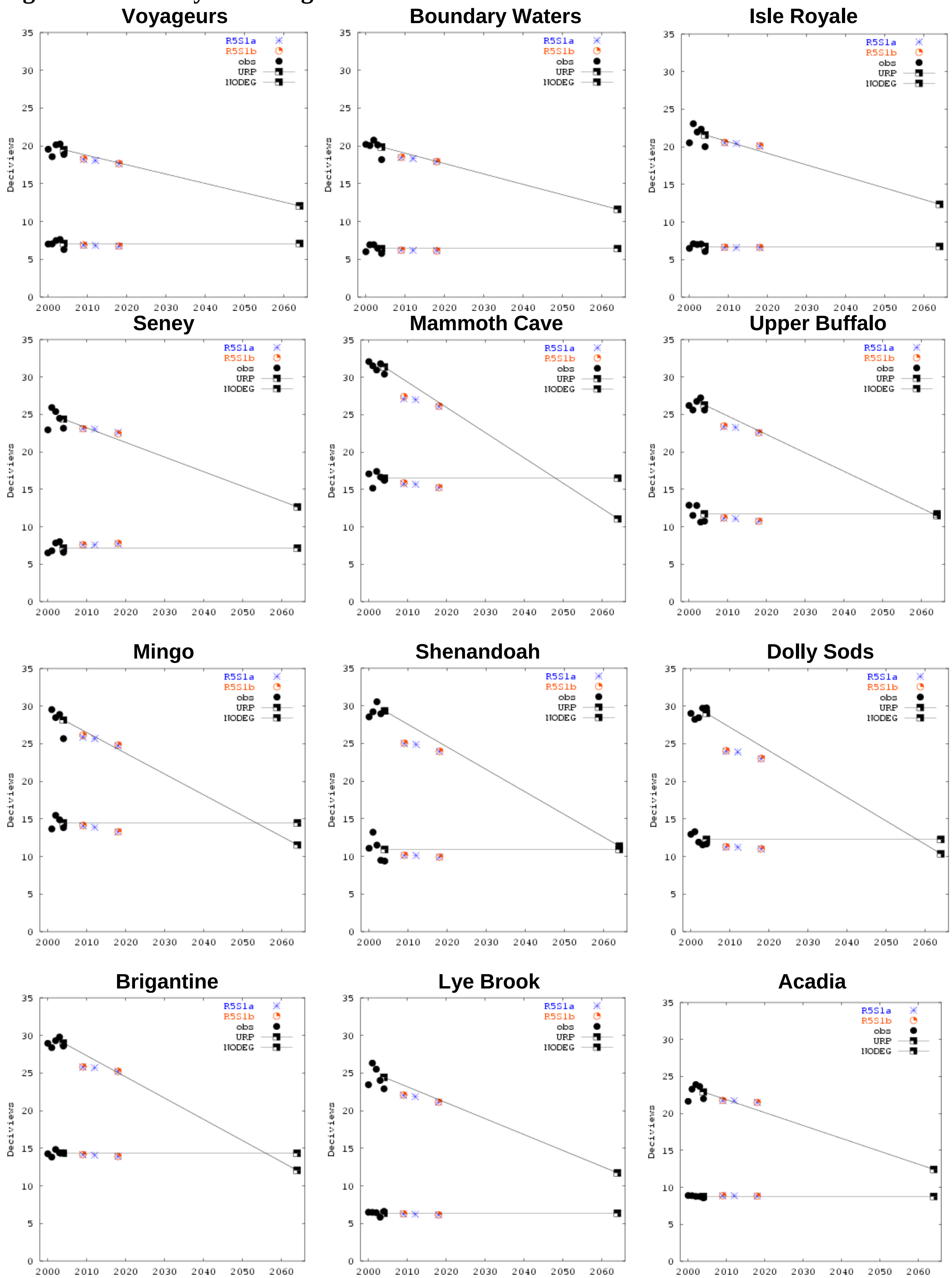


Table 7 Visibility Modeling Results (Deciviews) for Class 1 Areas in Eastern U.S. (Worst 20%)

Site	2000-2004 Baseline	2018 URP	2009 OTB	2009 OTB+Will Do	2012 OTB	2018 OTB	2018 OTB+Will Do
Boundary Waters	19.86	17.94	18.45	18.51	18.33	17.94	17.92
Voyageurs	19.48	17.75	18.2	18.28	18.07	17.63	17.66
Seney	24.38	21.64	23.1	23.1	23.04	22.59	22.42
Isle Royale 1	21.59	19.43	20.52	20.58	20.43	20.09	20.13
Isle Royale 9	21.59	19.43	20.33	20.37	20.22	19.84	19.82
Hercules-Glades	26.75	23.13	24.72	24.82	24.69	24.22	24.17
Mingo	28.15	24.27	25.88	26.13	25.68	24.74	24.83
Caney Creek	26.36	22.91	23.39	23.55	23.29	22.44	22.4
Upper Buffalo	26.27	22.82	23.34	23.47	23.27	22.59	22.55
Mammoth Cave	31.37	26.64	27.11	27.41	27.01	26.1	26.15
Dolly Sods	29.05	24.69	24	24.06	23.9	23	23.04
Shenandoah	29.31	25.12	24.99	25.04	24.87	23.92	23.95
James River Face	29.12	24.91	25.17	25.25	25.01	24.06	24.12
Brigantine	29.01	25.05	25.79	25.83	25.72	25.21	25.22
Lye Brook	24.45	21.48	22.04	22.08	21.86	21.14	21.14
Acadia	22.89	20.45	21.72	21.75	21.72	21.49	21.49

Table 8 Visibility Modeling Results (Deciviews) for Class 1 Areas in Eastern U.S. (Best 20%)

Site	2000-2004 Baseline	2018 URP	2009 OTB	2009 OTB+Will Do	2012 OTB	2018 OTB	2018 OTB+Will Do
Boundary Waters	6.42	6.42	6.21	6.2	6.19	6.14	6.12
Voyageurs	7.09	7.09	6.86	6.89	6.83	6.75	6.76
Seney	7.14	7.14	7.57	7.59	7.58	7.71	7.78
Isle Royale 1	6.75	6.75	6.62	6.64	6.59	6.6	6.62
Isle Royale 9	6.75	6.75	6.56	6.57	6.55	6.52	6.5
Hercules-Glades	12.84	12.84	12.51	12.56	12.32	11.66	11.64
Mingo	14.46	14.46	14.07	14.13	13.89	13.28	13.29
Caney Creek	11.24	11.24	10.88	10.95	10.85	10.52	10.52
Upper Buffalo	11.71	11.71	11.13	11.19	11.08	10.73	10.74
Mammoth Cave	16.51	16.51	15.76	15.88	15.69	15.25	15.25
Dolly Sods	12.28	12.28	11.25	11.29	11.23	11	11.01
Shenandoah	10.93	10.93	10.13	10.16	10.11	9.91	9.91
James River Face	14.21	14.21	13.38	13.43	13.38	13.14	13.14
Brigantine	14.33	14.33	14.15	14.16	14.08	13.92	13.92
Lye Brook	6.37	6.37	6.25	6.28	6.23	6.14	6.15
Acadia	8.78	8.78	8.86	8.88	8.86	8.82	8.82

URP - uniform rate of progress OTB - on-the-books controls
OTB+Will Do - on-the-books controls plus adjustments for controls from states commitments

7.0 Reasonable Progress Goals

7.1 Background

IDEM assessed each of the Class 1 areas identified in the MRPO report as being impacted by Indiana sources. Information provided by the MRPO and technical documents from the other RPOs are found in Appendix 1 and letters received from other states indicating their decisions regarding reasonable further progress goals, Appendix 2, were used to make these assessments.

In determining reasonable progress for regional haze, Section 169 of the Clean Air Act and U.S. EPA's visibility rule requires states to consider five factors:

- Costs of compliance
- Time necessary for compliance
- Energy and non-air quality environmental impacts of compliance
- Remaining useful life of any existing source subject to such requirements
- Uniform rate of visibility improvement (needed to attain natural visibility conditions by 2064)

LADCO's "Reasonable Progress for Class 1 Areas in the Northern Midwest – Factor Analysis" (July 18, 2007) addresses factor analysis to establish a reasonable progress goal toward achieving natural visibility conditions in mandatory Class 1 areas, see Appendix 9c. In addition, Appendix 9b provides additional information related to Indiana's emissions and visibility contributions and a detailed discussion of the measures needed to achieve Indiana's share of reductions.

Since Indiana has no Class 1 areas, the states with Class 1 areas took the lead in establishing reasonable progress goals. Indiana participated in the discussions and provided information to assist in setting the goals. The states developing the plans addressed the four factors and developed the uniform rate of progress glidepaths.

In the following sections, these analyses are summarized. A detailed analysis of each area is included in the appendices. In the previous section, MRPO modeling was used to identify areas possibly impacted by Indiana sources. In Sections 7.3 through 7.7, VISTAS modeling results are used to provide additional evidence regarding progress in achieving visibility improvements.

7.2 Voyageurs National Park and Boundary Waters Canoe Area Wilderness Area

Indiana sources have shown an impact on these Class 1 areas through modeling studies. Minnesota has determined that several other states are significant contributors to visibility impairment in these areas at this time and is working with them as they develop their reasonable progress goals.

The cover letter from the Minnesota Pollution Control Agency contains their reasonable progress analysis and can be found in Appendix 3. Indiana has participated in the consultation calls and the MRPO modeling process used by Minnesota to reach their conclusions.

As can be seen in the map in the Minnesota letter in Appendix 3, page 3-7, Indiana is barely in the Areas of Influence that impact their Class 1 areas. Minnesota has developed a long term strategy sufficient to meet their 2018 reasonable progress goals, and has not requested additional assistance from Indiana. Further, reductions for Indiana BART sources (and other states) resulting from new settlements, committed controls, current controls, and the proposed Transport Rule will be greater than those anticipated during the earlier modeling studies. Table 11 contains a table showing these projections. While specific modeling results will not be available for some time, it follows that Indiana's influence will be further reduced.

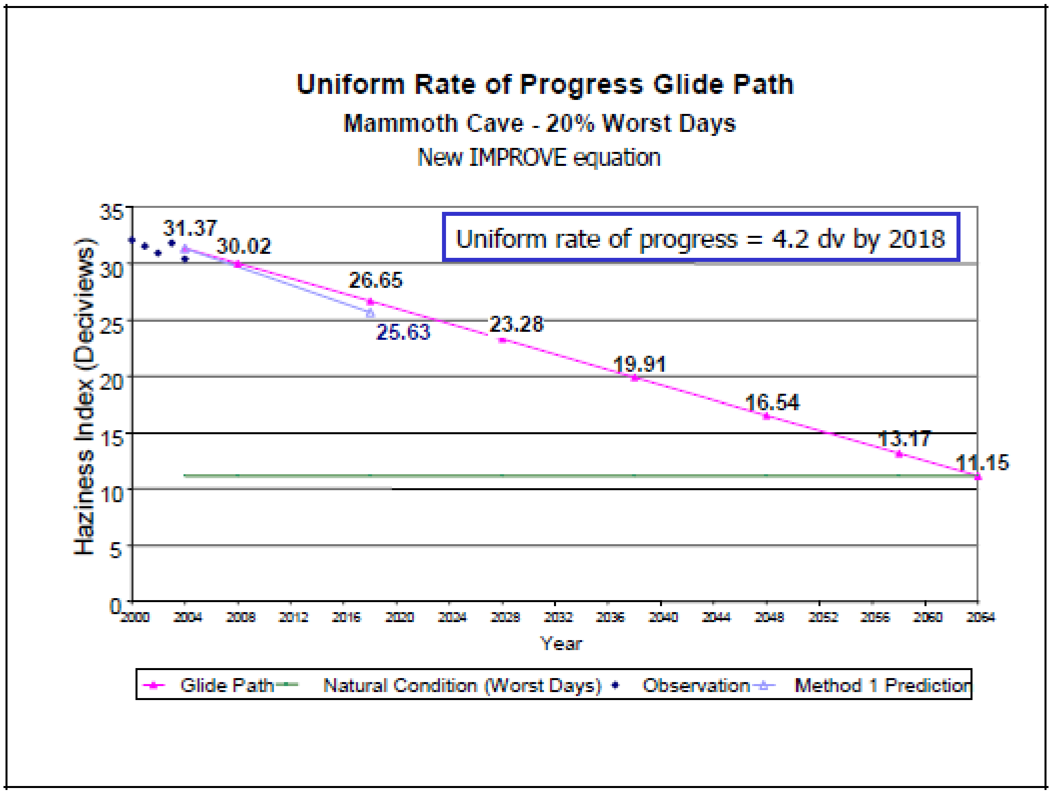
Indiana concurs that this is the best approach for addressing visibility impairment at Voyageurs and Boundary Waters Class 1 areas at this time. Therefore, no further analysis for this SIP is necessary.

7.3 Mammoth Cave National Park

Indiana sources have shown an impact on this Class 1 area through modeling studies. However, since sources in Kentucky and Indiana must comply with Clean Air Interstate Rule (CAIR) requirements, the Kentucky analysis has determined that these controls are sufficient to address visibility in this area. Further, VISTAS modeling has shown that Mammoth Cave is more than meeting its uniform rate of progress (glidepath) and has determined that no additional reductions are needed from Indiana at this time.

The cover letter from the Kentucky Department for Environmental Protection contains this information, Appendix 3, page 3-25. The results of the long term strategy developed by Kentucky and VISTAS provide anticipated visibility improvements below the glidepath, as can be seen in following figure.

Figure 11 Mammoth Cave Uniform Rate of Progress Glidepath

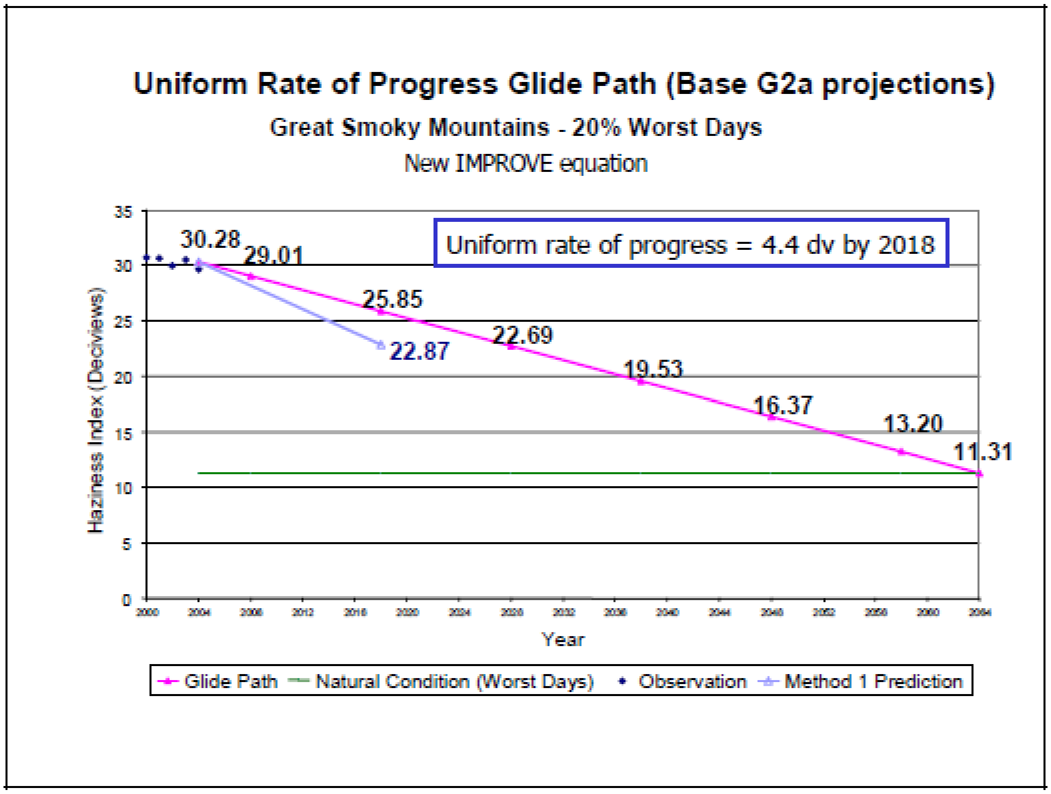


Analyses performed by the MRPO show similar results. Indiana concurs that this approach is an effective means of addressing visibility impairment at Mammoth. In addition, an Indiana source, Alcoa, was determined to significantly impact this area and is the subject of the Indiana BART rule. This is covered in Section 8.

7.4 Great Smoky Mountains National Park

In the MRPO summary of Class 1 areas impacted by sources from within the MRPO (Appendix 1), Indiana was determined to contribute to visibility impairment in this Class 1 area. Since that time, VISTAS has conducted several analyses to assist in developing reasonable progress goals.
The following figure shows that the long term strategy developed for this Class 1 area easily meets the glidepath through 2018.

Figure 12 Great Smoky Mountains Uniform Rate of Progress Glidepath

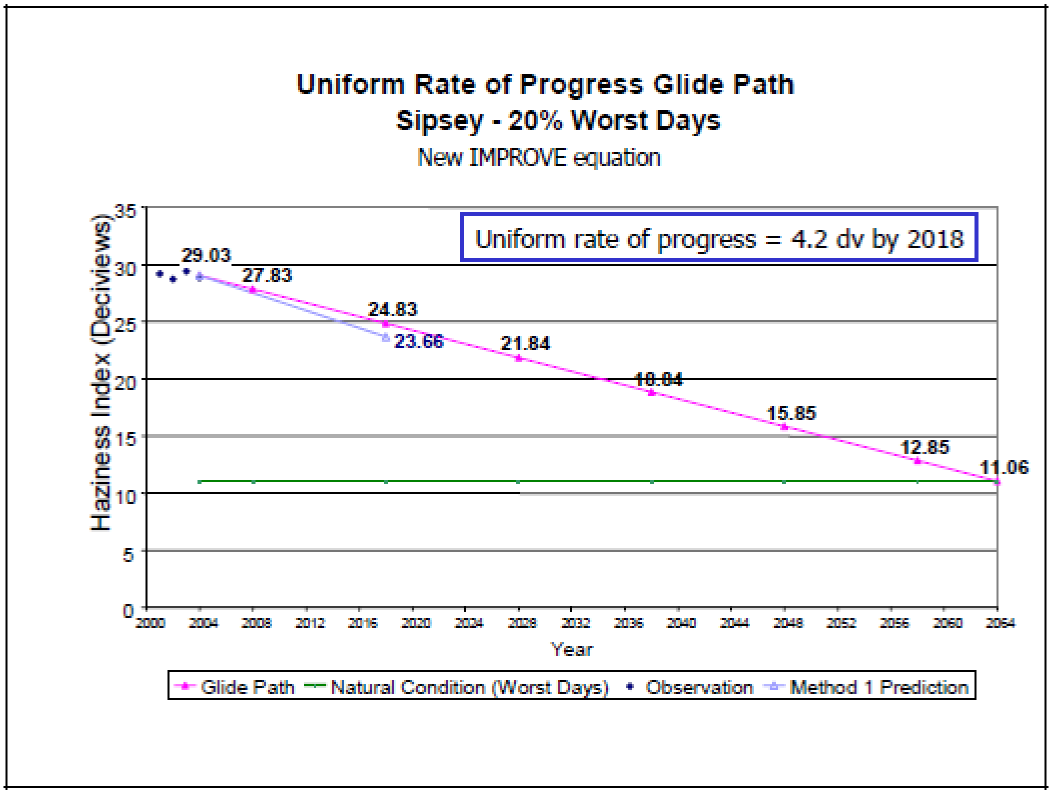


In the "Technical Analyses Supporting Regional Haze State Implementation Plan," June 8, 2007, North Carolina Department of Environment and Natural Resources stated that contributions from other RPOs are comparatively small and the greatest benefits would likely be from further EGU reductions within the VISTAS states. Indiana was not contacted by Tennessee or North Carolina regarding consultations for this area and believes that no further analysis for a long term control strategy is necessary at this time.

7.5 Sipsey Wilderness Area

In the MRPO summary of Class 1 areas impacted by sources from within the MRPO (Appendix 1), Indiana was determined to contribute to visibility impairment in this Class 1 area. Since that time, VISTAS conducted several analyses to assist in developing reasonable progress goals. The following figure shows that the long term strategy for this Class 1 area meets the glidepath through 2018.

Figure 13 Sipsey Uniform Rate of Progress Glidepath



Indiana has not been contacted by Alabama regarding consultations for this area and believes that no further analysis for a long term control strategy is necessary at this time.

7.6 James River Face Wilderness Area, Shenandoah National Park, Dolly Sods/Otter Creek Wilderness Areas

In the MRPO summary of Class 1 areas impacted by sources from within the MRPO (Appendix 1), Indiana was determined to contribute to visibility impairment in these more distant Class 1 areas. Since that time, VISTAS has conducted several analyses to assist in developing reasonable progress goals. The results of the long term strategy developed by the states and VISTAS provide anticipated visibility improvements below the glidepath. Figures 14, 15, and 16 show the glidepaths for each of these areas.

Figure 14 James River Face Uniform Rate of Progress Glidepath

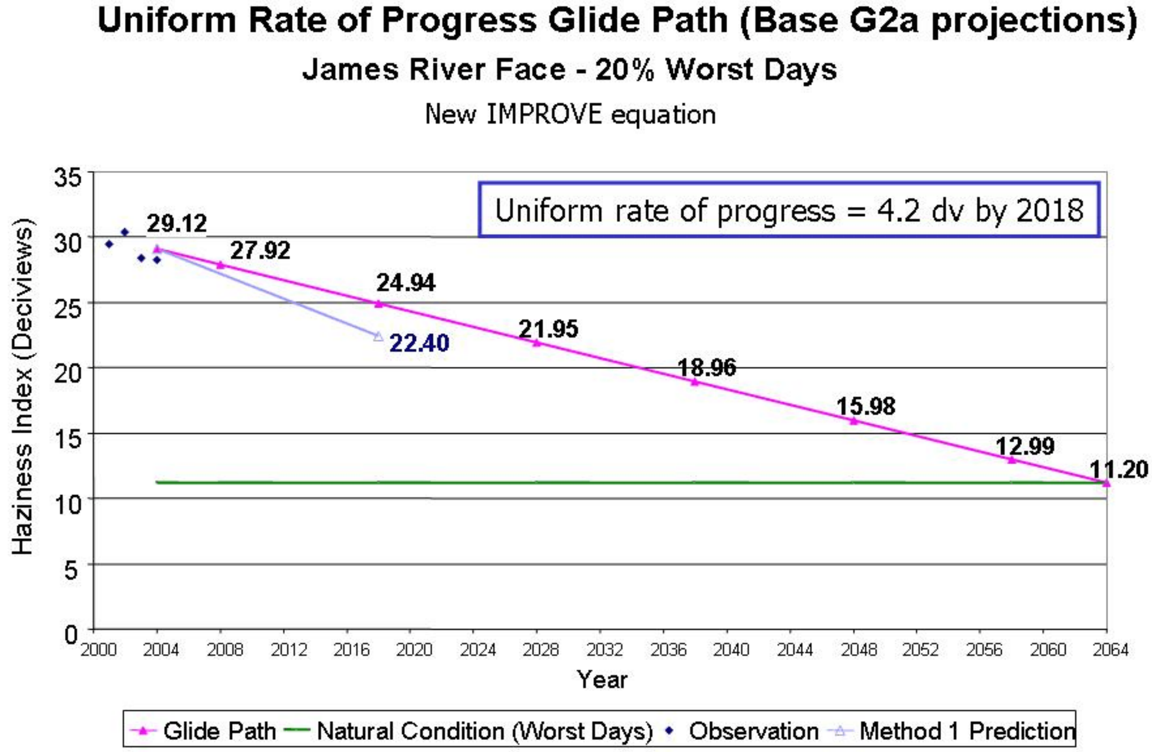


Figure 15 Shenandoah Uniform Rate of Progress Glidepath

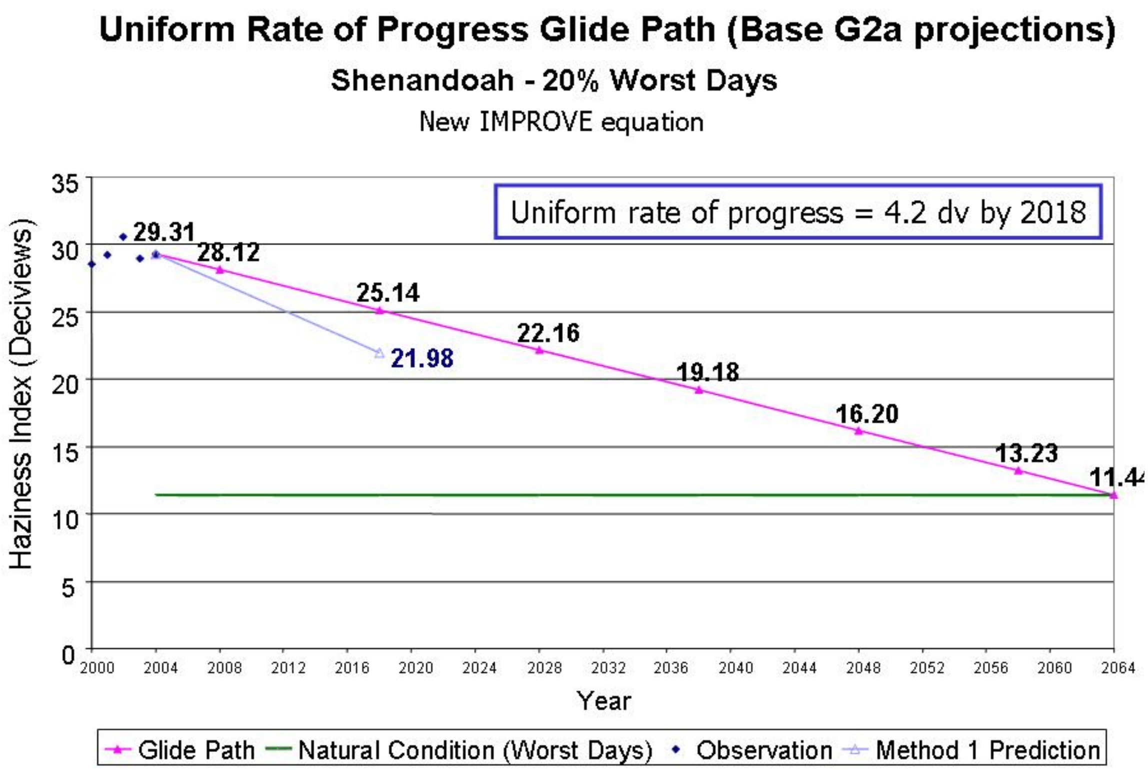
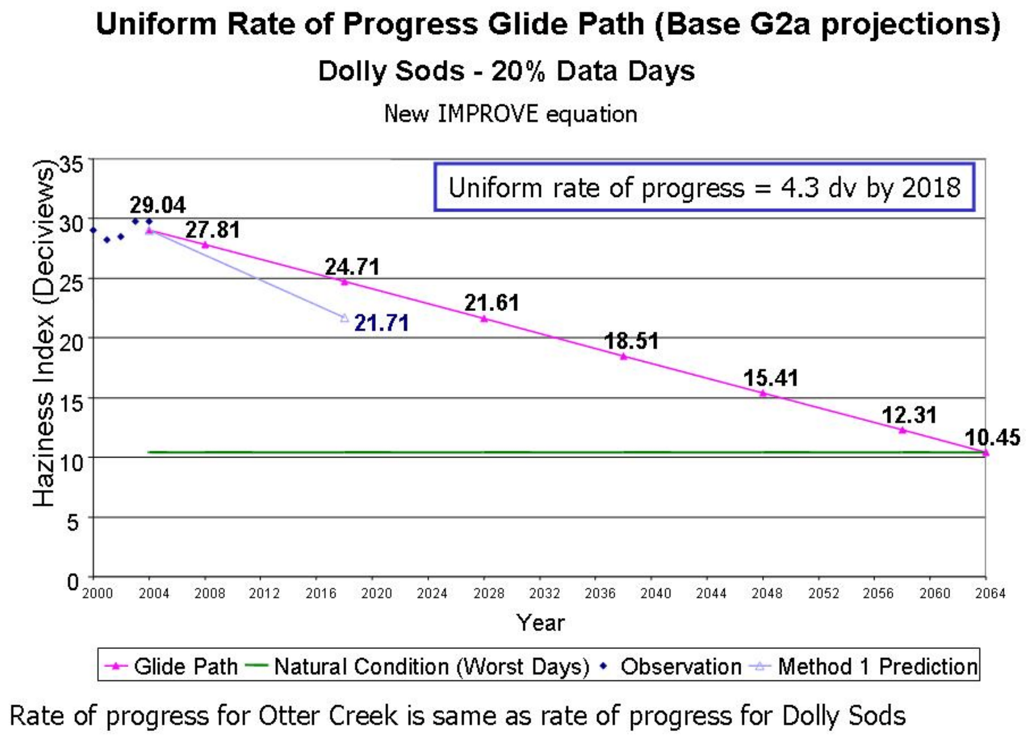


Figure 16 Dolly Sods Uniform Rate of Progress Glidepath



Neither Virginia nor West Virginia contacted IDEM to participate in consultations for these areas. The four factor analyses performed by the VISTAS states and resulting long term strategies indicate that controls closer to the Class 1 areas provide the most effective reductions at this time. Additionally, the long term strategies provide anticipated visibility improvements below the glidepaths. Indiana concurs with these conclusions.

7.7 Caney Creek and Upper Buffalo Wilderness Areas, AR, and Hercules-Glades and Mingo Wilderness Areas, MO

These areas were identified in early MRPO modeling and other analyses as being impacted by Indiana sources. Indiana was invited to participate in the consultation process for these areas, and attended the conference phone calls. Arkansas and Missouri notified IDEM that they consider the consultation process finished. They have developed long term strategies that meet Rate of Progress Goals by 2018. Further, Southwestern Indiana was included in the area of influence which impacts these areas (Appendix 3, page 52). The controls in existence in the 2002 inventory, those installed after 2002, and controls planned out to 2018, were analyzed. A large majority of these sources will be controlled by 2018, which will further aid in the progress toward their reasonable progress goals.

Figures 17 - 20 show glidepaths resulting from the long term strategies developed by the states. All the Class 1 areas are projected to meet their reasonable progress goals in 2018.

At this time, they have concluded that no reductions are necessary from Indiana. The letter providing this information is in Appendix 3, page 45.

Figure 17 Caney Uniform Rate of Progress Glidepath

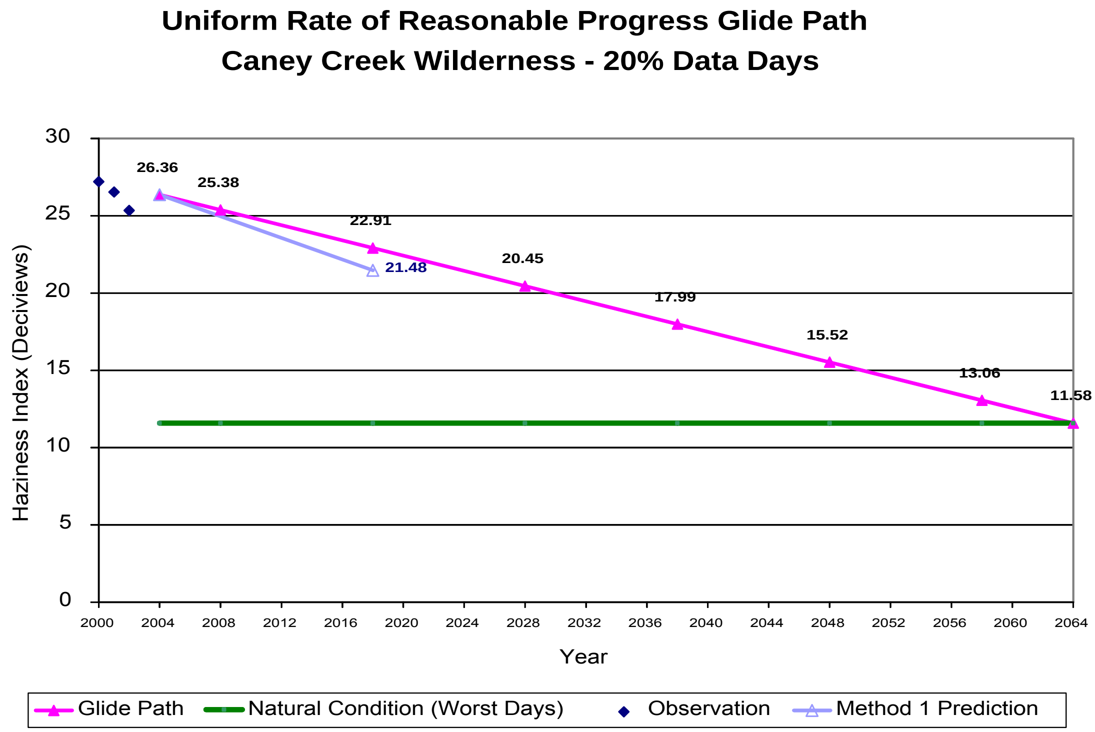


Figure 18 Upper Buffalo Uniform Rate of Progress Glidepath

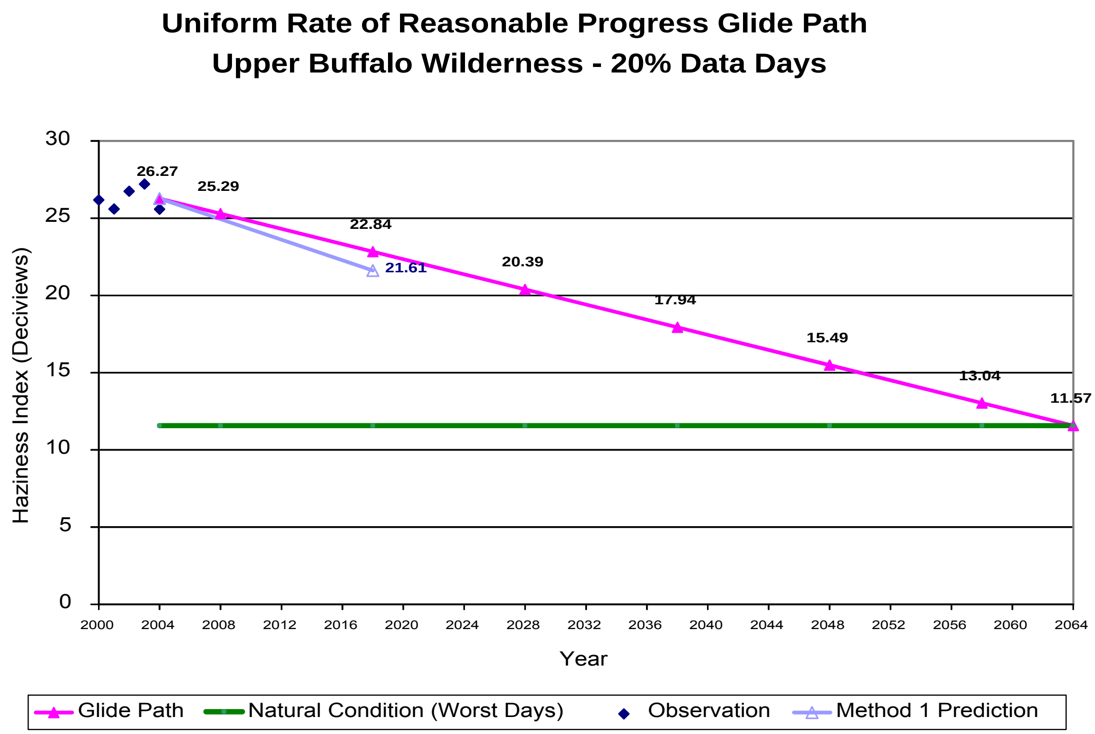


Figure 19 Hercules-Glades Uniform Rate of Progress Glidepath

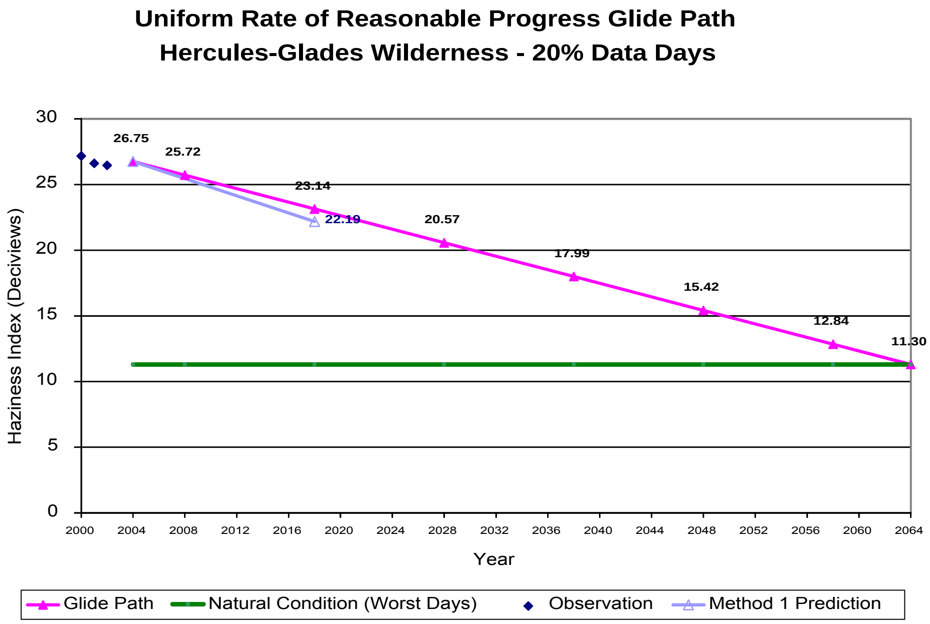
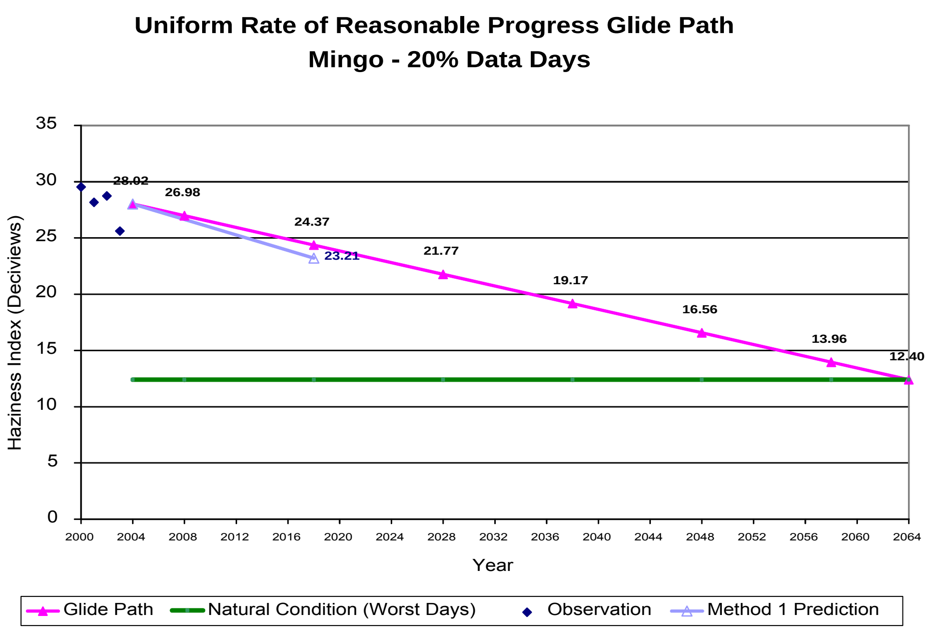


Figure 20 Mingo Uniform Rate of Progress Glidepath



7.8 Isle Royale National Park and Seney National Wildlife Refuge, MI

Indiana sources have shown an impact on these Class 1 areas through modeling studies. Indiana and the other Midwestern states participated extensively in the MRPO modeling and data analysis efforts for fine particulates, ozone, and haze in these areas. Michigan determined that existing and on-the-books controls (those controls scheduled in response to regulatory actions within this time period), combined with reductions necessary to meet the new 24-hour fine particulates standard and possibly the new ozone standard will be sufficient to meet their reasonable progress goals.

The letter from the Michigan Department of Air Quality, Appendix 3, page 3-56, contains their conclusions. Indiana concurs that this is the best approach for addressing visibility impairment at Isle Royale National Park and Seney National Wildlife Refuge Class 1 areas at this time. Therefore, no further analysis for this SIP is necessary.

In the Michigan SIP Submittal for Regional Haze, October 2010, Tables 10.3.2.c and 10.3.2.d showed the top 30 facilities impacting visibility at Isle Royale and Seney, inside and outside the state of Michigan. Included on this list were three Indiana facilities, Rockport in Spencer County, Gallagher in Floyd County, and Clifty Creek in Jefferson County.

There are controls planned for all three of these facilities. Rockport, which has 2 units, signed a consent decree in October 2007 in which they agreed to install SCR and FGD on Unit 1 by December 31, 2017 and SCR and FGD on Unit 2 by December 31, 2019. Gallagher, which has four units, signed a consent decree in December 2009, which according to U.S. EPA, by January 1, 2013, will reduce SO_2 emissions by 35,000 tons per year compared to 2008 and NO_x by 2100 tons per year. Clifty began construction of FGDs for all five units, but postponed completion when CAIR was vacated, citing economic concerns. It is anticipated these will be completed after 2014 as the Transport Rule becomes effective.

Finally, in January 2011, NIPSCO signed a consent decree. NIPSCO operates four large EGUs in northern Indiana. While these facilities were not listed as among the largest sources impacting Seney and Isle Royale, because of their size and proximity these controls will result in less visibility impairment. Specifically, Mitchell will be permanently shut down, two new FGDs at Schahfer and one at Michigan City will be added, and upgrades made to two FGDs at Schahfer and two upgrades to FGDs at Bailly. Also, some NOx controls will be added and upgraded, along with a system wide cap on overall emissions. According to U.S. EPA, these upgrades and additions will result in SO2 reductions of about 46,000 tons per year and NOx reductions of 18,000 tons per year compared to 2008. These controls will be phased in through the end of 2015.

Comparing these control requirements to LADCO modeling, Clifty Creek was not included in any year, Gallagher was not included in any year, and Rockport was included starting in 2012. For the NIPSCO sources, Bailly was included as existing controls, Michigan City was not included in any year, Mitchell was not included in any year, and for Schahfer, two units were included as existing controls and two were not included in any year. Overall, reductions from these settlements are much greater than anticipated by the modeling and will provide greater visibility benefits.

This summarizes reasonable progress for Indiana EGUs that likely have the greatest impacts upon Michigan's Class I areas. Indiana will continue to work with Michigan through the MRPO to evaluate the progress in the Class 1 areas.

More specific information regarding these controls is in Table 11. The U.S. EPA Compliance and Enforcement website, http://cfpub.epa.gov/compliance/cases/, has the consent decrees and supporting information.

7.9 Acadia National Park, ME, Moosehorn Wilderness Area, ME, Great Gulf Wilderness Area, NH, Brigantine Wilderness Area, NJ, and Lye Brook Wilderness Area, VT (MANE-VU)

Indiana sources have shown an impact on these Class 1 areas through the MRPO and MANE-VU modeling projects. Indiana, along with the other MRPO states, has participated in consultations with MANE-VU.

MANE-VU released "Assessment of Reasonable Progress for Regional Haze in MANE-VU Class 1 Areas - Methodology for Source Selection, Evaluation of Control Options, and Four Factor Analysis, July 2007" which supported requests of states outside that area to examine controls for specific types of sources. This assessment is a large document and is not included in this submittal. It is available online at the MANE-VU website, http://www.manevu.org, under "Consultations - Projects and Work Products." The resulting request is referred to as the "MANE-VU Ask".

MANE-VU Ask: In its "Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Request for a Course of Action by States Outside of MANE-VU Toward Assuring Reasonable Progress" (June 20, 2007), Appendix 3, pages 64 - 65, MANE-VU suggested that several control strategies should be pursued for adoption and implementation[15], including:

- Application of Best Available Retrofit Technology
- 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 1 areas
- 28% reduction in non-EGU (point, area, on-road, and off-road) SO_2 emissions relative to on-the-books and 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 NO_x) emissions beyond the current Clean Air Interstate Rule program

Of the 167 stacks, 15 are from 9 sources in Indiana (Appendix 3, page 63). Most of these stacks have or will have post-combustion emission controls (i.e., scrubbers). A list of these sources, along with the control information is in Table 11.

The two sets of charts from MRPO "Round 5" modeling show the culpability of geographic areas to visibility conditions in two Class 1 areas in the northeast. The left charts are the best days, the right charts are the worst days.

[15] The June 20 statement was transmitted to the MRPO States in letters dated July 30 from Anna Garcia, acting Executive Director, MANE-VU.

Figure 21 Acadia Visibility Impact Modeling

The figure on the left is modeled from the best 20% visibility days and the figure on the right is modeled from the worst 20% visibility days.

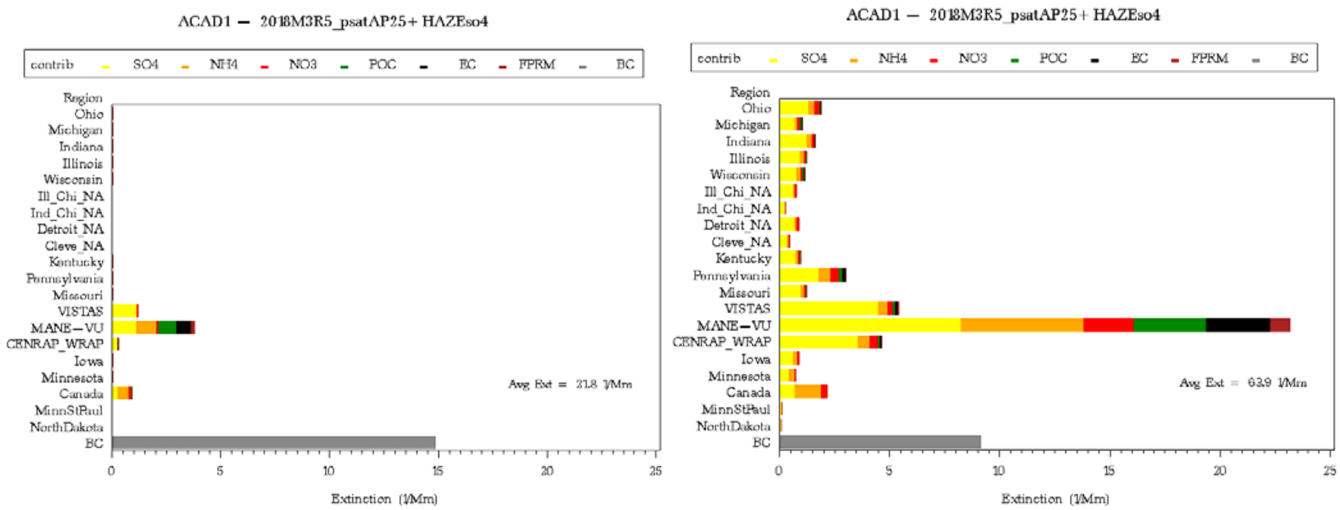
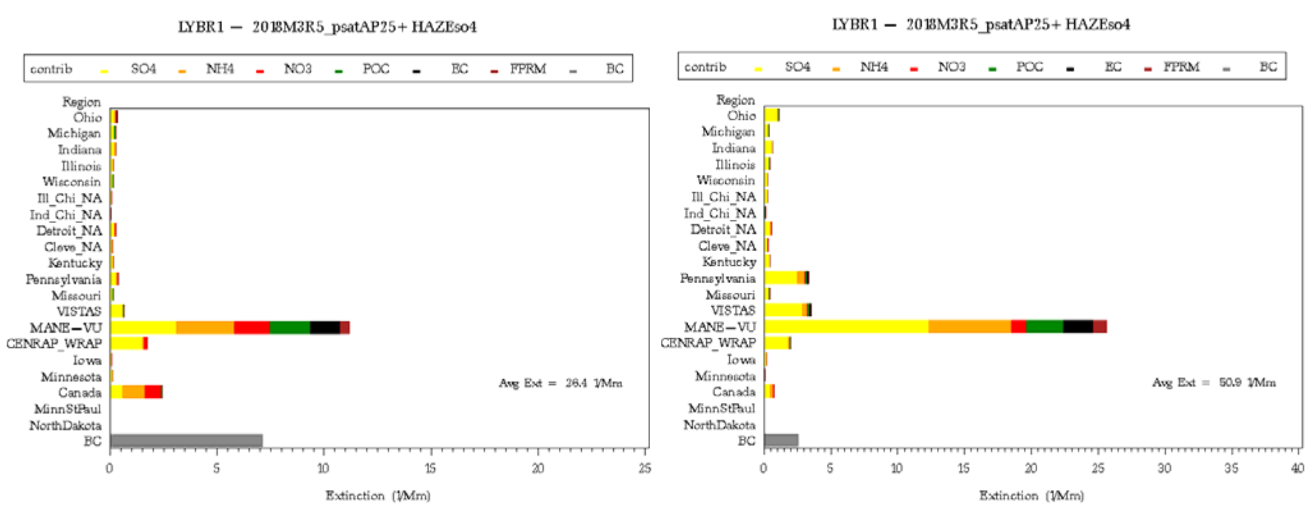


Figure 22 Lye Brook Visibility Impact Modeling

The figure on the left is modeled from the best 20% visibility days and the figure on the right is modeled from the worst 20% visibility days.



These charts demonstrate that Indiana sources have insignificant impacts on these areas.

The MRPO conducted modeling to evaluate the various levels of controls in place or planned between 2008 and 2018. From this "Round 5" modeling, Table 9 was produced for MANE-VU Class 1 areas.

Table 9 MRPO Round 5 Modeling Results (dv)

Best 20%	Baseline	2018	2009	2009	2012	2018	2018
Site	2000-2004	URP Value	Base	Will Do	Base	Base	Will Do
Brigantine	14.33	14.33	14.15	14.16	14.08	13.92	13.92
Lye Brook	6.37	6.37	6.25	6.28	6.23	6.14	6.15
Acadia	8.78	8.78	8.86	8.88	8.86	**8.82**	**8.82**
Worst 20%	**Baseline**	**2018**	**2009**	**2009**	**2012**	**2018**	**2018**
Site	**2000-2004**	**URP Value**	**Base**	**Will Do**	**Base**	**Base**	**Will Do**
Brigantine	29.01	25.05	25.79	25.83	25.72	**25.21**	**25.22**
Lye Brook	24.45	21.48	22.04	22.08	21.86	21.14	21.14
Acadia	22.89	20.45	21.72	21.75	21.72	**21.49**	**21.49**

However, in "Recent MANE-VU Projections of Visibility for 2018", MANE-VU Stakeholder Briefing, April 4, 2008, it is stated, "The Uniform Rate is achieved and exceeded at all MANE-VU Class I sites." This presentation is available on the MANE-VU website, www.nescaum.org/topics/regional-haze/regional-haze-documents.

These results show that for the northeastern Class 1 areas, controls already implemented and on-the-books may or may not result in achievement of reasonable progress goals. However, Indiana, along with the other MRPO states, has continued to work with MANE-VU states. Results of this work have assisted U.S. EPA in developing the recently proposed Air Transport Rule, which is discussed in the next section. One of the intentions of this proposed rule is to provide for reductions of regional pollutants to the level that upwind states are not contributing to nonattainment or interference with maintenance of the 1997 ozone and annual $PM_{2.5}$ and 2006 24-hour $PM_{2.5}$ standards. These reductions also will eliminate much of the regional contributions to regional haze. U.S. EPA has also committed to timely development of a second Transport Rule that will address contributions from non-EGU sectors. These sources were also of concern to MANE-VU and MRPO workgroups.

At this time, Indiana believes that these actions adequately address visibility concerns and are appropriate to meet reasonable progress goals given Indiana's marginal impact on those areas.

8.0 Best Available Retrofit Technology

BART Guidelines are a component of the July 1, 1999 Regional Haze regulations, that are intended to protect and improve visibility in national parks and wilderness areas.

The process of establishing BART emission limitations includes identification of those sources that meet the definition of "BART-eligible source", a determination of whether these sources are emitting any air pollutant that may be contributing to any impairment of visibility in a Class 1 area, and identification of the appropriate type and the level of control for reducing emissions.

8.1 BART - Eligible Sources in Indiana

The BART-eligible sources in Indiana are shown in the following table. The BART-eligible sources were identified using the methodology in the "Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations; Final Rule" (40 CFR Part 51).

Table 10 Indiana Sources with BART-Eligible Units

County	County ID	Plant ID	Name
Cass	017	00006	Logansport Municipal Light & Power
Cass	017	00005	ESSROC Materials, Inc.
Clark	019	00008	ESSROC Cement Corporation
Dearborn	029	00002	American Electric Power-Tanners Creek
Gibson	051	00013	Duke Energy – Gibson
Jasper	073	00008	NIPSCO - R. M. Schahfer
Lake	089	00318	Mittal Steel USA Inc.- Indiana Harbor West
Lake	089	00003	BP Products North America, Inc. - Whiting Refinery
Lake	089	00112	Carmeuse Lime, Inc.
Lake	089	00210	State Line Energy, L.L.C.
Lake	089	00121	U.S. Steel - Gary Works
Lake	089	00316	Mittal Steel USA Inc.- Indiana Harbor East
Lake	089	00117	NIPSCO - D. H. Mitchell Station
Laporte	091	00021	NIPSCO - Michigan City
Lawrence	093	00002	Lehigh Cement Company
Marion	097	00033	IPL Harding Street Station
Marion	097	00034	Citizens Thermal Energy
Pike	125	00002	Indianapolis Power & Light/AES Petersburg
Pike	125	00001	Hoosier Energy - Ratts Station
Porter	127	00002	NIPSCO - Bailly Station
Porter	127	00001	Mittal Steel USA Inc.- Burns Harbor
Posey	129	00002	SABIC Innovative Plastics (formerly GE Plastics)
Posey	129	00010	SIGECO - A. B. Brown
Putnam	133	00002	Buzzi Unicem USA
Sullivan	153	00005	Hoosier Energy - Merom Station
Tippecanoe	157	00012	Purdue University
Vermillion	165	00001	Duke Energy – Cayuga
Vermillion	165	00009	Eli Lilly and Company-Clinton Labs
Vigo	167	00021	Duke Energy – Wabash River
Warrick	173	00002 & 00007	ALCOA Inc.
Warrick	173	00001	SIGECO - F. B. Culley Generating Station
Wayne	177	00009	Richmond Power & Light

IDEM identified sources within the BART source categories and sent a survey to obtain additional information to develop a list of BART-eligible sources. Based on the surveys and subsequent discussions and comments, IDEM determined that sources in Table 10 have at least one BART-eligible unit. Supporting documentation is in Appendix 5 - BART Eligible Units.

8.2 Sources Subject to BART

IDEM conducted further modeling in coordination with the MRPO to determine which BART-eligible sources are subject to BART. Using dispersion modeling (Option 1 in the BART Guidelines), IDEM determined that the following non-EGUs were subject to BART: Alcoa Inc., ESSROC Cement Corporation, SABIC Innovative Plastics (formerly GE Plastics), and Mittal Steel USA Inc.-Burns Harbor. Modeling indicated that the following EGUs were subject to BART: ALCOA Inc., Hoosier Energy - Ratts Station, Richmond Power & Light, State Line Energy, NIPSCO - D. H. Mitchell Station, NIPSCO - Michigan City, NIPSCO - Bailly Station, SIGECO - A. B. Brown, and SIGECO - F. B. Culley Generating Station.

In addition, IDEM identified the following fossil-fuel fired generating power plants as having a capacity in excess of 750 megawatts: Duke Energy - Gibson, Duke Energy - Cayuga, Indianapolis Power & Light/AES Petersburg, IPL - Harding Street Station, NIPSCO - R. M. Schahfer, American Electric Power-Tanners Creek, Duke Energy - Wabash River, and Hoosier Energy - Merom Station.

Indiana accepted the U.S. EPA analysis that CAIR achieves greater progress than BART and may be used by States as a BART substitute (70 FR 39137). The Indiana Air Pollution Control Board, on November 1, 2006, adopted CAIR for the Indiana EGUs to participate in the cap and trade program. CAIR, therefore, satisfies the BART NO_x and SO_2 requirements for these sources. The PM impact on visibility on Class 1 areas was addressed for these sources. One EGU, ALCOA-Warrick Power Plant Boiler # 4, was determined to be subject to BART.

In December 2008, the DC Circuit Court remanded CAIR to U.S. EPA without vacatur because it found that "allowing CAIR to remain in effect until it is replaced by a rule consistent with our opinion would at least temporarily preserve the environmental values covered by CAIR." The CAIR requirements are currently in place and CAIR's regional control programs are operating while U.S. EPA develops replacement rules in response to the remand.

On July 6, 2010, U.S. EPA proposed a CAIR replacement, the Clean Air Transport Rule (TR), which as proposed, will achieve emission reductions of NO_x and SO_2 beyond those originally required by CAIR through additional air pollution reductions from power plants beginning in 2012. Therefore, Indiana believes that the Transport Rule will also achieve greater progress than BART. The TR is proposed to be initially in the form of a Federal Implementation Plan, which would not require action by Indiana to be put into place.

Table 11 contains a listing of all Indiana EGUs and the Megawatt capacities of each unit. It highlights the units which are BART-eligible and notes which units were included in the MANEVU “ask” list, which was described in Section 7.9.

Table 11 Indiana BART-eligible Electric Generating Units covered by CAIR

INDIANA COAL-FIRED UNITS					EPA IPM 3.0 2006 runs				LADCO Round 5 Runs	
BART-eligible Units *MANEVU Ask			SO_2	NOx						
FACILITY_ NAME	UNIT ID	Capacity MWatts	2009 + Projected SO_2_CONTROL	2009 + Projected NO_x_CONTROL	IPM Existing	IPM 2010 Retrofit	IPM 2015 Retrofit	IPM 2020 Retrofit	LADCO 2012 Retrofit	LADCO 2018 Retrofit
A B Brown Generating Station	1	250	Dual Alkali FGD	Selective Catalytic Reduction	SCR+FGD					
A B Brown Generating Station	2	250	Dual Alkali FGD	Selective Catalytic Reduction	SCR+FGD					
Alcoa Allowance Management Inc	1	144	Wet Limestone FGD (2008)	Low NO_x Burner Technology w/ Overfire Air	LNB w/SOFA					
Alcoa Allowance Management Inc	2	144	Wet Limestone FGD (2008)	Low NO_x Burner Technology w/ Overfire Air	LNB w/SOFA					
Alcoa Allowance Management Inc	3	144	Wet Limestone FGD (2008)	Low NO_x Burner Technology w/ Overfire Air	LNB w/SOFA					
Alcoa Allowance Management Inc	4	300	Wet Limestone FGD (2008)	Low NO_x Burner Selective Catalytic Reduction	SCR		FGD	FGD	FGD	FGD
Bailly Generating Station	7	160	Wet Limestone	Overfire Air / Selective Catalytic Reduction (2008)	SCR+FGD					
Bailly Generating Station	8	320	Wet Limestone	Overfire Air / Selective Catalytic Reduction	SCR+FGD					
Cayuga*	1	500	Wet Limestone (2008 - 95%)	Low NO_x Burner Technology w/ Separated OFA	FGD+LNB w/SOFA		SCR	SCR	SCR	SCR
Cayuga*	2	495	Wet Limestone (2008 - 95%)	Low NO_x Burner Technology w/ Separated OFA	FGD+LNB w/SOFA		SCR	SCR	SCR	SCR
Clifty Creek*	1	217	(FGD Scheduled possibly 2013)	Overfire Air Selective Catalytic Reduction	FGD+SCR					
Clifty Creek*	2	217	(FGD Scheduled possibly 2013)	Overfire Air Selective Catalytic Reduction	FGD+SCR					
Clifty Creek*	3	217	(FGD Scheduled possibly 2013)	Overfire Air Selective Catalytic Reduction	FGD+SCR					
Clifty Creek*	4	217	(FGD Scheduled possibly 2013)	Overfire Air Selective Catalytic Reduction	FGD+SCR					

INDIANA COAL-FIRED UNITS					EPA IPM 3.0 2006 runs				LADCO Round 5 Runs	
BART-eligible Units *MANEVU Ask			SO_2	NOx						
FACILITY_ NAME	**UNIT ID**	**Capacity MWatts**	**2009 + Projected SO_2_CONTROL**	**2009 + Projected NO_x_CONTROL**	**IPM Existing**	**IPM 2010 Retrofit**	**IPM 2015 Retrofit**	**IPM 2020 Retrofit**	**LADCO 2012 Retrofit**	**LADCO 2018 Retrofit**
Clifty Creek*	5	217	(FGD Scheduled possibly 2013)	Overfire Air Selective Catalytic Reduction	FGD+SCR					
Clifty Creek*	6	217	(FGD Scheduled possibly 2013)	Overfire Air	FGD	SCR	SCR	SCR	SCR	SCR
Dean H Mitchell Generating Station	11	125	Shut Down	Shut Down	LNB					
Dean H Mitchell Generating Station	4	125	Shut Down	Shut Down	Comb. Optimization			SCR		SCR
Dean H Mitchell Generating Station	5	125	Shut Down	Shut Down	Comb. Optimization			SCR		SCR
Dean H Mitchell Generating Station	6	110	Shut Down	Shut Down	LNB			SCR		SCR
Edwardsport	7-1	40	Unit will retire in 2012, IGCC will replace all the units in 2012	Unit will retire in 2012, IGCC will replace all the units in 2012		Retire	Retire	Retire	Retire	Retire
Edwardsport	7-2	40	Unit will retire in 2012, IGCC will replace all the units in 2012	Unit will retire in 2012, IGCC will replace all the units in 2012		Retire	Retire	Retire	Retire	Retire
Edwardsport	8-1	40	Unit will retire in 2012, IGCC will replace all the units in 2012	Unit will retire in 2012, IGCC will replace all the units in 2012		Retire	Retire	Retire	Retire	Retire
F B Culley Generating Station	2	90	Wet Limestone	Low NO_x Burner Technology (Dry Bottom only)	FGD+LNB			SNCR		SNCR
F B Culley Generating Station	3	270	Wet Limestone	Low NO_x Burner Technology (Dry Bottom only) Selective Catalytic Reduction	FGD+SCR					
Frank E Ratts	1SG1	122	U.S. EPA settlement, plant-wide from 2009 levels 42% reduction - 2012, 58% - 2014	Low NO_x Burner Technology (Dry Bottom only) OFA-2008	LNB			SCR		SCR

INDIANA COAL-FIRED UNITS					EPA IPM 3.0 2006 runs				LADCO Round 5 Runs	
BART-eligible Units *MANEVU Ask			SO_2	NOx						
FACILITY_ NAME	**UNIT ID**	**Capacity MWatts**	**2009 + Projected SO_2_CONTROL**	**2009 + Projected NO_x_CONTROL**	**IPM Existing**	**IPM 2010 Retrofit**	**IPM 2015 Retrofit**	**IPM 2020 Retrofit**	**LADCO 2012 Retrofit**	**LADCO 2018 Retrofit**
Frank E Ratts	2SG1	121	U.S. EPA settlement, plant-wide from 2009 levels 42% reduction - 2012, 58% - 2014	Low NO_x Burner Technology (Dry Bottom only) OFA-2008	LNB			SCR		SCR
Gibson*	1	630	Wet Limestone	LNB w/ Overfire Air Selective Catalytic Reduction	SCR+FGD					
Gibson*	2	630	Wet Limestone	Low NO_x Burner Technology w/ Overfire Air Selective Catalytic Reduction	SCR+FGD					
Gibson*	3	630	Wet Limestone	Low NO_x Burner Technology w/ Overfire Air Selective Catalytic Reduction	SCR+FGD					
Gibson*	4	622	Wet Limestone	Low NO_x Burner Technology w/ Overfire Air Selective Catalytic Reduction	SCR+FGD					
Gibson	5	620	Wet Limestone	Low NO_x Burner Technology w/ Overfire Air Selective Catalytic Reduction	SCR+FGD					
Harding Street Station (EW Stout)	50	109		LNB w/ Separated OFA Selective Non-catalytic Reduction	SNCR					
Harding Street Station (EW Stout)	60	109		LNB w/ Separated OFA Selective Non-catalytic Reduction	SNCR					
Harding Street Station (EW Stout)*	70	435	Wet Limestone	LNB w/ Closed-coupled/Separated OFA Selective Catalytic Reduction	SCR	FGD	FGD	FGD	FGD	FGD
IPL Eagle Valley Generating Station	3	43								

INDIANA COAL-FIRED UNITS					EPA IPM 3.0 2006 runs				LADCO Round 5 Runs	
BART-eligible Units *MANEVU Ask			SO_2	NOx						
FACILITY_ NAME	UNIT ID	Capacity MWatts	2009 + Projected SO_2_CONTROL	2009 + Projected NO_x_CONTROL	IPM Existing	IPM 2010 Retrofit	IPM 2015 Retrofit	IPM 2020 Retrofit	LADCO 2012 Retrofit	LADCO 2018 Retrofit
IPL Eagle Valley Generating Station	4	56		Low NOx Burner Technology w/ Separated OFA	LNB w/SOFA					
IPL Eagle Valley Generating Station	5	62		Low NOx Burner Technology w/ Separated OFA	LNB w/SOFA					
IPL Eagle Valley Generating Station	6	99		Low NOx Burner Technology w/ Separated OFA	LNB w/SOFA					
Merom	1SG1	507	upgrade FGD-90% 2012, upgrade to 95% 2014	Selective Catalytic Reduction Low Nox Burner Technology w/ Overfire Air	SCR+FGD					
Merom	2SG1	493	upgrade FGD-90% 2012, upgrade to 95% 2014	Selective Catalytic Reduction Low NO_x Burner Technology w/ Overfire Air	SCR+FGD					
Michigan City Generating Station	12	469		Overfire Air - Selective Catalytic Reduction	SCR			Hg Control		Hg Control
Petersburg	1	232	Wet Limestone	Low NO_x Burner Technology w/ Closed-coupled/Sep. OFA	FGD+LNB			SCR		SCR
Petersburg	2	407	Wet Limestone	LNB w/ Closed-coupled/Separated OFA Selective Catalytic Reduction	FGD+SCR					
Petersburg	3	510	Wet Limestone	LNB w/ Closed-coupled/Separated OFA Selective Catalytic Reduction	FGD+SCR					
Petersburg	4	545	Wet Limestone	Low NO_x Burner Technology w/ Closed-coupled/Sep. OFA	FGD+LNB		SCR	SCR		SCR
R Gallagher*	1	140	Shut down by 2/1/12 or Convert to NG 1/1/13	Shut down by 2/1/12 or Convert to NG 1/1/13	LNB					

INDIANA COAL-FIRED UNITS					EPA IPM 3.0 2006 runs				LADCO Round 5 Runs	
BART-eligible Units *MANEVU Ask			SO_2	NOx						
FACILITY_ NAME	**UNIT ID**	**Capacity MWatts**	**2009 + Projected SO_2_CONTROL**	**2009 + Projected NO_x_CONTROL**	**IPM Existing**	**IPM 2010 Retrofit**	**IPM 2015 Retrofit**	**IPM 2020 Retrofit**	**LADCO 2012 Retrofit**	**LADCO 2018 Retrofit**
R Gallagher*	2	140	Dry Sorbent Technology 1/1/11	Low NO_x Burner Technology w/ Overfire Air	LNB					
R Gallagher*	3	140	Shut down by 2/1/12 or Convert to NG 1/1/13	Shut down by 2/1/12 or Convert to NG 1/1/13	LNB					
R Gallagher*	4	140	Dry Sorbent Technology 1/1/11	Low NO_x Burner Technology w/ Overfire Air	LNB					
R M Schahfer Generating Station	14	431		Overfire Air Selective Catalytic Reduction	SCR			Hg Control		Hg Control
R M Schahfer Generating Station	15	472		LNB (Dry Bottom only) A 35% efficient stratified overfire air system was added in 2008	LNB			Hg Control		Hg Control
R M Schahfer Generating Station	17	361	Wet Limestone	LNB w/ Closed-coupled/Separated OFA	SCR	FGD+ LNB	FGD+ LNB	FGD+ LNB		
R M Schahfer Generating Station	18	361	Wet Limestone	LNB w/ Closed-coupled/Separated OFA	LNB	FGD+ LNB	FGD+ LNB	FGD+ LNB		
Rockport*	MB1	1300	FGD 12/31/17 TR allowances < CAIR 2012 and 2014	LNB (Dry Bottom only) (SCR 12/31/17)	LNB w/OFA	FGD	FGD	FGD+ SCR	FGD	FGD+ SCR
Rockport*	MB2	1300	FGD 12/31/17 TR allowances < CAIR 2012 and 2014	Low NO_x Burner Technology (Dry Bottom only) (SCR 12/31/19)	LNB w/OFA	FGD	FGD	FGD+ SCR	FGD	FGD+ SCR
State Line Generating Station (IN)	3	187								
State Line Generating Station (IN)	4	303		Overfire Air		SCR	SCR	SCR+Hg Control	SCR	SCR (-Hg Control)
Tanners Creek*	U1	140	Burn only coal with no more than 1.2 lb/MMBtu annual average	Low NO_x Burner Technology (Dry Bottom only) A 30% efficient SNCR will be in place in 2010. SNCR will operate year round	OFA					

INDIANA COAL-FIRED UNITS					EPA IPM 3.0 2006 runs				LADCO Round 5 Runs	
BART-eligible Units *MANEVU Ask			SO_2	NOx						
FACILITY_ NAME	**UNIT ID**	**Capacity MWatts**	**2009 + Projected** SO_2**_CONTROL**	**2009 + Projected** NO_x**_CONTROL**	**IPM Existing**	**IPM 2010 Retrofit**	**IPM 2015 Retrofit**	**IPM 2020 Retrofit**	**LADCO 2012 Retrofit**	**LADCO 2018 Retrofit**
Tanners Creek*	U2	140	Burn only coal with no more than 1.2 lb/MMBtu annual average	Low NO_x Burner Technology (Dry Bottom only) A 30% efficient SNCR will be in place in 2010. SNCR will operate year round	OFA					
Tanners Creek*	U3	200	Burn only coal with no more than 1.2 lb/MMBtu annual average	Low NO_x Burner Technology (Dry Bottom only) A 30% efficient SNCR will be in place in 2010. SNCR will operate year round	OFA			FGD+ SCR		FGD+ SCR
Tanners Creek*	U4	500	Burn only coal with no more than 1.2% sulfur content annual average	Overfire Air	OFA					
Wabash River Gen Station*	1	85	IGCC	IGCC						
Wabash River Gen Station*	2	85	Shut Down 9-30-09	Shut Down 9-30-09	LNB					
Wabash River Gen Station*	3	85	Shut Down 9-30-09	Shut Down 9-30-09	LNB			SNCR		SNCR
Wabash River Gen Station*	4	85		Low NO_x Burner Technology w/ Overfire Air	LNB					
Wabash River Gen Station*	5	95	Shut Down 9-30-09	Shut Down 9-30-09	LNB			SNCR		SNCR
Wabash River Gen Station*	6	318	TR allocation in 2014 < CAIR	Low NO_x Burner Technology w/ Separated OFA	LNB			FGD+ SCR		FGD+ SCR
Whitewater Valley	1	34.77		Low NO_x Burner Technology w/ Separated OFA Ammonia Injection Overfire Air	LNB					
Whitewater Valley	2	62.8	Other	Low NO_x Burner Technology w/ Separated OFA Ammonia Injection Overfire Air	LNB					

Table 11 also shows several control scenarios:

"2009+Projected SO_2 Controls": These are SO_2 controls currently in place, under construction, or required by legal action in the foreseeable future.

"2009+Projected NO_x Controls": These are NO_x controls currently in place, under construction, or required by legal action in the foreseeable future.

EPA IPM 3.0 2006 runs - There were several scenarios modeled by U.S.EPA to support the CAIR rule. The information in the table is taken directly from their parsed files:

> "IPM existing": These are the combinations of NO_x and SO_2 controls that were in existence, according to their records at the time.
>
> "IPM 2010 Retrofit": This column summarizes any controls added after "IPM existing".
>
> "IPM 2015 Retrofit": This column summarizes any controls added after 2010. The information contained is cumulative to 2015 – it includes all retrofits to 2015.
>
> "IPM 2020 Retrofit": This column summarizes any controls added after 2015. The information contained is cumulative to 2020 – it includes all retrofits to 2020.

For LADCO Round 5 Modeling Runs, the IPM 3.0 files were used with some adjustments based upon information from the states. Different years were modeled because of key regulatory program dates. The information in these columns is cumulative, as in the EPA scenarios:

> "LADCO 2012 Retrofit": Very similar to EPA's IPM 2015 Retrofit.
>
> "LADCO 2018 Retrofit": Very similar to EPA's IPM 2020 Retrofit.

The purpose of this table is to show the assumptions made in the various modeling scenarios upon which this Regional Haze SIP is based, compared to the best current information available regarding Indiana EGU controls. Several of the utilities completed NOx and SO2 control projects around 2008 to meet CAIR requirements. These varied from the IPM assumptions in some cases. Further, several consent decrees have been completed to the present time, These decrees include: American Electric Power, October 9, 2007, which affects Rockport and Tanners Creek; Duke R Gallagher, December 22, 2009; Hoosier Energy REC, July 23, 2010, which affects Merom and Frank E Ratts; and Northern Indiana Public Service, January 13, 2011, which affects Bailly Generating Station, Dean H Mitchell Generating Station, Michigan City Generating Station, and R M Schahfer Generating Station. This information was not available in 2006 when the IPM projections were made, and in some cases, add significant controls not assumed in the modeling for a particular year.

8.3 BART Analysis

IDEM began the BART rulemaking process in August 2006. Following the due process of rulemaking which included the notices of hearings and comments, the Indiana Administrative Code at 326 IAC 26-1, Best Available Retrofit Technology, was final adopted on October 3, 2007 and became effective February 22, 2008. A copy of this rule is in Appendix 7.

The rule requires that sources subject to BART, upon notification from the department, submit to the department a BART analysis. The rule incorporates by reference the BART Guidelines codified as Appendix Y at 40 CFR 51. The analysis should be performed following those guidelines. The analysis must address at a minimum SO_2, NO_x, and particulate matter (PM) and consider the following factors: (1) the cost of compliance, (2) the energy and non-air quality environmental impacts of compliance, (3) any existing pollution control technology in use at the source, (4) the remaining useful life of the source, and (5) the degree of visibility improvement that may reasonably be anticipated from the use of BART. The BART Guidelines require that the States consider, at a minimum, certain control alternatives in determining BART controls. These alternatives include: BACT, LAER, NSPS, and MACT, as applicable, pollution prevention, use of retrofit controls and, if available, improvement of existing controls. In addition, the rule allows sources to propose alternatives to source-specific BART, provided the alternative achieves greater reasonable progress towards improving visibility. The alternative could include emissions controls at different locations of the same source, different sources, or at a source not subject to BART. The requirements for sources that choose an alternative to source-specific BART, in detail, are included in 326 IAC 26-1 and 40 CFR 51.308(e).

The department was required to review the analyses for completeness and approvability in accordance with 326 IAC 26-1, the BART Guidelines, and 40 CFR 51.308(e). The emission limits representing BART or an alternative to BART are to be included in the sources' Part 70 permits and submitted to U.S. EPA for approval into the SIP. The sources shall be required to comply with these requirements within five years of the effective date of the state rule, i.e., in 2013.

Of the sources identified as BART-eligible, modeling indicated that one non-EGU source, Alcoa, was subject to BART. IDEM identified several EGUs subject to BART. However, as provided by the federal rule, IDEM assumed NO_x and SO_2 BART requirements are met by the participation of these sources in the CAIR NO_x and SO_2 trading program. Other non-EGU sources were also identified as being BART-eligible. These sources, SABIC Innovative Plastics-Mt. Vernon, ArcelorMittal-Burns Harbor LLC, and ESSROC Cement Corp.-Speed submitted modeling analyses showing that they did not contribute significantly to visibility impairment at any Class 1 areas. IDEM found that these analyses met all applicable criteria and have accepted the findings. An analysis for each follows.

8.4 BART Determination and Modeling for Burns Harbor

ArcelorMittal, LLC (Burns Harbor), formerly known as ISG Burns Harbor, operates a steelmaking facility located in Burns Harbor, Porter County, Indiana. In accordance with the BART Guidelines, Burns Harbor was identified as a BART-eligible source.

IDEM initially conducted long range transport modeling of the potential emissions from the BART-eligible emission units from Burns Harbor using the CALPUFF model. IDEM determined Burns Harbor to be subject to BART for having visibility impacts on nearby Class I areas. Subsequently, Burns

Harbor submitted its own BART exemption modeling analysis. This analysis used the maximum 24-hour average actual emission rates of sulfur dioxide and nitrogen oxides and compared modeled results with the annual average natural background light coefficient, according to the BART guidance. Burns Harbor conducted CALPUFF modeling at the four nearest Class I areas in which Burns Harbor had the greatest visibility impact, which were Mammoth Cave, Seney National Wildlife Refuge, Mingo Wilderness, and Isle Royale National Park. The CALPUFF results showed Burns Harbor would not be subject to BART. The following describes IDEM's revised BART modeling and Burns Harbor's BART exemption modeling analysis and results.

8.4.1 IDEM's BART Determination Process

IDEM sent BART surveys in the fall of 2005 to sources that were identified as having possible BART-eligible emission units. Potential BART-eligible sources at Burns Harbor's were identified as the Power Station including Boilers #7-#12, #1 and #2 Coke Battery pushing and underfire, Blast Furnaces C & D, Sinter Windbox, Steelmaking Stations #1 - #3, Steelmaking Vessels #1 and #2, Hot Strip Furnaces #1 - #3, 160" Plate Mill Furnaces #1 - #2 and #5 - #8, 110" Plate Mill Furnaces #1 - #3, and Blast Furnaces C & D and steelmaking fugitives. These Burns Harbor emission units, described at the end of this section, met all three of the BART-eligible criteria for SO_2, NO_x, and PM, as listed below:

1.) Identify whether emission units are in one of the 26 source categories - **Burns Harbor operates a steelmaking facility, identified as one of the 26 listed categories.**
2.) Identify whether emission units were in existence on August 7, 1977 and began operation after August 2, 1962 - **The construction dates for the BART-eligible emission units at Burns Harbor were estimated within the BART eligibility timeframe.**
3.) Compare potential emissions from emission units to 250 tons/yr or more threshold of a visibility impairing pollutant (NO_x, SO_2 and PM) - **Potential** NO_x **and** SO_2 **emissions from all BART-eligible emission units exceed 250 tons/year of any single visibility impairing pollutant with potential** NO_x **emissions of 7743.0 tons/yr and potential** SO_2 **emissions of 18769.0 tons/yr. Potential** PM_{10} **emissions from all BART-eligible units at Burns Harbor totaled 1168.9 tons/yr.**

Source specific stack and detailed emissions information were requested to be used in IDEM's BART determination modeling analyses. Burns Harbor submitted the survey results to IDEM on March 2, 2006. IDEM conducted preliminary CALPUFF modeling, in which potential NO_x, SO_2, and PM_{10} emissions from Burns Harbor's BART-eligible emission units were modeled to determine the visibility impacts. Results showed the visibility impacts from Burns Harbor exceeded the BART threshold of the 98^{th} percentile of 0.5 dv with a total of thirty days over 0.5 dv for 2002, thirty-nine days over 0.5 dv for 2003, and forty-four days over 0.5 dv for 2004 at the sixteen Class 1 areas modeled. Burns Harbor had the most visibility impact days at Seney National Wildlife Refuge with ten days in 2002, seventeen days in 2003 and nineteen days in 2004. Based on the information provided, Burns Harbor was determined to be subject to BART.

OCS Environmental, Inc. and ENSR Corporation prepared the Burns Harbor BART modeling analysis, conducted CALPUFF modeling, and submitted the results to IDEM on May 13, 2008. Additional information was submitted by Burns Harbor and its consultants and the information gathered from these submittals aided IDEM's review of Burns Harbor's subject to BART determination. This material is contained in Appendix 5a.

8.4.2 IDEM's BART Modeling Process

IDEM conducted long range transport modeling in coordination with the MRPO to determine which BART-eligible sources have visibility impacts that exceed BART modeling thresholds and are subject to BART. LADCO created a "Single Source Modeling to Support Regional Haze BART Modeling Protocol" for the states of Indiana, Illinois, Michigan, Wisconsin, and Ohio. This document can be found in Appendix 5a. IDEM used this protocol in order to remain consistent with the other MRPO states in conducting its subject to BART determinations.

CALPUFF was identified by U.S. EPA as the best regulatory modeling application available for long range transport of primary pollutants and the only EPA-approved model for predicting a single source's contribution to visibility impacts. CALPUFF inputs include several modules within CALPUFF to determine transport (CALPUFF), meteorology (CALMET), inorganic chemistry effects (POSTUTIL), and post-processing of the results (CALPOST). The versions used in the IDEM's CALPUFF modeling are as follows:

CALPUFF version 5.711a, Level 040716	CALMET version 5.53a, Level 040716
CALPOST version 5.51, Level 030709	CALMM5 version 2.0, Level 021111
POSTUTIL version 1.4, Level 040818	

Modeling options used in CALPUFF are consistent with guidance found in the Interagency Workgroup on Air Quality Modeling (IWAQM), "Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts" (EPA-454/R-98-019). Any modifications in the CALPUFF modeling approach from the IWAQM documents are discussed in detail in the MRPO CALPUFF modeling protocol. LADCO created a version of CALPUFF that could be executed on a Linux Red Hat operating system and created input files in order to conduct the CALPUFF modeling.

As a result of MRPO discussions with U.S. EPA, the change in dv is compared with natural visibility conditions on the 20% best days and not the average visibility conditions. The natural visibility conditions are defined as the 20% best days, as listed in the U.S. EPA's "Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule" (EPA, 2003). IDEM has accepted previous BART determination analyses using the average annual natural background conditions if the subject to BART source conducted more refined CALPUFF modeling in accordance with state or federally approved protocols.

8.4.3 Modeling Domain and Meteorology

The modeling domain used for the MRPO CALPUFF modeling analysis was a Lambert conformal grid projection centered at 97 West, 40 North with true latitudes at 33 North and 45 North and origin at (-900 km, -1620 km). The horizontal domain consisted of 97 36-kilometer cells in the east-west direction and 90 36-kilometer cells in the north-south direction. Approximately 15 kilometers in the vertical atmosphere were resolved with 16 vertical layers. Landuse and terrain data were extracted from global datasets, taken from United States Geological Survey (USGS) Composite Theme Grid landuse and USGS Digital Elevation Model terrain height.

IDEM modeling covered three years of meteorological data (2002-2004) with the meteorological inputs taken from the prognostic meteorological model using four-dimensional data-assimilation (FDDA). Meteorological Model 5 (MM5 version 3.6) output was used to supply hourly meteorological data for CALMET input. Observation data was included in the ETA analysis fields to initialize MM5.

8.4.4 Class 1 Areas

There were sixteen Class I areas analyzed in the MRPO area with discrete receptors covering the nearby Class I areas. The Class I areas were taken from the National Park Service Class I area receptor index. Receptor grids with a resolution of 1-kilometer were placed at each Class I area with a total of 4,434 receptors analyzed. The sixteen Class I areas and the states where the Class I areas are located are listed below:

Boundary Waters Canoe Area – MN
Dolly Sods/Otter Creek Wilderness – WV
Great Smoky Mountains National Park – TN
Isle Royale National Park – MI
Linville Gorge Wilderness– NC
Mammoth Cave National Park – KY
Seney National Wildlife Refuge – MI
Sipsey Wilderness – AL
Brigantine Wilderness Area – NJ
Great Gulf Wilderness – NH
Hercules-Glades Wilderness– MO
James River Face Wilderness – VA
Lye Brook Wilderness – VT
Mingo Wilderness Area – MO
Shenandoah National Park – VA
Voyageurs National Park – MN

8.4.5 Visibility Impairment Pollutants Analyzed

Pursuant to the U.S. EPA and MRPO guidance, SO_2, NO_x, and PM are considered the primary visibility impairing pollutants. U.S. EPA recommends states use their judgment in determining whether volatile organic compounds (VOCs) and ammonia contribute to visibility impairment. SO_2, NO_x, and PM_{10} were modeled using the CALPUFF model for the Burns Harbor analysis. Visibility impairing pollutants such as VOCs and ammonia were not modeled but may be evaluated at a later date. The Burns Harbor submittal contained information which included the methodologies for estimating daily emission rates from all the BART-eligible units at Burns Harbor, as found in Appendix 5a. The 24-hour average emission rates from the highest emitting day are preferred in the CALPUFF modeling analysis to be consistent with the Modeling Guidance determining visibility impairment for BART determinations. Burns Harbor calculated its emissions from its combustion units and process units using several methods to determine the maximum 24-hour emissions. Combustion unit emissions were calculated using actual daily fuel use records and emission factors based on fuel sampling, stack testing, or U.S. EPA's AP-42. Process unit emissions were calculated using the maximum 24-hour production rates and emission factors derived from stack tests and U.S. EPA's AP-42. For the smaller process units that only had monthly production data, the average daily production rates were calculated and used to determine the 24-hour average emission rates from the highest emitting day.

The stack parameters of all the BART-eligible sources at Burns Harbor, as well as the area source parameters that define the slag pits and steelmaking fugitive area dimensions are summarized in Table 18 at the end of this section. The coordinates of the Burns Harbor BART-eligible emission units are based on Lambert Conformal Conic (LCC) in order to project on the CALPUFF modeling domain.

8.4.6 IDEM's Subject to BART Determination Modeling Results

IDEM based its initial CALPUFF modeling on potential emissions from Burns Harbor's BART-eligible emission units. The differences between IDEM's initial BART determination modeling and the revised modeling conducted from Burns Harbor's BART exemption modeling submittals were the 24-hour average emission rate estimates from the highest emitting day supplied by Burns Harbor. Methodologies explaining Burns Harbor's emission calculations are found in Appendix 5a. The emission estimates meet the BART guidance for using the 24-hour average emission rates from the highest emitting day in the CALPUFF modeling.

The criteria used to determine if a source is "contributing" to visibility impairment is the 98th percentile that is equal to 0.5 dv for MRPO States using a maximum 24-hour emission rate and the peak value that is equal to 0.5 dv for MRPO States using an actual 24-hour emission rate. The 98th percentile is interpreted as any source with more than 21 days of visibility impairment over the 3 year modeling period or 7 days of visibility impairment in any one of the 3 years modeled is "contributing" to visibility impairment.

Results of IDEM's revised BART determination modeling showed that the 98th percentile dv impact from Burns Harbor was above 0.5 dv; with a total of ten days over 0.5 dv for 2002, seventeen days over 0.5 dv in 2003 and nineteen days over 0.5 dv in 2004. Table 12 shows IDEM's revised CALPUFF modeling results with the top eight rankings of the highest dv impacts from Burns Harbor for 2002 through 2004. The total number of days which modeled above 0.5 dv for all three modeled years is forty-six, above the twenty-two day threshold for 98th percentile of the cumulative three-year modeled period, as shown below in Table 13. Therefore, based on IDEM's CALPUFF analysis, Burns Harbor's BART-eligible emission units are subject to BART.

Table 12 IDEM's Revised CALPUFF Modeling Results for Burns Harbor

Impact Rank	2002 - Seney dv/Day		2003 - Seney dv/Day		2004 - Seney dv/Day	
1st	1.397	(274)	1.886	(321)	2.415	(364)
2nd	1.104	(263)	1.471	(281)	1.745	(250)
3rd	1.102	(315)	1.413	(350)	1.335	(321)
4th	1.071	(273)	1.285	(294)	1.328	(247)
5th	0.964	(245)	1.247	(32)	1.267	(60)
6th	0.875	(55)	1.238	(232)	1.170	(231)
7th	0.592	(159)	0.998	(315)	0.882	(3)
8th	0.561	(102)	0.993	(233)	0.766	(85)

Table 13 Number of Modeled Days over 0.5 dvs for Class 1 Areas

Year	2002	2003	2004	Total
Seney	10	17	19	**46**
Mammoth Cave	7	1	4	**12**
Mingo	5	3	3	**11**
Isle Royale	1	4	4	**9**

8.4.7 IDEM's Culpability Modeling Results for Burns Harbor

IDEM conducted additional CALPUFF modeling for Burns Harbor to determine if certain BART-eligible emissions points within Burns Harbor were contributing more to the visibility impacts on surrounding Class 1 areas then other emission points. To conduct the culpability analysis, BART-eligible emission points were grouped according to emissions. Five separate CALPUFF runs were conducted based on the following:

Group 1 – *Power Station Boilers #7 - #12:* SO_2 emissions = 218.31 grams/sec; NO_x = 29.60 grams/sec
Group 2 - *#1, #2 Coke Battery Underfire:* SO_2 emissions = 133.42 grams/sec; NO_x = 99.98 grams/sec
Group 3 – *Windbox/C&D Blast Furnaces:* SO_2 emissions = 109.11 grams/sec; NO_x = 50.19 grams/sec
Group 4 - *#1, #2, #3 Hot Strip Furnace/#1, #2 160" Plate Mill Furnace:*
SO_2 emissions = 67.07 grams/sec; NO_x = 31.17 grams/sec
Group 5 - *#1,#2 Coke Battery Pushing/Blast Furnace C&D Casthouse/ #1, #2 Steelmaking HMD Stations/Steel Making Vessel #3/Steelmaking FM Boiler/#5-#8 160" Plant Mill Furnace/#1,#2 110" Plate Mill Furnace/Steelmaking HMC Station #3/110" Plate Mill Normalizing Furnace:*
SO_2 emissions = 3.82 grams/sec; NO_x = 8.64 grams/sec

Results of IDEM's culpability modeling are shown below in Table 14. Separately, each source group showed impacts below the 98thpercentile of the 0.5 dv visibility threshold. The source group with the maximum impact was the Group 1 Power Station Boilers #7-#12.

Table 14 IDEM's Culpability Modeling Results for Burns Harbor

Impact Rank	2002 – Seney Max. dv/# of Days		2003 – Power Station Max. dv/# of Days		2004 – Power Station Max. dv/# of Days	
Power Station	0.557	1	0.629	3	0.785	3
Underfire	0.479	0	0.674	1	0.865	2
Windbox	0.331	0	0.469	0	0.589	1
Furnaces	0.229	0	0.318	0	0.382	0
Other	0.152	0	0.29	0	0.212	0

While this analysis does not constitute a subject to BART determination, it shows which sources contribute more to higher visibility impact days. The power station boilers, coke battery underfire, and windbox/blast furnace groups have the highest amount of impacts days over 0.5 dv.

8.4.8 Burns Harbor's BART Determination Modeling

Burns Harbor submitted modeling for its BART determination, using information and inputs taken from the VISTAS BART Modeling Protocol, the MRPO BART Modeling Protocol, and IDEM's initial CALPUFF input files. Burns Harbor used the latest EPA-approved version of CALMET (version 5.8) to create a more refined 6-kilometer CALMET data set from 2002 through 2004. Burns Harbor's approach to processing the CALMET data is referenced in Section 3.0 "Meteorological Data" in their

Source Specific BART Modeling Report: ArcelorMittal Burns Harbor LLC, found in Appendix 5a. This approach was accepted by IDEM after consultation with U.S. EPA, Region 5.

Burns Harbor used the latest EPA-approved version of CALPUFF (version 5.8) along with selected MRPO options listed in the MRPO "Single Source Modeling to Support Regional Haze BART Modeling Protocol". IDEM's preliminary CALPUFF modeling used a more conservative extinction coefficient (20% best day natural background), due to the 36-kilometer modeling grid used by the MRPO, rather than an annual average natural background coefficient. Burns Harbor's use of a more refined 6-kilometer grid warranted the use of the average annual natural background concentrations for Class I areas in the eastern United States, pursuant to U.S. EPA's "Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program" (EPA-454/B-03-005).

Information from the LADCO MRPO protocol was used in the modeling and the protocol approved by U.S. EPA included the domain seasonal ammonia values, taken from annual 2002 CAMx simulations, which represented the best available information to conduct CALPUFF modeling for the MRPO states. Burns Harbor used background ammonia values of 0.3 ppb in January through March with 0.5 ppb the rest of the year, which follows MRPO protocol for BART modeling. For the purposes of BART analyses, the U.S. EPA has determined that it did not intend to limit States to the use of the 20% best visibility days. States may use 20% best visibility days or annual average natural background values.

IDEM conducted additional CALPUFF runs, using Bondville ammonia data collected from November 2003 through October 2005. This data was not available at the time the LADCO MRPO BART modeling protocol was created and distributed to the LADCO states in early 2006. Below in Table 15 is the comparison of the 2002 seasonal averages with the 2003 to 2005 Bondville average monitored monthly ammonia data.

Table 15 Comparison of Ammonia Concentrations (ppb) for CALPUFF modeling for ArcelorMittal

Data Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CAMx 2002	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bondville 03-05	0.43	0.57	2.16	2.31	1.69	1.45	1.5	1.7	1.58	1.81	2.17	0.57

The new IMPROVE equation is used to estimate light extinction, and was used to determine the visibility impacts from Burns Harbor. The new IMPROVE equation approach was accepted by U.S. EPA and the Federal Land Managers for previous BART modeling analyses and is referenced in Section 4.0 "CALPUFF Modeling" in the Source Specific BART Modeling Report: ArcelorMittal Burns Harbor LLC. This is found in Appendix 5a.

Table 16 below shows the results of Burns Harbor's modeling, submitted on September 4, 2008. The CALPUFF results show visibility impacts below the 98th percentile of the 0.5 dv threshold at the four nearest Class 1 areas: Mammoth Cave in Kentucky, Seney National Wildlife Refuge and Isle Royale National Park in Michigan, and Mingo Wilderness Area in Missouri. Results are summarized in Table 17. Visibility impacts for an individual year or the 3-year cumulative total do not exceed the 98th percentile of the 0.5 dv threshold at any Class 1 areas.

Table 16 Burns Harbor's CALPUFF Modeling Results over 0.5 Dv

Impact Rank	2002 dv/Location/(day)	2003 dv/Location/(day)	2004 dv/Location/(day)
1st	0.751 at Seney (314)	1.165 at Seney (320)	1.030 at Seney (344)
2nd	0.750 at Seney (269)	0.695 at Seney (31)	0.891 at Seney (363)
3rd	0.568 at Seney (261)	0.54 at Seney (350)	0.865 at Seney (320)
4th	0.501 at Seney (50)	0.508 at Seney (280)	0.845 at Seney (79)
5th	0.45 at Seney (222)	0.487 at Seney (231)	0.794 at Seney (249)
6th	0.369 at Seney (273)	0.471 at Seney (66)	0.673 at Seney (78)
7th	0.359 at Seney (161)	0.398 at Seney (293)	0.547 at Seney (2)
8th	0.346 at Seney (272)	0.375 at Seney (342)	0.464 at Seney (230)

Table 17 Number of Modeled Days over 0.5 dv for Class 1 Areas

Year	Seney	Mammoth Cave	Mingo	Isle Royale
2002	4	2	3	0
2003	4	3	1	2
2004	7	1	0	2
TOTAL	15	6	4	4

8.4.9 Comparison of Burns Harbor and IDEM BART Determination Modeling

Due to Burns Harbor's use of more refined CALPUFF and CALMET 6-kilometer grid files, differences in the results occurred compared to IDEM's review. Based on the changes from the MRPO 36-kilometer grid and use of the 20% best visibility days to the 6-kilometer grid and annual average natural background values used by Burns Harbor, the number of days over the 0.5 dv threshold were lowered by 5 to 7 days.

Comparison of the Burns Harbor CALPUFF modeling results using the MRPO background ammonia concentrations and the 2003 – 2005 Bondville data showed only slight increases in overall light extinction and the delta deciview changes. The largest light extinction change was 1.06% and the delta deciviews change was 0.084 dv at Seney. There was an increase in the number of days compared to the BART threshold using the revised ammonia background at Mingo and Seney National Wildlife Refuges, however the results when calculated using the new IMPROVE model did not change. A summary of results for Burns Harbor, ESSROC Cement Corporation - Speed and SABIC can be found in Appendix 9e. The new IMPROVE equation spreadsheet results for Burns Harbor are included.

In addition, Burns Harbor's use of the new IMPROVE equation resulted in lower visibility impacts. Burns Harbor conducted a comparison of the old and new IMPROVE equations on their results and showed that for Seney, the new IMPROVE equation lowered the number of days with visibility impacts over the 0.5 dv threshold by 3 to 4 days. Table 18 shows a comparison of IDEM's 36 kilometer results with the previous IMPROVE equation and the new IMPROVE equation.

Table 18 IDEM's Revised CALPUFF Modeling Results at Seney
Comparing old and new IMPROVE equations

Seney	2002 IMPROVE		2003 IMPROVE		2004 IMPROVE	
Impact Rank	**Old**	**New**	**Old**	**New**	**Old**	**New**
1st	1.40	0.76	1.89	1.05	2.42	1.35
2nd	1.10	0.61	1.47	0.77	1.75	0.95
3rd	1.10	0.60	1.41	0.76	1.33	0.74
4th	1.07	0.57	1.28	0.68	1.33	0.72
5th	0.96	0.51	1.25	0.66	1.27	0.66
6th	0.87	0.45	1.24	0.67	1.17	0.64
7th	0.59	0.29	1.00	0.55	0.88	0.46
8th	0.56	0.29	0.98	0.53	0.77	0.41
Total Days over 0.5 DV	10	5	17	8	19	6

As illustrated, the new IMPROVE equation lowered the number of visibility impact days above 0.5 dv at Seney National Wildlife Refuge by 5 to 13 days. Resulting dv values were reduced by approximately 50%. Results for Mammoth Cave, Mingo Wilderness Area and Isle Royale National Park can be found in Appendix 5a.

Burns Harbor used default H_2O_2 background concentrations of 1.0 compared to the MRPO's seasonal H_2O_2 background concentrations, which varied from 0.5 to 3.5. This difference was not significant as these variables are only used when the option for aqueous phase reactions are taken into account. Another change was the total natural background extinction coefficients used by Burns Harbor were allocated to soils instead of distributed among sulfates, nitrates, organic and elemental carbon, coarse mass and soil. This change did not significantly affect visibility results as explained in Section 4.0 "CALPUFF Modeling" in their Source Specific BART Modeling Report: ArcelorMittal Burns Harbor LLC.

IDEM's review of the Burns Harbor modeling has shown that the refined modeling and use of the new IMPROVE equation and the annual average natural background concentrations have resulted in lower visibility impacts. Based on the more refined grid approach, Burns Harbor has demonstrated that the number of days with visibility impacts from the source fall below the visibility threshold of 22 days above 0.5 dv and the source will not be subject to BART.

8.4.10 Summary of Burns Harbor BART Determination Analysis

In accordance with 70 FR 39104 and the criteria set forth by U.S. EPA for sources which might be BART-eligible, Burns Harbor was identified as a BART-eligible source. IDEM conducted dispersion/long range transport modeling of the BART-eligible emissions units from Burns Harbor and determined Burns Harbor to be subject to BART. Subsequently, Burns Harbor submitted a BART modeling analysis and through updated emission estimates, revised stack parameters, refined grid modeling, use of annual average natural background concentrations, and determination of visibility impacts using the new IMPROVE equation, indicated Burns Harbor's BART-eligible emissions units would not be subject to BART. IDEM's review of Burns Harbor's modeling analysis and the revised emission rates show that Burns Harbor will not be subject to BART, with the 98th percentile dv value below the 0.5 dv threshold at surrounding Class I areas. Therefore, the BART-eligible units from Burns Harbor are not subject to BART and no further analysis is required.

Table 19 BART-eligible Stack Parameters for Burns Harbor

Emission Unit	Base Elevation	LLC East	LLC North	Stack Height	Stack Diameter	Exhaust Velocity	Exhaust Temperature
POINT Source	**(m)**	**(km)**	**(km)**	**(m)**	**(m)**	**(m/sec)**	**(^{o}K)**
Power Stations (Boilers #7 - #12)	187.14	816.32	225.26	67.06	3.43	13.34	505.00
#1 Coke Battery Pushing	187.54	816.09	224.28	20.12	0.76	9.44	323.00
#1 Coke Battery Underfire	187.15	816.02	224.26	76.81	3.78	7.15	547.00
#2 Coke Battery Pushing	187.15	816.13	224.04	26.82	2.44	20.20	335.00
#2 Coke Battery Underfire	187.14	816.02	224.10	75.90	4.18	4.48	505.00
Sinter Windbox Stack	187.15	815.98	225.24	24.08	2.39	55.12	319.00
Blast Furnace D Casthouse	187.14	816.14	225.30	18.90	1.56	24.70	533.00
Blast Furnace C Stoves	187.15	816.18	225.27	61.26	3.48	15.89	519.00
Blast Furnace D Stoves	187.14	816.15	225.42	61.26	3.59	14.93	519.00
Blast Furnace C Casthouse	187.14	816.14	225.30	18.90	1.56	24.70	533.00
Steelmaking HMD Station #1	187.14	816.38	225.89	25.91	2.05	12.95	305.00
Steelmaking HMD Station #2	187.14	816.41	225.89	25.91	3.04	5.89	305.00
Steelmaking Vessels #1 and #2	187.15	816.41	225.91	24.99	6.02	5.65	325.00
Steelmaking Vessels #3	187.15	816.41	225.99	11.58	3.71	2.64	332.00
Steelmaking FM Boiler	187.15	816.56	225.89	67.66	1.99	1.79	478.00
Hot Strip Furnace #1	187.14	816.97	225.23	41.45	4.30	7.06	811.00
Hot Strip Furnace #3	187.14	817.01	225.23	41.45	3.97	8.81	811.00
Hot Strip Furnace #2	187.14	817.00	225.23	41.45	4.30	7.02	811.00
160 " Plate Mill Furnace #1	187.14	816.98	225.06	54.25	3.10	4.37	673.00
160 " Plate Mill Furnace #2	187.14	817.0	225.06	54.25	3.10	4.09	693.00
160 " Plate Mill Furnace #5	187.14	817.02	225.06	39.92	1.95	12.48	783.00
160 " Plate Mill Furnace #6 and #7	187.14	817.02	224.94	32.92	2.24	9.99	783.00
160 " Plate Mill Furnace #8	187.14	817.02	224.92	50.90	1.74	2.99	673.00
110 " Plate Mill Furnace #1 and #2	187.14	817.02	224.83	54.56	4.44	2.13	838.00
Steelmaking HMD Station #3	187.14	816.47	225.92	25.91	2.05	12.95	305.00
110 " Plate Mill Normalizing Furnace	187.14	816.82	224.54	45.72	1.92	4.27	305.00
	Base Elevation	**LLC East**	**LLC North**	**Release Height**	**Area Side Length**	**Initial Vertical**	
AREA Source	**(m)**	**(km)**	**(km)**	**(m)**	**(m)**	**(m)**	
Blast Furnace C Slag Pit	187.14	816.15	225.38	50.00	30.00	30.00	
Blast Furnace D Slag Pit	187.14	816.13	225.52	50.00	40.00	30.00	
Steelmaking Fugitives	187.14	816.44	225.86	50.00	150.00	150.0	

8.5 BART Determination and Modeling for ESSROC Cement Corporation - Speed

ESSROC Cement Corporation (ESSROC) operates a Portland cement manufacturing facility located in Speed, Clark County, Indiana. In accordance with the BART Guidelines and criteria for BART-eligible sources, ESSROC was identified as a BART-eligible source.

IDEM initially conducted long-range transport modeling of the potential emissions from the BART-eligible emission units from ESSROC using the CALPUFF model. IDEM determined ESSROC to be subject to BART for having visibility impacts on nearby Class I areas. Subsequently, ESSROC submitted their own BART exemption modeling analysis using the 24-hour average actual emission rates from the highest emitting day, according to the BART Guidance. Based on IDEM's comments, ESSROC submitted additional information concerning the SO_2 and NO_x emissions used in the CALPUFF modeling. ESSROC's CALPUFF results showed ESSROC would not be subject to BART. This information is all contained in Appendix 5b. This document contains IDEM review of ESSROC's BART modeling analysis and the results of IDEM's revised BART modeling. IDEM's results showed that the visibility impairment from the ESSROC's sulfur dioxide and nitrogen oxide emissions would not exceed thresholds established in the BART Guidelines and, therefore, will not be subject to BART.

8.5.1 IDEM's BART Determination Process

IDEM sent out BART surveys in the fall of 2005 to sources that were identified as having possible BART-eligible emission units. ESSROC's Kilns #1 and #2 were identified as potential BART-eligible sources as these two ESSROC emission units met all three of the BART-eligible criteria, as listed below:

1.) Identify whether emission units are in one of the 26 source categories - **ESSROC operates a Portland cement plant, identified as one of the 26 listed categories.**
2.) Identify whether emission units were in existence on August 7, 1977 and began operation after August 2, 1962 - **The construction date of Kiln #1 was 1971 and Kiln #2 was in existence before August 7, 1977 and operating after August 1962.**
3.) Compare potential emissions from emission units to 250 tons/yr or more threshold of a visibility impairing pollutant (i.e. sulfur dioxide (SO_2), nitrogen oxide (NO_x) and particulate matter (PM)) - **Potential** NO_x **and** SO_2 **emissions from both kilns exceed 250 tons/year of any single visibility impairing pollutant with potential** NO_x **emissions of 3,600.4 tons/yr and potential** SO_2 **emissions of 12,772.1 tons/yr. Potential PM10 emissions from all BART-eligible units at ESSROC totaled 895.1 tons/yr.**

Source specific stack and detailed emissions information was requested to be used in IDEM's BART determination modeling analyses. A BART survey was sent to ESSROC, but no response was received from the company; therefore, ESSROC was determined to be subject to BART. IDEM conducted preliminary CALPUFF modeling, in which potential NO_x and SO_2 emissions from ESSROC's Kiln #1 and Kiln #2 were modeled to determine the visibility impacts. Results showed the visibility impacts from ESSROC exceeded the BART threshold of 98th percentile of 0.5 dv with a total of ten days over 0.5 dv for 2002, eight days over 0.5 dv for 2003, and seven days over 0.5 dv for 2004. The cumulative number of days over 0.5 dv for the three year modeled period was twenty-five days, over the 98th percentile of the three-year modeled period threshold of twenty-two days.

Trinity Consultants prepared and submitted to IDEM a BART modeling protocol for ESSROC on January 18, 2007. Based on IDEM's comments and responses to comments concerning the protocol, an IDEM-approved protocol was sent to ESSROC on February 15, 2007. The response and additional continuous emissions monitoring (CEM) data for the revised emission rates that were submitted by

ESSROC can be found in Appendix 5b. Information gathered from these submittals aided IDEM in conducting a revised CALPUFF modeling analysis for ESSROC's subject to BART determination.

IDEM's BART modeling process, the modeling domain and meteorology, and the Class 1 areas analyzed are the same as in Section 8.4.

SO_2, NO_x, and PM were modeled using the CALPUFF model for the SABIC analysis. Visibility impairing pollutants such as VOCs and ammonia were not modeled, but may be evaluated at a later date. IDEM received the BART exemption submittal from ESSROC on July 20, 2007. The emissions listed in ESSROC's initial submittal included a proposed plantwide applicability limitation (PAL) for NO_x and CEM data from the two kilns. Average 24-hour maximum emission rates are preferred for use in the CALPUFF model, consistent with the Modeling guidance to determine a source's visibility impairment. The emission rates can be found in Table 20.

It should be noted that ESSROC's initial submittal contained general information on the SO_2 CEM data for Kilns #1 and #2. The submittal showed that from January 1, 2006 through June 28, 2007, the maximum daily average hourly emission rates for Kiln #1 was 92.4 lb/hr and for Kiln #2 was 334.2 lb/hr. At IDEM's request for further information, ESSROC's latest submittal from May 7, 2008 further detailed the CEM data for SO_2 and NO_x from Kilns #1 and #2. The highest emitting day from the period reviewed by ESSROC (April 26, 2006 through March 1, 2008) showed NO_x emissions from December 4, 2006 were measured at 17,928 lb/day. The highest emitting day for SO_2 was May 20, 2006 with SO_2 emissions measured at 10,706 lb/day.

Table 20 BART Emission Rates for ESSROC - Speed

Emission Unit	**Potential** NO_x **Emissions**	**Potential** SO_2 **Emissions**	**Highest** NO_x **Emission Rate** [1]	**Highest** SO_2 **Emission Rate** [1]	**Highest** NO_x **Emission Rate**	**Highest** SO_2 **Emission Rate**
	(lb/hr)	(lb/hr)	(lb/day)	(lb/day)	(lb/hr)	(lb/hr)
Kiln #1	360.0	1104.0			302.6	37.8
Kiln #2	462.0	1812.0			444.4	408.3
TOTAL	822.0	2916.0	17928.0	10706.0	747.0	446.1

[1] Highest emission rates determined from CEM data taken from April 26, 2006 to March 1, 2008

In order to be consistent with previous BART analyses, the ESSROC analysis was run with both stack parameters averaged to give one representative point and also run with each individual stack in one run. Both scenarios were run to determine the overall visibility impact from ESSROC. The coordinates of the kilns are based on LCC in order to project on the CALPUFF modeling domain. Table 21 shows the stack parameters of Kilns #1 and #2 that were modeled in CALPUFF. The average of the stack parameters were calculated, in order to replicate the initial BART modeling conducted by IDEM. IDEM's BART analysis modeled both the individual and averaged stack parameters.

Table 21 BART-eligible Stack Parameters for ESSROC - Speed

Emission Unit	Base Elevation	LLC East	LLC North	Stack Height	Stack Diameter	Exhaust Velocity	Exhaust Temperature
	(m)	(km)	(km)	(m)	(m)	(m/sec)	(^oK)
Kiln #1	137.16	972.493	-114.574	36.58	2.44	22.16	513.70
Kiln #2	138.07	972.738	-114.621	64.92	2.97	16.31	422.00
AVERAGE	137.62	972.61	-114.60	50.76	2.71	19.24	467.88

8.5.2 ESSROC's BART Determination Modeling Results

ESSROC submitted modeling for its BART determination, using information and inputs taken from VISTAS BART Modeling Protocol, MRPO BART Modeling Protocol and IDEM's CALPUFF input files. ESSROC used a more refined 4-kilometer CALMET data set taken from 2001 through 2003 as well as a 4-kilometer CALPUFF grid, as supplied by VISTAS. ESSROC's initial modeling showed visibility impacts lower than the 98th percentile (8th highest day of the year) of the 0.5 dv threshold. ESSROC's revised modeling, submitted on May 7, 2008, took into account the CEM data for Kilns #1 and #2 and showed visibility impacts below the 98th percentile of the 0.5 dv threshold, as shown in Table 22.

Table 22 ESSROC – Speed's CALPUFF Modeling Results

Impact Rank	2002 dv (day)	2003 dv (day)	2004 dv (day)
1st	0.698 (81)	0.977 (342)	1.038 (244)
2nd	0.591 (303)	0.697 (60)	1.014 (296)
3rd	0.552 (291)	0.687 (23)	0.614 (274)
4th	0.505 (140)	0.636 (312)	0.552 (56)
5th	0.495 (330)	0.490 (220)	0.529 (179)
6th	0.480 (46)	0.486 (30)	0.426 (270)
7th	0.442(317)	0.485 (311)	0.386 (21)
8th	0.440 (55)	0.428 (99)	0.372 (228)

8.5.3 IDEM's BART Determination Modeling Results

IDEM based its initial CALPUFF modeling on potential emissions from ESSROC's BART eligible emission units. ESSROC's initial BART exemption submittal indicated SO_2 and NO_x emissions were much less than the potential emission calculations. IDEM requested further CEM data from ESSROC. This information was submitted on May 7, 2008. Modeled differences between IDEM's initial BART determination modeling and ESSROC's revised modeling were a result of lower NO_x and SO_2 emission rates for ESSROC's Kilns #1 and #2, as taken from the CEM data. ESSROC calculated its emissions from available CEM data from the kilns, taken from March 26, 2006 to April 1, 2008. This determination met the subject to BART modeling requirements for using the 24-hour average actual emission rate from the highest emitting day.

Table 23 IDEM's Revised CALPUFF Modeling Results for ESSROC - Speed

Impact Rank	2002 dv (day)	2003 dv (day)	2004 dv (day)
1st	0.747 (81)	1.033 (342)	1.088 (244)
2nd	0.637 (291)	0.744 (23)	1.083 (296)
3rd	0.581 (303)	0.712 (60)	0.660 (56)
4th	0.573 (317)	0.689 (312)	0.609 (179)
5th	0.537 (140)	0.556 (220)	0.574 (274)
6th	0.517 (46)	0.553 (311)	0.465 (21)
7th	0.463 (330)	0.504 (30)	0.415 (270)
8th	0.456 (55)	0.461 (99)	0.408 (247)

Table 23 above shows IDEM's revised CALPUFF modeling results, using the CEM data for Kilns #1 and #2 with the top eight rankings of the highest dv impacts from ESSROC for 2002 through 2004. There were six days above 0.5 dv in 2002, seven days above 0.5 dv in 2003 and five days above 0.5 dv in 2004. The 98th percentile for all three modeled years is eighteen days above 0.5 dv, below the twenty-two day threshold for 98th percentile of the three-year modeled period. While CALPUFF modeled impacts exceeding 0.5 dv, all at Mammoth Cave, the 98th percentile of modeled impacts were below 0.5 dv and did not exceed the subject to BART threshold.

8.5.4 Summary of ESSROC BART Determination Analysis

ESSROC operates a Portland cement manufacturing facility in Speed, Clark County, Indiana. In accordance with BART Guidelines and the criteria for sources which might be BART-eligible, ESSROC was identified as a BART-eligible source. IDEM conducted dispersion/long range transport modeling of the BART-eligible emissions units from ESSROC and determined ESSROC to be subject to BART. Subsequently, ESSROC submitted a BART modeling analysis and through revised emissions and stack parameters, indicated that their CALPUFF modeling showed ESSROC would not be subject to BART. IDEM's review of ESSROC's modeling analysis and the revised emission rates have shown that ESSROC would not be subject to BART, with the 98th percentile dv value below the 0.5 dv threshold. Therefore, the BART-eligible units from ESSROC are not subject to BART and no further analysis is required.

8.6 BART Determination and Modeling for SABIC Innovative Plastics – Mount Vernon Modeling Project Overview

SABIC Innovative Plastics Mt. Vernon, LLC (SABIC), formerly known as G.E. Plastics, operates a chemical manufacturing facility located in Mount Vernon, Posey County, Indiana. In accordance with the BART Guidelines and criteria set forth for BART-eligible sources, SABIC was identified as a BART-eligible source.

IDEM initially conducted long range transport modeling of the potential emissions from the BART-eligible emission units from SABIC using the CALPUFF model. IDEM determined SABIC to be subject to BART for having visibility impacts on nearby Class I areas. Subsequently, SABIC submitted their own BART exemption modeling analysis using the maximum 24-hour average actual emission rates and comparing modeled results with the annual average natural background light coefficient, according to the Modeling Guidance. SABIC conducted CALPUFF modeling at the nearest Class I areas in which SABIC had the greatest visibility impact, which were Mammoth Cave and Mingo Wilderness. These CALPUFF results showed SABIC was not subject to BART. This document contains IDEM's review of SABIC's BART exemption modeling analysis and the results of IDEM's revised BART modeling. IDEM's CALPUFF modeling results show that the visibility impairment from the appropriate maximum 24-hour average emission rates of sulfur dioxide, nitrogen oxides, and particulate matter from SABIC's Mount Vernon facility will not exceed thresholds established in the BART Guidelines, and therefore, will not be subject to BART.

8.6.1 IDEM's BART Determination Process

IDEM sent out BART surveys in the fall of 2005 to sources that were identified as having possible BART-eligible emission units. SABIC's B&W, Erie and Lasker boilers, nine of the sixteen carbon monoxide generators, Heater H109, and portions of the transfer and finishing units were identified as potential BART-eligible sources as these SABIC emission units met all three of the BART-eligible criteria for SO_2, NO_x, and PM, as listed below:

1.) Identify whether emission units are in one of the 26 source categories - **SABIC operates a chemical manufacturing plant, identified as one of the 26 listed categories.**
2.) Identify whether emission units were in existence on August 7, 1977 and began operation after August 2, 1962 - **The construction dates for the BART eligible emission units at SABIC are as follows: B&W Boiler- 1975, Erie Boiler- 1975, Lasker Boiler- 1962, Riley Boiler- 1962, Heater H109- 1974 and nine of the sixteen existing carbon monoxide generators were estimated in the BART eligibility timeframe.**
3.) Compare potential emissions from emission units to 250 tons/yr or more threshold of a visibility impairing pollutant (NO_x, SO_2 and PM) - **Potential** NO_x **and** SO_2 **emissions from all BART eligible emission units exceed 250 tons/yr of any single visibility impairing pollutant with potential** NO_x **emissions of 2431.7 tons/yr and potential** SO_2 **emissions of 5644.2 tons/yr. Potential PM_{10} emissions from all BART-eligible units at SABIC total 1391.4 tons/yr.**

Source specific stack and detailed emissions information were requested to be used in IDEM's BART determination modeling analyses. A BART survey was sent to SABIC and SABIC submitted the survey results to IDEM on December 6, 2005. IDEM conducted preliminary CALPUFF modeling, in which potential NO_x and SO_2 emissions from SABIC's BART eligible emission units were modeled to determine the visibility impacts. Results showed the visibility impacts from SABIC exceeded the BART threshold of the 98th percentile of 0.5 dv with a total of nine days over 0.5 dv for 2002, twelve days over 0.5 dv for 2003, and seven days over 0.5 dv for 2004. Based on the information provided, SABIC was determined to be subject to BART.

SABIC and GZA GeoEnvironmental, Inc. (GZA) met with IDEM staff on February 25, 2008 to discuss the BART modeling results and submitted a BART exemption modeling protocol to IDEM. IDEM reviewed and approved the protocol on February 28, 2007. This protocol can be found in Appendix 5c. GZA prepared the SABIC BART modeling analysis, conducted CALPUFF modeling and submitted revised emissions, stack information and the results to IDEM on May 7, 2008. Additional information submitted by SABIC and GZA, also found in Appendix 5c, aided IDEM's review of SABIC's subject to BART determination.

IDEM's BART Modeling Process, the Modeling Domain and Meteorology, and the Class 1 areas analyzed are the same as in Section 8.4.

8.6.2 Visibility Impairment Pollutants Analyzed

SO_2, NO_x, and PM were modeled using the CALPUFF model for the SABIC analysis. Visibility impairing pollutants such as VOCs and ammonia were not modeled but may be evaluated at a later date. SABIC's submittal included the methodologies for estimating daily emission rates from the boilers and carbon monoxide generators and the emissions for all BART-eligible units at SABIC, as found below in Table 24. Average 24-hour maximum emission rates are preferred in the CALPUFF modeling analysis to be consistent with the Modeling Guidance determining visibility impairment for BART determinations.

Table 24 BART Emission Rates for SABIC

Emission Unit	Maximum Actual Emissions (pounds/hour)			
	NO_x	SO_2	PM_{10}	$PM_{2.5}$
B&W (09-001) [1]	54.21	117.64	10.81	7.64
Erie Boiler (09-002) [1]	81.20	702.82	17.75	15.88
Lasker Boiler (09-002) [1]	41.97	363.27	8.24	7.5
Carbon Monoxide Generators COS (08-706) [2]	0.62	152.80	0.03	0.007
Riley Boiler (09-106)	17.85	0.11	1.34	1.34
Heater (H109)	1.88	0.011	0.14	0.14
Transfer/Finishing Units [3]	0.0	0.0	3.42	0.86
TOTAL	197.7	1336.6	41.7	33.4

[1] Maximum actual 24-hour average emission rates estimated from SO_2 emission profile analysis.
[2] Nine of the sixteen carbon monoxide generators were constructed prior to August 7, 1977.
[3] Conservative estimates of fugitive emissions from transfer/finishing units of 15 tons/yr.

SABIC calculated its emissions from the Erie, Lasker boilers, and the carbon monoxide generators, taking into account the enforceable sulfur input limit, as listed in its Part 70 Operating Permit (T129-

6794-00002). Data was based on the coal bunkered for the boilers, daily coal sampling, amount of coke purchased for feed to COS, and sulfur content of the purchased coke. Nine of the sixteen carbon monoxide generators were built during the BART eligible construction period so the emissions from those emission units were ratioed to account for only the BART eligible units. The other seven COS units were built after August 7, 1977 and therefore, are not BART eligible.

Table 25 shows the stack parameters of all the BART-eligible sources at SABIC, as well as the area source parameters that define the transfer and finishing area dimensions. The coordinates of the SABIC BART eligible emission units are based on LCC in order to project on the CALPUFF modeling domain.

Table 25 BART-Eligible Stack Parameters for SABIC

Emission Unit	Base Elevation	LLC East	LLC North	Stack Height	Stack Diameter	Exhaust Velocity	Exhaust Temperature
POINT Source	**(m)**	**(km)**	**(km)**	**(m)**	**(m)**	**(m/sec)**	**(^{o}K)**
B&W	122.0	793.329	-195.36	30.48	1.68	48.68	450
Erie & Lasker	122.0	793.29	-195.33	76.2	2.29	21.02	431
Riley	122.0	793.276	-195.36	16.76	1.73	24.75	471
COS	122.0	793.392	-195.30	48.77	1.57	4.37	889
Heater	122.0	793.437	-195.58	22.98	0.99	5.21	644
	Base Elevation	**LLC East**	**LLC North**	**Release Height**	**Area Side Length**	**Initial Vertical**	
AREA Source	**(m)**	**(km)**	**(km)**	**(m)**	**(m)**	**(m)**	
Transfer/Finish	122.0	790.34	-192.17	22.9	201	10.6	

8.6.3 SABIC's BART Determination Modeling Results

SABIC submitted modeling for its BART determination, using information and inputs taken from the VISTAS BART Modeling Protocol, the MRPO BART Modeling Protocol, and IDEM's initial CALPUFF input files. SABIC used a more refined 4-kilometer CALMET data set from 2001 through 2003 as well as a 4-kilometer CALPUFF grid, as supplied by VISTAS. IDEM's preliminary CALPUFF modeling used a more conservative extinction coefficient (20% best day natural background), due to the 36-kilometer modeling used by MRPO, rather than an annual average natural background coefficient. SABIC's use of a more refined 4-kilometer grid warranted the use of average annual natural background concentrations for Class I areas in the eastern United States, pursuant to U.S. EPA's "Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program" (EPA-454/B-03-005). This approach was accepted by IDEM.

SABIC submitted a permit modification application to IDEM on May 29, 2008, which requested IDEM to remove the provision to burn oil in the B&W Boiler from SABIC's Part 70 Operating Permit. While the B&W boiler is not capable of burning residual oil since the oil storage tank and oil supply system are no longer operable, the oil burning provision still exists in the Part 70 Operating Permit and, therefore, was analyzed for visibility impacts for the BART determination.

Table 26 below, shows the results of SABIC's modeling, submitted on May 7, 2008, July 10, 2008 and August 8, 2008. The CALPUFF results show visibility impacts below the 98th percentile of the 0.5 dv threshold at the two nearest Class 1 areas, Mammoth Cave in Kentucky and Mingo Wilderness Area in Missouri. SABIC modeled above the 0.5 dv threshold on one day in 2001, two days above the threshold at Mammoth Cave and one day at Mingo in 2002, and two days above the threshold at Mingo and one day at Mammoth in 2003. The visibility impacts for an individual year or the 3-year cumulative total do not exceed the 98th percentile of the 0.5 dv threshold level at any Class 1 areas.

Table 26 SABIC's CALPUFF Modeling Results over 0.5 dv

Impact Rank	2001 dv/Location/(day)	2002 dv/Location/(day)	2003 dv/Location/(day)
1st	0.506 at Mammoth (55)	0.657 at Mammoth (347)	0.703 at Mammoth (349)
2nd		0.562 at Mingo (345)	0.575 at Mingo (253)
3rd		0.550 at Mammoth (213)	0.558 at Mingo (53)

8.6.4 IDEM's BART Determination Modeling Results

IDEM based its initial CALPUFF modeling on potential emissions from SABIC's BART eligible emission units. The differences between IDEM's initial BART determination modeling and the revised modeling conducted from SABIC's BART exemption modeling submittals were the maximum 24-hour average emission rate estimates supplied by SABIC. Methodologies explaining SABIC's emission calculations are found in Appendix 5c. The emission estimates follow the Modeling Guidance for using the maximum 24-hour average emission rates in the CALPUFF modeling.

Results of IDEM's revised BART determination modeling show that the 98th percentile dv impact from SABIC is below 0.5 dv. Table 27 shows IDEM's revised CALPUFF modeling results with the top eight rankings of the highest dv impacts from SABIC for 2002 through 2004. The total number of days which modeled above 0.5 dv for all three modeled years is seventeen, below the twenty-two day threshold for 98th percentile of the cumulative three-year modeled period. Therefore, SABIC's BART-eligible emission units are exempt from BART.

Table 27 IDEM's Revised CALPUFF Modeling Results for SABIC

Impact Rank	2002 dv/Location/(day)	2003 dv/Location/(day)	2004 dv/Location/(day)
1st	1.050 at Mingo (345)	1.004 at Mingo (253)	0.705 at Mammoth (38)
2nd	0.632 at Mammoth (347)	0.827 at Mammoth (349)	0.601 at Mingo (328)
3rd	0.625 at Mammoth (361)	0.707 at Mammoth (263)	0.570 at Linville (15)
4th	0.563 at Mammoth (16)	0.678 at Mammoth (346)	0.569 at Mammoth (14)
5th	0.501 at Mammoth (360)	0.669 at Mammoth (6)	0.522 at Mammoth (30)
6th	0.327 at Mammoth (12)	0.600 at Mingo (252)	0.506 at Hercules (363)
7th	0.311 at Mammoth (213)	0.476 at Mammoth (360)	0.413 at Mammoth (346)
8th	0.311 at Mammoth (351)	0.471at Mammoth (361)	0.394 at Mammoth (289)

8.6.5 Summary of SABIC BART Determination Analysis

SABIC operates a chemical manufacturing facility in Mount Vernon, Posey County, Indiana. The BART Guidelines in the Federal Register (70 FR 39104) are a component of the Regional Haze regulations, published on July 1, 1999, and are intended to protect and improve visibility in national parks and wilderness areas. In accordance with 70 FR 39104 and the criteria set forth by U.S. EPA for sources which might be BART-eligible, SABIC was identified as a BART-eligible source. IDEM conducted dispersion/long range transport modeling of the BART-eligible emissions units from SABIC and determined SABIC to be subject to BART. Subsequently, SABIC submitted a BART modeling analysis and through revised emissions, stack parameters, and use of annual average natural background concentrations, indicated that their CALPUFF modeling showed SABIC's BART-eligible emissions units would not be subject to BART. IDEM's review of SABIC's modeling analysis and the revised emission rates show that SABIC will not be subject to BART, with the 98th percentile dv value below the 0.5 dv threshold at surrounding Class I areas. Therefore, the BART-eligible units from SABIC are not subject to BART and no further analysis is required.

8.7 BART Determination and Modeling for Alcoa

Of the sources identified as BART-eligible, modeling indicated that one non-EGU source, Alcoa - Alcoa Warrick Operations and Alcoa Power Generation (APGI) - are subject to BART. Alcoa submitted a BART analysis in which it developed BART and alternative BART control strategies. Due to technical or economic concerns relating to BART units, the alternative requires less emissions reductions from several subject-to-BART units. However, it proposes to control emissions from Boiler 1 that is not a BART-eligible unit, resulting in greater overall emission reductions. The modeling analysis shows that the alternative also achieves greater visibility improvement than BART.
IDEM has reviewed the analyses for completeness and approvability in accordance with 326 IAC 26-1, the BART Guidelines, and 40 CFR 51.308(e). The emission limits representing BART or the alternative to BART will be included in this rulemaking and the Part 70 permit for each unit subject to BART. The completed BART rulemaking will be submitted to U.S. EPA for approval into the SIP. The Alcoa BART analysis is in Appendix 5d. Note that there is an addendum to Appendix 5d that contains updated information provided by Alcoa. The tables in this document use the updated information.

8.7.1 Summary of Alcoa BART Analysis

Alcoa, located in Newburgh, Warrick County, Indiana, is subject to BART. The source submitted a BART analysis in December 2008, in which it developed BART and alternative BART control strategies. Since then, IDEM and the source worked together to address several issues related to the analysis. The alternative achieves a visibility improvement equal to 0.46 dv and an overall improvement in visibility equal to 75% over the baseline. It will be seen in the discussion to follow that sulfates are the major contributor to visibility impairment. The alternative, though it achieves greater reductions in all pollutants (PM, SO_2, and NO_x), achieves significantly higher reductions in SO_2, equal to approximately 21,600 tons. This section briefly describes the Alcoa BART proposal including the BART-eligible units, analysis, and control strategy. This also includes four tables: Table 30 shows proposed BART controls, Table 31 shows proposed emission limitations, while Tables 32 and 33 show source culpability toward the highest estimated visibility impact.

8.7.2 BART-eligible units at Alcoa

Alcoa identified 18 ingot furnaces, three boilers (Boilers 2, 3, and 4), and five aluminum refining furnaces (Potlines 2-6) as meeting the BART-eligibility criteria. Boilers 2 and 3 are classified as industrial boilers. Boiler 4 is classified as an EGU. Alcoa, in its December analysis addressed PM, SO_2, and NO_x for all its BART-eligible units including Boiler 4. According to the Indiana BART rule, 326 IAC 26-1-5, participation of this boiler in CAIR satisfies the SO_2 and NO_x requirements. The BART analysis will therefore address PM only for this boiler.

Boilers 2, 3, and 4 are dry bottom, pulverized coal-fired units. Boiler 2 came online in January 1964, Boiler 3 came online in October 1965, and the construction of Boiler 4 started on March 16, 1968. Boilers 2 and 3 each had a nominal heat input capacity of 1,357 MMBtu/hr prior to a recent upgrade to a nominal heat input capacity of 1,589 MMBtu/hr. Boiler 4 has a nominal heat input capacity of 2,958 MMBtu/hr. Each boiler is equipped with an electrostatic precipitator (ESP) for PM control. Boiler 2 was equipped with a low NO_x burner (LNB) and overfire air (OFA) in 2004, Boiler 3 was equipped with LNB and OFA in 2002, and Boiler 4 was equipped with a LNB in 1998 and a selective catalytic reduction (SCR) system in 2004. Wet flue gas desulfurization (FGD) scrubbers were installed on all boilers in 2008.

Emissions from potlines are captured and controlled with primary controls. Any uncaptured emissions escape through the roof monitors atop the potline buildings. The primary controls consist of a gas treatment system followed by a fabric filtration system. The total fluoride and particulate removal efficiencies of the control systems are estimated to exceed 99%.

Ingot furnace emissions are uncontrolled. There are several material handling operations at the facility that meet the criteria for beginning operation between 1962 and 1977. However, the BART Guidelines require that only those operations at primary aluminum ore reduction plants that meet the NSPS applicability criteria for this source category should be considered for BART controls. These operations are the potroom groups and anode bake plants. The department also identified three (3) ingot furnaces in the Alcoa Title V permit that meet the 1962-1977 timeline criteria but were not included in the analysis. According to Alcoa, one of these furnaces has been physically removed and the other two furnaces did not operate in the baseline years. As discussed later, based on the impact of the other 18-furnaces included in the analysis, the impact of these furnaces would be negligible.

8.7.3 BART Analysis

Before beginning the five step case-by-case BART analysis, Alcoa performed a baseline visibility impact analysis following a protocol submitted to IDEM. It determined the visibility impact for each of the years 2001-2003 using the CALPUFF model with emission rates based on the 24-hour average actual emissions from the highest emitting day. The initial screening model projected the highest visibility impact at Mammoth Cave National Park (MCNP). Other Class I areas screened included Mingo Wilderness Area, Sipsey Wilderness Area, Great Smokey Mountains National Park, Joyce Kilmer – Slick Rock Wilderness Area, Cohutta Wilderness Area, and Shining Rock Wilderness Area. The impact at MNCP exceeded 0.5 dv. Since the visibility impact was highest at MCNP, the BART analysis was solely based on the impact at MCNP.

With a few exceptions (as explained below), Alcoa followed the following five-steps in its BART analysis, as required by the Indiana BART rule and the BART Guidelines:

Step 1- Identify all available retrofit control technologies
Step 2- Eliminate technically infeasible options
Step 3- Evaluate control effectiveness of remaining control technologies
Step 4- Evaluate impacts and document the results
Step 5- Evaluate visibility impacts.

8.7.4 Control Strategy

As stated above, Alcoa proposed an alternative to BART. The alternative requires less emissions reductions on some units for technical or economic reasons. However, it proposes to control emissions from Boiler 1 which is not a BART-eligible unit. For example, Alcoa determined SO_2 BART for Boilers 2 and 3 as 92% reduction, but it proposes to control SO_2 emissions from these boilers by 90% as an alternative. Alcoa currently limits sulfur in the anode grade coke to ≤ 2%. Based on a market study, it has determined that the supply of <3% sulfur coke cannot be ascertained beyond 2013. Therefore, it proposes BART as ≤ 3% sulfur coke and the alternative as ≤ 3.5% sulfur coke. In the alternative, the source proposes to control SO_2 emissions from Boiler 1 by 91% and NO_x emissions at 0.38 lb/MMBtu. The proposed controls and the associated emission limits are shown in Tables 31 and 32, respectively. As can be seen in Tables 28 and 29, below, the alternative achieves greater visibility improvement and emissions reductions.

Table 28 Summary of Visibility Modeling Analysis

Modeling scenario	Visibility impact (dv) 2001	2002	2003	Average impact (dv)
1. Baseline, BART-eligible units only	1.852	1.906	1.788	1.849
2. BART, BART-eligible units only	0.444	0.299	0.402	0.382
Average improvement				1.467
3. Baseline, BART-eligible units and Boiler 1	2.311	2.774	2.549	2.545
4. Alternative BART	0.686	0.463	0.595	0.581
Average improvement				1.964
Incremental improvement due to alternative control strategy =				**0.497 dv**

Table 29 Summary of emissions impact of various control scenarios

Emissions (tons)

	Baseline BART-eligible units only	BART	Baseline including boiler 1	Alternative BART
NO_x	9,786.35	4,935.68	14,718.72	7,326.55
SO_2	60,268.69	10,062.80	86,171.53	14,373.70
PM	5,717.84	2,680.84	6,594.14	3,353.56

Emissions reductions (tons)

	Alternative BART	BART	Difference
NO_x	7,392.17	4,850.67	2,541.50
SO_2	71,797.83	50,205.89	21,591.94
PM	3,240.58	3,037.00	203.58

A discussion of the proposed control strategy follows.

8.7.5 Discussion

The BART Guidance does not specify a visibility threshold, cost effectiveness ($/ton), or cost/benefit ($/dv improvement) value that a control measure should meet for it to be considered as BART. This analysis therefore proceeded to determine a feasible control strategy on a case-by-case basis, taking into consideration the visibility impact, applicable control technologies, their cost, and other factors.

1. Highest Contributors to Visibility Impairment
Table 32 shows species contribution for each BART-eligible unit for its highest contribution in any baseline year. Table 33 shows total contribution and % species contribution for each BART-eligible unit at the highest modeled baseline contribution. Staff developed these tables from the source contribution table provided by Alcoa in its April 2, 2009 communication. It can be seen from these tables that Boilers 2 and 3 are the highest contributors to visibility impairment. In the year of maximum impact, Boilers 2 and 3 contribute approximately 95%, followed by potlines 3%, followed by Boiler 4 equal to 2%, and the contribution from ingot furnaces is zero. Sulfates and nitrates from Boilers 2 and 3 account for 73% and 25% of the impacts, respectively. It will be seen from the discussion to follow that the proposed controls significantly reduce visibility impact and that any additional incremental control will be achieved at high cost.

2. Boilers 2 and 3 - SO_2
Alcoa determined BART as wet limestone flue gas desulfurization (FGD) for these boilers at control efficiency equal to 92% and alternative control as 90% reduction. As an alternative, Alcoa proposes to control SO_2 from Boiler 1 (which is not a BART-eligible unit) by 91%.

3. Boilers 2 and 3 - NO_x
Alcoa proposes low NO_x Burners (LNB) and OFA with an emission limit equal to 0.38 lb/MMBtu as BART and as alternative BART for these boilers. U.S.EPA's presumptive BART limit for these boiler types is equal to 0.39 lb/MMBtu. Baseline modeling without these controls shows the highest visibility impact due to these boilers equal to 0.458 dv, which is projected to decrease to 0.064 dv with the above controls. Alcoa identified Selective Non-catalytic Reduction (SNCRs) and SCRs as feasible technologies to control NO_x from these boilers; however, it did not perform visibility impact analysis with these technologies. The capital and annual costs of SNCR controls on these boilers are estimated at $3 million and $2.8 million respectively. The capital and annual costs of SCRs are estimated at $70 million and $13 million. Additional controls on these boilers are likely to yield visibility improvement at a very high cost/benefit ($/dv improvement).

4. Potlines
The maximum impact from these sources is 0.231 dv. This includes contributions due to vents and primary controls. Sulfates are the main contributors, at approximately 0.188 dv. Contributions due to other species are less than 0.01 dv. Therefore, any add-on controls for these pollutants will result in insignificant improvements in visibility. Due to insignificant impact from vents (0.013 dv), Alcoa did not perform the 5-step analysis for these sources. Further, these sources are subject to 40 CFR 63, Subpart LL, Maximum Achievable Control Technology (MACT). In order to comply with these standards, Alcoa follows work practices which minimize emissions escaping roof vents.

Sulfur dioxide from potlines can be controlled by lowering sulfur content in the anode grade coke and/or by installing wet scrubbers. Alcoa presently limits sulfur at ≤ 2%. From a market study, Alcoa has concluded that a supply of coke below 3% sulfur cannot be ensured beyond 2013, the year when the BART controls will be needed. Therefore it proposes ≤ 3% sulfur coke as BART and ≤ 3.5% sulfur coke as alternative BART. The 3.5% sulfur limit in the coke translates into 2.919% sulfur in the baked anode composite, the practice Alcoa follows to measure the sulfur content.

The installed and annual costs of wet scrubbers on potlines are estimated at $300 million and $55 million respectively. Modeling shows that SO_2 scrubbers on potlines can improve visibility by 0.138 dv. This improvement will be achieved at a cost/benefit ratio equal to $398 million/dv. Also, there are severe space and access limitations at the facility that would complicate the installation.

5. Boilers 2, 3 and 4 - PM

The maximum baseline impact due to filterable PM emissions from these sources is 0.035 dv. Alcoa proposes ESPs with an emission limit equal to 0.03 lb/MMBtu as BART controls for Boilers 2 and 3. Alcoa determined BART for Boiler 4 as 0.015 lb/MMBtu, but it proposes alternative BART for this boiler as 0.1 lb/MMBtu. This boiler has a LNB and SCR for NO_x control. Alcoa has noticed excessive conversion of SO_2 to SO_3 in the SCR due to the addition of an extra catalyst layer. To reduce SO_3, which has the potential to adversely affect the downstream equipment and in order to comply with the sulfuric acid limit in its permit, Alcoa has applied for a permit to install a dry reagent injection system between the SCR and ESP. This system will remove SO_3 from the gas stream, but it is expected to adversely affect the performance of the downstream ESP. The impact of this system on the ESP performance is not yet known. To account for this uncertainty, Alcoa proposes 0.1 lb/MMBtu as the alternative BART limit. A recent test, after the startup of the SO_2 scrubber on this boiler, measured an emission rate equal to 0.05 lb/MMBtu which includes PM and sulfuric acid.

The above limits are projected to lower the contribution from Boilers 2, 3, and 4 to approximately 0.005 dv. Alcoa identified fabric filters as feasible control technology for these boilers. However, estimating that these controls will not significantly improve visibility, it did not perform cost and visibility impact analyses with these controls. It roughly estimated the cost of fabric filters on these boilers at $97.18 million. This estimate is based on the cost of a fabric filter installed on a utility boiler. Alcoa estimates that installation of fabric filters on these boilers will improve visibility by 0.024 dv at a cost/benefit ratio equal to $445 million/dv.

6. Ingot furnaces

The maximum baseline impact from these sources is 0.003 dv. Due to insignificant impact from these sources, Alcoa did not perform a 5-step BART analysis for these sources.

Table 30 Alcoa Proposed BART Control Strategy

Emission unit	**BART**	**Alternative BART**
Boiler 1	not a BART-eligible unit	
PM		ESP
SO_2		wet FGD with 91% emissions reduction efficiency
NO_x		LNB with staged OFA
Boilers 2 and 3		
PM	ESP	ESP
SO_2	wet FGD with 92% emissions reduction efficiency	wet FGD with 90% emissions reduction efficiency
NO_x	LNB with staged OFA	LNB with staged OFA
Boiler 4 - PM	ESP	ESP
Potlines		
- Fugitive emissions		
PM	no add-on control	no add-on control
SO_2	limit anode grade coke to 3% sulfur	limit anode grade coke to 3.5% sulfur
NO_x	no add-on control	no add-on control
- Primary emissions		
PM	gas treatment system followed by fabric filter	gas treatment system followed by fabric filter
SO_2	limit anode grade coke to 3% sulfur	limit anode grade coke to 3.5% sulfur
NO_x	no add-on control	no add-on control
Ingot Furnaces	no add-on control	no add-on control

Table 31 Alcoa Proposed BART Emission Limits

Emission unit	Emission limit	Compliance demonstration method
Boiler # 1		
PM (filterable)	0.03 lb/MMBtu, 24-hour daily average	CEMS at the scrubber outlet according to PS-11, 40 CFR Part 60, Appendix B
SO_2	91% reduction, 24-hour daily average	CEMS at the scrubber inlet and outlet, according to 40 CFR Part 60, following Appendix B, PS-2
NO_x	0.38 lb/MMBtu, 24-hour daily average	CEMS at the scrubber outlet, following PS-2
Boilers 2 and 3		
PM (filterable)	0.03 lb/MMBtu, 24-hour daily average	CEMS at the scrubber outlet according to PS-11, 40 CFR Part 60, Appendix B
SO_2	90% reduction, 24-hour daily average	CEMS at the scrubber inlet and outlet, following PS-2
NO_x	0.38 lb/MMBtu, 24-hour rolling average	CEMS at the scrubber outlet, following PS-2
Boiler #4		
PM (filterable and sulfuric acid)	0.1lb/MMBtu	The compliance method is according to 40 CFR 60, Appendix A, Method 5
Potlines 2-6		
PM (filterable)	0.005 grains/scf	The compliance method is according to 40 CFR 60, Appendix A, Method 5
SO_2	The sulfur content in each monthly baked anode composite shall not exceed 2.919%, provided however that hourly SO_2 emissions from the potlines shall not exceed 1,456 lbs/hr. on a combined basis, and determined on a monthly basis.	ASTM D3177-02, modified by adding saturated bromine water before the pH adjustment. Alternatively, determination of sulfur content by x-ray fluorescence.

Table 32 Highest Contribution from BART-eligible Units in any Modeling Scenario

			Contribution (dv)					
BART-eligible unit	Year of maximum contribution	Modeling scenario	Sulfates	Nitrates	Filterable PM 2.5	Filterable PM 10	Condensable	Total
Boilers 2 and 3	2002	Baseline: BART-eligible units +boiler 1	1.331	0.458	0.014	0.000	0.011	1.814
Boiler 4	2002	Baseline: BART-eligible units +boiler 1			0.021	0.000	0.010	0.031
Potlines	2003	Alternative BART-BART-eligible units +boiler 1						
Vents			0.003	0.000	0.004	0.001	0.005	0.013
Primary controls			0.185	0.002	0.005	0.000	0.008	0.200
Ingot furnaces	2003	Baseline: BART-eligible units only	0.000	0.003	0.000	0.000	0.000	0.003

Table 33 Source Culpability for the Highest Baseline Impact

Year of maximum impact	2002			
Modeling scenario:	Baseline with BART-eligible units and boiler 1			
BART-eligible unit (s)	Contribution (dv)	Total contribution (dv)	% contribution	% species contribution
Boilers 2 and 3		**1.814**	95.17%	
Sulfates	1.331			73.37%
Nitrates	0.458			25.25%
Filterable PM2.5	0.014			0.77%
Filterable PM10	0			0.00%
Condensables	0.011			0.61%
Boiler 4		**0.031**	1.63%	
Filterable PM2.5	0.021			67.74%
Filterable PM10	0			0.00%
Condensables	0.01			32.26%
Potlines				
Vents				
Sulfates	0.001	0.004	0.21%	25.00%
Nitrates	0			0.00%
Filterable PM2.5	0.001			25.00%
Filterable PM10	0			0.00%
Condensables	0.002			50.00%
Primary controls		0.057	2.99%	
Sulfates	0.05			87.72%
Nitrates	0.001			1.75%
Filterable PM2.5	0.002			3.51%
Filterable PM10	0			0.00%
Condensables	0.004			7.02%
Ingot furnaces		0	0.00%	
Sulfates	0			
Nitrates	0			
Filterable PM2.5	0			
Filterable PM10	0			
Condensables	0			
Total contribution		1.906	100.00%	

8.8 Indiana BART Rule

On November 3, 2010, the Indiana Air Pollution Control Board adopted as final the Indiana BART rule, 326 IAC 26-2. It includes the limits listed in the section above. It will become effective three to four months after this date. The rule is found in Appendix 7.

9.0 Long Term Strategy

9.1 Strategy requirements

Federal provisions at 40 CFR 51.308(d)(3) require Indiana to include in its SIP a long-term strategy that addresses regional haze visibility impairment for each mandatory Class 1 Federal area which may be affected by emissions from Indiana sources. The long-term strategy must include enforceable emissions limitations, compliance schedules and other measures necessary to achieve the reasonable progress goals established by the states or tribes where the Class 1 areas are located. The strategy must be based on consultation with the states with Class 1 areas impacted by Indiana emissions and must be based on factors such as ongoing air pollution programs, smoke management techniques for agricultural and forestry management purposes, source retirement and replacement schedules, and emission limitations and schedules for compliance to achieve the reasonable progress goals. This section describes how Indiana plans to meet its long-term strategy obligations.

9.2 Strategy

Indiana does not have any Class 1 areas; however, emissions from Indiana were determined to impact Class 1 areas in other states. Indiana consulted with those states to develop reasonable progress goals. The consultation with other states and Federal Land Managers is explained in detail in Sections 2 and 3 respectively. Indiana consulted with other states and tribes by participation in the MRPO Regional Haze Workgroup calls and other MRPO discussions to develop technical information necessary for development of coordinated strategies. Indiana also coordinated with CENRAP and MANE-VU to develop a weight of evidence analysis that was used to develop Indiana's long-term strategy. Strategy development considered the impacts of Indiana's emissions on Class 1 areas outside of Indiana. The emission inventory and modeling used to develop reasonable progress goals are described in detail in Sections 4.0, 5.0, and 6.0. The results of Class 1 area analyses are described in detail in Section 7.0.

Each state must obtain its fair share of reductions necessary to reduce visibility impacts in neighboring states with Class 1 areas. Appendix 8c addresses the analyses performed by EC/R for LADCO in the document "Reasonable Progress for Class I Areas in the Northern Midwest – Factor Analysis", July 18, 2007. As stated in the report:

"The purpose of this report is to analyze these reasonable progress factors for several
possible control strategies intended to improve visibility in the northern-Midwest Class I areas:
• SO_2 and NO_X emissions from electric generating units (EGUs)
• SO_2 and NO_X emissions from Industrial, commercial and institutional (ICI) boilers
• Ammonia from agricultural operations
• NO_X emissions from onroad and nonroad mobile sources
• NO_X emissions from reciprocating engines and turbines

In addition, an analysis is provided of existing ("on the books") control programs:
• Clean Air Interstate Rule (CAIR)
• BART for available States (i.e., MI, MN, WI, and ND)
• Maximum Available Control Technology (MACT) standards for combustion turbines and industrial boilers
• On-road mobile source programs (i.e., 2007 Highway Diesel Rule, Tier II/Low Sulfur Gasoline)
• Non-road mobile source programs (i.e., Non-road Diesel Rule, Control of Emissions from Unregulated Non-road Engines, Locomotive/Marine ANPRM)"

The report concludes that EGU control programs to reduce SO_2 and NO_x emissions are the most effective in reducing visibility impacts.

Table 11, from Section 8, shows the list of all Indiana EGUs and includes their existing and projected controls, as identified by IDEM, compared to the assumptions made in the EPA IPM runs and LADCO Round 5 modeling runs. Tables 34 and 35 summarize the megawatts controlled under the various scenarios. The generating capacity with IDEM known and projected control devices are compared scenario by scenario with EPA and LADCO cases. This table is an approximation because specific control efficiencies assumed by IDEM and EPA may vary and the controls specified by the consent decrees may have options for timing and ending control equipment. However, this is the best way to represent the overall amount of advanced control devices installed and planned to the Indiana electrical generating system.

The table indicates that EGUs installed controls early for the NOX SIP call and later in response to CAIR. At the end of the projection periods, essentially the same amount of capacity is controlled for both pollutants. The most important of the projections are the comparisons with LADCO controls for 2012 and 2018, as these are the years relied upon for the haze modeling in this SIP. SO_2 controls are 3.5% less than anticipated in 2012, which would result in slightly less visibility improvement than expected, but 32.9% greater in 2018, the end of this 10 year period. This would result in substantially greater improvement in visibility than anticipated. For NO_x, projected controls are 10.3% greater in 2012 and 1.6% less in 2018, resulting in slightly less improvement at the end of the period. Overall, with SO_2 being the most significant pollutant, Indiana's contributions to visibility impairment would be less in 2018 than predicted by the modeling.

Table 34 Indiana EGUs Megawatts with SO_2 Controls, Comparison of Actual or Projected Controls to Projections Made in EPA IPM Runs and Scenarios Modeled by LADCO

IDEM Base Case	EPA Base Case	IDEM 2010	EPA 2010	IDEM 2015	EPA 2015	IDEM 2020	EPA 2020	IDEM 2012	LADCO 2012	IDEM 2018	LADCO 2018
10,800	9,463	10,800	13,220	12,810	13,520	15,882	13,978	11,077	11,496	15,882	11,954

Table 35 Indiana EGUs Megawatts with NO_x Controls, Comparison of Actual or Projected Controls to Projections Made in EPA IPM Runs and Scenarios Modeled by LADCO

IDEM Base Case	EPA Base Case	IDEM 2010	EPA 2010	IDEM 2015	EPA 2015	IDEM 2020	EPA 2020	IDEM 2012	LADCO 2012	IDEM 2018	LADCO 2018
12,981	11,420	12,981	11,637	13,103	12,425	15,703	15,958	13,103	11,880	15,703	15,958

Beyond the projections made for the tables above, the CAIR replacement rule will also have an impact on Indiana utilities. The largest remaining uncontrolled units have proposed allocations under the TR that are substantially below present emissions levels. It is unknown how the utilities will address the budgets, but it is likely there will be additional reductions in the 2015 to 2018 timeframe over those projected above..

In addition to the EGU reductions, Indiana anticipates significant reductions from federal programs, such as the 2007 diesel rule, Tier II/Low Sulfur fuels and the non-road mobile source programs. These have been factored into future year modeling.

Other area source, mobile source, and non-EGU point source reduction programs currently in place, "on the books" controls, were listed in Section 5.8. Some of the measures include Reasonably Available Control Technology (RACT) on particulate and VOC sources, measures in the Rate of Progress Plans (RFPs) to meet the 1-hour ozone NAAQS, the NO_x SIP Call (Phase 1 for EGUs and Phase 2 for stationary internal combustion engines), and CAIR. As described in Section 8, Indiana has a fully adopted CAIR rule, which will be replaced by the newly proposed Clean Air Transport Rule, which will provide additional reductions.

Indiana is currently, or will be shortly, working on additional programs to address the revised SO_2, $PM_{2.5}$ and 8-hour ozone NAAQS. These programs will further reduce Indiana's contribution to Class 1 areas in other States.

Indiana has in its state rules sections that apply specifically to visibility in Class 1 areas. First, "adverse impact on visibility" is defined and then responsibilities of sources impacting federal Class I areas. These are contained in Indiana's Permit Review Rules, 326 IAC 2-2, Prevention of Significant Deterioration (PSD) Requirements.

In Indiana, prescribed burning must be conducted in accordance with state law under Indiana Code (IC) 13-17-9 and regulations under 326 IAC 4-1. County or local ordinances may also apply in some parts of the state. In addition, the Indiana Department of Natural Resources (IDNR) has developed a fact sheet on prescribed burning that includes smoke management recommendations (Appendix 6). Prescribed burning of state-owned land by IDNR is allowed under 326 IAC 4-1-3(c), but must be extinguished if it creates a pollution problem. Prescribed burning also may not be conducted during unfavorable weather conditions, including when a pollution alert or ozone action day has been declared. Most burning of agricultural land is exempt from regulation.

9.3 Future Activities

As explained above, at this time, reductions in Indiana emissions from the BART rule and other programs are sufficient to meet the reasonable progress goals in other states. However, to continue to assist those states in meeting their reasonable progress goals and to minimize its contribution to those states, Indiana commits to the following actions:

1. Effectively enforce the existing control measures.
2. Work with U.S. EPA and other states and regional planning organizations to address multi-pollutant air quality problems in the eastern and northeastern U.S.
3. Continue consultation with states with Class 1 areas to monitor their progress in meeting their reasonable progress goals and develop coordinated strategies, as and when needed, to mitigate visibility impacts in those areas.

10.0 State Implementation Plan Revisions and Adequacy of the Existing Plan

10.1 State Implementation Plan Revisions

The federal rule at 40 CFR 51.308(f) requires Indiana to revise its regional haze implementation plan and submit a plan revision to U.S. EPA by July 31, 2018, and every ten years thereafter. In accordance with the requirements listed in 40 CFR 51.308(f) of the federal rule for regional haze, Indiana commits to doing this.

In addition, 40 CFR 51.308(g) requires periodic reports evaluating progress towards the reasonable progress goals established for each mandatory Class 1 area. In accordance with the requirements listed in 40 CFR 51.308(g) of the federal rule for regional haze, Indiana commits to submitting a report on reasonable progress to U.S. EPA every five years following the initial submittal of the SIP. The report will be in the form of a SIP revision. The reasonable progress report will evaluate the progress made towards the reasonable progress goal for each mandatory Class 1 area which may be affected by emissions from Indiana sources. All requirements listed in 40 CFR 51.308(g) shall be addressed in the SIP revision for reasonable progress.

10.2 Determination of the Adequacy of the Existing Plan

Depending on the findings of the five-year progress report, Indiana commits to taking one of the actions listed in 40 CFR 51.308(h), "Determination of the adequacy of existing implementation plan". The findings of the five-year progress report will determine which action is appropriate and necessary. The actions in 40 CFR 51.308(h) include the following:

(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.

11.0 Public Participation

Indiana published notification for a public hearing and solicitation for public comment concerning the draft Indiana Regional Haze State Implementation Plan in the Indianapolis Star, Indianapolis, Indiana on December 10, 2010.

A public hearing to receive comments concerning the SIP was conducted on January 11, 2011 at the Indianapolis-Marion County Public Library-West Indianapolis Branch. The comments from the Federal Land Managers were also presented at this hearing. The public comment period closed on January 13, 2011. Comments were received by the agency concerning this submission. Appendix 8 documents the public hearing process and includes a copy of the public notice, certification of publication, and the public hearing transcript. There were no public comments received by IDEM, however comments from the National Park Service and United States Forest Service are included in Appendices 9 and 10, respectively.

Appendices

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