DRAFT

Michigan Department of Environmental Quality
Air Quality Division

STATE IMPLEMENTATION PLAN SUBMITTAL

FOR

REGIONAL HAZE

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Table of Contents

Table of Contents, Continued

Table of Contents, Continued

List of Tables

Table of Contents, Continued

List of Figures

List of Appendices

LIST OF ACRONYMS

AOI	Area of influence
ASOA	Anthropogenic secondary organic aerosol
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
dv	deciviews
EC	Elemental carbon
ECR	EC/R Incorporated consulting firm
EGU	Electric generating unit
ENVIRON	ENVIRON International Corporation
EPA	United States Environmental Protection Agency
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
ICI	Institutional, commercial and industrial
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPM	Integrated Planning Model
ISLE1	Isle Royale National Park
LADCO	Lake Michigan Air Director’s Consortium
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
MDEQ	Michigan Department of Environmental Quality
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
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
PM10	Particulate matter with aerodynamic diameters less than 10 microns
PM2.5	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
RPG	Reasonable progress goal
RPO	Regional Planning Organization
RRF	Relative response factor
SENE1	Seney Wilderness Area
SESARM	Southeast State Air Resource Managers, Inc.
SIP	State Implementation Plan
SMP	Smoke Management Plan
SO2	Sulfur dioxide
SO4	Sulfate
SOA	Secondary organic aerosol
TIP	Tribal Implementation Plan
tpy	tons per year
TSD	Technical Support Document
URP	Uniform rate of progress

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

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.*

In 1977, Congress added the goal of restoring pristine visibility conditions in national parks and wilderness areas to the CAA. Section 169 of the Act calls for the prevention of any future, and the remedying of any existing, human-made visibility impairment in Class I areas. Over the following 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 made so far. In 1993, the National Academy of Sciences concluded that "current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility."[1]

In addition to authorizing creation of visibility transport commissions and setting forth their duties, Section 169B(f) of the CAA mandated creation of the Grand Canyon Visibility Transport Commission (Commission) to make recommendations to the 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

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

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 US Court of Appeals, DC 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 US Court of Appeals, DC 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.

All Regional Haze state implementation plans (SIPs) are 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 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 a 571,790-acre island 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 United States 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%[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.

At a 5% contribution level, Michigan sources only impact Isle Royale and Seney. However, the MDEQ received letters from four other states indicating impacts from Michigan sources based on their analyses (See Appendix 1A). These letters and 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%. The states that make a 5% contribution or more to total light extinction accounts for 75-80% of total light extinction, whereas using a 2% contribution accounts for 90-95% of total light extinction. Since this is the first planning stage for regional haze, MDEQ believes the 5% contribution of states is more appropriate and can be tightened in later planning stages if needed.

2 General Planning Provisions

Pursuant to the requirements of 40 CFR 51.308(a) and (b), the MDEQ 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 the BART components of 40 CFR 50.308(e). In addition, the SIP addresses Regional Planning, state and Federal Land Manager coordination, and contains a commitment to provide SIP revisions and adequacy determinations.

The MDEQ 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 MDEQ provided public notice of the opportunity to comment on the SIP on October 29, 2007. The MDEQ provided notice of the opportunity to request a public hearing on October 29, 2007. Although a hearing was scheduled for December 4, 2007, no requests for a hearing were made. 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 and hearing were held. The MDEQ provided the second public notice of the opportunity to comment on the SIP on <date>. The MDEQ provided notice of the opportunity to request a second public hearing on <date>. The second public hearing was held on <date>. Public comments were address and are summarized in Appendix 2A.

<This section will be updated pending the public comment/hearing.>

3 Regional Planning

3.1 Midwest Regional Planning Organization (MRPO)

In 1999, the EPA and affected states/tribes agreed to create five Regional Planning Organizations (RPOs) to facilitate interstate coordination on Regional Haze SIP/TIPs. The State of Michigan is a member of the Midwest RPO (MRPO). Members of MRPO are listed in Table 1.

Table 3.1.a: MRPO Members

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

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 has established an active committee structure to address both technical and non-technical issues related to regional haze. The three main committees are as follows. LADCO provides supportive activities for the three committees (see Appendix 3A).

- The Policy Steering Committee provides shall provide the overall policy direction for the regional planning effort, and shall serve as the forum for the resolution of disputes. This Committee is composed of state environmental commissioners, tribal representatives, the EPA and 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).

MRPO technical workgroups***:***
The MRPO has three main workgroups that meet monthly and/or as needed for project inputs. The workgroups are for data analysis, emissions inventory and modeling. Meetings are scheduled separately for each technical workgroup. Most information is shared through conference calls, e-mails, and in person at annual or semi-annual

conferences. Because of its centrally located staff, MRPO also communicates and provides 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. 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 website.

3.2 State Consultation

A chief purpose of the RPO is 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. MRPO has 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 MDEQ has worked with states that are members of CENRAP, MRPO, and the Western Regional Air Partnership (WRAP) 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 MDEQ also worked with states from the MANE-VU region that indicated Michigan as contributing to five of their Class I areas. Any state that contributes >2% sulfate, >0.1ug/m^3 sulfate, or one of the top ten sulfate-contributing states based on the 20% 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 Minnesota, Michigan, 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 FLMs from the U.S. Department of the Interior National Park Service and USDA Forest Service, as well as representatives from the EPA. This consultation partially fulfills the MDEQ'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. This process included several conference calls and a meeting in Madison, Wisconsin held on May 24, 2005.

Formal discussions geared toward specific SIP requirements began in July 2006, when the MDEQ met 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 to meet 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 of 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 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 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 website. This website 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 MDEQ in "Ask" letters. These letters indicated that Michigan was impacting their Class I areas and requested consultation with the MDEQ and several other states outside of MANE-VU to fulfill the consultation requirements of the Regional Haze Rule.

The MDEQ and MANE-VU had several telephone calls and a conference in person on August 6, 2007 (see Appendix 3C). MANE-VU shared the results of their modeling and indicated 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.

4 State and Federal Land Manager Coordination

40 CFR 51.308(i) requires coordination between states/tribes and the FLMs. Opportunities have been provided by MRPO for FLMs to review and comment on the technical documents developed by MRPO. The MDEQ 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 MDEQ provided FLMs an opportunity for consultation approximately 60 days prior to holding a public hearing on the SIP.

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

The MDEQ had 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 MDEQ gave the FLMs a second review period. The draft SIP was sent to the FLMs on <date>. The MDEQ notified the FLMs of a tentatively scheduled public hearing for <date>. Comments received from the FLMs on the SIP were addressed and a summary of the FLMs comments and responses is included in the Appendix 2A.

The MDEQ will continue 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 5-year progress reports; and
- Development and implementation of other programs that may contribute to impairment of visibility in Class I areas.

<This section will be updated pending FLM comments.>

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). 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 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.

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 IL's vehicle emissions tests (NE IL), IN's vehicle emissions testing program (NW IN), OH's E-check program (NE OH), and WI's vehicle inspection program (SE WI) – 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 RVP gasoline
- Reformulated gasoline, including Chicago-Gary,-Lake County, IL,IN; and Milwaukee, Racine, WI

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 solvents
- AIM coatings
- Aerosol coatings
- Portable fuel containers

Power Plants
- Title IV (Phases I and II)
- NOx SIP Call
- Clean Air Interstate Rule

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.

5.2 Results

The uniform rate of visibility improvement values for the 2018 planning year were derived for the 20% worst visibility days based on a straight line between 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% best visibility days should not degrade from the 2004 baseline values over the sixty year period. Plots of these "glide paths" for the 20% worst days (downward sloping line) and the 20% best days (horizontal line) for Isle Royale and Seney with the Base M modeling results are presented in Figure 5.2.a (LADCO, 2008). Tabular summaries of measured baseline and modeled future year deciview values for both areas are provided in Table 5.2.a (2002 base year) and Table 5.2.b (2005 base year) (LADCO, 2008).

Isle Royale Seney

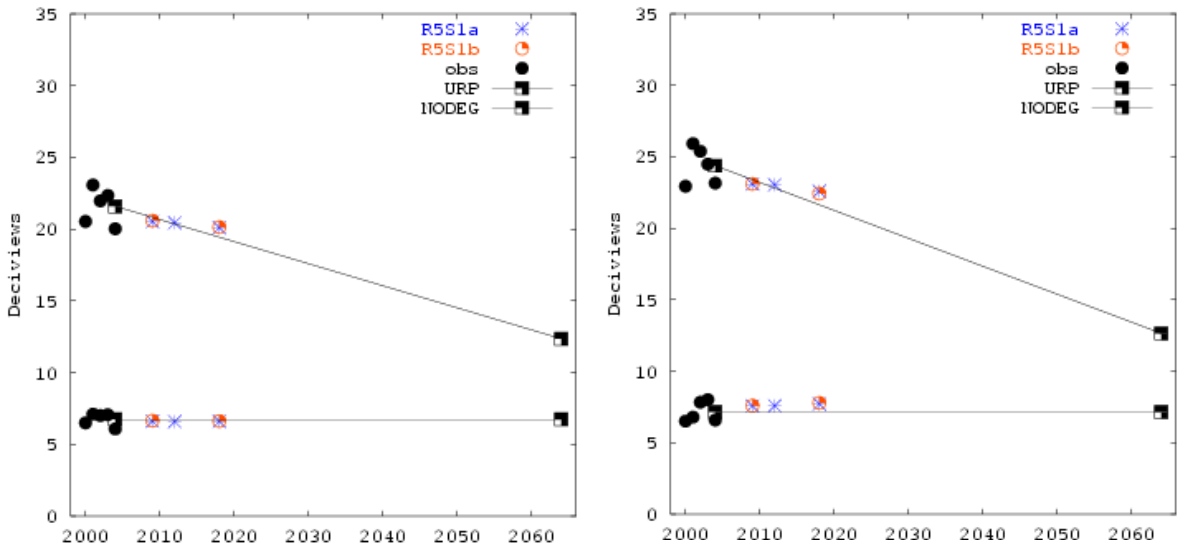


Figure 5.2.a: Visibility Modeling Results for Isle Royale and Seney.

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 results show that several Class I areas in the eastern U.S. 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 U.S. Many other Class I areas in the eastern U.S. 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.

5.3 CAIR Court Decision

As of the writing of this SIP document, the U.S. Court of Appeals for the D.C. Circuit Court has vacated the CAIR rule. It is unclear how this action will change expected EGU emissions for several reasons. It is possible the vacatur order will be stayed pending further appeal. There is also a possible Congressional fix being considered. Another uncertainty is how utilities will operate the existing CAIR controls, as well as their plans to continue installing such controls. Also, if CAIR is gone, many EGUs will be required to install presumptive BART controls that have not been accounted for in LADCO's Round 5 modeling.

To date, LADCO has begun additional modeling of several scenarios reflecting possible emissions from EGUs if CAIR is not in place. An explanation of the modeling methodologies and results can be found in a revised Technical Support Document in Appendix 5A *(to be added when available).*

Because of the timing constraints under which the MDEQ is operating for submitting the Haze SIP, this SIP document reflects haze planning, modeling, etc. with CAIR still in place. However, the MDEQ acknowledges that EGU emissions are likely to be different if CAIR is not reinstated.

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 EPA guidance provides states a "default" method of estimating natural visibility. The MRPO estimated natural visibility using the default method. The MRPO calculated estimates for the 20% best and worst days using the new IMPROVE equation. 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%), 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% worst days. Table 6.a shows the averages for the 20% 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 of the 20% 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 deciviews for the cleanest 20% of the days and 21.59 deciviews for the 20% worst visibility days. This is based on data at the Isle Royale (ISLE1) Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring site (near Eagle Harbor), described in Appendix 6A. A five-year average (2000 to 2004) was calculated for each 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 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% of days. These best and

worst 20% 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	53.07	32.97	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 deciviews for the cleanest 20% of the days and 24.37 deciviews for the 20% 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 for each 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% of days. These best and worst 20% 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

40 CFR 51.308(d)(4) of the federal Regional Haze Rule requires a monitoring strategy for measuring, characterizing, and reporting regional haze visibility impairment that is representative of all mandatory Class I areas within the state of Michigan. 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 MDEQ commits to meet 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 cut for the IMPROVE network, the state of Michigan may not be able to continue monitoring at Isle Royale and Seney. The MDEQ has cut several monitors in other locations of Michigan because of state budget problems and EPA funding cuts , and cannot afford to maintain additional monitors. Should federal funding be cut, the state would seek funding from other sources.

8 Emissions Inventory

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

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 MDEQ will update this inventory every three years.

In addition, emissions were projected to 2012 and 2018 to support the RFP demonstration. The base year, 2012 and 2018 modeling inventories were prepared by LADCO. The future year projections take into account existing control measures and measures that are 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 and on their website at: http://ladco.org/References/TSD_Version_IV_April_25_2008_FINAL.pdf. LADCO has produced numerous summary reports with state and county total emissions and has posted them on their website at: http://www.ladco.org/tech/emis/basem/baseM_reports.htm

Table 8.a: 2005 Emissions Inventory Annual Emissions, Tons per Year

	Pollutant					
	NOx	PM10-Primary	PM25-Primary	SO2	VOC	NH3
Point[1]	206230	18430	8863	408985	34192	946
Area[1]	39085	65505	65090	13294	252114	231
Off-Road[1]	96821	8716	8234	12655	158906	96
On-Road[2]	257567	6811	4843	7333	188620	10395

[1] Emissions from LADCO 2005 Base M modeling growing summer day emissions to annual totals.

[2] Emissions from Draft EPA 2005 NEI mobile inventory given to the Great Lakes Commission RAPIDS committee.

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 nitrogen oxides, sulfur dioxides, 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.

9.1 BART-Subject Sources in the State of Michigan

The non-EGU BART-subject sources in the state of Michigan are shown in Table 9.1.a. A description of each BART-subject source is included in Appendix 9A.

Table 9.1.a: Non-EGU Bart-Subject Sources in the State of Michigan

BART-Subject Facility Name	City	Category	SIC
LaFarge Midwest Inc.	Alpena	4	3241
Saint Mary's Cement	Charlevoix	3	3241
Smurfit/Stone Container Corp	Ontonagon	22	2611
Escanaba Paper Company	Escanaba	22	2611
Cleveland Cliffs Corporation:			
Tilden Mining Co	Marquette	24	1011
Empire Iron Mining	Marquette	24	1011

Source: MDEQ

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.

A major BART decision made by MDEQ involved EGUs. The EPA allows states to consider the CAIR program to be equivalent to BART for EGUs. However, with the recent CAIR vacatur, EGUs may now be subject to BART. The MDEQ is evaluating how BART may affect EGUs pending the final court mandate on CAIR.

A second major BART determination made by MDEQ was which non-EGUs were BART-subject and therefore require a detailed BART engineering analysis. The first step taken by the MDEQ was to determine all potentially-affected sources based on the criteria listed in the EPA guidelines. The MDEQ identified 34 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 AI-1 in Appendix 9A).

Next, using emission inventory data from the years 2002 and 2004, the MDEQ 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 TPY/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 15. (See Table AI-2 in Appendix 9A.)

The next step involved CALPUFF modeling for each of the 15 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 deciviews (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 the six non-EGU BART-subject sources shown in Table A1-3 in Appendix 9A and listed above.

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

BART determinations for the six non-EGU BART-subject sources in Michigan have not been completed. This section of the SIP will be amended when the MDEQ has completed the BART determinations and incorporates BART emission limits and provisions in consent orders and/or permits.

9.3 For State/Tribes with Class I Areas; Analysis of Visibility Improvement Achievable from all BART Sources in the Region

The modeled visibility improvement that will be achieved in each mandatory Class I federal area as a result of the emission reductions achievable from all BART-subject sources is not yet available. This section of the SIP will be amended when the MDEQ has completed the BART determinations, incorporates BART emission limits and provisions in consent orders and/or permits, and has similar information from the other impacting states.

10 Reasonable Progress Goals and Long-term Strategy

40 CFR 51.308(d)(1) requires the MDEQ 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 MDEQ 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 MDEQ is involved in 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 website: http://www.ladco.org/Regional_haze_consultation.htm.

10.2 Basis for Emissions Reduction Obligations

The MDEQ 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 area are most impacted by emissions from Michigan and which states' emissions most impact visibility in Michigan's Class I areas.

The MDEQ 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 MDEQ used the following steps to determine Michigan's contribution to visibility impairment at various Class I areas.

10.2.1 Baseline Inventory

The MDEQ used MRPO's Base M emissions inventory to assess RPGs as a baseline for 2005 and 2018. 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 MDEQ 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).

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 MRPO's 2018 particulate source apportionment modeling, Michigan contributes from 12% to 18% of the visibility impairment at both Class I areas (See Table 10.2.2.a and Appendix 3B). Using the MDEQ's determination that a significant contribution to visibility impairment is a contribution over 5%[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% 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 that 5% 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% sulfate contribution or 0.1 ug/m^3 sulfate contribution to the 20% worst days as their significance level.

The MANE-VU states requested states they identified to 1) reduce sulfate emissions by 90% from their key list of EGUs; 2) reduce non-EGU SO_2 emissions by 28%; 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-Monroe (two units), St. Clair and Trenton Channel, and Consumers Energy-Karn-Weadock Power Plants.

10.2.3 States Impacting Michigan's Class I Areas

The MDEQ identified the states expected to contribute significantly to Michigan's Class I areas, defined as more than 5% contribution to visibility impairment at either Seney or Isle Royale, using MRPO's Round 5 2018 PSAT modeling. The states that are

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

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% contribution level in the later modeling (see Table II-2 in Appendix 3B).

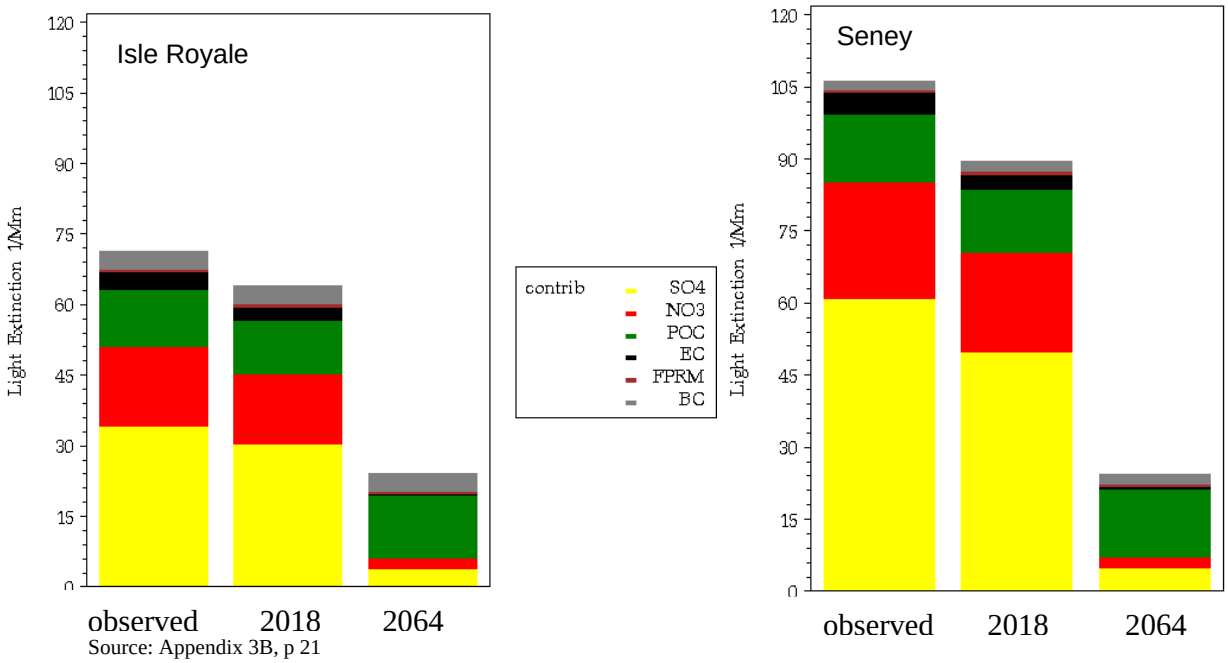
Table 10.2.3.a: 2018 PSAT (Round 5) contribution to light extinction by state

	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

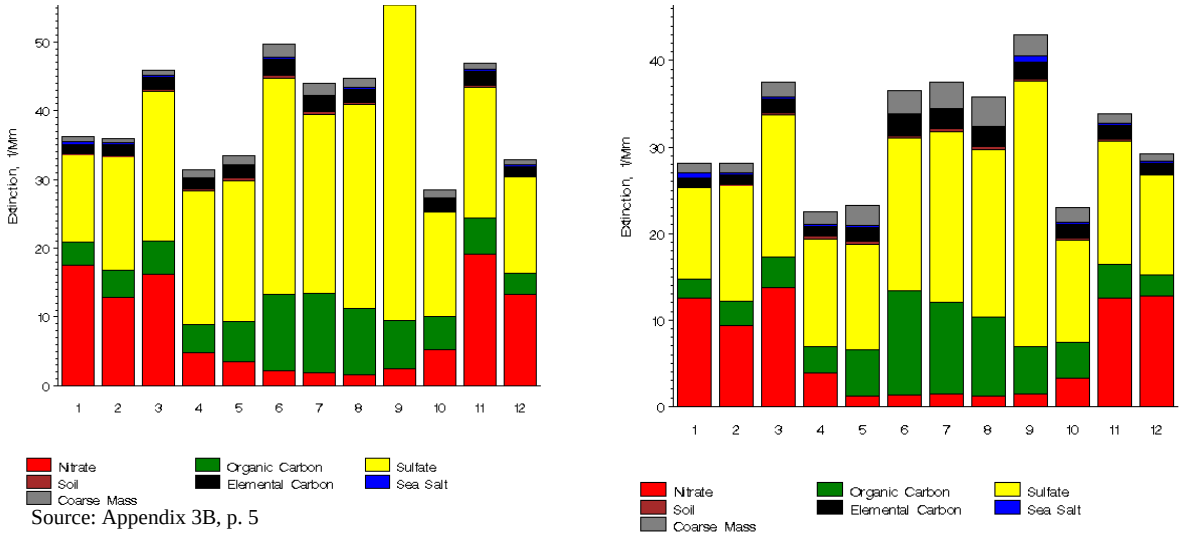
10.2.4 Pollutants and Sources Impacting Michigan's Class I Areas

The main pollutants predicted to impact visibility at Michigan's Class I areas on the 20% 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 nitrite 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, p.19), which is more reflective of background conditions and will not be pursued for control. The MDEQ will focus on sulfate and nitrate reductions.



Source: Appendix 3B, p 21

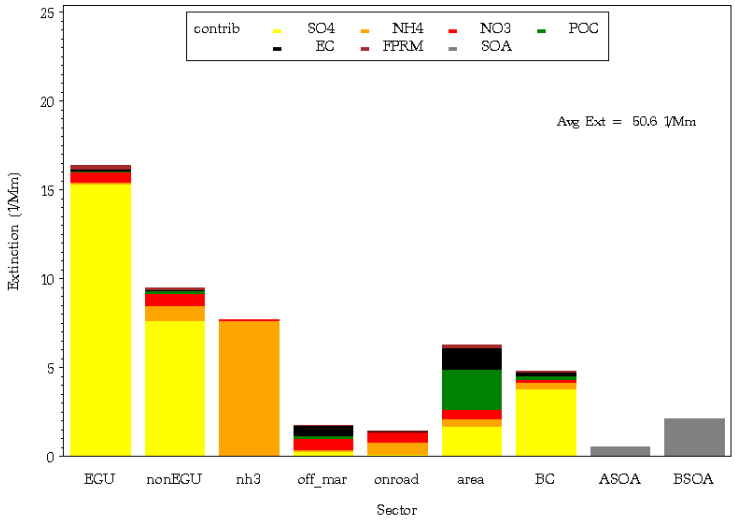
Figure 10.2.4.a: Comparison of pollutant contribution to visibility impact for 2002 base year, 2018 future year and 2064 natural conditions for Michigan's Class I areas on the 20% worst days.



Source: Appendix 3B, p. 5

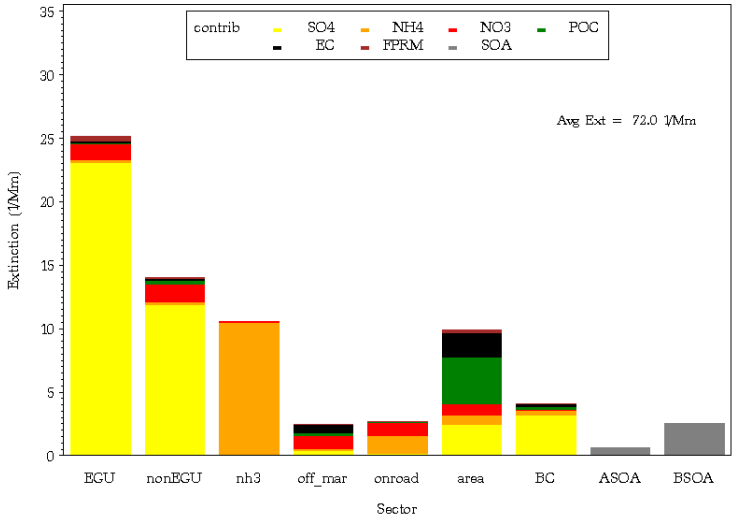
Figure 10.2.4.b: Pollutant contribution to monthly light extinction values for Michigan's Class I areas (2000-2004).

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_2 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 specie 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 specie on 20% 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

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 "glidepath" into account. … The glidepath 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 glidepath."

The glidepath, also known as the uniform rate of progress (URP), is a line between the baseline conditions for the 20% 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 MDEQ 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 (threes 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 (e.g., 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 MDEQ'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 to direct a contract to investigate and evaluate control options for those priority sources. This effort served as the primary method the MDEQ used to evaluate an RPG approach for the state.

From the outset of this effort, the MDEQ 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 MDEQ, 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 $PM_{2.5}$ SIP. 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 MDEQ 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 on-road sources are expected to decrease significantly. EGU sources are expected to have large reductions based on 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% 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.

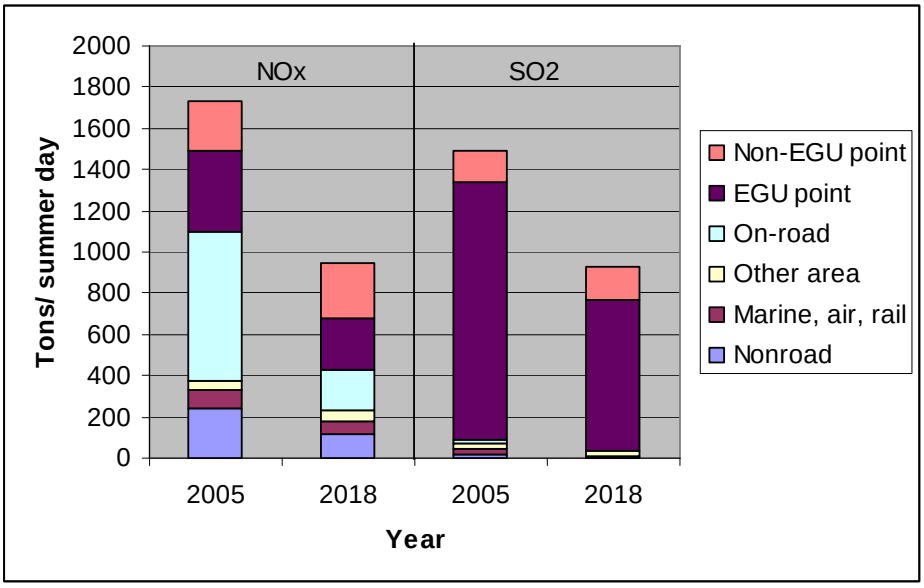


Figure 10.3.2.a: NOx and SO_2 emissions in Michigan for 2005 and 2018 by source category. Source: MDEQ generated from LADCO 2008 TSD, p. 52

The individual Michigan point sources with the highest impacts for Isle Royale and Seney are shown in Appendices 10D and 10E, respectively. The top 10 contributing sources indicated by modeling and Q/d for in-State sources indicate EGUs and BART-subject sources. EGUs were originally subject to CAIR, but with the CAIR vacatur, some may be required to install BART controls in accordance with the requirement of 40

CFR 51.302. Other BART-subject sources are still being evaluated for BART controls (see Table 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 SO2 (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 formerly 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 SO2 (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 the state and out-of-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 multi-state 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 MDEQ is currently working with other states in the region and northeast to find acceptable emission limits for this source category.

Identify Control Options for Priority Sources: The MDEQ 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 the state and out-of-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
- On-Road Mobile Source Programs
    - 2007 Highway Diesel Rule
    - Tier II/Low Sulfur Gasoline
- Non-road mobile source programs
    - Non-road Diesel Rule
    - Control of Emissions from Unregulated Non-road Engines
    - Locomotive/Marine advance notice of proposed rule making (ANPRM)

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

- EGU control scenarios setting regional emission limits based on
    - Strategy 1: SO2 limits of 0.15 lbs/MMBtu
      NOX limits of 0.10 lbs/MMBtu
    - Strategy 2: SO2 limits of 0.10 lbs/MMBtu

NOX limits of 0.07 lbs/MMBtu

- ICI Boilers
  - Strategy 1: SO2 reduction of 40% from 2018 baseline emissions
    NOx reduction of 60% from 2018 baseline emissions
  - Strategy 2: SO2 reduction of 77% from 2018 baseline emissions,
    NOx reduction of 70% from 2018 baseline emissions

- Reciprocating Engines and Turbines-89% reduction for reciprocating engines and 84% 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% reduction in emissions
  - Strategy 2: 15% reduction in emissions

The majority of EGUs whose emissions significantly affect Isle Royale and Seney were subject to CAIR. However, if the recent CAIR vacatur remains in effect, BART is no longer addressed by CAIR. The MDEQ and other states in the region are in the process of determining which EGUs are proceeding with their CAIR plans, and LADCO is doing model runs to determine the affect of any changes. In addition, the MDEQ is beginning the process to re-evaluate the EGUs subject to BART under 40 CFR 51.302 requirements to determine if additional controls are required under BART.

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 MDEQ 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 effectiveness ($/ton)	Percent Emission Reductions from 2002 baseline in 2018		Percent Emission Reductions from 2002 baseline at full implementation		Energy	Solid waste produced (1000 tons/year)	Remaining Useful Life
CAIR and other cap-and-trade programs (e.g., Acid Rain, NOX SIP Call) for EGUs	$720 - $2,600	3-State SO2: NOX: 9-State SO2: NOX:	13% 75% 34% 79%	3-State SO2: NOX: 9-State SO2: 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 SO2: NOX:	10% 5%	9-State SO2: NOX:	10% 5%			
Highway vehicle programs	$1,300 - $2,300	3-State NOX: 9-State SO2:	83% 80%	3-State NOX: 9-State SO2:	83% 80%			
Nonroad mobile sources	($1,000) - $1,000	3-State NOX: 9-State SO2:	39% 27%	3-State NOX: 9-State SO2:	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 deciviews greater than those provided on the IMPROVE website.

[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: Baytte, 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% reduction in SO_2 limit and a 60% 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 MDEQ considers EGUs as the primary priority source, but is evaluating additional controls for ICI boilers, as well.

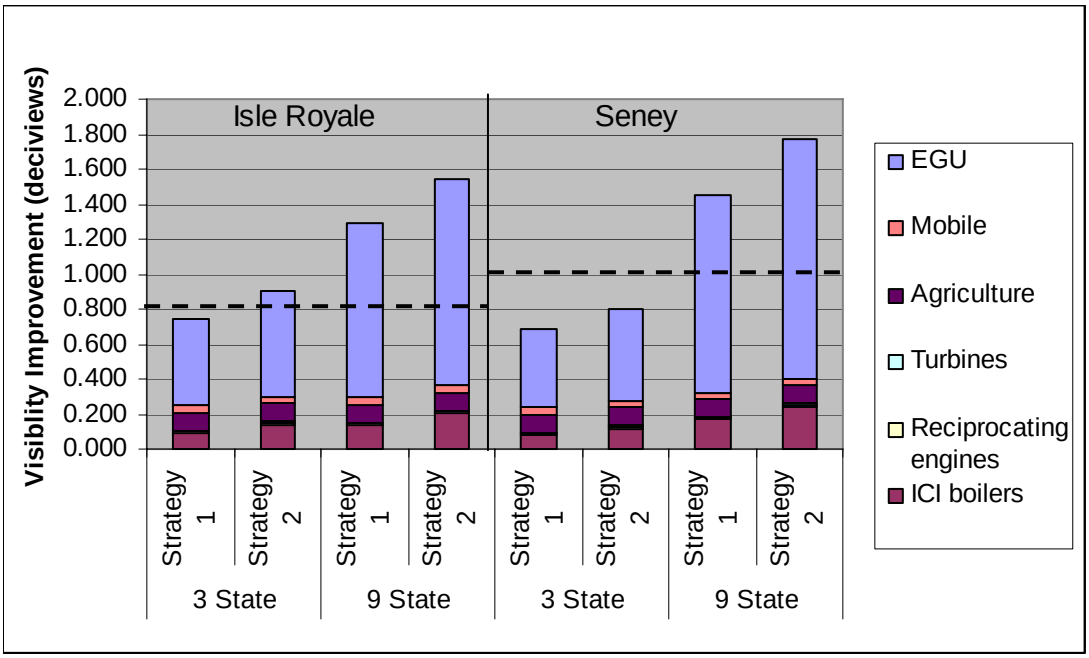


Figure 10.3.2.b: Source sector contribution to visibility improvement (deciviews) at Isle Royale and Seney on the 20 percent worst days for 2018 for possible additional control measures. Source: DEQ generated from Battye, 2007.

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.

In order 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 vacatur, EGU controls are very uncertain. The MDEQ will continue to evaluate EGU controls in light of the BART requirements in 40 CFR 51.302.

EGUs are clearly the top priority source category for control in order to realize significant visibility improvement at Michigan's two Class I areas. Until the recent court action vacating the CAIR rule, these EGUs were automatically presumed to be achieving reasonable emission reductions via the CAIR rule. With CAIR now in question, the MDEQ will conduct BART analyses on the affected EGUs and establish the appropriate level of control. Also, 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.

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 are therefore expected to install BART controls. Those ICI boilers that are not addressed by BART are likely to eventually be controlled further. The MDEQ and other LADCO states, along with a number of northeastern states, have been evaluating reasonable control levels for ICI boilers in the region. State rules or federal rules for these sources are likely to 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 MDEQ is currently working 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 10F).

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 MDEQ currently has a rule for large reciprocating engines. The MDEQ will review this sector in more detail in the future.

Mobile Source Emissions - There appear 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 MDEQ 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 MDEQ is not considering controls for this sector at this time.

Compare Control Strategies with Uniform Rate of Progress: At this time, the MDEQ can only identify the “on-the-books” controls (includes CAIR) as being a reasonable level of control for setting Michigan’s RPG. 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 MDEQ does believe, 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 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 MDEQ's long-term strategy, along with all currently known controls being applied by other states. However, several of these controls include CAIR controls that may not occur. As yet, the repercussions of the CAIR vacatur are still being determined.

10.5 Long-Term Strategy

40 CFR 51.308(d)(3) requires the MDEQ to submit a long-term strategy (LTS) 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 MDEQ meets the long-term strategy requirements.

10.5.1 Emission reductions due to ongoing air pollution programs

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

Clean Air Interstate Rule (CAIR)
Although CAIR was recently vacated by the courts, several EGUs in the region have already begun to install controls for CAIR. These controls that are or soon will be installed will likely be used even in the absence of CAIR. If the CAIR vacature remains in place, the MDEQ will evaluate BART controls for affected EGUs in the state. Such controls may result in emission reductions similar to those of CAIR for EGUs in Michigan and the region. The timing for CAIR controls are set in the CAIR rules. If

CAIR remains vacated, states will be on their own to set schedules for additional EGU controls. Every effort will be made to achieve at least CAIR-like reductions by the 2018 haze date.

Best Available Retrofit Technology (BART)
Six non-EGU sources in Michigan are subject to BART (see section 9 for details). The MDEQ is still in the process of determining what controls are BART. Two of Michigan's BART sources are taconite plants, similar to Minnesota. The MDEQ will continue to work with Minnesota in determining BART for those sources consistent with Minnesota's plan. Final BART determinations for Michigan's six non-EGUs will be completed in several months, and the sources will comply with appropriate BART timeframes in Michigan and EPA's BART rules.

The MDEQ had determined that CAIR=BART as provided for in EPA BART rules. However, due to the possible CAIR vacatur mandate, several EGU sources will be subject to BART analysis. The MDEQ is in the process of determining which EGU sources will be subject to BART and notifying the sources.

Because the BART work is on a different schedule than this SIP document, it will be submitted to EPA at a later date after appropriate public comment.

Other Federal Programs
The MDEQ 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

40 CFR 51.308(d)(3)(v)(C) requires the MDEQ 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 MDEQ believes that reasonable controls are "on-the-books" controls including BART for applicable EGUs if CAIR is not available. 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.

10.5.3 Measures to Mitigate the Impacts of Construction Activities

40 CFR 51.308(d)(3)(v)(B) requires the MDEQ 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 MDEQ'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 and Prevention of Significant Deterioration. 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 at the Class I areas.

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 MDEQ 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.

OC and 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. Organic carbon 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.

Organic carbon 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 organic carbon 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 from 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 a MRPO (2005a) 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.

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% worst days had a 0.2 deciview 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% 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 MDEQ 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. Emissions from prescribed and managed fires within Michigan will be managed in conformance with Michigan's Smoke Management Plan (SMP).

The Michigan Department of Natural Resources is currently developing a SMP similar to *EPA's Interim Air Quality Policy on Wildland and Prescribed Fires,* and will certify in a letter to the Administrator of the EPA that a basic program has been adopted and implemented. Special consideration will be given to minimizing air quality impacts resulting from fires managed for resource benefits.

10.5.6 Enforceability of Emission Limitations and Control Measures

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

The CAIR requirements have been adopted as state regulations. The BART controls will be required by a state rule that will be in effect in several weeks, and the limits and provisions of each sources BART determination will be made enforceable through consent orders, permits, or rules.

The state rulemaking that makes BART an applicable requirement for stationary sources will be included in the MDEQ's future BART SIP submittal.

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

CFR 51.308(d)(3)(v)(G) requires the MDEQ 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 is working on a Renewable Energy Portfolio, which will require 10% 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 MDEQ is developing state rules for mercury reductions from coal-fired EGUs. These rules will reduce mercury emissions throughout the state by 90% or approximately 2,000 lb/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 in order to conform to mercury removal controls. A second option is a multi pollutant strategy. This option would allow a 75% reduction for mercury as long as the project garners significant reductions in other pollutants with known adverse health affects such as oxides of nitrogen (NOx) and sulfur dioxide (SO_2).

$PM_{2.5}$ and Ozone SIPs

Michigan is not attaining the annual and 24-hour $PM_{2.5}$ NAAQS and the new ozone standard. Michigan and other surrounding states with similar nonattainment may need to make additional reductions in precursor pollutants or these pollutants in the future. Such control measures are not yet proposed or implemented but will likely further reduce haze by 2018. Some programs that will contribute to this effort have already been mentioned. The MDEQ along with LADCO and the northeast states are working on a proposal for ICI boilers to submit to EPA to make a federal rule or for a state/regional rule. The MDEQ also intends to further investigate control measures that were shown by the ECR report to be potentially reasonable under the four factors.

Greenhouse Gas Programs

Michigan has created the Climate Action Council that is currently engaged in determining what actions the state should take in response to global climate change. Although any measures undertaken as a result of this process 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 two scenarios depicted as "LADCO Scenario B" and "LADCO Scenario C with BART for EGUs" may more accurately reflect the level of control for determining the RPG. This will be further clarified in the next several months as the MDEQ and other LADCO states settle on BART controls for EGUs and non-EGUs, and as additional court or Congressional actions regarding CAIR occur.

Table 10.6.a: Reasonable Progress Goals for 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
LADCO Scenario C with BART for EGUs					
Isle Royale	20.18	6.66	0.10	6.04	2096
Seney	22.36	7.80	0.14	8.66	2085

Source: MDEQ
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. LADCO Scenario C with BART for EGUs reflects on the book controls with CAIR-like controls on many formerly CAIR-subject EGUs based on utilities pre-vacature planning.

In terms of the URP, 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 MDEQ 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 in the future. The MDEQ believes that the RPG set in this SIP meets the provisions of the haze rule, 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.

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

40 CFR 51.308(f) requires a state to revise its regional haze implementation plan and submit a plan revision to the EPA by July 31, 2018 and every 10 years thereafter. In accordance with these requirements of the regional haze rule, the MDEQ commits to revising and submitting this regional haze implementation plan by July 31, 2018 and every 10 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 51.308(g) of the federal rule for regional haze, the MDEQ commits to submitting 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 51.308(g) will be addressed in the SIP revision for reasonable progress.

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

In addition, the MDEQ 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
Complete BART emission limit determinations for non-EGU BART-subject facilities	MDEQ
Incorporate non-EGU BART emission limits into facility permits, orders	MDEQ
Determine BART controls for EGUs if CAIR vacatur is mandated, incorporate in facility permits, orders	MDEQ, MRPO, EPA
Track emission changes in Michigan and in other states contributing to Michigan Class I areas	MDEQ Other states

The MDEQ 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 MDEQ will undertake an emission review in order to determine if the emission reductions projected to occur through the application of BART, CAIR (or a CAIR substitute), the Mercury Rule, and the other components of the MDEQ'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 MDEQ 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 MDEQ determines that the existing SIP requires no further substantive revision in order to achieve established goals, the MDEQ would provide to the Administrator a negative declaration that further revision of the SIP is needed at this time. The Class I areas monitoring data is on track or lower than the MDEQ's RPG, based on MRPO's modeling for 2012 no revision would be necessary.

2. If the MDEQ 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 MDEQ would notify the Administrator and the states that participated in regional planning. The MDEQ would collaborate with states through the regional planning process, as resources allow, to address the SIP's deficiencies. (Funding for RPO activities has been proposed for elimination; if this situation remains, there will be limited collaboration among states.)

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

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

12 References

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