Michigan Department of Natural Resources and Environment
Air Quality Division

STATE IMPLEMENTATION PLAN SUBMITTAL

FOR

REGIONAL HAZE

Michigan Department of Natural Resources and Environment
Air Quality Division
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LIST OF ACRONYMS

AFGD	Advanced flue gas desulfurization
AOI	Area of influence
ASOA	Anthropogenic secondary organic aerosol
AQD	Air Quality Division
B20%	Best 20 percent (days of visibility)
BACT	Best Available Control Technology
BART	Best Available Retrofit Technology
BC	Boundary conditions
Bext	Light extinction
BOWA, BWCA	Boundary Waters Canoe Area Wilderness
BSOA	Biogenic secondary organic aerosol
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CALPUFF	California Puff Model
CAMR	Clean Air Mercury Rule
CAMx	Comprehensive Air Quality Model with extensions
CEED	Center for Energy and Economic Development
CENRAP	Central Regional Air Planning Association
CFR	Code of Federal Regulations
CM	Coarse mass
CMAQ	Community Multiscale Air Quality Modeling System
Commission	Grand Canyon Visibility Transport Commission
DAA	Dry absorption addition
DSI	Dry Sorbent Injection
EC	Elemental carbon
ECR	EC/R Incorporated consulting firm
EFGR	External flue gas recirculation
EGU	Electric generating unit
EIMP	Empire Iron Mining Partnership
ENVIRON	ENVIRON International Corporation
EPA	United States Environmental Protection Agency
EPC	Escanaba Paper Company
FGD	Flue gas desulfurization
f(RH)	Relative Humidity adjustment factor
FLM	Federal Land Manager
FPRM	Primary particulate (i.e. soil, crustal and metals)
FS	Forest Service
FWS	Fish and Wildlife Service
HAPs	Hazardous Air Pollutants
ICI	Institutional, commercial and industrial
IDF	Indirect firing system
IFGR	Induced flue gas recirculation
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPM	Integrated Planning Model

ISLE1	Isle Royale National Park
LADCO	Lake Michigan Air Directors Consortium
LNB	Low NOx Burner
LTO	Low temperature oxidation
km	kilometers
LTS	Long-term strategy
MACT	Maximum Achievable Control Technology
MANE-VU	Mid-Atlantic, Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association
DNRE	Michigan Department of Natural Resources and Environment
MDOT	Michigan Department of Transportation
Mm-1	Inverse Megameters
MM5	Mesoscale Meteorological Model, 5th Generation (developed by Pennsylvania State University / National Center for Atmospheric Research PSU/NCAR)
mmBtu	Million British thermal units
MOBILE6	MOBILE Vehicle Emission Modeling Software Version 6
MPCA	Minnesota Pollution Control Agency
MRPO	Midwest Regional Planning Organization
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NESCAUM	Northeast State for Coordinated Air Use Management
NH4	Ammonium
NO3	Nitrate
NOx	Nitrogen oxides
NOV	Notice of Violation
non-EGU	Non-electrical generating units
NPS	National Parks Service
NSR	New Source Review
obs	observed
OC	Organic carbon
OMC	Organic mass carbon
OTB	On-the-books
p80	80^{th} percentile
PM	Particulate matter
PM_{10}	Particulate matter with aerodynamic diameters less than 10 microns
$PM_{2.5}$	Particulate matter with aerodynamic diameters less than 2.5 microns
PMF	Positive matrix factorization method
POC	Particulate organic matter
PSAT	Particulate Matter Source Apportionment Technology
PSD	Prevention of Significant Deterioration
Q/D	Emissions over distance (to Class I area)
REMSAD	Regional Modeling Systems for Modeling and Deposition
RH	Relative Humidity
RHR	Regional Haze Rule
ROG	Reactive organic gasses

ROP	Renewable operating permit
RPG	Reasonable progress goal
RPO	Regional Planning Organization
RRF	Relative response factor
RVP	Reid Vapor Pressure
SCR	Selective catalytic reduction
SDA	Spray dryer absorption
SENE1	Seney Wilderness Area
SESARM	Southeast State Air Resource Managers, Inc.
SIP	State Implementation Plan
SMC	St. Mary's Cement
SMP	Smoke Management Plan
SNCR	Selective non-catalytic reduction
SO_2	Sulfur dioxide
SO_4	Sulfate
SOA	Secondary organic aerosol
SSCC	Smurfit Stone Container Corporation
TIP	Tribal Implementation Plan
TMC	Tilden Mining Company
tpy	tons per year
TSD	Technical Support Document
URP	Uniform rate of progress
VIP	Visibility impairing pollutant
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOC	Volatile organic compounds
VOYA	Voyageurs National Park
W20%	Worst 20 percent (days of visibility)
WRAP	Western Regional Air Partnership
WWESP	Wet walled electrostatic precipitator

1 Background and Overview of the Federal Regional Haze Regulation

1.1 General Background/History of Federal Regional Haze Rule

In the 1977 amendments to the Clean Air Act (CAA), Congress added Section 169 (42 USC 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 I Federal areas which impairment results from man-made air pollution.*

Over the subsequent years, modest steps were taken to address the visibility problems in Class I areas. The control measures taken mainly addressed plume blight from specific pollution sources and did little to address regional haze issues in the Eastern United States.

When the CAA was amended in 1990, Congress added Section 169B (42 USC 7492), authorizing further research and regular assessments of the progress being made. 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 CAA mandated creation of the Grand Canyon Visibility Transport Commission (Commission) to make recommendations to the U.S. Environmental Protection Agency (EPA) for the region affecting the visibility of the Grand Canyon National Park. The Commission submitted its report to the EPA in June 1996, following four years of research and policy development. The Commission report, as well as the many research reports prepared by the Commission, contributed invaluable information to the EPA in its development of the federal Regional Haze Rule.

The EPA's Regional Haze Rule was adopted July 1, 1999, and went into effect on August 30, 1999. The Regional Haze Rule 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 I Areas – are required to participate in haze reduction efforts. The EPA designated five Regional Planning Organizations (RPOs) to assist with the coordination and cooperation needed to address the haze issue. The northern Midwest states of Indiana, Illinois, Michigan, Ohio, and Wisconsin formed the Midwest Regional Planning Organization (MRPO).

The EPA's Regional Haze rulemaking process was not without controversy and strife. On May 24, 2002, the U.S. Court of Appeals, D.C. District Court ruled on the challenge brought by the American Corn Growers Association against the EPA's Regional Haze Rule of 1999. The court remanded to the 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. The EPA has revised the Regional Haze Rule pursuant to the remand and on July 6, 2005, finalized its guideline for determining BART.

On February 18, 2005, the U.S. Court of Appeals, D.C. Circuit Court issued a ruling based on a second suit, this one brought by the Center for Energy and Economic Development (CEED) challenging an optional emissions trading program (the WRAP Annex Rule). The EPA finalized revisions to the alternative trading programs on December 12, 2006.

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

All Regional Haze State Implementation Plans (SIPs) were due three years after the EPA designates $PM_{2.5}$ attainment and nonattainment areas. The EPA finalized $PM_{2.5}$ designations for all areas of each state on December 17, 2004, and has determined that the Regional Haze SIPs were due by December 17, 2007.

1.2 Michigan's Class I Areas

Isle Royale National Park and Seney Wilderness Area are the two Class I areas in Michigan subject to the Regional Haze Rule.

Isle Royale National Park, Michigan's largest wilderness area, is an island, 571,790 acres in size, located in Lake Superior. Isle Royale was established as a national park in 1940 by President Franklin D. Roosevelt and was designated part of the National Wilderness Preservation System in 1976. In 1981, Isle Royale was designated an International Biosphere Reserve by the United Nations, giving it global scientific and educational significance. Well known for its timber wolves and moose, Isle Royale is the site of the longest running large mammal predator-prey study in the world.

Seney Wilderness Area is 25,150 acres located in the western portion of the Seney National Wildlife Refuge in the Upper Peninsula of Michigan. The Refuge was established in 1935 and the Wilderness Area was designated by the U.S. Congress in 1970. Seney's "string bogs" provide a unique habitat to a large variety of birds, mammals, and unusual plants.

1.3 Other States' Class I Areas

In accordance with 40 CFR 51.308, photochemical modeling has been performed to evaluate Michigan's impact on other Class I areas. The criteria used to define one state's "impact" on another state's Class I area was not determined by the EPA; therefore, each state and RPO was given its own discretion to determine impacts. Based on the MRPO modeling and using a 5 percent[2] or more contribution to total light extinction as impact criteria, emissions sources within Michigan impact only Isle Royale and Seney. More detailed analysis on Class I impacts is included in Appendix 1A.

Additionally, the Michigan Department of Natural Resources and Environment (DNRE), formerly the Michigan Department of Environmental Quality, received letters from four states regarding impacts from Michigan sources. Based on the states' analyses (see Appendix 1A), Class I areas within their jurisdiction are impacted by emissions from Michigan sources. The Class I areas are Acadia National Park and Moosehorn Wilderness Area in Maine, Great Gulf Wilderness Area in New Hampshire, Brigantine Wilderness Area in New Jersey, and Lye Brook Wilderness in Vermont.

[2] Depending on the chosen impact level, more Class I areas may be impacted. Michigan chose a higher impact level of 5 percent. The states that make a 5 percent contribution or more to total light extinction accounts for 75-80 percent of total light extinction, whereas using a 2 percent contribution accounts for 90-95 percent of total light extinction. Since this is the first planning stage for regional haze, the DNRE believes the 5 percent contribution of states is more appropriate and can be tightened in later planning stages if needed.

2 General Planning Provisions

NOTE – THIS SIP IS BEING REVISED FOR THE THIRD TIME, WITH THE KEY REVISIONS BEING THE INCLUSION OF A SECTION ON BART (PART 9). THIS SECTION WAS NOT COMPLETE IN THE EARLIER VERSIONS OF THIS SIP, AS DETAILED BELOW. THE OTHER PARTS OF THIS SIP DOCUMENT HAVE MINIMAL CHANGES FROM THE PREVIOUS VERSION THAT RECEIVED PUBLIC COMMENT.

Pursuant to the requirements of 40 CFR 51.308(a) and (b), the DNRE submits this SIP to meet the requirements of the EPA's Regional Haze Rule adopted to comply with CAA requirements. Elements of this SIP address the Core Requirements pursuant to 40 CFR 51.308(d) and preliminary BART components of 40 CFR 50.308(e). In addition, the SIP addresses Regional Planning, state and Federal Land Manager (FLM) coordination, and contains a commitment to provide SIP revisions and adequacy determinations.

The DNRE has authority to adopt the SIP under Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451).

The DNRE provided the first public notice of the opportunity to comment on the SIP on October 29, 2007, as well as an opportunity to request a public hearing. Although a hearing was tentatively scheduled for December 4, 2007, no requests for a hearing were received. Public comments were addressed and are summarized in Appendix 2A.

Due to the extensive changes requested from the first comment period and the updating of information, a second public comment period was held. The DNRE provided the public notice of the second opportunity to comment on the SIP on September 29, 2008. The DNRE also provided notice of the opportunity to request a public hearing on September 29, 2008. Although a second hearing was tentatively scheduled for November 3, 2008, no requests for a hearing were received. Public comments were addressed and are summarized in Appendix 2A.

The DNRE provided a third public comment period based on revisions made to the BART portion of the Regional Haze SIP. The DNRE provided the public notice of the third opportunity to comment on the SIP on May 24, 2010. The DNRE also provided notice of the opportunity to request a public hearing on May 24, 2010. A public hearing was tentatively scheduled for June 29, 2010, but no requests for a hearing were received. Public comments were addressed and summarized in Appendix 2A.

Public comments for the 2007 Regional Haze SIP draft varied, from being generally supportive of the SIP to being very critical. Commenters supported the "Clean Air Interstate Rule (CAIR) equals BART" assumption and DNRE's regional progress approach. Commenters also wanted monitoring to continue at the Class I areas, encouraged using the 2005 inventory for planning purposes, discussed the Isle Royale monitor location, and wanted glide path diagrams included in the SIP. The DNRE agreed with these comments and updated the SIP appropriately. One commenter wanted clearly defined milestones to 2064. The DNRE believes the Reasonable Progress Goals (RPGs) indicate these milestones. The FLMs were critical, expressing concern that a number of areas were not adequately addressed. Additional information was added to the document to address these concerns.

Public comments for the 2008 draft of the Regional Haze SIP were received only from the FLMs and from Region 5 EPA. The FLMs generally repeated their comments from the 2007 public

comment period. The EPA agreed with the comments submitted by the FLMs, commenting that BART and other control measures should be included in the SIP. The DNRE addressed these comments in Appendix 2A, as well as in the SIP document. The EPA also suggested some editorial changes, which the DNRE has made.

Public comments for the 2010 draft of the Regional Haze SIP were received only from the FLMs and from Region 5 EPA. The FLMs repeated some comments from the 2008 public comment period, but also had several comments on the BART section of the SIP. The EPA had many similar comments as the FLMs. The DNRE addressed these comments in Appendix 2A, as well as in the SIP document.

3 Regional Planning

3.1 Midwest Regional Planning Organization (MRPO)

In 1999, the EPA and affected states/tribes agreed to create five RPOs to facilitate interstate coordination on Regional Haze SIP/TIPs. The State of Michigan is a member of the MRPO, although the organization is not actively involved in Regional Haze work because of lack of federal funding. Members of the MRPO are listed in Table 3.1.a., below:

Table 3.1.a. MRPO Members

Indiana	Wisconsin
Illinois	Tribal Leaders (MI and WI)
Michigan	EPA Region V
Ohio	Federal Land Managers

The Lake Michigan Air Directors Consortium (LADCO) was started in 1989 by the states of Illinois, Indiana, Michigan, and Wisconsin in conjunction with the EPA to oversee the Lake Michigan ozone study. Ohio later joined as the fifth state member. The EPA encouraged states to form regional partnerships to address the Regional Haze Rule and the MPRO was formed in 1999.

The MRPO established an active committee structure to address both technical and non-technical issues related to regional haze. The three main committees are as follows:

- The Policy Steering Committee provides the overall policy direction for the regional planning effort and serves as the forum for the resolution of disputes. This committee is composed of state environmental commissioners, tribal representatives, the EPA and the FLMs.
- The Technical Steering Committee is responsible for the management of the regional planning effort. This committee is composed of the state air directors, as well as tribal, EPA, and FLM representatives.
- The Project Team meets on a regular basis to carry out the directions of the Technical Steering Committee and to guide the development of the regional planning effort. The Project Team may form appropriate technical workgroups as necessary to address specific concerns (e.g., monitoring, emissions, data analysis, and modeling).

LADCO provided supportive activities for the three committees (see Appendix 3A).

MRPO technical workgroups
The MRPO has three technical workgroups that met monthly and/or as needed for project inputs. The workgroups are for data analysis, emissions inventory, and modeling.

Meetings were scheduled separately for each technical workgroup. Most information was shared through conference calls, via e-mail, and in person at annual or semi-annual conferences. Because of its centrally located staff, the MRPO also communicated and provided data, tools, and information individually to states based on specific needs.

This SIP utilizes data analysis, modeling results and other technical support documents prepared for MRPO members. The LADCO staff provided much of the technical resources for the MRPO. Many of these technical analyses, as well as minutes for the Northern Class I area consultation process, can be found on their Web site.

3.2 State Consultation

A chief purpose of the RPO was to provide a means for states to confer on all aspects of regional haze, including consulting on reasonable progress goals and long-term strategies based on determinations of baseline and natural visibility conditions. The MRPO provided a forum for the member states and tribes to consult on the determination of visibility conditions in each of the Class I areas.

The DNRE has worked with states that are members of the Central Regional Air Planning Association (CENRAP), MRPO, and the Western Regional Air Partnership to convene meetings of representatives from the states and tribes that impact visibility in the four Northern Class I areas – Boundary Waters and Voyagers in Minnesota and Isle Royale and Seney in Michigan – along with FLMs and EPA representatives involved with the Northern Class I areas. This group engaged in extensive consultation about visibility conditions and control strategies needed to improve visibility at these four Class I areas.

The DNRE also worked with states from the Mid-Atlantic, Northeast Visibility Union (MANE-VU) region that identified Michigan as contributing to five of their Class I areas. Any state that contributes >2 percent sulfate, >0.1ug/m^3 sulfate, or one of the top ten sulfate-contributing states based on the 20 percent worst days were contacted by MANE-VU (MANE-VU, 2007). The five MANE-VU Class I areas are Acadia National Park and Moosehorn Wilderness Area in Maine, Great Gulf Wilderness Area in New Hampshire, Brigantine Wilderness Area in New Jersey, and Lye Brook Wilderness in Vermont.

3.2.1 Northern Class I Area Consultation

As described above, consultation among states is a requirement of the Regional Haze Rule. As part of the long-term strategy for regional haze, a state whose emissions are “reasonably anticipated” to contribute to impairment in other states’ Class I area(s) must consult with those states; likewise, a Class I host state must consult with those states whose emissions affect its Class I area(s) (40 CFR 51.308(d)(3)). The Northern Class I area consultation was convened to assist in the SIP development for the Class I areas in Michigan and Minnesota.

Participants

The Northern Class I areas consultation process included the states of Michigan, Minnesota, North Dakota, Wisconsin, Iowa, Illinois, Indiana, and Missouri. The consultation process also included representatives from other governments, such as the Ontario Ministry of the Environment and tribes including the Leech Lake Band of Ojibwe, Mille Lacs Band of Ojibwe, Fond du Lac Band of Lake Superior Chippewa, Grand Portage Band of Chippewa, Upper/Lower Sioux, and Huron Potawatomi.

The Northern Class I consultation process included representatives from federal agencies, including the FLMs from the U.S. Department of the Interior National Park Service and the U.S. Department of Agriculture Forest Service, as well as representatives from the EPA. This consultation partially fulfills the DNRE’s requirement under 40 CFR 51.308(i) to coordinate and

consult with FLMs on areas such as implementation, assessment of visibility impairment, recommendations regarding the reasonable progress goal, and strategies for improvement.

Process

In 2004 and 2005, a number of discussions were held between state and tribal representatives in the upper Midwest concerning air quality planning to address regional haze in the four Class I areas in Michigan and Minnesota.

Formal discussions geared toward specific SIP requirements began in July 2006, when the DNRE participated in a conference call with representatives from North Dakota, Iowa, Wisconsin, Minnesota, the Mille Lacs and Leech Lake Bands of Ojibwe, and FLMs, RPO, and EPA representatives. This group determined that additional parties should be added to the process and that this group should continue the dialog through conference calls approximately every three weeks during the development of the Regional Haze SIPs.

The first several months of calls focused on developing an agreed-upon technical base of information about the visibility conditions in the four Class I areas. This included documenting baseline and natural visibility conditions and determining the chemical constituents of haze and key contributors to visibility impairing emissions (i.e., geographical location, type of sources, and source categories). The shared technical work is documented in a technical memo, “Regional Haze in the Upper Midwest: Summary of Technical Information,” (see Appendix 3B).

The consultation group also shared modeling results, discussed visibility improvement expected to result from on-the-books controls, and discussed BART and other control strategies. As part of the consultation process, LADCO managed a contract where various control strategies were evaluated based on the designated four factors. The four factors of cost, time necessary for compliance, energy and other impacts, and remaining equipment life must be considered in establishing a reasonable progress goal (RPG) toward achieving natural visibility conditions in mandatory Class I areas. The consultation group provided input to LADCO on each part of the project. The control strategies that were evaluated included on-the-books controls, various sector level controls, and some facility-specific control measures (Battye, et. al., 2007).

The states involved in the consultation group also collaborated to ensure that a consistent future year scenario was used by all states. For example, it was agreed to use version 3.0 of the EPA’s Integrated Planning Model (IPM) as the basic prediction tool for EGU emissions in 2018.

All documentation of the Northern Class I areas consultation process can be found on the LADCO/MRPO Web site. This Web site includes documentation of the minutes from each group conference call, including a list of participants, as well as various other documents related to the Northern Class I consultation process. The minutes and documents show the major decisions that the members of the Northern Class I consultation process felt were important to discuss and document at the group level.

3.2.2 MANE-VU Consultation

The four MANE-VU states containing Class I areas are Maine, Vermont, New Jersey and New Hampshire, and they contacted the DNRE in "Ask" letters. These letters indicated that Michigan was impacting their Class I areas and requested consultation with the DNRE and several other states outside of MANE-VU to fulfill the consultation requirements of the Regional Haze Rule.

The DNRE and MANE-VU had several telephone calls and an in-person conference on August 6, 2007 (see Appendix 3C). MANE-VU shared the results of their modeling and their requests for emissions reductions from other states. This information is detailed in MANE-VU's "Inter-RPO Consultation Briefing Book," (MANE-VU, 2007) and is outlined in Section 10 of this SIP. In addition, the LADCO and MANE-VU states formed a workgroup to develop a proposal to give EPA for a CAIR replacement rule and ICI boiler controls. The joint letter to EPA discusses the proposal where all states were in agreement. The separate letters from LADCO and MANE-VU are areas where the groups did not agree, thus sent separate letters with each group's proposal. The letters sent to EPA as a result of these discussions are shown in Appendix 3D.

4 State and Federal Land Manager Coordination

Coordination between state/tribes and the FLMs is required by 40 CFR 51.308(i). Opportunities have been provided by the MRPO for the FLMs to review and comment on the technical documents developed by the MRPO. The DNRE has provided agency contacts to the FLMs as required. In development of this SIP, the FLMs were consulted in accordance with the provisions of 40 CFR 51.308(i)(2). FLMs participated in the Northern Class I area calls, as well as the MANE-VU consultation, as described in Section 3.

The DNRE provided the FLMs an opportunity for consultation prior to the scheduled date of a public hearing on the SIP. Since no public hearings were requested, none were held.

During the consultation process, the FLMs were given the opportunity to provide their:

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

The DNRE sent the draft SIP to the FLMs on October 16, 2007. The DNRE notified the FLMs of the opportunity for a public hearing tentatively scheduled for December 4, 2007. Comments received from the FLMs were addressed. A summary of the FLM comments and responses is included in Appendix 2A.

The DNRE held a second comment period and opportunity to request a public hearing on the Regional Haze SIP due to extensive comments, additional information (e.g., the emissions inventory), and changes due to the CAIR vacatur. The draft SIP was sent to the FLMs on September 30, 2008. The DNRE notified the FLMs of a tentatively scheduled public hearing for November 3, 2008. Comments received from the FLMs were addressed, and a summary of the FLMs comments and responses is included in Appendix 2A.

The DNRE held a third comment period and opportunity to request a public hearing on the Regional Haze SIP due to completion of the BART portion of the SIP. The draft SIP was sent to the FLMs in May 2010. The DNRE notified the FLMs of a tentatively scheduled public hearing for June 29, 2010. Comments received from the FLMs on the SIP were addressed and a summary of the FLMs comments and responses were included in Appendix 2A.

In response to the FLM comments to date, the DNRE has made significant updates to the emissions inventory, monitoring, and RPGs for the best and worst 20 percent visibility days, areas of influence, modeling information, wildland fires, contingency measures, and information in periodic reports. The DNRE also made some editorial corrections as suggested by the FLMs.

The FLMs made several comments about BART being incomplete and not including electric generating units (EGUs). The DNRE acknowledged that BART was incomplete and is submitting BART determinations in this 2010 regional haze SIP submittal.

The DNRE commits to coordinate and consult with the FLMs during the development of future progress reports and SIP revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas. The FLMs will be consulted in the following instances:

- Development and review of Regional Haze SIP revisions;
- Review of five-year progress reports; and
- Development and implementation of other programs that may contribute to impairment of visibility in Class I areas.

5 Modeling

A description of the photochemical modeling performed for this SIP can be found in Regional Air Quality Analysis for Ozone, $PM_{2.5}$ and Regional Haze: Final Technical Support Document (LADCO 2008, Appendix 5A). Section 5 of this document discusses the modeling analysis and Section 10 discusses reasonable progress for regional haze.

5.1 Methodology

LADCO performed the modeling for both 2002 and 2005 base years using the Comprehensive Air Quality Model with extensions (CAMx). The most recent modeling run, for 2005, is called Base M. Examination of multiple base years provides for a more complete technical assessment. The future year of interest for the Haze SIP is 2018, the first milestone year, and therefore was modeled as well (page 47 of TSD, Appendix 5A).

A "base" control scenario was prepared for each future year based on the following "on-the-books" controls:

On-Highway Mobile Sources
- Federal Motor Vehicle Emission Control Program, low-sulfur gasoline and ultra-low sulfur diesel fuel.
- Inspection - maintenance programs, including Illinois's vehicle emissions tests (northeast Illinois), Indiana's vehicle emissions testing program (northwest Indiana), Ohio's E-check program (northeast Ohio), and Wisconsin's vehicle inspection program (southeast Wisconsin) – note: a special emissions modeling run was done for the Cincinnati/Dayton area to reflect the removal of the state's E-check program and inclusion of low Reid Vapor Pressure (RVP) gasoline.
- Reformulated gasoline, including Chicago-Gary, Lake County in Illinois and Indiana; and Milwaukee, Racine in Wisconsin; and Low RVP in Southeast Michigan.

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 (Base M only)
- Consumer products/solvents.
- AIM coatings.
- Aerosol coatings.
- Portable fuel containers.

Power Plants
- Title IV (Phases I and II).
- Nitrogen oxides (NOx) SIP Call.
- CAIR.

Other Point Sources
- VOC 2-, 4-, 7-, and 10-year MACT standards.
- Combustion turbine MACT.

Other controls included in the modeling include consent decrees (refineries, ethanol plants, and ALCOA), NOx RACT in Illinois and Ohio, and BART for a few non-EGU sources in Indiana and

Wisconsin. Modeling will be redone to include BART for Michigan when emissions information for the Lafarge controls is determined. These data are scheduled to be available no later than 2016. Other BART sources in other states are expected to have controls in place by this date as well, allowing for revised modeling.

5.2 Results

The uniform rate of visibility improvement values for the 2018 planning year were derived for the 20 percent worst visibility days based on a straight line between baseline concentration value (plotted in the year 2004 -- end year of the 5-year baseline period) and natural condition value (plotted in the year 2064 -- date for achieving natural conditions). The 20 percent best visibility days should not degrade from the 2004 baseline values over the 60-year period. Plots of these "glide paths" for the 20 percent worst days (downward sloping line) and the 20 percent best days (horizontal line) for Isle Royale and Seney with the Base M modeling results are presented in Figure 5.2.a. (LADCO, 2008, see Appendix 5A). An updated glide path analysis was performed by LADCO in February 2010 and can be found in Appendix 5B. Tabular summaries of measured baseline and modeled future year deciview (dV) values for both areas are provided in Table 5.2.a. (2002 base year) and Table 5.2.b. (2005 base year) (LADCO, 2008, see Appendix 5A).

Isle Royale Seney

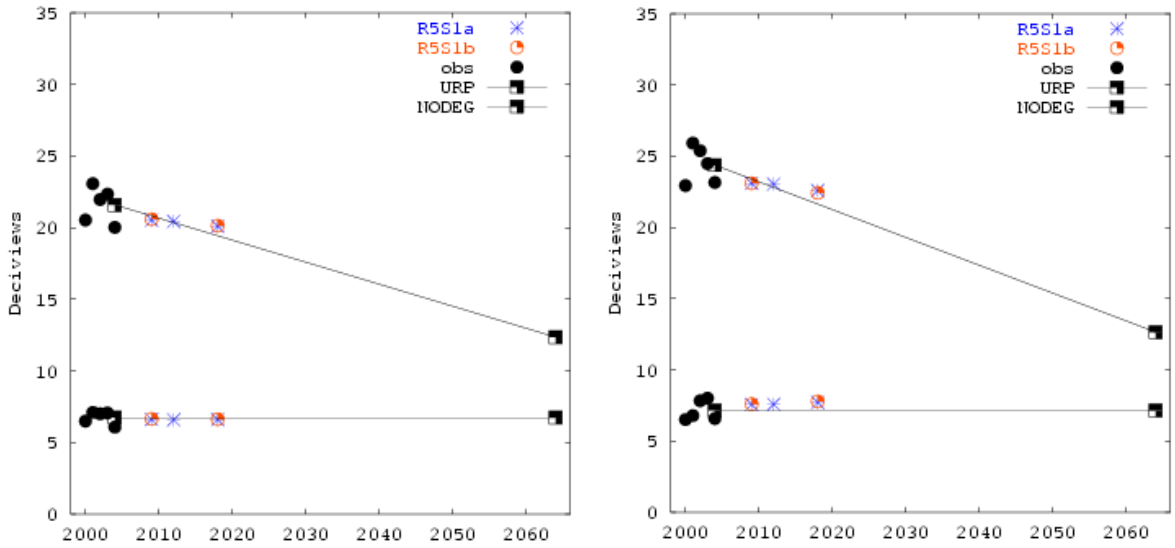


Figure 5.2.a. Visibility Modeling Results for Isle Royale and Seney

Table 5.2.a. Haze Results - Round 4 (Based on 2000-2004)

Worst 20%		2018	2009	2012	2018	2018	2018
Site	Baseline	URP	OTB	OTB	OTB	EGU2 (5-state region)	EGU2 (12-state region)
BOWA1	19.86	17.70	19.05	19.01	18.94	18.40	17.72
VOYA2	19.48	17.56	19.14	19.19	19.18	18.94	18.38
SENE1	24.38	21.35	22.98	22.71	22.38	21.26	20.63
ISLE1	21.59	19.21	20.46	20.28	20.04	19.09	18.64
HEGL1	26.75	22.76	24.73	24.34	23.85	23.01	22.04
MING1	28.15	24.08	25.18	24.67	24.01	22.53	21.45
CACR1	26.36	22.55	24.01	23.55	22.99	22.43	21.57
UPBU1	26.27	22.47	24.02	23.58	23.06	22.31	21.38
MACA1	31.37	26.14	28.06	27.03	25.52	24.27	22.57
DOSO1	29.04	24.23	24.86	23.59	22.42	21.60	20.15
SHEN1	29.31	24.67	24.06	22.79	21.57	20.43	19.42
JARI1	29.12	24.48	24.81	23.79	22.42	21.59	20.88
BRIG1	29.01	24.68	25.87	25.25	24.39	23.91	23.45
LYBR1	24.45	21.16	21.80	21.32	20.69	20.18	19.79
Best 20%		2018	2009	2012	2018	2018	2018
Site	Baseline	URP	OTB	OTB	OTB	EGU2 (5-state region)	EGU2 (12-state region)
BOWA1	6.42	6.42	6.71	6.73	6.87	6.83	6.81
VOYA2	7.09	7.09	7.21	7.25	7.34	7.31	7.26
SENE1	7.14	7.14	7.19	7.19	7.23	7.06	6.91
ISLE1	6.75	6.75	6.57	6.51	6.47	6.20	6.06
HEGL1	12.84	12.84	12.61	12.62	12.61	12.43	12.02
MING1	14.46	14.46	13.96	13.93	13.94	13.74	13.33
CACR1	11.24	11.24	10.91	10.92	10.90	10.75	10.42
UPBU1	11.71	11.71	11.47	11.46	11.42	11.28	11.01
MACA1	16.51	16.51	16.06	15.91	15.54	15.18	14.75
DOSO1	12.28	12.28	11.72	11.45	11.19	10.93	10.67
SHEN1	10.93	10.93	9.73	9.53	9.17	9.05	8.90
JARI1	14.21	14.21	13.56	13.33	12.97	12.65	12.46
BRIG1	14.33	14.33	13.74	13.69	13.47	13.32	13.21
LYBR1	6.36	6.36	6.12	6.05	5.96	5.88	5.82

Source: LADCO TSD p 99

Table 5.2.b. Haze Results - Round 5.1 (Based on 2000-2004)

Worst 20%		2018	2009	2012	2018	2018
Site	Baseline	URP	OTB	OTB	OTB	OTB+Will DO
BOWA1	19.86	17.94	18.45	18.33	17.94	17.92
VOYA2	19.48	17.75	18.20	18.07	17.63	17.66
SENE1	24.38	21.64	23.10	23.04	22.59	22.42
ISLE1	21.59	19.43	20.52	20.43	20.09	20.13
ISLE9	21.59	19.43	20.33	20.22	19.84	19.82
HEGL1	26.75	23.13	24.72	24.69	24.22	24.17
MING1	28.15	24.27	25.88	25.68	24.74	24.83
CACR1	26.36	22.91	23.39	23.29	22.44	22.40
UPBU1	26.27	22.82	23.34	23.27	22.59	22.55
MACA1	31.37	26.64	27.11	27.01	26.10	26.15
DOSO1	29.05	24.69	24.00	23.90	23.00	23.04
SHEN1	29.31	25.12	24.99	24.87	23.92	23.95
JARI1	29.12	24.91	25.17	25.01	24.06	24.12
BRIG1	29.01	25.05	25.79	25.72	25.21	25.22
LYBR1	24.45	21.48	22.04	21.86	21.14	21.14
ACAD1	22.89	20.45	21.72	21.72	21.49	21.49
Best 20%		2018	2009	2012	2018	2018
Site	Baseline	Max	OTB	OTB	OTB	OTB+Will DO
BOWA1	6.42	6.42	6.21	6.19	6.14	6.12
VOYA2	7.09	7.09	6.86	6.83	6.75	6.76
SENE1	7.14	7.14	7.57	7.58	7.71	7.78
ISLE1	6.75	6.75	6.62	6.59	6.60	6.62
ISLE9	6.75	6.75	6.56	6.55	6.52	6.50
HEGL1	12.84	12.84	12.51	12.32	11.66	11.64
MING1	14.46	14.46	14.07	13.89	13.28	13.29
CACR1	11.24	11.24	10.88	10.85	10.52	10.52
UPBU1	11.71	11.71	11.13	11.08	10.73	10.74
MACA1	16.51	16.51	15.76	15.69	15.25	15.25
DOSO1	12.28	12.28	11.25	11.23	11.00	11.01
SHEN1	10.93	10.93	10.13	10.11	9.91	9.91
JARI1	14.21	14.21	13.38	13.38	13.14	13.14
BRIG1	14.33	14.33	14.15	14.08	13.92	13.92
LYBR1	6.37	6.37	6.25	6.23	6.14	6.15
ACAD1	8.78	8.78	8.86	8.86	8.82	8.82

Source: LADCO TSD, p. 100

The haze modeling results show that several Class I areas in the Eastern United States are expected to be greater than (less improved than) the uniform rate of visibility improvement values for 2018, including those in northern Michigan and several in the Northeastern United States. Many other Class I areas in the Eastern United States are expected to be less than (more improved than) the uniform rate of visibility improvement values for 2018. As noted above, states should consider these results, along with information on the other four factors, in setting reasonable progress goals.

For Seney, the 20 percent best days shows a slight increase in baseline values by 2018. Since the increase at Seney is small (only a few percent), a reasonable interpretation of the modeling is that there is little expected change in the clean day visibility levels. In looking at the clean day model results, it appears that there is a significant increase in nitrate levels due apparently to greater ammonia emissions (in 2018). While growth for ammonia was assumed for 2018, and no controls on ammonia emissions were added, any assumptions regarding levels of ammonia emissions are estimates at best. An assumption could also be made that no growth occurs; in that case, the modeling would show a decrease in the 2018 clean day visibility levels. Thus the modeled change should not be interpreted to reflect a negative change. Further, the 2018 modeling generally did not include BART emission reductions from non-EGUs. Thus BART controls in northern Minnesota, Wisconsin, and Michigan will result in lower values than those shown in the Base M modeling. In addition in recent model runs (see Appendix 5B) the actual values (red triangles) are lower than the modeled values. The values on the 20 percent best days are well below the baseline values and the values for the 20 percent worst days are in line with uniform rate of progress. While modeled values continue to be refined, there remains much uncertainty, and modeled values may be over predicting the actual values.

5.3 CAIR Court Decision

On December 23, 2008, the U.S. Court of Appeals for the D.C. Circuit issued its opinion remanding the CAIR rule to the EPA. The EPA has been working on a CAIR replacement rule, and in August 2010 the proposed CAIR replacement rule, called by some the Clean Air Transport Rule (CATR) was published in the Federal Register. It is unclear how similar the new rule will be to CAIR Phase II until CATR is finalized.

LADCO did some additional modeling of a scenario reflecting emissions from EGUs with only CAIR Phase 1 in place along with other known EGU emission reductions. An explanation of the modeling methodologies and results can be found in a revised Technical Support Document in Appendix 5B.

Because of the timing constraints under which the DNRE is operating for submitting the Haze SIP, this SIP document reflects haze planning, modeling, etc. with CAIR still in place. However, the DNRE acknowledges that EGU future emissions may be different when CATR is finalized.

Current controls on EGUs in Michigan are detailed below.

The following data was taken from the Michigan Air Emissions Reporting System (MAERS):

Marquette Board of Light and Power
Boiler #2, 22 MW with Baghouse
Boiler #3, 44 MW with flue gas desulphurization (dry scrubber) and Baghouse

Consumers Energy JH Campbell
Boiler #1 265.2 MW with ESP and low NOx Burners
Boiler #2 403.92 MW with ESP and low NOx Burners
Boiler #3 855.43 MW with ESP, low NOx Burners and SCR

Consumers Energy B. C. Cobb Plant
Boiler #1 809 MMBTU with Low NOx Burners*
Boiler #2 809 MMBTU with Low NOx Burners*
Boiler #3 809 MMBTU with Low NOx Burners*
Boiler #4 156.25 MW with ESP
Boiler #5 156.25 MW with ESP

Consumers Energy Karn-Weadock Facility
Karn Boiler #1 272 MW with ESP and SCR
Karn Boiler #2 272 MW with ESP, low NOx Burners and SCR
Karn Boiler #3 692.5 MW with Low NOx Burners**
Karn Boiler #4 709.75 MW with Low NOx Burners**
Weadock Boiler #7 156.25 MW with ESP
Weadock Boiler #8 156.25 MW with ESP

DTE Monroe Power Plant
Boiler #1 800 MW with ESP, low NOx Burners and SCR
Boiler #2 800 MW with ESP and low NOx Burners
Boiler #3 800 MW with ESP, low NOx Burners, SCR and Wet Scrubber
Boiler #4 800 MW with ESP, low NOx Burners, SCR and Wet Scrubber

DTE St Clair / Belle River
St Clair boiler #1 150 MW with ESP
St Clair boiler #2 150 MW with ESP
St Clair boiler #3 150 MW with ESP
St Clair boiler #4 150 MW with ESP
St Clair boiler #5 with ESP (Not operating)
St Clair boiler #6 350 MW with ESP
St Clair boiler #7 450 MW with ESP
Belle River Unit #1 697 MW with ESP
Belle River Unit #2 635 MW with ESP
Has several small diesel generators that are uncontrolled.

Wisconsin Electric Power Co
Boiler #3 44 MW with Baghouse
Boiler #4 44 MW with Baghouse
Boiler #5 79 MW with Baghouse, ESP and Low NOx Burners
Boiler #6 79 MW with Baghouse, ESP and Low NOx Burners
Boiler #7 79 MW with Baghouse, ESP and Low NOx Burners
Boiler #8 79 MW with Baghouse, ESP and Low NOx Burners
Boiler #9 79 MW with Baghouse, ESP and Low NOx Burners

* Natural gas fired

** Permitted to burn natural gas and fuel oil

Escanaba Power Plant
Boiler #1, 12.5 MW with multi-cyclone and ESP
Boiler #2, 12.5 MW with multi-cyclone and ESP

The following data was obtained from DTE:

DTE Trenton Channel
Unit 9A, 520 MW with ESP and Low NOx Burners

6 Assessment of Baseline and Natural Conditions

Under the CAA, the Regional Haze SIPs must contain measures to make reasonable progress toward the goal of achieving natural visibility. Comparing natural visibility levels to current baseline conditions helps indicate how much progress we should try to make in the next five years. Determining natural visibility conditions is a SIP element and each state containing a Class I area (in consultation with FLMs and other states) must estimate natural visibility levels.

The MRPO calculated dV estimates for the 20 percent best and worst days using the new Interagency Monitoring of Protected Visual Environments (IMPROVE) equation. However, the MRPO, along with Minnesota, discovered several days in the data set that had high sulfate or nitrate (which would be in the worst 20 percent), but due to missing data (e.g., coarse mass, soil), were not included in the estimate. Since sulfates and nitrate are from anthropogenic sources, the MRPO and Minnesota included these days in our estimated 20 percent worst days. Table 6.a. shows the average baseline deciviews for the 20 percent worst day averages with and without the missing days and the difference in deciviews between the two averages. Table 6.b. shows the days that were added for Isle Royale and Seney.

Table 6.a. The average baseline dv of the 20 percent worst days with and without the missing data days

	Average Worst Day (dV), per RHR	Average Worst Day (dV), with Missing Data Days	Difference
Isle Royale	20.74	21.59	0.85
Seney	24.16	24.37	0.22

Source: Kenski, 2007

Table 6.b. List of days added for Isle Royale and Seney showing the light extinction for each fraction and the deciviews for the day

Date	Fine Soil (Mm-1)	Ammonium Nitrate (Mm-1)	Light Absorbing Carbon (Mm-1)	Course Mass (Mm-1)	Ammonium Sulfate (Mm-1)	Organic Mass (Mm-1)	p80	Deciview
Isle Royale								
2/23/2000		83	4.9		33.7	11.4	16.4	26.7
8/5/2000	0.4		3.6	7.9	22.7	13	16.4	17.8
8/12/2000	0.3		2.8	7.8	20.2	10.2	16.4	16.7
3/29/2001		53.8	4		36.7	6.9	18	24.3
4/1/2001		5.2	3.1		53.6	5.2	18	20.7
9/8/2002		1.6	4.1		132.9	18.9	16.9	28.3
2/26/2003	0.5	61.4		4.4	16.2		15.9	22.5
3/16/2003		140.3	6.2		51.6	12.3	15.9	31
7/26/2003		3.8	5.8		50.1	21.3	15.9	22.3
8/19/2003		3.4	5.4		62	21.5	15.9	23.4
9/9/2003		3.7	5.4		88.1	15.4	15.9	25.2
9/12/2003		2.2	6.7		299.7	11.7	15.9	35
3/25/2004		47.6	5.2		58	15.5	15.7	26.3
Seney								
3/22/2000	0.2	25.7		0.8	48.3		19.5	21.6
12/12/2001		105.9	5.8		60.8	17.7	22	30.1
9/8/2002		4.1	6.4		351.6	19.5	21.6	36.7

Source: Kenski, 2007

6.1 Isle Royale National Park Class I Area

The Isle Royale National Park Class I area has an established baseline visibility of 6.77 dV for the cleanest 20 percent of the days and 21.59 dV for the 20 percent worst visibility days. This is based on data at the Isle Royale (ISLE1) IMPROVE monitoring site (near Eagle Harbor), described in Appendix 6A. A 5-year average (2000 to 2004) was calculated to derive each baseline value (see Table 6.1.a.) in accordance with 40 CFR 51.308(d)(2), and is detailed on pages 6 and 7 of Appendix 3B.

Natural background represents the visibility goal for each Class I area to be reached in 2064 and is visibly representative of the conditions before human activities affected air quality in the area. The EPA guidance provides a “default” method of estimating natural visibility, which the MRPO used to estimate natural visibility. The Isle Royale Class I area has an estimated natural background visibility of 3.72 on the best days and 12.36 on the worst 20 percent of days. These best and worst 20 percent conditions were calculated using the above-referenced EPA

guidelines, and the baseline and natural conditions along with the URP line are shown in Figure 5.2.a., above.

Table 6.1.a. Baseline value, natural conditions, and uniform rate of progress (URP) for 2018 for Isle Royale

	2000	2001	2002	2003	2004	Baseline Value	2018 URP Value	Natural Conditions
20% Worst Days	20.53	23.07	21.97	22.35	20.02	21.59	19.43	12.36
20% Best Days	6.49	7.16	7.07	6.99	6.12	6.77		3.72

Modified from Appendix 3B, p. 8

6.2 Seney Wilderness Area Class I Area

The Seney Wilderness Area Class I area has an established baseline visibility of 7.14 dV for the cleanest 20 percent of the days and 24.37 dV for the 20 percent worst visibility days. This is based on onsite data at the Seney (SENE1) IMPROVE monitoring site, described in Appendix 6A. A five-year average (2000 to 2004) was calculated to derive each baseline value (see Table 6.2.a.) in accordance with 40 CFR 51.308(d)(2), and is detailed on pages 6 and 7 of Appendix 3B.

Natural background represents the visibility goal for each Class I area to be reached in 2064, visibly representative of the conditions before human activities affected air quality in the area. The Seney Class I area has an estimated natural background visibility of 3.73 on the best days and 12.65 on the worst 20 percent of days. These best and worst 20 percent conditions were calculated using the above-referenced EPA guidelines, and the baseline and natural conditions along with the URP line are shown in Figure 5.2.a., above.

Table 6.2.a. Baseline value, natural conditions, and uniform rate of progress for 2018 for Seney

	2000	2001	2002	2003	2004	Baseline Value	2018 URP Value	Natural Conditions
20% Worst Days	22.94	25.91	25.38	24.48	23.15	24.37	21.64	12.65
20% Best Days	6.5	6.78	7.82	8.01	6.58	7.14		3.73

Modified from Appendix 3B, p. 8

7 Monitoring Strategy

A monitoring strategy for measuring, characterizing, and reporting regional haze visibility impairment that is representative of all mandatory Class I areas within the state of Michigan is required by 40 CFR 51.308(d)(4) of the federal Regional Haze Rule. The monitoring strategy relies upon participation in the IMPROVE network.

The state evaluates its monitoring network periodically and makes changes as needed. However, to be able to assess whether reasonable progress goals are being achieved in each of Michigan's mandatory Class I areas, the federal IMPROVE monitors are needed.

The DNRE commits to meeting the requirements under 40 CFR 51.308(d)(4)(iv) to report to the EPA visibility data for each of Michigan's Class I areas annually based on IMPROVE data. Should federal funding be eliminated for the IMPROVE network, the state of Michigan may not be able to continue monitoring at Isle Royale and Seney. The DNRE has eliminated several monitors in other locations of Michigan because of state budget problems and reduced EPA funding. Michigan cannot afford to maintain additional monitors. Should federal funding be eliminated, the state would seek funding from other sources.

8 Emissions Inventory

A statewide emission inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area is required by 40 CFR 51.308(d)(4)(v). The DNRE believes that sulfur dioxide (SO_2) and NOx are the main components of regional haze and thus are included in our analyses. As specified in the applicable EPA guidance, the pollutants inventoried by the DNRE include volatile organic compounds (VOCs), NOx, fine particulate ($PM_{2.5}$), coarse particulate (PM_{10}), ammonia, and SO_2.

A description of the methodology used to prepare the inventory appears in Appendix 8A. Mobile emissions were prepared by the MRPO contractor using traffic and vehicle information provided by the Michigan Department of Transportation (MDOT). A summary of the emissions inventory is shown in Table 8.a. The DNRE will update this inventory every three years.

In addition, emissions were projected to 2009 and 2018 to support the RFP demonstration. The base year, 2009, and 2018 modeling inventories were prepared by LADCO. LADCO did not do any formal emissions processing for 2012; instead they simply interpolated between 2009 and 2018. Therefore, 2009 emissions are reported since they were determined by modeling. The future year projections take into account existing control measures and measures that were known to be on the way (e.g., CAIR measures). This inventory is referred to as the LADCO Base M inventory. Procedures used to prepare these inventory products can be found in the "Regional Air Quality Analyses for Ozone, $PM_{2.5}$, and Regional Haze: Technical Support Document," prepared by LADCO (see Appendix 5A). LADCO has produced numerous summary reports with state and county total emissions and has posted them on their Web site at: http://www.ladco.org/tech/emis/current/index.php.

Table 8.a. 2005, 2009 and 2018 Emissions Inventory Annual Emissions, Tons Per Year

2005	NH_3	NOx	SO_2	PM_{10}	$PM_{2.5}$	ROG*
EGU	140	120,332	350,701	5,392	2,358	1,418
nonEGU	806	85,898	58,284	13,038	6,505	32,774
onroad	11,084	244,345	4,211	5,530	3,652	119,431
nonroad	82	70,541	6,830	7,739	7,340	156,755
MAR	14	26,280	5,824	977	894	2,151
area	231	39,085	13,294	65,505	65,090	252,114
NH_3	55,132	0	0	0	0	0
total	67,489	586,482	439,145	98,181	85,839	564,643

2009	NH_3	NOx	SO_2	PM_{10}	$PM_{2.5}$	ROG
EGU	774	83,118	227,296	13,784	8,931	1,351
nonEGU	813	89,534	57,440	13,691	6,716	35,526
onroad	11,382	159,356	1,489	4,508	2,673	88,734
nonroad	84	58,717	1,088	6,589	6,231	137,022
MAR	10	16,694	2,795	588	539	1,399
area	208	39,756	13,051	66,140	71,630	221,739
NH_3	60,099	0	0	0	0	0
total	73,369	447,176	303,159	105,301	96,720	485,771

2018	NH_3	NOx	SO_2	PM_{10}	$PM_{2.5}$	ROG
EGU	774	79,544	242,853	13,784	8,931	1,351
nonEGU	798	88,062	56,724	13,288	6,537	34,512
onroad	11,963	56,758	1,201	3,463	1,683	50,965
nonroad	89	34,486	106	3,987	3,743	99,199
MAR	10	12,820	1,553	409	375	1,174
area	192	37,879	11,891	63,821	69,216	199,720
NH3	64,331	0	0	0	0	0
total	78,156	309,549	314,328	98,753	90,485	386,921

*ROG = Reactive organic gases.

9 Best Available Retrofit Technology

On June 15, 2005, the EPA issued final amendments to its July 1999 Regional Haze Rule. These amendments apply to the provisions of the Regional Haze Rule that require emission controls known as Best Available Retrofit Technology, or BART, for industrial facilities emitting air pollutants that reduce visibility. These pollutants include $PM_{2.5}$ and compounds that contribute to $PM_{2.5}$ formation such as NOx, SO_2, certain VOCs, and ammonia. The amendments include final guidelines, known as BART Guidelines, for states to use in determining which facilities must install controls and the type of controls the facilities must use.

The DNRE developed BART rules (see Appendix 9A) that describe the process for determining BART and the applicability provisions. One such provision states that the CAIR addresses BART for EGUs. The DNRE is evaluating whether the CATR will also address BART for EGUs. Section 9.1 describes the process for identifying non-EGU sources subject to BART.

9.1 Process for Determining BART-subject Sources in the State of Michigan

The non-EGU BART-subject sources were identified using the methodology in the Guidelines for BART Determinations under the Regional Haze Rule, 40 CFR Part 51, Appendix Y. The first step taken by the DNRE was to determine all potentially affected sources based on the criteria listed in the BART Guidelines. The DNRE identified 35 non-EGU facilities with a total of 84 emission units within the state that were potentially subject to BART (i.e., BART-eligible) based on dates of installation and commencement of operations (see Table 1 in Appendix 9B).

Next, using emission inventory data from the years 2002 and 2004, the DNRE evaluated the quantity of emissions in relationship to the distance from Michigan's Class I areas and other Class I areas in the region. This is called the Q/d analysis and was used as a screening method to identify those facilities most likely to impact the Class I areas. It was determined that a Q/d value of 10 tons per year/km is a reasonable threshold such that facilities at or above 10 would be likely to significantly impact a Class I area. This analysis reduced the BART-eligible facilities to a total of six (see Table 2 in Appendix 9B.)

The BART Guidelines recommend addressing the visibility-impairing pollutants SO_2, NOx, and particulate matter. The DNRE addressed these three pollutants and used particulate matter less than ten (10) microns in diameter (PM_{10}) as an indicator for particulate matter to identify BART-eligible units.

Culpability analyses by both CAMx and CALPUFF models have indicated that regional particulate background concentrations are based mostly upon secondary particulate contributions (nitrates and sulfates). Similar analyses indicate primary particulates tend to contribute mostly in a near field manner. As such, comprehensive $PM_{2.5}$ studies now include "hot spot" analysis to address near field impacts of primary particulates in conjunction with regional transport and impact of secondary particulates. Consistent with the BART Guidelines, the DNRE did not evaluate emissions of ammonia and VOCs in BART determinations for these reasons:

- Ammonia: In the BART Guidelines, the EPA recommends that states consider ammonia as a precursor to $PM_{2.5}$ formation on a case-by-case basis, describing that "states are required to make BART determinations only for stationary sources that fall within certain industrial categories." A review of the specific industrial categories in Michigan indicates

that these sources do not emit ammonia in a "significant" (potential to emit 250 tons per year or more) amount. Thus, the inclusion of ammonia, while a potential contributor to visibility impairment, would not impact the DNRE BART eligibility determination. However, ammonia from sources that may contribute to visibility impairment is included in the regional scale modeling used in this SIP.

- VOCs: In the BART Guidelines, the EPA suggests that states consider VOCs as a precursor to $PM_{2.5}$ formation on a case-by-case basis. Only specific VOC compounds form secondary organic aerosols that affect visibility, and these compounds are a fraction of the total VOCs reported in the emissions inventory. For the BART analysis, the DNRE does not have the breakdown of VOC emissions necessary to model those that only impair visibility. Although not included in BART, VOCs, both anthropogenic and biogenic, are included in the regional scale modeling used in this SIP

The next step involved CALPUFF modeling for each of the six facilities using 2002 through 2004 meteorological data in a 36 km resolution grid. Emissions data for the same time period was based on the best available estimate of maximum actual 24-hour emissions. Any facility that was determined to contribute 0.5 dV or more for seven or more days during any year at any Class I area was considered subject to BART regulations. Facilities that contributed less than this threshold were eliminated from further review. This final step resulted in six non-EGU BART-subject sources, as follows: Lafarge Midwest, Inc.; St. Mary's Cement; Smurfit-Stone Container Corp.; New Page Paper; Tilden Mining Co; and Empire Mining Co., shown in Table 3, Appendix 9B. When a source was determined to be BART-subject, the DNRE then required a detailed BART engineering analysis from the source.

However, in the process of doing BART reviews for the six sources, Empire Mine provided new information that one furnace had been permanently shut down. With the resulting lower emissions, Empire modeling showed that the facility does not exceed the 0.5 dV threshold BART level. Therefore this facility is no longer subject to BART. Michigan's remaining non-EGU BART-subject sources are shown in Table 9.1.a.

Table 9.1.a. Non-EGU BART-subject Sources in the State of Michigan

BART-Subject Facility Name	City	SIC
Lafarge Midwest, Inc.	Alpena	3241
New Page Paper Company	Escanaba	2611
St. Mary's Cement	Charlevoix	3241
Smurfit-Stone Container	Ontonagon	2611
Tilden Mining Co.	Marquette	1011

9.2 Determination of BART Requirements for Identified Non-EGU BART-Subject Sources and Analysis of BART Controls for Each Source

Five non-EGU BART-eligible sources were identified for engineering analysis, including two Portland cement plants, one taconite plant, and two paper products plants. These sources have submitted a BART engineering analysis to the DNRE that includes their evaluation of potential BART options and their proposed BART control strategies and are summarized in Table 9.2.d.

The proposed BART determinations from the five sources have been reviewed by the DNRE. In addition, comments from the EPA regarding certain methodologies for CALPUFF modeling criteria and concepts of the Regional Haze Rule were discussed with the sources. An additional BART analysis discussion summary, for each source, is included in this section.

For detailed information of BART controls and analysis submitted by sources, see Appendices 9C through 9J.

The following is a summary of the Non-EGU BART-subject sources' control options and emission limit determinations by the DNRE.

Lafarge Midwest (Lafarge)

Affected Emission Units
The BART subject emission units include five Portland cement manufacturing kilns: EU-KILN 19, EU-KILN 20, and EU-KILN 21 are part of Kiln Group 5 (KG 5); EU-KILN 22 and EU-KILN 23 are part of Kiln Group 6 (KG 6).

Lafarge BART Analysis
The BART analysis submitted by the company discussed the following control systems for PM, NOx and SO_2:

PM
In accordance with Regional Haze Rule, BART for PM emissions was determined to be equivalent to the Portland Cement MACT, which regulates PM as a surrogate to hazardous air pollutants (HAPs). Lafarge has emission controls (baghouses) in place to control HAPs and thereby meets both the MACT requirements and the BART for PM.

NOx
- Process optimization
- Low NOx Burners
- Selective non-catalytic NOx reduction (SNCR) and
- Selective catalytic NOx reduction (SCR)

Lafarge's analysis states that the only cost-effective control for all emission units for NOx emissions was SNCR with a control efficiency of 38 percent.

SO_2
- Duct Sorbent injection; and
- Flue Gas Desulfurization (FGD).

Lafarge's analysis states that wet scrubbers (FGD) are the cost-effective control for SO_2 emissions for the two larger kilns (KG 6) with a control efficiency of over 80 percent. For the three smaller kilns (KG 5), Lafarge's analysis states that no SO_2 controls are cost-effective. This BART analysis as submitted by the company is included in Appendix 9C.

Additional BART Analysis
On March 18, 2010, Lafarge entered into a Global Settlement/Consent Decree (hereinafter Consent Decree) with the EPA and Michigan to reduce NOx and SO_2 emissions at the Alpena facility along with other Lafarge facilities in the United States.

The emission controls in the Consent Decree include SNCR for Kiln Groups KG 5 and KG 6 for NOx control. For SO_2 control, wet scrubbers for kiln group KG 6 and a Dry Absorption Addition (DAA) system for Kiln Group KG 5 are required. These controls are consistent with the BART Guidelines to control visibility impairing pollutants (NOx and SO_2) emissions and are acceptable to Michigan. It should be noted that an additional control not included in the BART analysis but agreed to in the Consent Decree is the DAA system for SO_2 controls on KG 5. Michigan includes all controls contained in the Consent Decree, including the DAA system, as part of the BART controls.

The Lafarge Alpena facility will reduce NOx and SO_2 according to the schedule and conditions given in the Consent Decree (see Appendix 9D). Beginning January 1, 2011, Lafarge will maintain an interim, facility-wide, 12-month rolling tonnage limit for NOx of 8,650 tons per year and SO_2 at 13,100 tons per year. The final emission limits will be established according to the Consent Decree "Control Technology Demonstration Requirements," as given in the Appendix of the Consent Decree. The control technology demonstration describes in detail a stepwise emission control optimization program to establish the 30-day rolling average emission limits for NOx and SO_2 at individual affected kilns. Additional requirements include a demonstration phase, facility-wide, 12-month rolling average NOx emission limit of 4.89 lb NOx per ton clinker and an SO_2 emission limit of 3.68 lb SO_2 per ton clinker. The demonstration phase limit will be followed by a period of testing of control efficiency and subsequently establish a 30-day rolling average limit for both NOx and SO_2 to be calculated at the end of each 24-hour period.

BART Limits

PM
The DNRE accepts the MACT limit for PM at 0.30 lb PM per ton of dry feed as BART at subject kilns in KG 5 and KG 6 and has taken the approach that BART equals MACT for all affected sources.

NOx and SO_2
The DNRE also accepts the Consent Decree requirements as BART. The specific limits to date are as follows:

- The NOx limits are 8,650 tons per year and 4.89 lb NOx per ton clinker.
- The SO_2 limits are 13,100 tons per year and 3.68 lb SO_2 per ton clinker.

The DNRE will assure that the final limits will be made legally enforceable in the facility permits.

More details of emission limits can be found in the Lafarge Consent Decree dated March 18, 2010. The portions relevant to this Lafarge plant are in Appendix 9D. The Web link to the consent decree is http://www.epa.gov/compliance/resources/cases/civil/caa/lafarge.html. This URL is subject to change. In case of change, please contact the DNRE for further information.

New Page Paper Company (New Page)

Affected Emission Units
The BART subject emission units for this Kraft pulp mill include No. 8 Boiler (EU8B13), No. 9 Boiler (EU9B03), No. 10 Recovery Furnace (EURF15), Smelt Dissolving Tank (EUST15), and Lime Kiln (EULK29).

New Page BART Analysis
The BART analysis submitted by New Page reviewed the following for BART-subject units:

PM
The recovery furnace, smelt dissolving tank, and lime kiln are subject to the MACT for Kraft, soda, sulfite, and stand-alone semi chemical pulp mills (40 CFR Part 63, Subpart MM), which contains PM emission limits of 0.044 grain per dry standard cubic foot corrected to 8 percent oxygen for the recovery furnace; 0.064 grains per dry standard cubic foot, corrected to 10 percent for the lime kiln; and 0.2 pounds per ton of black liquor, or 0.15 lbs per 1,000 lbs of exhaust gases for the smelt dissolving tank. Boiler Nos. 8 and 9 will be subject to the Boiler MACT when it is revised by the EPA. The original Boiler MACT was vacated by the U.S. Court of Appeals. The company's existing PM permit limits for Boiler No. 9 are: when wood residue heat input is greater than 75 percent of total heat input, 0.50 lbs per 1,000 lbs of exhaust gases, measured at operating conditions, corrected to 50 percent excess air; and when wood residue heat input is less than or equal to 75 percent of total heat, 0.67 lbs per 1,000 lbs of exhaust gases, measured at operating conditions, corrected to 50 percent excess. There is no PM permit limit for Boiler No. 8.

NOx
For the recovery furnace, smelt dissolving tank, and lime kiln, New Page did not find control technologies available as none have been installed on such processes. New Page currently uses combustion control techniques and judges them to be BART. Current NOx emission limits are 400 parts per million (ppm) by volume or 468 lbs per hour for the recovery furnace. There are no NOx limits for the smelt tank and lime kiln.

For Boilers Nos. 8 and 9, New Page examined the following:

- Selective Catalytic Reduction (SCR)
- Low NOx Burners
- Selective Non-Catalytic Reduction (SNCR)
- Combustion Controls

For the No. 8 boiler, the analysis shows costs of the options are greater than $10,000 per ton, except for the use of low NOx burners with an approximate $4,000 per ton cost-effectiveness. However, New Page rejects this option as their visibility modeling does not indicate it will result in a significant visibility improvement (i.e., at least 0.5 deciviews). Therefore, New Page concludes that the existing operation of the flue gas recirculation system during the ozone season is BART. The existing NOx emission limit for the No. 8 boiler is, when firing gas, 0.20 lbs/MMBtu (limit effective only during ozone control period, May 1 through September 30) and, when firing residual oil, 0.40 lbs/MMBtu (limit effective only during ozone control period, May 1 through September 30).

For the No. 9 boiler, the company's report showed that all options had costs of greater than $10,000 per ton and thus judged not to be cost-effective. New Page concluded that operation of the existing overfire air combustion control with a NOx emission limit as specified in Table 81 of DNRE Rule 336.1801 when the boiler meets the definition of fossil fuel-fired emission unit per DNRE Rule 336. 1801(1)(b) is BART. However, No. 9 boiler primarily burns wood residue, but may also burn natural gas and paper cores. When burning natural gas the NOx emission limit from Table 81 is 0.2 lbs per million BTU of natural gas.

SO_2

For the recovery furnace, smelt dissolving tank, and lime kiln, New Page did not find control technologies available as none have been installed on such processes. Currently SO_2 emission limits are, for the recovery furnace, 250 ppm by volume or 407 lbs per hour, and, for the lime kiln, 9 lbs per hour. There is no limit for the smelt tank.

For the No. 8 boiler, New Page examined the following:

- 100 percent Natural Gas Fuel
- Switch to the No. 2 Fuel Oil
- Wet Scrubbing
- Dry Scrubbing
- Semi-Dry Scrubbing

The company's analysis showed that all options except the switch to exclusive use of natural gas were not cost-effective, with costs above $30,000 per ton of SO_2 controlled. The natural gas use cost is $4,200/ton. However, New Page rejects all options as their visibility modeling does not show significant visibility improvements from any of the five options. Therefore, New Page concludes that the existing operation of No. 8 boiler is BART. There is no current SO_2 emission limit for No. 8 boiler.

For the No. 9 boiler, New Page evaluated the following:

- Switching to Caustic in the Wet Scrubber
- Dry Scrubber
- Semi-Dry Scrubber

New Page determined that the dry and semi-dry scrubber options were not technically feasible, as none have been installed on such biomass-fired stoker grate boilers. The analysis showed the cost of the switch to caustic scrubbing media as more than $21,000/ton, which New Page concluded was not cost-effective. New Page concluded that use of the current inherently low sulfur biomass fuel constitutes BART. There is no current SO_2 limit for the No. 9 boiler.

For details of the New Page BART analysis, see Appendix 9I.

Additional BART Analysis

In a letter dated February 2, 2010, New Page reaffirmed that the methods, data, and conclusions in their January 2007 BART submittal remain accurate and complete. New Page contends that although there are technically feasible and cost-effective NOx and SO_2 options for the No. 8 boiler, the demonstration that no significant visibility improvement will result justifies eliminating these options.

The February 2, 2010 letter is attached in Appendix 9J.

BART Limits
The DNRE accepts New Page's existing PM, NOx, and SO_2 limits as representing BART for the subject emission units as described in the New Page BART Analysis section above.

An excerpt containing the emission limits from the renewable operating permit (ROP) is in Appendix 9M. For more details of permit conditions see ROP No. MI-ROP-A0884-2008, at the AQD Web site for ROP at: www.deq.state.mi.us/aps/downloads/rop/pub_ntce/pub_ntce.shtml. This URL is subject to change. In case of change, please contact the DNRE for further information.

St. Mary's Cement (SMC)

Affected Emission Units
There is only one BART-subject emission unit, the in-line kiln with a pre-calciner system (EUKILN).

SMC BART Analysis
The BART analysis submitted by the company discussed the following control systems for PM, NOx and SO_2.

PM
The Regional Haze Rules allow application of other standards such as MACT to regulate a pollutant. The Portland Cement MACT regulates PM as a surrogate to hazardous air pollutants. SMC has MACT controls (baghouse on main stack and ESP on bypass stack) for HAPS and thereby meets both the MACT requirements and the BART for PM.

NOx
- Selective catalytic NOx reduction (SCR)
- Mid-Kiln firing
- Biosolids injection
- CemStar™
- Low NOx Burners (LNB) [Indirect Firing System (IDF)]
- Use of pre-calciner
- Selective non-catalytic NOx reduction (SNCR)

The SMC NOx emissions control analysis demonstrates that all of the controls listed above, except for the IDF and pre-calciner, are technically infeasible or not cost-effective. SMC proposes that the existing IDF controls for the kiln are equivalent to LNB. SMC believes that the existing pre-calciner also reduces some of the NOx emissions.

SMC proposes to reduce 15.3 percent of NOx emissions by continuing to optimize existing NOx controls, which include the IDF for the kiln burners and a pre-calciner system ahead of the main kiln.

SMC has taken the existing SNCR (installed to fulfill Michigan's NOx SIP rule for the summer ozone season) out of its BART proposal for control of NOx emissions. Operating the system has caused problems for SMC, and operating it year round would increase the problems. For

example, SMC's BART engineering analysis claims that the existing SNCR is technically infeasible due to very cold external temperatures. The hard freezing temperatures during winters in Charlevoix cause problems keeping the reactant chemicals at certain operational temperatures. To overcome these operational difficulties, extensive heating lines are needed to prevent solidification of reactant chemicals in pumps and piping. This results in higher installation and operating costs to keep the system operating throughout the year. Also, frequent buildup of materials inside the ductwork between the kiln and pre-calciner, which is the optimal location for the reactant chemicals to be effective, requires frequent cleanups causing loss of production time, thus making the SNCR control very expensive to sustain throughout the year. SNCR is not cost-effective as per BART Guidelines.

SO_2

- Advanced Flue Gas Desulfurization (AFGD)
- Wet Flue Gas Desulfurization (wet FGD)

The analysis indicates that AFGD for SO_2 retrofit control is not a technically viable option for SMC. The wet FGD is not cost-effective. SMC will try to minimize sulfur input through managing the raw feed content of sulfur of the quarried raw material (lime/limestone) that is processed in the kiln (EUKILN). This could reduce SO_2 emissions monthly by about 16 percent.

For details of the BART analysis submitted by SMC, see Appendix 9E.

Additional BART Analysis

In final negotiations between SMC and the DNRE in February 2010, SMC proposed the incorporation of more restrictive emission limits for BART permit conditions, but stated that the limits should be conditional on the resolution of issues identified in the EPA's Notice of Violation dated September 29, 2009. The proposed limits are contained in a document, attached in Appendix 9F. However, the DNRE is not in a position at this time to accept this conditional SMC proposal because the DNRE is not involved in the Notice of Violation between SMC and the EPA, and therefore has no control of the outcome of this matter.

BART Limits

The DNRE has accepted the original SMC proposal as BART. The BART limits will remain the same as the existing permitted limits for the PM, NOx, and SO_2, as follows:

- The PM limit is 0.30 lbs/ton of dry feed.
- The NOx limits are 6.5 lbs/ton of clinker from May through September and 7.67 lbs/ton of clinker from October through April.
- The SO_2 limits are 2800 lbs per hour, 550 tons per month, 4404 tons per year.

An excerpt containing the emission limits from the renewable operating permit (ROP) is in Appendix 9G. For more details of permit conditions see ROP No. MI-ROP-B1559-2008, at the AQD Web site for ROP at: www.deq.state.mi.us/aps/downloads/rop/pub_ntce/pub_ntce.shtml. This URL is subject to change. In case of change, please contact the AQD for further information.

Smurfit Stone Container Corporation (SSCC)

Affected Emission Units
There is only one BART-subject emission unit at this facility. It is the Riley Boiler # 1 (EUBR 1).

Smurfit Stone BART Analysis
The BART analysis submitted by SSCC reviewed the following for the BART-subject unit:

PM
Riley Boiler # 1 will be subject to the Boiler MACT when it is revised by the EPA. The original Boiler MACT was vacated by the U.S. Court of Appeals. The company's existing PM permit limits for Riley Boiler # 1 are: the particulate emissions shall not exceed 0.25 lbs per 1,000 lbs of exhaust gases, corrected to 50 percent excess air.

NOx
Current NOx emission limits are 0.95 lbs per million BTU heat input averaged over the ozone control period. Total NOx emissions not to exceed 350 lbs per hour.

For the Riley Boiler # 1, SSCC examined the following control:

- Low NOx Burners
- Mobotec's Rotating Opposed Fire Air (ROFA) fan system

SO_2
Current SO_2 emission limits are 2.50 lbs per million BTU heat input.

For the Riley Boiler # 1, SSCC examined the following control:

- Limestone injection. The Mobotec's Furnace Sorbent Injection (FSI) system

The company's analysis (see Appendix 9N) showed that the existing control system would be the most cost-effective option for controlling all BART subject emissions including PM, NOx and SO_2. The current control system, the Mobotec integrated system, currently controls PM and NOx and has the retrofit capability for SO_2 controls. Control of SO_2 can be achieved through addition of the Mobotec furnace injection of limestone sorbent ("furnace sorbent injection" or FSI). SO_2 control is cost-effective since the system allows retrofit addition for FSI using most of the capabilities of the existing Mobotec integrated system.

BART Limits
The DNRE accepts SSCC's existing PM permitted limits as representing BART for the subject emission unit as described in the SSCC BART Analysis section above.

The DNRE has accepted the original SSCC proposal as BART. The acceptable BART limits for PM, NOx, and SO_2, are as follows:

- The PM limit is 0.25 lbs per 1,000 lbs of exhaust gases, corrected to 50 percent excess air.
- The NOx limits are 0.39 lbs per million BTU heat input at 375 BTU per hour fuel load.
- The SO_2 limits are 0.97 lbs per million BTU heat input at 375 BTU per hour fuel load.

The BART limits for NOx and SO_2 will be put in an enforceable NSR permit if the company begins operation in the future.

An excerpt containing the emission limits from the renewable operating permit (ROP) is in Appendix 9O. For more details of permit conditions see ROP No. MI-PTI-ROP-A5754-2007b, at the AQD Web site for ROP at:
www.deq.state.mi.us/aps/downloads/rop/pub_ntce/pub_ntce.shtml.
This URL is subject to change. In case of change, please contact the DNRE for further information.

Tilden Mining Company LLC (TMC)

Affected Emission Units
The BART-subject emission units include indurating furnace/grate-kiln EUKILN 1, EU PRIMARY CRUSHER, EU COOLER 1, EU DRYER 1, EU BOILER 1, and EU BOILER 2.

TMC BART Analysis
The BART analysis submitted by the company discussed the following control systems for PM, NOx and SO_2:

PM
The Regional Haze Rules allow application of other standards such as MACT to regulate a pollutant. The taconite MACT regulates PM as a surrogate to HAPs and TMC has MACT controls (wet scrubbers on dryer, scrubber and primary crusher; electrostatic precipitator for kiln) for HAPS and thereby meets both the MACT requirements and the BART for PM.

NOx

Table 9.2.a. Indurating Furnace NOx Control Technology – Availability, Applicability, and Technical Feasibility
(Taken from Table 5-9 of TMC BART submittal):

NOx Pollution Control Technology	Available	Applicable	Technically Feasible
External Flue Gas Recirculation (EFGR)	Yes	No	No
Low NOx Burners (LNB)	Yes	Yes	No
Induced Flue Gas Recirculation Burners (IFGR)	Yes	Yes	No
Energy Efficiency Projects	Yes	Yes	Project Dependent
Ported Kilns (Applies to Grate-Kilns Only)	Yes	Yes	No
Alternative Fuels	Yes	Yes	Yes - Not Required by BART
Process Optimization	Yes	No	No
Non-Selective Catalytic Reduction (NSCR)	Yes	No	No
Selective Catalytic Reduction (SCR) with conventional reheat	Yes	Yes	Yes
Regenerative SCR	Yes	No	No
Selective Non-Catalytic Reduction (SNCR)	Yes	No	No
Low Temperature Oxidation (LTO)	Yes	No	No

The only technically feasible control for NOx emissions is SCR with conventional reheat. However, the company's analysis indicates that the cost per ton of NOx removal is $8,416, which is not cost-effective for this source.

Compared to the indurating furnace (EUKILN 1), the other BART eligible emission units (EU PRIMARY CRUSHER; EU COOLER 1; EU DRYER 1; EU BOILER 1; and EU BOILER 2), with existing controls, have negligible visibility impairing pollutant (VIP) emissions. No additional analysis was performed for these emission units.

SO_2

Table 9.2.b. Indurating Furnace SO_2 Control Technology – Availability, Applicability, and Technical Feasibility
(Taken from Table 5-1 of TMC BART submittal)

SO_2 Pollution Control Technology	Available	Applicable	Technically Feasible
Wet Walled Electrostatic Precipitator (WWESP)	Yes	Yes	Yes
Wet Scrubbing	Yes	Yes	Yes
Dry sorbent injection (DSI)	Yes	Yes	Yes
Spray Dryer Absorption (SDA)	Yes	Yes	Yes
Energy Efficiency Projects	Yes	Yes	Project Dependent
Alternative Fuels	Yes	Yes	Yes – Not Required by BART
Coal Processing	No	No	No

All the technically feasible controls for SO_2 emissions are shown not to be cost-effective for this emission unit. The minimum cost of controls is $6,557 per ton SO_2, and the maximum cost is $22,407 per ton. This cost range is not cost-effective.

Table 9.2.c. Process Boilers SO_2 Control Technology – Availability, Applicability, and Technical Feasibility
(Taken from Table 5-17 of TMC BART submittal):

SO_2 Pollution Control Technology	Available	Applicable	Technically Feasible
Wet Walled Electrostatic Precipitator (WWESP)	Yes	Yes	Yes
Wet Scrubbing	Yes	Yes	Yes
Spray Dry Absorption (SDA)	Yes	Yes	Yes
Dry sorbent injection (DSI)	Yes	Yes	Yes
Energy Efficiency Projects	Yes	Yes	Project Dependent
Alternative Fuels	Yes	Yes	Yes - Not Required by BART

Tilden concluded that all four of the technically feasible controls for SO_2 removal in the BART-subject process boilers are not cost-effective.

Compared to the indurating furnace (EUKILN 1) and the boilers (EU BOILER 1 and EU BOILER 2), the other BART-eligible emission units (EU PRIMARY CRUSHER; EU COOLER 1; EU DRYER 1) with existing controls have negligible VIP emissions. No additional analysis was performed for these emission units. For details of BART analysis initially submitted, see Appendix 9G.

Additional BART Analysis
In a technical memorandum dated February 19, 2010, Tilden proposed a revised BART scenario for the indurating furnace. For PM, the taconite MACT limit is BART, as previously stated. For NOx and SO_2, emissions were modeled to determine visibility impacts based on the maximum 24-hour actual emissions for each visibility impairing pollutant emitted from the indurating furnace. To evaluate the maximum rate for NOx and SO_2 as mandated by BART,

100 percent natural gas usage for NOx emissions and 100 percent coal usage for SO_2 emissions were assumed. The modeling results showed SO_2 emissions do not cause visibility impairment to the Class I areas. Therefore, the company concluded that the current Title V permit limits for SO_2 emissions of 28,800 lbs per calendar day should be considered BART, and the BART proposal should focus on NOx emissions.

For NOx, due to the lack of sufficient emissions data representing good combustion practices and the range of operating conditions that influence NOx emissions, the company believes, it is currently not possible to propose a NOx emission limit that corresponds to BART for EUKILN 1. Tilden proposes to develop a NOx emission factor in pounds of NOx per million BTU of heat input by collecting sufficient emissions data through stack testing to determine appropriate limits based on "good combustion practices." The establishment of the NOx emission factor through stack testing is similar to the requirements in the Minnesota Regional Haze SIP for taconite facilities. The established NOx emission factor can then be incorporated into Tilden's Title V ROP, pursuant to 40 CFR Part 51 Appendix Y.

The Tilden Technical Memorandum dated February 19, 2010, is attached in Appendix 9H.

BART Limits
The DNRE accepts that existing permit conditions for PM and SO_2 limits represent BART, based on currently available information. The BART limits will remain the same as the existing permitted limits for the PM and SO_2, as follows:

- The PM limit for magnetite is 0.01 grains per dry standard cubic foot (gr/dscf) and 0.03 gr/dscf for hematite (taconite MACT limit).
- The SO_2 limit is 28,800 lbs SO_2 per calendar day.

The DNRE accepts Tilden's proposal to set a BART NOx emission limit in a manner similar to the Minnesota Regional Haze SIP. The new NOx limits will be set after testing to determine appropriate limits based on "good combustion practices" before December 31, 2012. An excerpt containing the emission limits from the ROP is in Appendix 9J. For more details of permit conditions see ROP No. MI-ROP-B4885-2008 at the AQD Web site for ROP at: www.deq.state.mi.us/aps/downloads/rop/pub_ntce/pub_ntce.shtml. This URL is subject to change. In case of change, please contact AQD for further information.

BART Summary
The analyses from the five companies and DNRE BART conclusions are summarized in Table 9.2.d.

Table 9.2.d. Summary of Company Analysis for BART Controls

Source Name	SO_2 Controls Considered in BART Analysis	SO_2 Control Cost ($/ton) **Selected Controls**	SO_2 Control Eff. (%)	NOx Controls Considered in BART Analysis	NOx Control Cost ($/ton) **Selected Controls**	NOx Control Eff. (%)	Proposed BART Controls
Lafarge Cement	1. Sorbent injection KG5 2. Sorbent injection KG6 3. Wet LSFO FGD KG5 4. Wet LSFO FGD KG6	$3,367 $754 $7,952 $1,087	25 25 90 90	1. Process optimization 2. LNB burners 3. SNCR KG5 4. SNCR KG6	Existing Existing $713 $498	N/A N/A 35 40	SNCR for KG5 & KG6 NOx, DAA for KG5 SO_2, Wet FGD for KG6 SO_2
New Page No. 8 Boiler	1. 100% natural gas fuel 2. Switch to No. 2 fuel oil 3. Wet scrubber 4. Dry scrubber 5. Semi-dry scrubber	$4,200 $39,426 $30,855 $129,390 $118,822	99 91 61 25 25	1. SCR 2. Low NOx burner 3. SNCR 4. Flue gas recirc. operate year-round	$15,500 $3,600 $43,100 $44,600	90 40 20 12	Existing controls are BART
New Page No. 9 Boiler	1. Wet scrubber, Caustic 2. Dry scrubber 3. Semi-dry scrubber	$21,808 N/A N/A	50	1. SCR 2. Low NOx Burner 3. SNCR 4. Flue gas recirc.	$13,761 $18,884 $10,741 $19,200	90 40 35 20	Existing controls are BART
St. Mary's Cement	1. Dry Scrubbers	$4,012	80	1. Process optimization 2. (IDF)=LNB burners 3. Use of pre-calciner 4. SNCR	Existing Existing Existing $7,568	 10	Existing controls are BART
Smurfit-Stone	Mobotec's Furnace Sorbent Injection (FSI) system.	$1337	60	Mobotec's Rotating Opposed Fire Air (ROFA) fan system.	Existing, installed in 2007 to comply with Boiler MACT	57	Existing Mobotec" ROFA and proposed FSI are BART
TMC	1. Wet scrubbing 2. Spray dryer absorption 3. Wet walled ESP 4. Dry sorbent injection	$6,557 $22,407 $15,091 $15,729	80 90 80 55	1. Low NOx burners 2. Induced flu gas recirc. burners 3. Energy eff. projects 4. Ported kilns 5. Alternate fuels 6. Coal processing 7. Low temp. oxidation 8. SCR 9. SNCR 10. Process optimization parametric monitoring	N/A N/A N/A N/A N/A N/A $8,416 N/A N/A	 80	Existing controls are BART

9.3 Determination of the impacts of visibility impairing pollutant emissions from Non-EGU BART-subject sources on Class I areas

The two Class I areas in Michigan, Isle Royale National Park and Seney Wilderness Area, are affected by the emissions of visibility impacting pollutants (VIP). The Pre-BART CALPUFF modeling has shown that the five BART-subject sources impact Isle Royale, Seney, or both.

Details of the CALPUFF modeling analysis showing pre-BART and post-BART impacts and the visibility are given below in Table 9.3.a.

Table 9.3.a. BART Controls and Comparison of Visibility-Impairing Pollutant Impacts on Class I Areas

Name of Source	Controls for BART		Pre-BART Emissions		Post BART Emissions		3 yr. 98th. Pctl. Ave. Pre-BART deciviews	3 yr. 98th. Pctl. Ave. Post BART deciviews	Comments
	SOx	NOx	SOx lb/day ton/day	NOx lb/day ton/day	SOx lb/day ton/day	NOx lb/day ton/day			
Lafarge	DAA scrubber	SNCR							
			233,610	94,363	24,197	32,153			
			116	47	12.1	16.1	1.22	to be determined see comments	Post BART 98th percentile averages to be determined after completion of Control Technology Demonstration
New Page	Existing controls								
			9,236	13,053	9,236	13,053			
							0.7	0.7	Existing controls/permitted
			4.62	6.51	4.62	6.51			limits
St. Mary's Cement	Existing controls								
			67,200	31,460	67,200	31,460			
							1.06	1.06	Existing controls/permitted limits
			33.6	15.73	33.6	15.73			
Smurfit Stone	Furnace Sorbent Injection (FSI)	Rotating Opposed fire Air (ROFA)	22500	8400	8730	3510			Plant has been shut down since Feb. 2010
			11.25	4.2	4.37	1.76	0.71	0.46	
Tilden Mining	Existing controls								
			6,552	26,208	6,552	26,208			Existing controls/ permitted limits
			3.27	13	3.27	13	0.55	0.55	

10 Reasonable Progress Goals and Long-term Strategy

The DNRE is required under 40 CFR 51.308(d)(1) to establish, for each Class I area within the state, goals (in deciviews) that provide for reasonable progress towards achieving natural visibility. The goals should provide improvement in visibility over the SIP period for the most impaired days and ensure no degradation in visibility for the least impaired days.

10.1 Consultation

In determining a reasonable progress goal (RPG) and long-term strategies for each Class I area, 40 CFR 51.308(d)(3)(i) requires the DNRE to consult with other states/tribes that are reasonably anticipated to cause or contribute to visibility impairment in each of these Class I areas. The DNRE had monthly consultation calls with MRPO states, Minnesota, several CENRAP states, tribes, FLMs, the Ontario Ministry of Environment, and Region 5 EPA. Minutes from these calls can be found on the MRPO Web site at: http://www.ladco.org/reports/rpo/consultation/.

10.2 Basis for Emissions Reduction Obligations

The DNRE is required to demonstrate that its implementation plan includes all measures necessary to obtain its fair share of emission reductions needed to meet RPGs at all Class I areas where visibility is impacted by emissions from Michigan (40 CFR 51.308(d)(3)(ii)). Determining that fair share of emission reduction requires knowledge of which Class I areas are most impacted by emissions from Michigan and which states' emissions most impact visibility in Michigan's Class I areas.

The DNRE relied on technical analyses developed by MRPO to demonstrate that the state's emissions reductions, when coordinated with those of other states, are sufficient to achieve all RPGs. The DNRE used the following steps to determine Michigan's contribution to visibility impairment at various Class I areas.

10.2.1 Baseline Inventory

The DNRE used MRPOs Base M emissions inventory to assess RPGs as a baseline for 2005 and 2018. The MRPO developed two inventories. Base K is based on the 2002 emissions inventory and Base M is based on the 2005 inventory. Both base years are SIP quality inventories; however, the DNRE focused on the 2005 inventory since the more recent inventory should be more accurate due to greater understanding of emissions changes that occurred or will be occurring. These inventories were compared in LADCO's Technical Support Document (LADCO 2008, Appendix 5A).

10.2.2 Michigan's Impact on Class I Areas

Michigan contributes to its two Class I areas in the state: Seney and Isle Royale. Based on the MRPO's 2018 particulate source apportionment modeling, Michigan contributes from 12 percent to 18 percent of the visibility impairment at both Class I areas (See Table 10.2.2.a. and Appendix 3B). Using the DNRE's determination that a significant contribution to visibility

impairment is a contribution over 5 percent[3], Michigan is not expected to significantly contribute to visibility impairment at any other Class I area.

Table 10.2.2.a. Class I areas impacted by Michigan

Class I Areas	Michigan's Contribution to Light Extinction in 2018	
	Round 4 (2002 base year)	Round 5 (2005 base year)
Isle Royale	12.7%	13.4%
Seney	13.8%	18.1%

Source: Appendix 3B, p. 45

Michigan had less than a 5 percent impact on Minnesota's Class I areas and was not indicated by Minnesota as contributing to their Class I areas (See Appendix 10A).

Michigan contributed less than 5 percent to all other Class I areas (see Appendix 1A); however, four states in the MANE-VU region indicated that Michigan contributed to their Class I areas: Acadia and Moosehorn in Maine, Great Gulf in New Hampshire, Brigantine in New Jersey, and Lye Brook in Vermont (MANE-VU, 2007). MANE-VU used a very low threshold of 2 percent sulfate contribution or 0.1 ug/m^3 sulfate contribution to the 20 percent worst days as their significance level.

The MANE-VU states requested states they identified to 1) reduce sulfate emissions by 90 percent from their key list of EGUs; 2) reduce non-EGU SO_2 emissions by 28 percent; and 3) BART sulfate reductions (MANE-VU, 2007). The five EGUs from four Michigan facilities MANE-VU specifically identified as contributing to their Class I areas are Detroit Edison's Monroe (two units), St. Clair and Trenton Channel power plants, and Consumers Energy's Karn Weadock power plants.

10.2.3 States Impacting Michigan's Class I Areas

The DNRE identified the states expected to contribute significantly to Michigan's Class I areas, defined as more than 5 percent contribution to visibility impairment at either Seney or Isle Royale, using MRPO's Round 5 2018 PSAT modeling. The states that are contributing are Michigan, Wisconsin, Illinois, Indiana, Minnesota and Iowa (see Table 10.2.3.a.). In the MRPO initial PSAT modeling, Round 4, Missouri was also identified; however, Missouri fell below the 5 percent contribution level in the later modeling (see Table II-2 in Appendix 3B).

[3] Depending on the chosen impact level, more Class I areas may be impacted. Michigan chose a higher impact level of 5 percent. The states that make a 5 percent contribution or more to total light extinction accounts for 75-80 percent of total light extinction, whereas using a 2 percent contribution accounts for 90-95 percent of total light extinction. Since this is the first planning stage for regional haze, the DNRE believes the 5 percent contribution of states is more appropriate and can be tightened in later planning stages if needed.

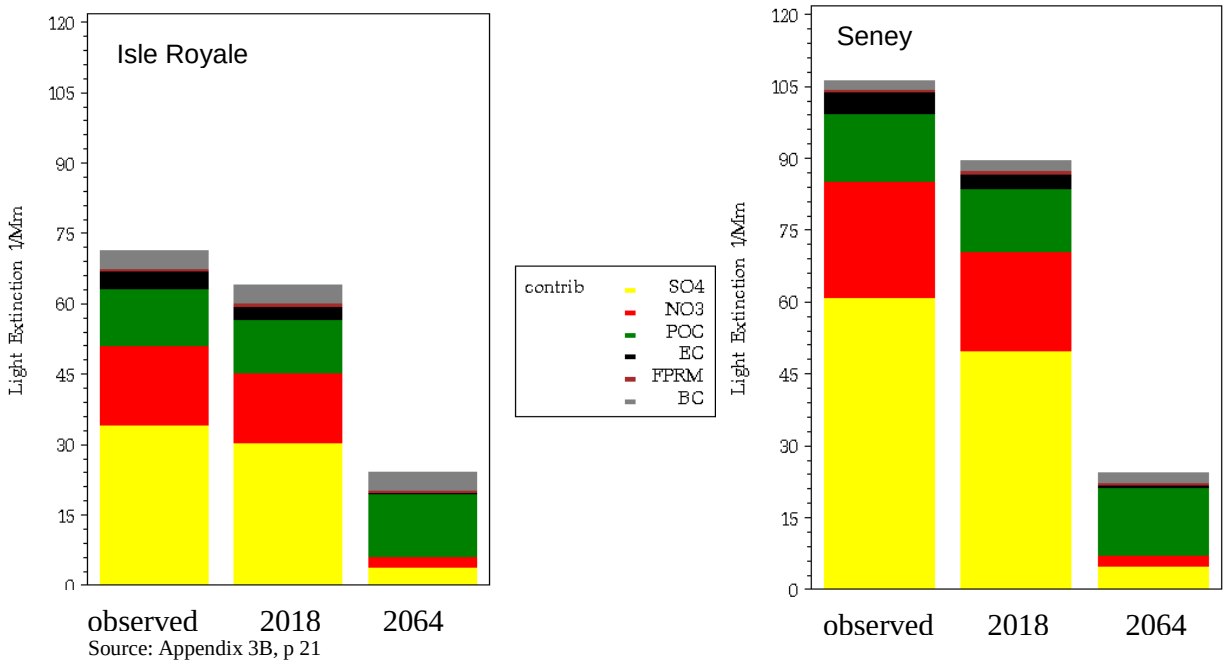
Table 10.2.3.a. 2018 PSAT (Round 5) contribution to light extinction by state

	Isle Royale	Seney
Michigan	13.4%	18.1%
Minnesota	9.5%	1.6%
Wisconsin	14.7%	10.9%
Illinois	8.7%	14.3%
Indiana	5.2%	11.6%
Iowa	8.3%	3.8%
Missouri*	4.6%	4.8%

* Missouri is not considered culpable.
Source: Appendix 3B, p. 45

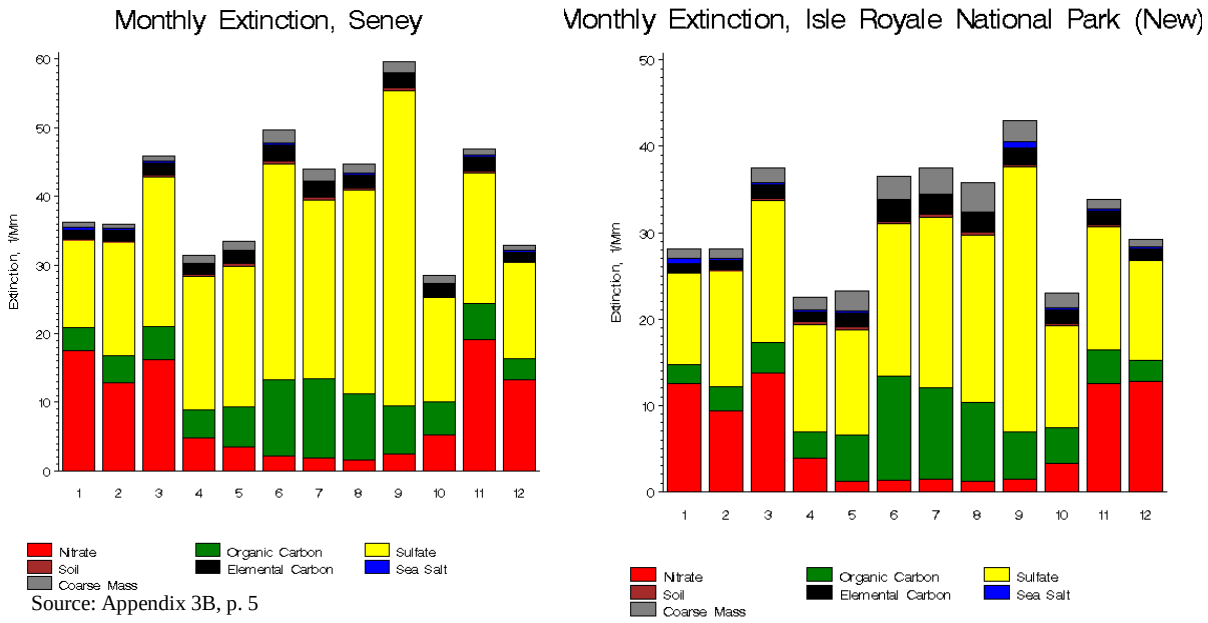
10.2.4 Pollutants and Sources Impacting Michigan's Class I Areas

The main pollutants predicted to impact visibility at Michigan's Class I areas on the 20 percent worst days for the base year, 2018, and 2064 are sulfate, nitrate and organic matter (see Figure 10.2.4.a., also Appendix 3B and Appendix 10B). Based on observed visibility (Appendix 10C), sulfate is a significant component year around, whereas nitrate is significant in the winter and organic carbon is most abundant in the summer (Figure 10.2.4.b.). Organic carbon is largely from biogenic sources and wildfires (Sheesley and Schauer, 2004, and Appendix 3B, page 19), which is more reflective of background conditions and will not be pursued for control. The DNRE will focus on sulfate and nitrate reductions.



Source: Appendix 3B, p 21

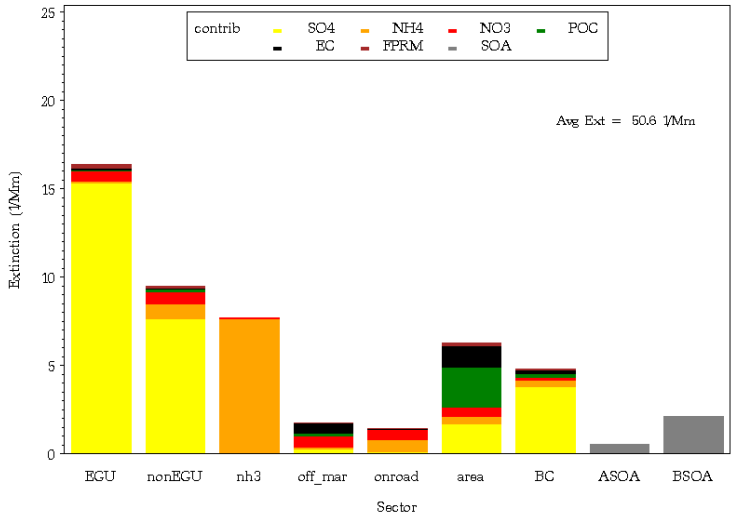
Figure 10.2.4.a. Comparison of pollutant contribution to visibility impact for 2002 base year, 2018 future year and 2064 natural conditions for Michigan's Class I areas on the 20 percent worst days.



Source: Appendix 3B, p. 5

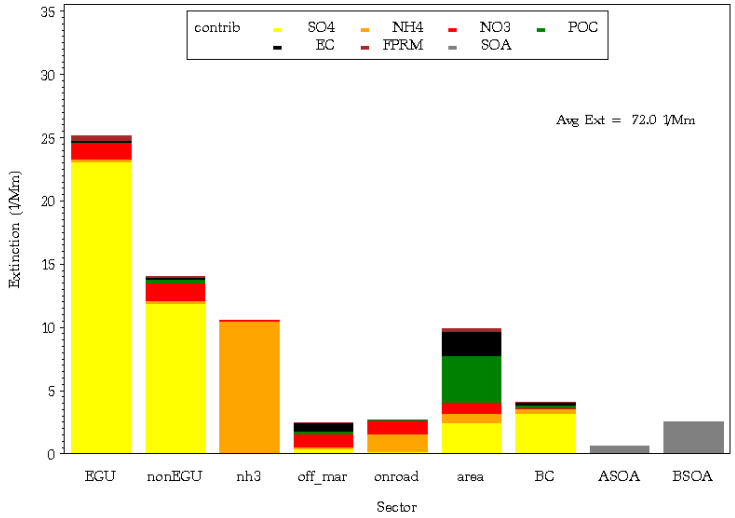
Figure 10.2.4.b. Pollutant contribution to monthly light extinction values for Michigan's Class I areas (2000-2004).

The information portrayed in Figures 10.2.4.c. and 10.2.4.d. shows expected extinction by source sector and by pollutant. It shows the large impact of SO_4 coming from EGUs, with a lesser amount from non-EGUs, at both Isle Royale and Seney.



Source: Appendix 3B, p. 43

Figure 10.2.4.c. Isle Royale 2018 (LADCO, Round 5) modeled extinction by sector for each species on 20% worst days.



Source: Appendix 3B, p. 41

Figure 10.2.4.d. Seney 2018 (LADCO, Round 5) modeled extinction by sector for each species on 20 percent worst days.

These figures document the anthropogenic sources of visibility impairment by regional sources in developing the long-term strategy according to 40 CFR 51.308(d)(3)(iv).

10.3 RPG Determination

The EPA released its final guidance on June 1, 2007 to use in setting RPG. The guidance states:

> RPGs are interim goals that represent incremental visibility improvement over time toward the goal of natural background conditions. In determining what would constitute reasonable progress, Section 169A(g) of the CAA requires States to consider the following four factors:
>
> - The costs of compliance;
> - The time necessary for compliance;
> - The energy and non-air quality environmental impacts of compliance; and
> - The remaining useful life of existing sources that contribute to visibility impairment.
>
> States must demonstrate in their SIPs how these factors are taken into consideration in selecting the RPG for each Class I area in the State ... the RHR establishes an additional analytical requirement for States in the process of establishing the RPG. This analytical requirement requires States to determine the rate of improvement in visibility needed to reach natural conditions by 2064, and to set each RPG taking this "glide path" into account. … The glide path is not a presumptive target, and states may establish a RPG that provides for greater, lesser, or equivalent visibility improvement as that described by the glide path.

The glide path, also known as the uniform rate of progress (URP), is a line between the baseline conditions for the 20 percent worst days to the natural background conditions for 2064. Seney

would require a 0.19 deciview decrease in visible impairment per year, and Isle Royale would require a 0.15 deciview decrease per year to reach natural conditions by 2064. For more details, see Section 6 above and pages 6-8 of Appendix 3B.

10.3.1 General Approach to Determining RPG

The DNRE used the following approach to determine its RPG. The specific methodology was developed by MRPO (2005b) and is based on EPA's draft guidance for setting reasonable progress goals.

The general steps laid out for determining the RPG were as follows, with more specifics found in Section 10.3.2:

Identify and Prioritize Sources: Determine the existing visibility conditions, examine which sources and geographic regions are contributing to worst and best visibility days, and identify the major anthropogenic sources/sectors contributing to worst visibility days (i.e., priority sources).

The priority emission sources agreed upon by the Northern Class I consultation group were: 1) SO_2 from EGUs and non-EGUs; 2) NOx from EGUs, non-EGUs and mobile sources; and 3) NH3 from agricultural sources. These sources were further evaluated by a contractor, ECR (Battye, et. al., 2007) for the MRPO and Minnesota.

The ECR report also evaluated these sources in a three-state region (Michigan, Wisconsin, and Minnesota) and a nine-state region (these three states plus Illinois, Indiana, Iowa, Missouri, North Dakota, and South Dakota).

Identify Control Options for Priority Sources: Develop control options for reducing the emissions from the priority sources, including existing and expected control programs (e.g., CAIR, BART, and nonattainment area controls) and other possible control programs. These various control strategies were examined in *Reasonable Progress in the Northern Midwest—Factor Analysis* (Battye et. al., 2007).

Assess Effect of Existing Programs for Priority Sources: Assess the expected emission reduction from existing control programs for the priority sources, especially for the important visibility impairing pollutants (i.e., SO_2 and NOx).

Evaluate Control Options for Priority Sources: Using the four statutory factors, evaluate the control options for all priority sources and determine which measures may be reasonable.

Compare Control Strategies with Uniform Rate of Progress: Compute the appropriate visibility metrics for the existing/expected controls and the reasonable controls for the Class I areas. Compare the expected improvement in visibility from these controls with the 60-year glide path to natural conditions. If the expected improvement is above the URP line, then the state must calculate the year in which natural conditions would be met if the reasonable progress rate expected between 2000-2004 and 2018 is held constant.

10.3.2 DNRE's Approach to RPG

The states involved in the Northern Class I consultation process worked together to identify and prioritize sources, assess the impact of existing control programs on priority sources, and direct a contract to investigate and evaluate control options for those priority sources. This effort served as the primary method the DNRE used to evaluate an RPG approach for the state.

From the outset of this effort, the DNRE has approached the decision on RPG with a focus on "reasonableness" of controls needed to reduce haze by 2018, following the haze rule guidance. For the DNRE, a key consideration in making a reasonableness determination is the level of controls already in place on the primary impacting sources and the reductions being achieved by these sources to meet other programs such as the $PM_{2.5}$ and ozone SIPs. For the largest impacting sources, the EGUs, considerable expense and effort already has been directed at meeting NOx SIP reductions and CAIR reductions.

Identify and Prioritize Sources: The DNRE identified the major sources of sulfate and nitrates within the state. Figure 10.3.2.a. shows the emissions in tons of the major sources for 2005 and 2018. Point sources are a major contributor. NOx emissions for onroad sources are expected to decrease significantly. EGU sources are expected to have large reductions based on current CAIR requirements; however, they still remain a large contributor in 2018.

The major pollutant and source impacting Michigan's Class I areas appears to be SO_2 from EGUs, which forms ammonium sulfate. As discussed in Section 10.2, modeling and visibility data show that sulfate is one of the main components of haze at Isle Royale and Seney on the 20 percent worst days (pages 2-5 in Appendix 3B and Appendix 10C). EGU SO_2 emissions from Michigan, Wisconsin, Illinois, Indiana, Iowa, and Minnesota appear to be the key contributors. Ammonium nitrate is also an important anthropogenic contributor to visibility impairment, with EGUs being the second largest source behind mobile sources.

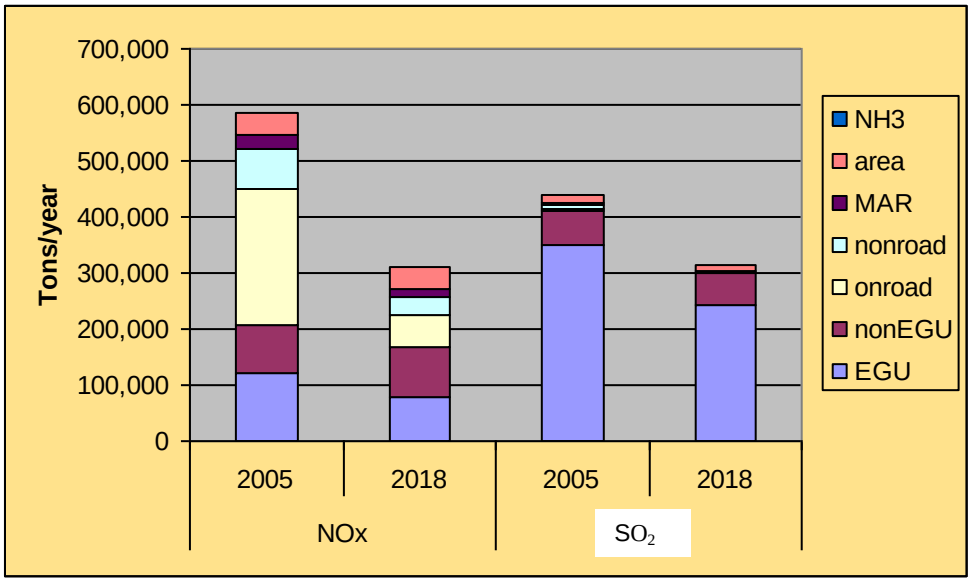


Figure 10.3.2.a. NOx and SO_2 emissions in Michigan for 2005 and 2018 by source category. Source: DNRE generated from LADCO emission inventories

The individual Michigan point sources with the highest impacts for Isle Royale and Seney are shown in Appendices 10D and 10E, respectively. The top ten contributing sources indicated by modeling and Q/d for in-state sources indicate EGUs and BART-subject sources. EGUs are subject to CAIR and the proposed CATR rule. Other BART-subject sources were evaluated for BART controls (see Tables 10.3.2.a. and 10.3.2.b.).

Table 10.3.2.a. Calpuff modeling, visibility and Q/d results for top ten (based on CALPUFF) sources in Michigan impacting visibility at Isle Royale. Gaps reflect unavailable data

FACILITY	CITY	Facility ID	Calpuff results 1/(M-m)	Visibility (dv)	2018 Q/d for NOx (tons/ day*km)	2018 Q/d for SO_2 (tons/ day*km)
Wisconsin Electric Power Co.[1]	Marquette	B4261	0.775	0.839	0.141	0.342
Empire Iron Mining Partnership[2]	Ishpeming	B1827	0.766	0.037	0.087	0.011
Tilden Mining Company L.C.[2]	Ishpeming	B4885	0.209	0.175	0.164	0.059
Stone Container Corporation[2]	Ontonagon	A5754	0.205		0.025	0.051
J. H. Campbell Plant[1]	West Olive	B2835	0.088	0.507	0.028	0.304
Detroit Edison/Monroe Power[1]	Monroe	B2816	0.084	0.136	0.029	0.253
Escanaba Paper Company[2]	Escanaba	A0884	0.067		0.053	0.039
Marquette Board Of Light & Power[1]	Marquette	B1833	0.064		0.019	0.043
Neenah Paper - Michigan, Inc.	Munising	B1470	0.046			
Lafarge North America - Alpena[2]	Alpena	B1477	0.040	0.170	0.060	0.137

[1] EGUs subject to CAIR
[2] BART-subject sources

Table 10.3.2.b. Calpuff modeling, visibility and Q/d results for top ten (based on CALPUFF) sources in Michigan impacting visibility at Seney. Gaps reflect unavailable data

FACILITY	CITY	Facility ID	Calpuff results 1/(M-m)	Visibility (dv)	2018Q/d for NOx (tons/ day*km)	2018Q/d for SO_2 (tons/ day*km)
Wisconsin Electric Power Company[1]	Marquette	B4261	0.565	0.222	0.139	0.336
Empire Iron Mining Partnership[2]	Ishpeming	B1827	0.494	0.067	0.081	0.011
J. H. Campbell Plant[1]	West Olive	B2835	0.493	0.768	0.040	0.428
Escanaba Paper Company[2]	Escanaba	A0884	0.316		0.105	0.076
Karn - Weadock Facility[1]	Essexville	B2840	0.311	0.270	0.038	0.206
St Marys Cement Inc[2]	Charlevoix	B1559	0.187		0.096	0.097
B. C. Cobb Plant[1]	Muskegon	B2836	0.182		0.021	0.124
Tilden Mining Company L.C.[2]	Ishpeming	B4885	0.148	0.109	0.149	0.053
Escanaba Power Plant[1]	Escanaba	B1573	0.128			
Manistique Papers Inc	Manistique	A6475	0.120		0.016	0.061

[1] EGUs formerly subject to CAIR
[2] BART-subject sources

The top 30 sources both, within and outside the state, are shown in Table 10.3.2.c. for Isle Royale and Table 10.3.2.d. for Seney. Of these sources, most are EGUs or BART-subject sources that may already be installing controls or are being evaluated for BART controls.

Table 10.3.2.c. Top 30 facilities impacting visibility at Isle Royale, includes facilities in and out of state

Area	Deciviews	State	County	Facility ID	Facility Name
ISLE1	0.83927	MI	Marquette	B4261	WI_Electric
ISLE1	0.50708	MI	Ottawa	B2835	JH_Campbell
ISLE1	0.44585	MN	Sherburne	2714100004	NSP
ISLE1	0.43193	WI	Sheboygan	460033090	WPL_Alliant
ISLE1	0.35391	WI	Brown	405032870	FortJames
ISLE1	0.34702	MN	Itasca	2706100004	MinnesotaPower_Bos
ISLE1	0.33165	WI	Columbia	111003090	Alliant
ISLE1	0.27882	MN	Cook	2703100001	MinnesotaPower_Tac
ISLE1	0.23289	IL	Will	197809AAO	MidwestGen
ISLE1	0.22347	WI	Outagamie	445031180	Intl_Paper
ISLE1	0.17458	MI	Marquette	B4885	TildenMining
ISLE1	0.16985	MI	Alpena	B1477	LaFarge
ISLE1	0.16743	ND	Mercer	11	NA
ISLE1	0.16559	ND	Oliver	1	NA
ISLE1	0.15244	ND	McLean	17	NA
ISLE1	0.14597	MI	St_Clair	B2796	BelleRiver
ISLE1	0.14482	IN	Spencer	20	IN_MI_Power
ISLE1	0.13599	MI	Monroe	B2816	Detroit_Ed
ISLE1	0.13172	MI	Bay	B2840	Karn_Weadock
ISLE1	0.11052	ND	Mercer	4	NA
ISLE1	0.10953	ND	Mercer	1	NA
ISLE1	0.1088	MN	StLouis	2713700005	US_Steel
ISLE1	0.07696	MN	StLouis	2713700113	EVTAC_Mining
ISLE1	0.06756	IN	Jefferson	1	IKEC
ISLE1	0.05745	MN	StLouis	2713700063	KeewatinTaconite
ISLE1	0.05186	IL	Massac	127855AAC	ElectricEnergyInc
ISLE1	0.04685	IN	Floyd	4	PSI_EnergyGallagher
ISLE1	0.03674	MI	Marquette	B1827	EmpireIronMining
ISLE1	0.03061	MN	StLouis	2713700061	HibbingTaconite
ISLE1	0.02097	MN	StLouis	2713700062	IspatInlandMining
ISLE1	0.0194	OH	Clemont	1413100008	Cinergy
sum =	6.1				

Table 10.3.2.d. Top 30 facilities impacting visibility at Seney, includes facilities in and out of state

Area	Deciviews	State	County	Facility ID	Facility Name
SENE1	0.76837	MI	Ottawa	B2835	JH_Campbell
SENE1	0.50992	IL	Will	197809AAO	MidwestGen
SENE1	0.47144	WI	Sheboygar	460033090	WPL_Alliant
SENE1	0.40775	MI	St_Clair	B2796	BelleRiver
SENE1	0.34743	WI	Columbia	111003090	Alliant
SENE1	0.32325	IN	Spencer	20	IN_MI_Power
SENE1	0.32295	MI	Monroe	B2816	Detroit_Ed
SENE1	0.30828	MI	Alpena	B1477	LaFarge
SENE1	0.29421	MN	Sherburne	2714100004	NSP
SENE1	0.29202	WI	Brown	405032870	FortJames
SENE1	0.27039	MI	Bay	B2840	Karn_Weadock
SENE1	0.22242	MI	Marquette	B4261	WI_Electric
SENE1	0.19289	WI	Outagamie	445031180	Intl_Paper
SENE1	0.18886	IN	Jefferson	1	IKEC
SENE1	0.14692	MN	Itasca	2706100004	MinnesotaPower_Bos
SENE1	0.11993	IN	Floyd	4	PSI_EnergyGallagher
SENE1	0.11411	ND	Mercer	11	NA
SENE1	0.10921	MI	Marquette	B4885	TildenMining
SENE1	0.10301	ND	McLean	17	NA
SENE1	0.10086	IL	Massac	127855AAC	ElectricEnergyInc
SENE1	0.09836	ND	Oliver	1	NA
SENE1	0.07361	ND	Mercer	4	NA
SENE1	0.06732	ND	Mercer	1	NA
SENE1	0.06681	MI	Marquette	B1827	EmpireIronMining
SENE1	0.06078	OH	Clemont	1413100008	Cinergy
SENE1	0.04868	MN	Cook	2703100001	MinnesotaPower_Tac
SENE1	0.02468	MN	StLouis	2713700005	US_Steel
SENE1	0.02044	MN	StLouis	2713700113	EVTAC_Mining
SENE1	0.01312	MN	StLouis	2713700063	KeewatinTaconite
SENE1	0.00874	MN	StLouis	2713700061	HibbingTaconite
SENE1	0.00535	MN	StLouis	2713700062	IspatInlandMining
sum =	6.1				

The ECR study evaluated some of the major source categories for impacts and costs to control in the Northern Class I region. Besides EGUs, the source categories of industrial, commercial, institutional (ICI) boilers, reciprocating engines and turbines, ammonia from agricultural operations, mobile sources, and several specific manufacturing operations were evaluated. EGUs accounted for the bulk of SO_2 emissions in the multistate area in 2002, and are also projected to account for the bulk of SO_2 emissions in 2018. Mobile sources contributed the bulk of NOx emissions in 2002, followed by EGUs. NOx emissions from both EGU and mobile sources are projected to decline between 2002 and 2018, but they are still projected to be the largest sources of NOx in 2018. Agricultural sources account for the bulk of ammonia emissions in both 2002 and 2018. (See Table 2-1 and Figure 3-4 in the ECR document titled *Reasonable Progress in the Northern Midwest—Factor Analysis*, Battye et al, 2007).

The same ECR document (Battye, et. al., 2007) contains a summary of the analysis of these source categories, found in Tables 6.5-2 and 6.5-3 in the document. While the cost-effectiveness expressed in dollars per ton in Table 6.5-3 would be considered reasonable for the majority of the options considered, the visibility impacts in deciviews shown in Table 6.5-2 are more varied. EGU controls clearly provide the most improvement and are therefore high priority sources to control. Agricultural source emission reductions are also shown to provide significant visibility improvement, but are not currently being considered because of the large uncertainty of the emission estimates and because of the complexity of regulating this source sector at this time. ICI boilers do show potential for measurable visibility improvements, although not nearly to the degree EGUs do. The DNRE is worked with other states in the region and Northeast to find acceptable emission limits for this source category (see Appendix 3D).

A rationale for DNRE's determination of the reasonable progress goal in light of the ECR information is located in part 10.5.2 of this document.

Identify Control Options for Priority Sources: The DNRE first identified those controls that are currently in place or legally required. These "on-the-books" control measures are:

- Clean Air Interstate Rule
- The top 30 sources, both within and outside the state, are shown in Table 10.3.2.c for Isle Royale and Table 10.3.2.d for Seney. Of these sources, most are EGUs and BART-subject sources.
- MACT
    - Reciprocal Internal Combustion Engines
    - Industrial Boilers and Process Heaters
- Onroad Mobile Source Programs
    - 2007 Highway Diesel Rule
    - Tier II/Low Sulfur Gasoline
- Nonroad mobile source programs
    - Nonroad Diesel Rule
    - Control of Emissions from Unregulated Nonroad Engines
    - Federal railroad/locomotive standards
    - Federal commercial marine vessel engine standards

Next, a number of other control options or scenarios were examined, as follows:

- EGU control scenarios setting regional emission limits based on
    - Strategy 1: SO_2 limits of 0.15 lbs/MMBtu
      NOx limits of 0.10 lbs/MMBtu
    - Strategy 2: SO_2 limits of 0.10 lbs/MMBtu
      NOx limits of 0.07 lbs/MMBtu
- ICI Boilers
    - Strategy 1: SO_2 reduction of 40 percent from 2018 baseline emissions
      NOx reduction of 60 percent from 2018 baseline emissions
    - Strategy 2: SO_2 reduction of 77 percent from 2018 baseline emissions
      NOx reduction of 70 percent from 2018 baseline emissions

- Reciprocating Engines and Turbines-89 percent reduction for reciprocating engines and 84 percent reduction for turbines depending on size class:
    - Strategy 1: emissions greater than 100 tpy
    - Strategy 2: emissions greater than 10 tpy
- Ammonia Emission from Agriculture Sources
    - Strategy 1: 10 percent reduction in emissions
    - Strategy 2: 15 percent reduction in emissions

The majority of EGUs whose emissions significantly affect Isle Royale and Seney are subject to CAIR and may be subject to the proposed CATR rule. However, DNRE is assuming that CAIR and its replacement rule will be equal to BART. The DNRE and other states in the region are in the process of determining which EGUs are proceeding with their CAIR plans, and LADCO will be doing model runs to determine the affect of any changes.

Control options for various other control measures were evaluated in the ECR report for the MRPO and Minnesota (Battye et. al., 2007). As mentioned above, control options for ICI boilers, mobile sources, agricultural or ammonia sources and reciprocating engines were examined in this report.

Assess Effect of Existing Programs for Priority Sources: The DNRE will obtain emissions reductions from some of the priority sources. The impact of the existing programs is discussed in the ECR report. Table 10.3.2.e., below from the ECR report (Table 4.2 in report, Battye, et. al, 2007) indicates results of the four factors for on-the-books controls. Table 10.3.2.f., (Table 4.5.1 in Battye, et. al, 2007) shows the change in deciviews predicted from on-the-books controls, including CAIR. (Since it is taken from the ECR report, it includes the two Minnesota Class I areas.)

Table 10.3.2.e. Summary of four-factor analysis of on-the-books controls

	Factor 1	Factor 2				Factor 3		Factor 4
Control Strategy	Cost-effective-ness ($/ton)	Percent Emission Reductions from 2002 baseline in 2018		Percent Emission Reductions from 2002 baseline at full implementation		Energy	Solid waste produced (1000 tons/yr)	Remaining Useful Life
CAIR and other cap-and-trade programs (e.g., Acid Rain, NOx SIP Call) for EGUs	$720 - $2,600	3-State SO_2: NOx: 9-State SO_2: NOx:	13% 75% 34% 79%	3-State SO_2: NOx: 9-State SO_2: NOx:	47% 75% 48% 80%	4.5% of total energy consumed	2,383	The IPM model projects that 53 units will retire by 2018.
BART: Based on company BART analyses from MN and ND for non-EGUs	$248 - $1,770							
Combustion MACTs	$1,477 - $7,611	9-State SO_2: NOx:	10% 5%	9-State SO_2: NOx:	10% 5%			
Highway vehicle programs	$1,300 - $2,300	3-State NOx: 9-State SO_2:	83% 80%	3-State NOx: 9-State SO_2:	83% 80%			
Nonroad mobile sources	($1,000) - $1,000	3-State NOx: 9-State SO_2:	39% 27%	3-State NOx: 9-State SO_2:	39% 27%	350 MM gallons of fuel saved		

Source: Battye, 2007, p. 16

Table 10.3.2.f. Comparison of Uniform Rate of Progress (URP) in 2018 with Projected Impacts for On-the-books Controls

	Estimated visibility impairment on the 20% worst visibility days (deciviews)[a]			
	Boundary Waters	Voyageurs	Isle Royale	Seney
Baseline conditions (2000-2004)[a]	19.86	19.48	21.62	24.48
Projected conditions in 2018 with on-the-books controls[b]	18.94	19.18	20.04	22.38
Net change	0.92	0.3	1.58	2.1
Glide path/URP	17.7	17.56	19.21	21.35

[a] The baseline condition values reflect the recent adjustments proposed by the Midwest RPO to include several missing days. The adjusted values are, on average, less than 0.5 dV greater than those provided on the IMPROVE Web site.

[b] Based on CAMX modeling by the MRPO. These modeling analyses used preliminary estimates of the impacts of BART controls, which are generally larger than the impacts estimated in industry BART analyses.

Source: Battye, 2007, p.20

Evaluate Control Options for Priority Sources: Again, many control options for priority sources were evaluated in the ECR report. Particular attention was paid in the Northern Class I consultation group to the "EGU1" control strategy proposed by MRPO, which is a 0.15 lb/MMBtu SO_2 limit and a 0.10 lb/MMBtu NOx limit assumed to take effect in 2013. Many in the Northern Class I consultation group also believe it is important to take a look at ICI boilers and the control strategies proposed by MRPO for those sources, including a 40 percent reduction in SO_2 limit and a 60 percent reduction NOx by 2013. Figure 10.3.2.b. depicts the impacts on visibility of the various control scenarios evaluated in the ECR report (Battye, et al, 2007).

The states in the Northern Class I consultation process have largely agreed on the priority pollutants (SO_2 and NOx) and sources (EGU, and to a lesser extent ICI boilers), with each state adding some specific priority sources or source categories. For purposes of this SIP analysis, the DNRE considers EGUs as the primary priority source, but is also evaluating additional controls for ICI boilers.

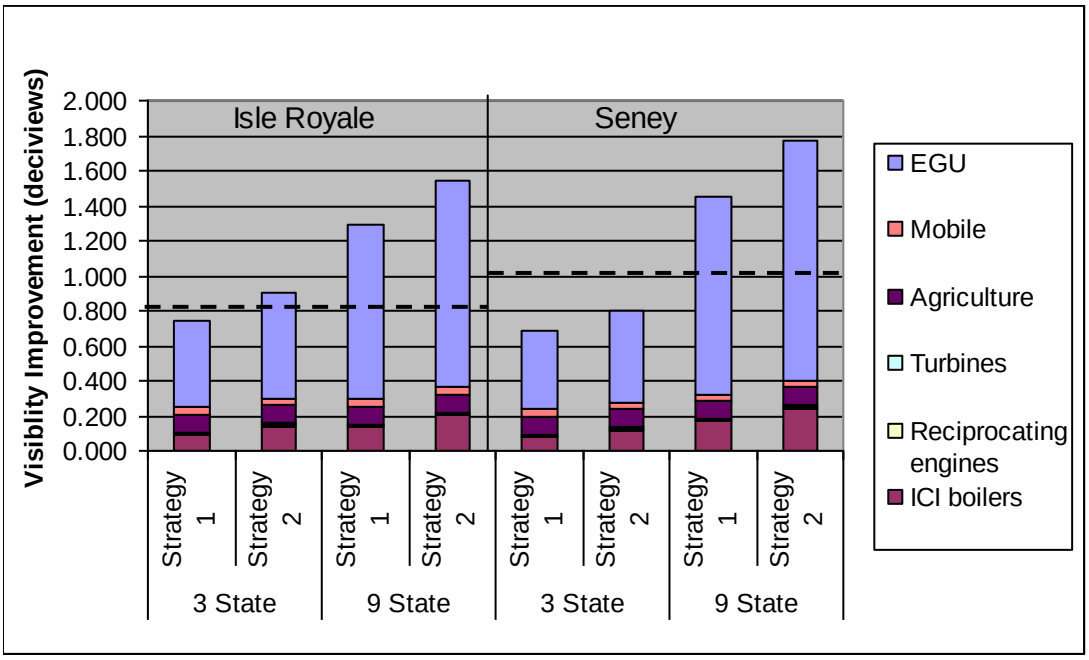


Figure 10.3.2.b. Source sector contribution to visibility improvement (deciviews) at Isle Royale and Seney on the 20 percent worst days for 2018 for possible additional control measures Source: DNRE-generated from Battye, 2007.

Improvements in visibility are for both NOx and SO_2 controls (the mobile category does not have two strategy levels, thus the same level was used for both). The dashed line shown in Figure 10.3.2.b indicates the deciview improvement needed to reach the EPA's suggested URP glide path for 2018.

For most states in the nine-state region to implement either of the EGU strategies (EGU1 or EGU2) described in the ECR report, large reductions in EGU emissions would be needed beyond what CAIR would have required. With the current status of the CAIR rule, EGU controls are very uncertain. The DNRE will continue to evaluate EGU controls in light of the proposed CATR rule.

EGUs are clearly the top priority source category for control in order to realize significant visibility improvement at Michigan's two Class I areas. EGUs are automatically presumed to be achieving reasonable emission reductions via the CAIR rule and the proposed CATR rule. Some of the largest EGUs, such as DTE's Monroe power plant and Consumer Energy's Campbell plant, have installed or are in the process of installing CAIR-compliant controls. EGUs in other states that have been shown to impact Michigan's Class I areas (see Section 10.3.2 of this document) also are expected to install and operate CAIR-compliant controls.

Since all EGUs are subject to CAIR and will likely be subject to the proposed CATR, the DNRE believes that no further controls on EGUs should be considered as reasonable for purposes of reasonable progress at this time.

A number of non-EGU facilities also have significant impact on the two areas, as identified in Section 10.3.2 of this document. These facilities are subject to BART analysis and have been evaluated to determine if additional controls represent BART. Those ICI boilers that are not

addressed by BART may eventually be controlled further. The DNRE and other LADCO states, along with a number of Northeast states, have been evaluating reasonable control levels for ICI boilers in the region. State rules or federal rules for these sources may be forthcoming in the next several years.

Other controls evaluated in the ECR report, Battye, et. al, 2007 are evaluated as follows:

ICI Boiler Emissions – The DNRE worked with LADCO and the Northeast states to develop recommendations for a federal ICI boiler rule. Several of these states have sent a letter to the EPA requesting a cooperative work effort to reduce pollutants from EGUs, ICI boilers and mobile sources (see Appendix 3D). A federal ICI boiler rule would be much more effective for emissions reductions from these sources because they would be reduced regionally. The proposed timing of this rule would occur before the first milestone year of 2018.

Other Point Source Emissions − Reciprocating engines and turbines appear to be a sector with potential cost-effective NOx controls; the ECR report estimates the cost of NOx controls to be between $240 - $8,200/ton, but visibility impacts are small compared to EGUs and ICI boilers. The DNRE currently has a rule for large reciprocating engines. The DNRE will review this sector in more detail in the future.

Mobile Source Emissions − There appears to be relatively few additional cost-effective NOx controls on mobile sources available to states, partially due to the large reductions resulting from federal requirements (Battye, et. al., 2007).

Ammonia and Agricultural Sources − More study on ammonia is needed to improve our understanding of the role of ammonia in haze formation and potential ammonia controls. The DNRE does not have resources to conduct such research and encourages the EPA and the regional planning organizations to continue work in these areas. Due to the uncertainties, the DNRE is not considering controls for this sector at this time.

Compare Control Strategies with Uniform Rate of Progress: At this time, the DNRE can only identify the “on-the-books” controls (includes CAIR) as being a reasonable level of control for setting Michigan’s RPG. A more detailed rationale is found in Section 10.5.2. Comparison to the URP has been made in Table 10.3.2.g and has been discussed in other sections of this document as well. The DNRE believes, however, that additional controls will be in place that will lower the RPG by 2018. Some other such scenarios have been modeled recently by LADCO and are also reflected in Table 10.6.b (see Section 10.6).

Table 10.3.2.g. Visibility Conditions, URP and RPG for Michigan’s Class I areas (dv)

	Baseline W20%	Baseline B20%	URP W20%	RPG W20%	Natural W20%	Natural B20%
Isle Royale	21.59	6.77	19.43	20.86	12.36	3.72
Seney	24.37	7.14	21.64	23.58	12.65	3.73

10.4 Share of Emission Reductions

Each state must obtain its share of emission reductions needed to attain the RPG. Between now and 2018, there will be reductions in emissions of SO_2 and NOx in Michigan and the region impacting Michigan's Class I areas due to both on-the-books control strategies and additional emission control measures. However, because of each state's attainment status for criteria pollutants and contribution towards haze, each state must ultimately make its own decision as to which control measures are reasonable. Many of the states that contribute to visibility impairment in Michigan's Class I areas are tackling multiple SIP issues at once (haze, $PM_{2.5}$ and ozone) and have or will submit their haze SIPs at a future date. Thus the RPG for Michigan's two Class I areas remains somewhat uncertain, but is expected to be lower as other states develop SIPs with additional controls impacting the Class I areas.

All of the control measures that Michigan currently plans to undertake are included in the long-term strategy and described in the following section. The RPG is set at the visibility level shown to result from the application of all the elements of the DNRE's long-term strategy, along with all currently known controls being applied by other states. However, several of these control measures include CAIR controls that currently are being revised by the EPA.

10.5 Long-term Strategy

The DNRE is required by 40 CFR 51.308(d)(3) to submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I federal area within and outside the state that may be affected by emissions from within the state. The long-term strategy must include enforceable emissions limitations, compliance schedules and other measures necessary to achieve the reasonable progress goals established by states where the Class I areas are located. This section describes how the DNRE meets the long-term strategy requirements.

10.5.1 Emission Reductions Due to Ongoing Air Pollution Programs

Under 40 CFR 51.308(d)(3)(v)(A), the DNRE is required to consider emission reductions from ongoing pollution control programs. The DNRE considered the following ongoing or expected programs in developing its RPG.

Clean Air Interstate Rule (CAIR)
Although a CAIR replacement rule is being developed, several EGUs in the region have already begun to install controls for CAIR. The timing for CATR (Phase I-2012 and Phase II-2014) is adequate to address the 2018 milestone for regional haze. The DNRE is still evaluating how CATR will affect regional haze and BART for EGUs.

Best Available Retrofit Technology (BART)
Five non-EGU sources in Michigan are subject to BART. Final BART determinations for Michigan's five non-EGUs have been completed. Emission reduction information from BART controls is located in Section 9 of this document.

Other Federal Programs
The DNRE also anticipates significant emission reductions resulting from several federal rules that will be implemented in the next several years. These reductions were included in the modeling of predicted 2018 emissions.

- Tier II for on-highway mobile sources.
- Heavy-duty diesel (2007) engine standards.
- Low sulfur fuel standards.
- Federal control programs for nonroad mobile sources.

10.5.2 Additional Emission Limitations and Schedules of Compliance

The DNRE is required under 40 CFR 51.308(d)(3)(v)(C) to identify additional measures to meet visibility goals when ongoing programs alone are not sufficient. However, the EPA haze rule is clear that the basis for setting the visibility goal for a Class I area is determination of reasonable controls based on the four factors plus visibility impacts. Therefore sufficient controls are those that are shown to be reasonable. The DNRE believes that reasonable controls are "on-the-books" controls, including CAIR and its replacement rule for EGUs. For non-EGUs, BART will also suffice for reasonable controls, and ICI boiler controls may also be pursued when the current study addressed elsewhere in this report is completed.

The DNRE's rationale for determining that "on-the-books" controls meet the reasonable controls provisions of the Regional Haze Rule is as follows: As has already been described herein, the study by the LADCO contractor ECR evaluated the primary source categories that may impact Class I areas in the region. The category of sources having the largest impact on Class I areas is EGUs. All major EGUs are subject to CAIR and will be subject to CATR. The DNRE is still evaluating CATR to determine if this can be considered as adequate to meet the reasonableness criteria of the haze rule for EGUs.

Another category reviewed by the consultant, which showed potentially reasonable additional controls on a cost basis, is ICI boilers. This category has been extensively reviewed by a workgroup formed by a collaborative group of Midwest and Northeast states. As a result, a joint letter for additional controls on ICI boilers was sent to the EPA on September 2, 2009. Therefore it is premature for the DNRE to proceed with its own set of controls for ICI boilers.

The other categories of sources analyzed by ECR have less impact on the Class I areas than EGUs and boilers and are not being pursued for control beyond what is already on the books.

The facilities in other states that have the largest impact on Michigan's Class I areas are primarily EGUs and other sources that are subject to BART. Therefore Michigan expects to receive the benefit of future controls from these sources on our Class I areas. Future LADCO modeling will account for these additional controls and will show their impact on Michigan's Class I areas.

10.5.3 Measures to Mitigate the Impacts of Construction Activities

Under 40 CFR 51.308(d)(3)(v)(B), the DNRE is required to consider measures to mitigate the impacts of construction activities. Some of the main impacts of construction activities include the impacts of emissions from nonroad mobile and diesel engine emissions and fugitive emissions resulting from land clearing and construction.

Emissions from nonroad mobile sources and diesel engines will be decreased between now and 2018 due to federal on-the-books control strategies. The impact of construction activities will

continue to be mitigated through the federal general conformity and transportation conformity rules. These rules are already included in the DNRE's SIP.

In terms of the construction of new major sources, the visibility impacts of such sources will continue to be managed in conformance with existing requirements pertaining to New Source Review (NSR) and Prevention of Significant Deterioration (PSD). This involves analysis of visibility impacts and consultation with FLMs in determining if a new major source or major modification is installing BACT and if it has an adverse impact on visibility in Class I areas. The DNRE's RFP plans include growth factors and the controls required by PSD, thus Michigan should attain its visibility goals even if new sources are permitted.

10.5.4 Source Retirement and Replacement Schedules

Source retirement and replacement schedules, which must be considered under 40 CFR 51.308 (d)(3)(v)(D) in developing reasonable progress goals, will be managed in conformance with existing requirements under the PSD program.

10.5.5 Agricultural and Forestry Smoke Management

Under the requirements of 40 CFR 51.308(d)(3)(v)(E), the DNRE must consider smoke management techniques for the purposes of agricultural and forestry management in developing the long-term strategy to achieve the reasonable progress goal.

Organic carbon (OC) and elemental carbon (EC) are formed from fire; however, neither are unique products of fire. EC is produced from combustion of any carbon fuels and therefore can come from diesel emissions as well as vegetative burning. OC comes from both primary emissions and secondary formation from gas phase emissions. OC can be attributed to anthropogenic sources of VOCs or to biogenic emissions from plants and trees in the summer growing season.

OC is generally a large component of $PM_{2.5}$ mass measured in the warmer months at Isle Royale and Seney. When light extinction is calculated from the filter measurements, OC is proportionally less significant but still an important pollutant (see Appendix 10C).

In general, biogenic emissions of OC are not easily distinguished from emissions from fire, but several studies have been done to determine the causes of high OC in the Class I areas. It appears that most OC seen in the Northern Class I areas is biogenic, coming from plants as opposed to fire.

Sheesley and Schauer (2004) conducted a study at Seney Wilderness that examined the sources of OC affecting the area. Using a marker species associated with vegetative burning, they found the highest levels of this marker in the winter months, likely indicating burning due to use of wood stoves and fireplaces. There was a lesser peak from June through September, possibly indicating fires in Canada. The summertime levels of other marker species indicated secondary organic aerosols from biogenic sources as the main source of OC, not primary emissions from wood smoke.

These findings were reviewed in an MRPO (2005) issue paper, which concluded that "the contribution of fires to annual average $PM_{2.5}$ concentrations and visibility impairment in the

upper Midwest is relatively small. Nevertheless, fires may cause problems on an episodic basis."

To further investigate the impact of fire, an MRPO contractor (Boyer, et. al., 2004) developed an inventory of fire emissions from agricultural, prescribed, and wildfire burning in 2001 – 2003 for the Midwest states. The report shows that Michigan has low emissions from fires, although Michigan's fire activity for prescribed and agricultural burns is likely underreported.

The MRPO (2007) identified three days at Isle Royale and one day at Seney that had high OC. Using back trajectories and satellite maps of fires, it appears that monitoring data for all of the days was influenced by wildfires in Canada. Subtracting these days from the 20 percent worst days had a 0.2 dV reduction for Isle Royale and no change at Seney.

Although the data show that fires do have some impact on visibility at Isle Royale, the impacts on the 20 percent worst days tend to be only a few poor visibility days in the summer caused by wildfires. Often these wildfires occur in Canada. For these reasons, the DNRE determined that OC particles are not good candidates for additional controls as part of the long-term strategy. Emissions from wildfires should be included in natural condition estimates, and any transboundary fire impacts must be addressed by the EPA.

Per the RHR guidelines, the DNRE has determined that emissions from prescribed fires are not significantly affecting Class I areas in Michigan, thus current approaches to forestry and agricultural burning are adequate for long-term progress. However, the DNRE is currently developing further smoke management approaches for prescribed fire using basic smoke management practices that may become the basis for a Michigan Smoke Management Plan (SMP) if needed.

10.5.6 Enforceability of Emission Limitations and Control Measures

Under 40 CFR 51.308(d)(3)(v)(F) the DNRE is required to ensure that emission limitations and control measures used to meet the RPG are enforceable.

The CAIR requirements have been adopted as state regulations and the CATR requirements will also likely be adopted as state regulations as well. The BART control evaluations are required by a state rule adopted on September 11, 2008, and the limits and provisions of each source's BART determination are enforceable through consent order and permits. The state rulemaking that makes BART an applicable requirement for stationary sources can be found in Appendix 9A.

10.5.7 Anticipated Net Effect on Visibility Resulting from Projected Changes to Emissions

Under 40 CFR 51.308(d)(3)(v)(G), the DNRE is required to address the net effect on visibility resulting from changes projected in point, area, and mobile source emissions by 2018.

The emission inventory used for this SIP addresses changes to point, area, and mobile source inventories by the end of the first implementation period resulting from population growth; industrial, energy and natural resources development; land management; and air pollution control. These changes, and their net effect on visibility, are described in Section 8 and Appendix 10F for the base year and LADCO's Technical Support Document (LADCO 2008) for

future year inventories. Table 10.6.a provides the net impact on visibility based on the original "on-the-books" scenario, as well as other possible control scenarios.

10.5.8 Potential Future Projects That Will Reduce Emissions

Other actions are likely to take place over the next 10 years that will improve visibility in the Class I areas in 2018, but which are not included in the RPG, as follows:

Renewable Energy
Michigan has adopted a Renewable Energy Portfolio, which will require 10 percent of the state's energy to come from renewable sources by 2015. This is likely to lead to less fuel usage and more non-fossil fuel based energy generation, perhaps leading to lower future emissions from electricity generating units.

Mercury/Multi-pollutant Rules
The DNRE developed state rules for mercury reductions from coal-fired EGUs. These rules will reduce mercury emissions throughout the state by 90 percent or approximately 2,000 lbs/year by 2015. Since intrastate trading is not allowed, all coal-fired EGUs will be required to comply. Several EGUs in the state will be upgrading their ESPs to baghouses to conform to mercury removal controls. The resultant reduction in particulate emissions may contribute to a reduction in haze.

A second option the mercury rule provides is a multipollutant strategy. This option would allow a 75 percent reduction for mercury as long as the project garners 85 to 90 percent reduction in NOx and 85 to 95 percent reduction in SO_2. This reduction also may contribute to a reduction in regional haze.

$PM_{2.5}$ and Ozone SIPs
As the EPA continues to tighten the National Ambient Air Quality Standard (NAAQS) for ozone and $PM_{2.5}$, parts of Michigan and other surrounding states may become nonattainment for one or both of these pollutants, requiring reductions in precursor pollutants. Any such additional reductions in precursor emission will likely further reduce haze by 2018. Some programs that will contribute to this effort have already been mentioned. The DNRE, along with LADCO and the Northeast states, have made a proposal for ICI boiler control to the EPA, suggesting the EPA promulgate a federal rule. The DNRE also may further investigate control measures that were shown by the ECR report to be potentially reasonable under the four factors analysis, as resources allow.

Greenhouse Gas Programs
Governor Jennifer M. Granholm issued Executive Directive 2009-4 to implement the recommendations of the Michigan Climate Action Council in its Climate Action Plan. Although any measures undertaken will be intended to reduce greenhouse gases, it is likely that some reductions may have the added benefit of reducing emissions of fine particulate matter and its precursors and thereby reducing haze.

10.6 Reasonable Progress Goals

Section 10.5.1 of this document describes the control programs that constitute Michigan's RPG for meeting the 2018 interim date. This decision is based on an analysis of the four factors and visibility in relation to the priority sources of haze, as described in previous portions of this document. This reasonable progress goal results in the deciview levels shown in the Table 10.6.a. While "on-the-books" controls are considered the primary RPG, the other scenario depicted as "LADCO Scenario B" may more accurately reflect the level of control for determining the RPG. This will be further clarified when the CATR is finalized and the DNRE and other LADCO states evaluate future EGU emission reductions reflecting compliance with the CATR.

Table 10.6.a. Adjusted Reasonable Progress Goals for Michigan Class I Areas

Class I area	2018 Visibility 20% Worst Days (dv)	2018 Visibility 20% Best Days (dv)	Projected Annual Improvement 2004-2018 (W20%, dv)	Projected Improvement by 2064 (W20%, dv)	Year Reaching Natural Conditions (W20%)
On-the-books controls including CAIR					
Isle Royale	20.09	6.60	0.11	6.43	2090
Seney	22.59	7.71	0.13	7.67	2096
LADCO Scenario B					
Isle Royale	20.86	6.76	0.05	3.13	2181
Seney	23.58	7.78	0.06	3.43	2209

Source: DNRE
Note: LADCO Scenario B reflects on-the-books controls, but only including those CAIR EGU controls that are currently enforceable by state consent orders or permits.

The RPG provides for less annual progress by 2018 than is reflected in the URP.

Table 10.3.2.f. shows 2018 URP values of 19.21 at Isle Royale and 21.35 at Seney. Following the rate of progress of the DNRE, RPG provides the values in the last column of Table 10.6.a. However, these values are of little meaning since they are so distant into the future. The DNRE believes that the RPG set in this SIP meets the provisions of the haze rule for making reasonable progress, and that there will be many more reductions in emissions over the next 10 years and beyond that will continue to bring the Class I areas closer to natural background. At this time, it is not known whether natural conditions will be met by 2064. Further analysis will be made for the 2012 haze rule-required review process and periodically as required in the haze rule.

11 Comprehensive Periodic Implementation Plan Revisions and Determination of the Adequacy of the Existing Plan

Under 40 CFR 51.308(f), a state is required to revise its regional haze implementation plan and submit a plan revision to the EPA by July 31, 2018 and every ten years thereafter. In accordance with these requirements of the Regional Haze Rule, the DNRE commits to revising and submitting this regional haze implementation plan by July 31, 2018 and every ten years thereafter.

In addition, 40 CFR 51.308(g) requires periodic reports evaluating progress towards the reasonable progress goals established for each mandatory Class I area. In accordance with the requirements listed in Section 51.308(g) of the federal rule for regional haze, the DNRE will submit a report on reasonable progress to the 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 I area located within Michigan. No mandatory Class I area located outside Michigan is expected to be affected by emissions from within Michigan. All requirements listed in Section 51.308(g) will be addressed in the SIP revision for reasonable progress.

The DNRE will be developing emissions inventories every three years as required by the EPA. LADCO will continue to update modeling. The DNRE will use this information as well as monitoring data to determine if the two Class I areas are meeting their RPGs.

In addition, the DNRE will be reviewing several aspects of the SIP. The actions laid out in Table 11.1 will be occurring prior to the five-year report. More information on these actions is described elsewhere in the SIP.

Table 11.1. Activities Prior to Five-year SIP Assessment

Description	Responsible Party
Continue to determine BART emission limit determinations for non-EGU BART-subject facilities (complete determinations expected in 2016)	DNRE
Incorporate non-EGU BART emission limits into facility permits, orders	DNRE
Determine controls for EGUs for CATR, incorporate in facility permits, orders	DNRE, EPA
Track emission changes in Michigan and in other states contributing to Michigan Class I areas	DNRE Other states

The DNRE will continue to have periodic calls as needed with the Northern Class I consultation group including states, tribes, FLMs, and EPA. The LADCO states and Minnesota will continue to do technical evaluations that will be necessary to determine if the Class I areas are reaching their RPGs.

In the five-year report, the DNRE will undertake an emission review to determine if the emission reductions projected to occur through the application of BART, CATR, the mercury rule, and the other components of the DNRE's long-term strategy have occurred. The review will also look at what new emission sources have begun operation.

Depending on the findings of the five-year progress report, the DNRE commits to taking one of the actions listed in 40 CFR 51.308(h). The findings of the five-year progress report will determine which action is appropriate and necessary.

List of Future Actions from 40 CFR 51.308(h) Scenarios

1. If the DNRE determines that the existing SIP requires no further substantive revision to achieve established goals, the DNRE would provide to the EPA Administrator a negative declaration stating that further revision of the SIP is not needed at that time. Monitoring data from the Class I areas would need to be on track or lower than the 2012 visibility estimate, based on MRPO's modeling for 2012, and therefore no revision action would be necessary.

2. If the DNRE determines that the existing SIP may be inadequate to ensure reasonable progress due to emissions from other states that participated in the regional planning process, the DNRE would notify the EPA Administrator and the states that participated in regional planning. The DNRE would collaborate with states through the regional planning process, as resources allow, to address the SIP's deficiencies. (Federal funding for RPO activities has ended. Unless funds are restored, there may be limited collaboration among states and limited future RFP analyses.)

3. If the DNRE determines that the existing SIP may be inadequate to ensure reasonable progress due to emissions from another country, the DNRE would provide notification, along with available information, to the EPA Administrator.

4. If the DNRE determines that the existing SIP is inadequate to ensure reasonable progress due to emissions from within the state of Michigan, the DNRE would revise its SIP to address the plan's deficiencies within the required time period. The DNRE would evaluate contingency measures, including ICI boilers, other point sources (such as reciprocating engines), mobile sources, or any other sources as appropriate to determine which should be adopted.

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