OFFICE OF THE GOVERNOR
STATE OF MONTANA

STEVE BULLOCK
GOVERNOR

MIKE COONEY
LT. GOVERNOR

November 7, 2017

Doug Benevento
Regional Administrator
United States Environmental Protection Agency
Region VIII, 8P-AR
1595 Wynkoop Street
Denver, Colorado 80202-1129

RE: Montana State Implementation Plan Action – Protection of Visibility

Dear Mr. Benevento:

For your consideration, this submittal contains a proposed action regarding the Montana State Implementation Plan (SIP) for protection of visibility. The Montana Department of Environmental Quality (Department) has worked closely with the Environmental Protection Agency (EPA) Region 8 staff in the development of the proposed SIP action.

The submittal addresses 40 CFR §51.308(g) concerning periodic progress reports for the Regional Haze program. The 1999 Regional Haze Rule required states to submit SIPs to reduce sources of haze and protect visibility at mandatory federal Class I areas. The Rule also called for periodic reports on progress at five-year intervals following approval of a SIP. As you know, in 2006 the State of Montana declined to submit a Regional Haze SIP, resulting in the publication of a Montana Regional Haze Federal Implementation Plan (Montana FIP) effective October 18, 2012. Since that time, EPA has administered the Regional Haze program as it applies to several of Montana's large industrial sources and power plants. In accordance with the five-year schedule, a periodic progress report on the Montana FIP is due this fall. In communication with EPA Region 8, and in preparation to gain state authority for the Regional Haze program in the near future, Montana elected to prepare the periodic progress report.

The information contained in the attachment and proposed for incorporation into the SIP was published for a 30-day public comment period ending on September 22, 2017. One favorable public comment was received. In addition, on July 12, 2017, the Department notified Federal Land Managers of the opportunity for consultation on the attached document. The Department received supportive comments from the National Park Service and informal comments from the U.S. Fish and Wildlife Service regarding the need for additional analysis of visibility impacts from oil and gas development. Copies of all comments are included in this submittal.

STATE CAPITOL • P.O. BOX 200801 • HELENA, MONTANA 59620-0801
TELEPHONE: 406-444-3111 • FAX: 406-444-5529 • WEBSITE: WWW.MT.GOV

Should you have any questions regarding this action, please contact Rebecca Harbage, the Department's Regional Haze Project Manager, by telephone at (406) 444-1472 or by email at rharbage@mt.gov.

Sincerely,

STEVE BULLOCK
Governor

Enc.

cc: Monica Morales, Director, Air Program, USEPA Region 8
Scott Jackson, Chief, Air Quality Planning Unit, USEPA Region 8
Tom Livers, Director, Montana Department of Environmental Quality (DEQ)
David L. Klemp, Air Quality Bureau Chief, Montana DEQ

STATE OF MONTANA

RECORD

State Implementation Plan Requirements for Protection of Visibility

Date of Governor Signature:

November 7, 2017

STATE OF MONTANA

REGIONAL HAZE 5-YEAR PROGRESS REPORT

DEQ
Montana Department of Environmental Quality

SEPTEMBER 2017

Table of Contents

EXECUTIVE SUMMARY i
CHAPTER 1. INTRODUCTION 1-1
CHAPTER 2. STATUS OF IMPLEMENTATION OF CONTROL MEASURES 2-1
2.1. MONTANA'S BART & REASONABLE PROGRESS MEASURES 2-1
2.1.1. Colstrip Steam Electric Station Units 1 and 2 2-5
2.1.2. JE Corette 2-5
2.1.3. Ash Grove Cement 2-5
2.1.4. Oldcastle Cement 2-6
2.1.5. Blaine County #1 Compressor Station 2-7
2.1.6. Improvements at Other Sources Referenced in the Montana FIP 2-7
2.2. ADJACENT STATES' BART IMPLEMENTATION 2-8
2.2.1. Idaho 2-8
2.2.2. North Dakota 2-9
2.2.3. Oregon 2-9
2.2.4. South Dakota 2-9
2.2.5. Wyoming 2-10
2.3. STATE & FEDERAL PROGRAMS RELIED ON IN THE MONTANA FIP 2-10
2.3.1. Minor Source Permitting Program 2-10
2.3.2. Prevention of Significant Deterioration 2-11
2.3.3. New Source Performance Standards – 40 CFR Part 60 and National Emission Standards for Hazardous Air Pollutants – 40 CFR Part 63 2-11
2.3.4. Montana Smoke Management Program 2-12
2.3.5. National Petroleum Refinery Initiative 2-12
2.3.6. Federal Mobile Source Regulations 2-13
2.4. ADDITIONAL FEDERAL MEASURES 2-13
2.4.1. Mercury and Air Toxics Rule 2-13
2.4.2. Revised National Ambient Air Quality Standards 2-15
2.5. ADDITIONAL STATE MEASURES 2-17
2.5.1. Closure/Cancellations & Derating 2-17
2.5.2. Montana Renewable Portfolio Standard 2-17
2.5.3. State Implementation Plans 2-18
2.6. CONCLUSION 2-19
CHAPTER 3. CHANGES IN EMISSIONS OF VISIBILITY-IMPAIRING POLLUTANTS 3-1
3.1. EMISSION REDUCTIONS RESULTING FROM CONTROLS IN THE FEDERAL IMPLEMENTATION PLAN 3-2
3.1.1. Emissions Reductions at BART Facilities 3-2
3.2. EMISSIONS CHANGES BETWEEN THE BASELINE AND PROGRESS PERIODS, BY SOURCE CATEGORY 3-5
3.2.1. Oxides of Nitrogen 3-5
3.2.2. Oxides of Sulfur 3-7
3.2.3. Particulate Matter – Coarse and Fine 3-8
3.3. STATEWIDE EMISSION TRENDS 3-9
3.4. ADDITIONAL REDUCTIONS IN ANTHROPOGENIC EMISSIONS 3-11
3.5. CONCLUSION 3-14
CHAPTER 4. VISIBILITY CONDITIONS AND TRENDS 4-1
4.1. IMPROVE MONITORING NETWORK 4-1
4.1.1. Data Completeness 4-2
4.1.2. Review of State's Monitoring Strategy 4-3

4.2. Assessment of Visibility Conditions at IMPROVE Sites 4-4
4.3. Analysis of Wildfire Contribution 4-8
4.3.1. Impacts of Wildfire Contribution on Worst Visibility Days 4-8
4.3.2. Visualizing Wildfire Impacts in Montana 4-10
4.4. Conclusion 4-12
CHAPTER 5. SIGNIFICANT CHANGES IN ANTHROPOGENIC EMISSIONS POSSIBLY IMPEDING PROGRESS 5-1
5.1. Incomplete Implementation of BART Controls 5-1
5.1.1. Oldcastle Cement 5-1
5.1.2. Colstrip Units 1 and 2 5-2
5.1.3. Comparison of Reported Emissions to Projected Emissions 5-2
5.2. Oil & Gas Development in Montana, North Dakota, and Wyoming 5-4
5.2.1. Montana 5-4
5.2.2. North Dakota 5-5
5.2.3. Wyoming 5-6
5.3. Emissions from International Sources 5-8
5.3.1. Analysis of Weather Patterns 5-8
5.3.2. Analysis of Nearby Canadian Sources 5-12
5.3.3. Contribution to Light Extinction at Medicine Lake 5-17
5.4. Conclusion 5-20
CHAPTER 6. ASSESSMENT OF CURRENT STRATEGY 6-1
6.1. Visibility has Improved at all Sites on the Best Days 6-1
6.2. Anthropogenic Components have Decreased 6-2
6.3. Visibility has Not Improved at most Sites on the Worst Days 6-3
6.4. Natural Fires are Driving Impairment on the Worst Days 6-4
6.5. Wildfires Obscure Reductions in Anthropogenic Impacts 6-5
6.6. Anthropogenic Emissions will Continue to Decrease 6-7
6.7. Visibility Impacts from International Sources 6-7
6.8. Conclusion: Determination of Adequacy 6-8
APPENDIX A. MONTANA SMOKE MANAGEMENT PLAN A-1
APPENDIX B. EMISSION INVENTORY DETAIL B-1
APPENDIX C. DETAILED VISIBILITY ANALYSIS C-1
APPENDIX D. DOCUMENTATION OF FEDERAL LAND MANAGER CONSULTATION & PUBLIC NOTICE PROCESS D-1

Crosswalk with 51.308(g) Requirements

Title 40 of the Code of Federal Regulations Part 51, subpart P addresses the requirements for Protection of Visibility. This document is intended to meet the requirements of 40 CFR 51.308(g)(1)-(7), (h), and the associated requirements for Federal Land Manager consultation and public notice. The following table shows the page at which this report begins to address each requirement.

(g)(1) A description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for mandatory Class I Federal areas both within and outside the State.	2-1
(g)(2) A summary of the emissions reductions achieved throughout the State through implementation of the measures described in paragraph (g)(1) of this section.	3-1
(g)(3) For each mandatory Class I Federal area within the State, the State must assess the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of 5-year averages of these annual values. (i) The current visibility conditions for the most impaired and least impaired days; (ii) The difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions; (iii) The change in visibility impairment for the most impaired and least impaired days over the past 5 years;	4-1
(g)(4) An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.	3-1
(g)(5) An assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility.	5-1
(g)(6) An assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Federal Class I areas affected by emissions from the State, to meet all established reasonable progress goals.	6-1
(g)(7) A review of the State's visibility monitoring strategy and any modifications to the strategy as necessary.	4-3
(h) *Determination of the adequacy of existing implementation plan.* At the same time the State is required to submit any 5-year progress report to EPA in accordance with paragraph (g) of this section, the State must also take one of the following actions based upon the information presented in the progress report: (1) If the State determines that the existing implementation plan requires no further substantive revision at this time in order to achieve established goals for visibility improvement and emissions reductions, the State must provide to the Administrator a negative declaration that further revision of the existing implementation plan is not needed at this time. (2) If the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another State(s) which participated in a regional planning process, the State must provide notification to the Administrator and to the other State(s) which participated in the regional planning process with the States. The State must also collaborate with the other State(s) through the regional planning process for the purpose of developing additional strategies to address the plan's deficiencies. (3) Where the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another country, the State shall provide notification, along with available information, to the Administrator. (4) Where the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources within the State, the State shall revise its implementation plan to address the plan's deficiencies within one year.	6-8
Documentation of Federal Land Manager Consultation & Public Notice	D-1

List of Tables

Table 2-1. List of BART-Eligible Sources in Montana....2-2
Table 2-2. Montana BART Controls and Current Status....2-4
Table 2-3. New and Proposed Renewable Generation in Montana as of November 2016....2-18
Table 2-4. Existing Montana Nonattainment Areas....2-19
Table 3-1. Emission Source Categories....3-1
Table 3-2. NO_x Emission Changes....3-6
Table 3-3. SO_x Emission Changes....3-7
Table 3-4. Coarse Particulate Matter Emission Changes....3-8
Table 3-5. Fine Particulate Matter Emission Changes....3-9
Table 3-6. NEI Tier 1 Categories....3-10
Table 3-7. Emissions Reductions from 2018 Projected Inventory (tons per year)....3-12
Table 4-1. Representative IMPROVE Monitoring Sites....4-2
Table 4-2. Contribution to Current Light Extinction (2011-2015)....4-5
Table 4-3. Change in Visibility between Baseline and Current Conditions....4-6
Table 5-1. Canadian Facilities Emitting >150 tpy of SOx, near the MT Border....5-17
Table 6-1. Visibility Changes on 20% Best Days....6-1
Table 6-2. Visibility Changes on 20% Worst Days....6-4

List of Figures

Figure 1-1. Mandatory Federal Class I Areas 1-1
Figure 1-2. Visibility in Glacier National Park 1-3
Figure 1-3. IMPROVE Monitoring Sites 1-4
Figure 2-1. Map of Montana BART-Eligible Sources 2-2
Figure 3-1. NO_x Emissions Changes at BART Sources - EGUs 3-3
Figure 3-2. SO_2 Emissions Changes at BART Sources - EGUs 3-3
Figure 3-3. $PM_{2.5}$ Emissions Changes at BART Sources - EGUs 3-3
Figure 3-4. NO_x Emissions Changes at BART Sources – Cement Kilns 3-4
Figure 3-5. SO_2 Emissions Changes at BART Sources – Cement Kilns 3-4
Figure 3-6. $PM_{2.5}$ Emissions Changes at BART Sources – Cement Kilns 3-4
Figure 3-7. NO_x, SO_2 and $PM_{2.5}$ PRI emissions in Montana, including biogenics and misc. tiers 3-11
Figure 3-8. NO_x, SO_2 and $PM_{2.5}$ PRI emissions in Montana, removing biogenics and misc. tiers 3-11
Figure 3-9. Emission Reductions Attributable to Changes in Projected Inventory 3-13
Figure 4-1. Montana IMPROVE Monitor Locations 4-1
Figure 4-2. Measured Visibility and Expected Rate of Progress at Each IMPROVE Site 4-7
Figure 4-3. Annual average contribution on the 20% worst days - Monture IMPROVE site 4-8
Figure 4-4. Total Flagged Monitored Days by Year 4-9
Figure 4-5. Light Extinction on 20% Haziest Days – Monture, MT – 2015 4-9
Figure 4-6. Wildfire Activity as Seen on Satellite Imagery on August 20, 2015 4-10
Figure 4-7. Wildfire Activity as Seen on Satellite Imagery on August 27, 2015 4-11
Figure 4-8. Webcam on August 20, 2015, in Butte, Montana 4-12
Figure 4-9. Webcam in the Bitterroot Valley, Montana, on smoky and clear days 4-12
Figure 5-1. NO_x Reported vs. Projected Emissions at BART Sources 5-3
Figure 5-2. SO_2 Reported vs. Projected Emissions at BART Sources 5-3
Figure 5-3. $PM_{2.5}$ Reported vs. Projected Emissions at BART Sources 5-4
Figure 5-4. Changes in Montana Oil & Gas Production 5-5
Figure 5-5. Changes in North Dakota Oil & Gas Production 5-5
Figure 5-6. Changes in Wyoming Oil & Gas Production 5-6
Figure 5-7. Change in Oil & Gas Production – Baseline to Current 5-6
Figure 5-8. Map of Oil & Gas Infrastructure in Montana & North Dakota 5-7
Figure 5-9. Wind Direction and Speed in Sidney, MT from 2010-2016 5-10
Figure 5-10. Wind direction and Speed in Sidney, MT by Season from 2010-2016 5-11
Figure 5-11. Smoke movement detected on Satellite on May 17, 2016 5-12
Figure 5-12. Baseline Regional Contribution to Sulfate at Medicine Lake 5-13
Figure 5-13. Baseline Regional Contribution to Nitrate at Medicine Lake 5-13
Figure 5-14. Relative SOx Emissions by Facility - Canada 5-14
Figure 5-15. Relative NO_x Emissions by Facility - Canada 5-14
Figure 5-16. Relative PM EMISSIONS by Facility - Canada 5-15
Figure 5-17. Nitrogen Oxide Emissions (tonnes), 2005-2014 – Poplar River 5-16

Figure 5-18. Sulfur Oxide Emissions (tonnes), 2005-2014 – Poplar River 5-16
Figure 5-19. Distribution of Worst Days (2011-2015).....5-18
Figure 5-20. 2011 Light Extinction on 20% Worst Days at MELA1.....5-19
Figure 5-21. 2015 Light Extinction on 20% Worst Days at MELA1.....5-19
Figure 6-1. Trends in SOx Contribution to Light Extinction 6-2
Figure 6-2. Trends in NO_x Contribution to Light Extinction.....6-3
Figure 6-3. Trends in Carbon Contribution to Light Extinction.....6-5
Figure 6-4. Contribution to Light Extinction on the 20% Best Days 6-6
Figure 6-5. Contribution to Light Extinction on the 20% Worst Days.....6-7

List of Acronyms

The following acronyms and abbreviations are used throughout the report and appendices.

µg/m3	**Micrograms per Cubic Meter**
µm	**Micron (Micrometer)**
ARM	**Administrative Rules of Montana**
BACT	**Best Available Control Technology**
BART	**Best Available Retrofit Technology**
bbls	**Barrels**
Bext	**Light Extinction Coefficient**
CAA	**Clean Air Act**
CAMD	**Clean Air Markets Division**
CAMR	**Clean Air Mercury Rule**
CEMS	**Continuous Emission Monitoring Systems**
CFR	**Code of Federal Regulations**
dv	**Deciview**
EC	**Elemental Carbon**
EE	**Exceptional Events**
EGU	**Electric Generating Unit**
EPA	**United States Environmental Protection Agency**
FIP	**Federal Implementation Plan**
hr	**Hour**
IMPROVE	**Interagency Monitoring of Protected Visual Environments**
in	**Inches**
km	**Kilometers**
lb	**Pounds**
LMP	**Limited Maintenance Plan**
LNB	**Low-NOx Burners**
MACT	**Maximum Achievable Control Technology**
MAQP	**Montana Air Quality Permit**
MATS	**Mercury and Air Toxics Standards**
MCF	**Million Cubic Feet**
mm	**Millimetres**
Mm-1	**Inverse Million Meters**
MM5	**Mesoscale Model 5**
mmBtu	**Million British Thermal Units**
MOBILE6	**Mobile Source Emission Factor Model, version 6**
Montana FIP	**Montana's Federal Implementation Plan**
MOVES	**Motor Vehicle Emissions Simulator**
MT	**Montana**
MW	**Megawatts**
NAAQS	**National Ambient Air Quality Standards**

NEI	**National Emission Inventory**
NH_3	**Ammonia**
NO_2	**Nitrogen Dioxide**
NO_x	**Nitrogen Oxides**
NSCR	**Nonselective Catalytic Reduction**
NSPS	**New Source Performance Standards**
NSR	**New Source Review**
O&G	**Oil and Gas**
OMC	**Organic Carbon**
Plan02d	**Typical-Year Baseline Inventory (Final Revision)**
PM	**Particulate Matter**
PM_{10}	**Particulate with a Diameter of 10 or Smaller µm**
$PM_{2.5}$	**Particulate with a Diameter of 2.5 or Smaller µm**
PMC	**Coarse Mass**
POA	**Primary Organic Aerosol**
POM	**Particulate Organic Matter**
ppb	**Parts per Billion**
ppm	**Parts per Million**
PRP18b	**Preliminary Reasonable Progress Inventory for 2018 (2nd Revision)**
PSD	**Prevention of Significant Deterioration**
Q/D	**Emissions (in tons)/Distance**
RHR	**Regional Haze Rule**
RPG	**Reasonable Progress Goal**
RPS	**Renewable Portfolio Standard**
SCC	**Standard Classification Code**
SCR	**Selective Catalytic Reduction**
SIP	**State Implementation Plan**
SMP	**Smoke Management Plan**
SNCR	**Selective Noncatalytic Reduction**
SO_2	**Sulfur Dioxide**
SOFA	**Separated Over-Fire Air**
SO_x	**Sulfur Oxides**
TBtu	**Trillion British Thermal Units**
TSS	**Technical Support System**
VOCs	**Volatile Organic Compounds**
WESTAR	**Western States Air Resources Council**
WRAP	**Western Regional Air Partnership**

EXECUTIVE SUMMARY

This document is intended to meet the requirements of the Regional Haze Rule (RHR) – codified in Title 40 of the Code of Federal Regulations (CFR), Part 51.308 – for a periodic progress report. The RHR requires that the following items be included in a progress report:

- The status of implementation of control measures included in the original plan (Montana FIP);
- The emissions reductions achieved through implementing control measures;
- An assessment of visibility conditions and changes;
- An analysis of emission trends;
- An assessment of any changes impeding visibility progress;
- An assessment of whether the current strategy is sufficient to meet the Reasonable Progress Goals (RPGs); and
- A review of the visibility monitoring strategy.[1]

This document evaluates visibility progress in Montana since the baseline years of 2000-2004 and, more specifically, progress since the Montana FIP was published in 2012. It provides a 5-year update on the current status of visibility at the Class I Areas affected by emissions from Montana sources of air pollution, describes statewide emissions reductions, and concludes with a determination that the Montana FIP is adequate and does not require substantive revision at this time in order to achieve established visibility goals.

To do so, this progress report relies on monitoring data collected from the IMPROVE (Interagency Monitoring of Protected Visual Environments) network, which is designed to measure visibility at each of Montana's Class I Areas. Additionally, Montana relied on data from the Western Regional Air Partnership (WRAP) Technical Support System (TSS) for summaries and analyses of comprehensive emissions and modeling datasets to help describe visibility progress in Montana.

Key Findings

The data and analysis included in this report support several conclusions about visibility progress in Montana. **Overall, visibility on the clearest days in a given year has improved at all Class I Areas in the state.** This is because, in Montana, these clear days are primarily affected only by very low levels of haze caused by manmade air pollution and, as described in this report, emissions of visibility-impairing pollutants have decreased over time. This assessment points to the conclusion that the strategies in the Montana FIP targeting reductions of manmade emissions have been successful at improving visibility.

On the other hand, visibility on the haziest days in a given year has worsened at all but two of Montana's Class I Areas. Analysis shows that, in Montana, the haziest days are primarily caused by wildfire activity both in and outside the state. At most Class I Areas in Montana, these haziest days usually

[1] EPA, 40 CFR § 51.308(g) (2016). Code of Federal Regulations references can be obtained from the following link: https://www.gpo.gov/fdsys/browse/collectionCfr.action?selectedYearFrom=2016&go=Go.

occur during wildfire season in the summer and fall when air monitors record high variability of organic and elemental carbon particles in the air. Wildfire activity is considered natural and is not something the state can control with regulatory measures or technology.

By contrast, the measured contribution to haze that is associated with manmade pollutants, like sulfates and nitrates, has decreased at all but one Class I Area on these same poor visibility days. In other words, although visibility on the haziest days has worsened over time, monitoring data suggests that this is due to increasing natural wildfire events and not increasing manmade air pollution. Indeed, this conclusion reflects the same general downward trend in manmade emissions that has contributed to visibility improvement on the clearest days.

This report also discusses the effects of international emissions on some of the state's Class I Areas. **Particularly in northeastern Montana, weather patterns at certain times of the year can bring pollution from Canadian facilities into the state.** This has been documented during spring wildfire events in Canada, when smoke has traveled over Montana, affecting particulate levels and visibility. For this reason, because the strategies in the Montana FIP can only focus on emissions from sources in Montana and the United States, they may not be adequate to improve visibility at the Class I Areas downwind of Canadian emissions.

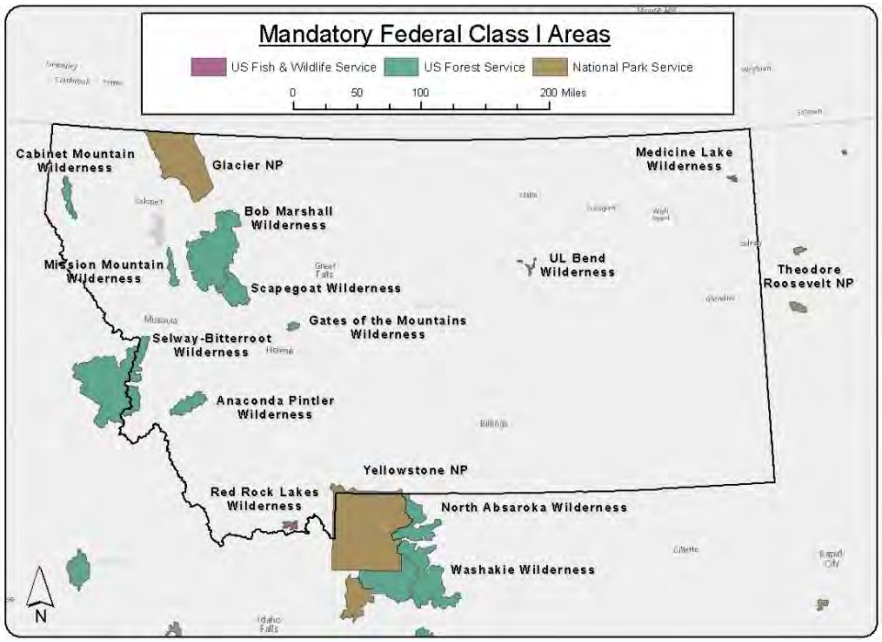
Ultimately, the findings in this progress report support the conclusion that the control strategies in the Montana FIP have been effective at decreasing visibility impacts from manmade emissions. Emission reductions resulting from the Montana FIP, *plus* additional emission reductions at Montana sources unrelated to the RHR, together have resulted in measured decreases in sulfates and nitrates at Class I Areas. Unfortunately, the increasing unpredictable impacts from wildfire activity mask any perceptible improvements in visibility that may result from reductions in manmade emissions. Recent revisions to the RHR may help account for the uncontrollable impact of wildfire smoke in future plan revisions.

Chapter 1. INTRODUCTION

On most days, in many parts of the country, any time of the year, how far you can see is affected by air pollution that can obscure views of mountain ranges and scenic vistas. Here in Montana, we have some of the oldest and most treasured national parks and wilderness areas in the nation. However, a wonderful experience in Glacier National Park can be negatively affected by hazy skies. Haze, caused by emissions of air pollution, can have a serious impact on one of our most valuable assets – our big skies. As the Big Sky State, Montana's scenery is a resource that is enjoyed and valued not only by Montanans, but also by the millions of tourists who visit every year, supporting the state's economy.

The 1977 amendments to the Clean Air Act (CAA) recognized the importance of reducing haze and protecting visibility in national parks and wilderness areas. Through the amendments, Congress established 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 manmade air pollution."[2] To achieve that goal, the United States Environmental Protection Agency (EPA) developed the Regional Haze Rule (RHR) in the late 1990s.[3] The RHR requires the protection of visibility in 156 mandatory federal Class I Areas across the United States. In Montana, there are 12 mandatory federal Class I Areas as shown in the map in Figure 1-1.[4]

FIGURE 1-1. MANDATORY FEDERAL CLASS I AREAS



[2] 1977 Federal Clean Air Act Amendments, Section 169A Visibility Protection for Federal Class I Areas (7 Aug. 1977), https://www.govtrack.us/congress/bills/95/hr6161/text/enr.
[3] The Regional Haze Rule is codified in Part 51, Section 308, of Title 40 of the Code of Federal Regulations (CFR).
[4] Where this report uses the term Class I Area, it is referring to a mandatory federal Class I Area, as described here and identified at 40 CFR Part 81, Subpart D, https://www.gpo.gov/fdsys/pkg/CFR-2016-title40-vol20/xml/CFR-2016-title40-vol20-part81-subpartD.xml.

History of the Regional Haze Rule in Montana

The primary purpose of the RHR is to reduce or eliminate manmade impairment of visibility at the 156 Class I Areas, working toward a goal of natural visibility conditions by 2064. To do so, the RHR requires that states develop State Implementation Plans (SIPs) containing strategies to control emissions of air pollutants that contribute to haze. In 2006, for a variety of reasons including available funding and staff resources, Montana declined to submit a SIP by the prescribed due date.[5] In response, on September 18, 2012, EPA finalized a Federal Implementation Plan (Montana FIP), thereby taking the lead on controlling haze in Montana.[6]

The Montana FIP described visibility conditions at each Class I Area in Montana for the baseline years of 2000-2004 and established a long-term strategy, to be implemented over the ten-year period ending in 2018, toward the ultimate goal of achieving natural visibility conditions. The Montana FIP also included visibility progress goals that each Class I Area was expected to achieve by 2018, referred to as Reasonable Progress Goals (RPGs). The RPGs are interim visibility improvement benchmarks on a path toward the long-term goal of natural conditions. Achievement of the RPGs relies on control measures to improve visibility, including existing federal and state air pollution control programs, as well as the installation of new retrofit controls on some older sources of air pollution. Because Montana did not submit a SIP, EPA performed the necessary analysis to determine what types of controls to include in the Montana FIP.

In June 2016, Montana Governor Steve Bullock released his blueprint for Montana's Energy Future. The blueprint "charts a course for the future that not only seeks to protect existing jobs in the coal industry, but also embraces the promise of new jobs in renewable energy, energy efficiency, and developing technologies to more cleanly and efficiently produce energy from fossil fuels."[7] This means ensuring that Montana controls the fate of the energy industry within the state, both for existing and potential new energy producers. As the state seeks to protect its scenic vistas for recreation, personal enjoyment, and tourism, it must also consider the potential impacts that decisions and regulations may have on the industries that support Montana's economy and residents. For this reason, the Governor's blueprint directs the state to take over authority for the Regional Haze program.

At this time, Montana intends to assume responsibility for the Regional Haze program by submitting a SIP revision when it is due for the ten-year period following 2018. Under current rule, the SIP revision is due to EPA by July 31, 2021. In the meantime, the state is taking this opportunity to become acquainted with visibility conditions and the RHR by providing EPA with a progress report. Submitting this progress report does not change the ownership of the program, and the Montana FIP will remain in place under

---

[5] Montana did submit limited SIP revisions regarding visibility, including a Smoke Management Plan (SMP), to satisfy that portion of the RHR and retain control of the SMP in our state.

[6] Environmental Protection Agency (EPA), Approval and Promulgation of Implementation Plans; State of Montana; State Implementation Plan and Regional Haze Federal Implementation Plan, 77 Fed. Reg. 57863 (18 Sep. 2012), https://www.federalregister.gov/d/2012-20918.

[7] State of Montana, "Montana Energy Future" (21 Jun. 2016), https://governor.mt.gov/Newsroom/governor-bullock-releases-blueprint-for-montanas-energy-future.

EPA's enforcement authority until such time that Montana submits and EPA approves a SIP to take its place.

Visibility Background

Haze is caused by the presence of tiny particles in the air that block, absorb, and scatter sunlight. The more particles are present, the more light is scattered, and the less clearly we are able to see. We call this diminished clarity haze. Haze obscures the color, texture, and form of objects that we are able to see at a distance. Just look at the difference between the pictures below. All three photographs were taken at Lake McDonald in Glacier National Park.

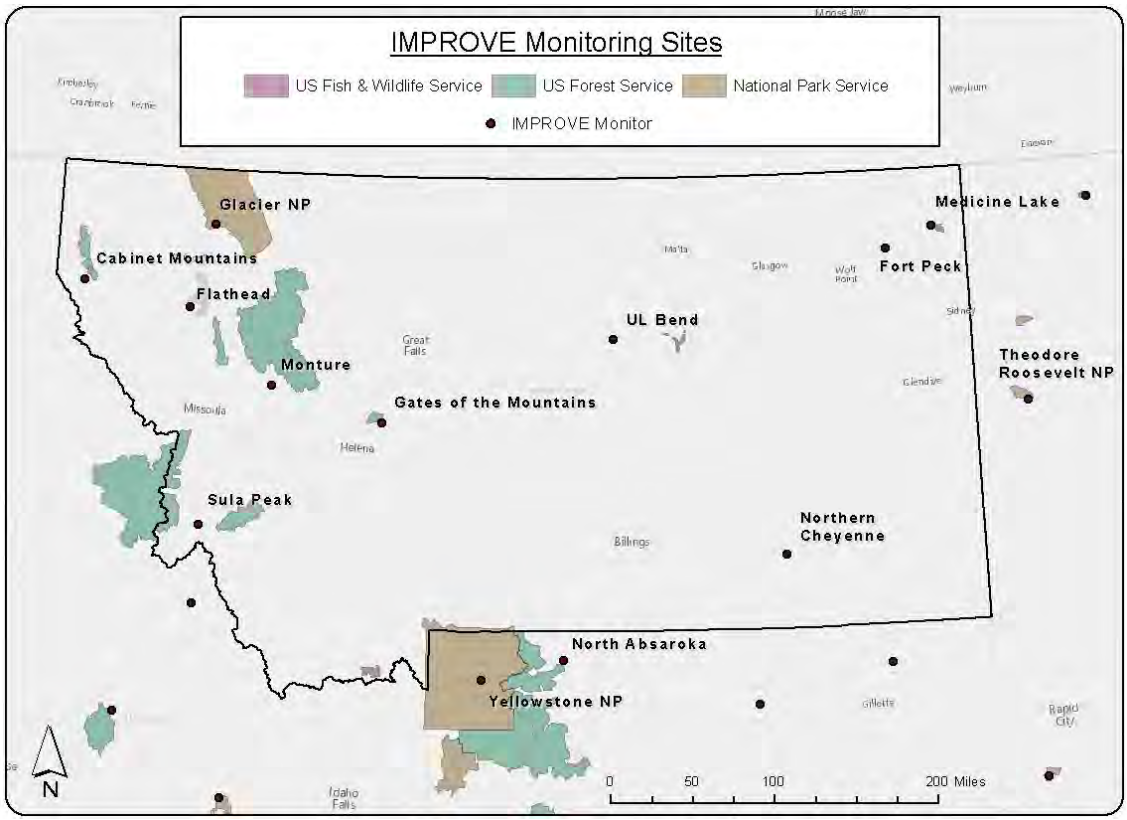
FIGURE 1-2. VISIBILITY IN GLACIER NATIONAL PARK

The picture on the left shows a day with relatively good visibility. Not much haze obscures the color and texture of the mountains in the distance. The picture in the middle is a bit hazier, with less texture visible on the mountains. On the right, the mountains are completely obscured by smoke from wildfires. Smoke is made up of several different types of fine particles that contribute to haze. Wildfire smoke is just one source of haze in Montana. Haze is also caused by emissions from activities such as electric power generation, industrial and manufacturing processes, motor vehicle emissions, burning related to forestry and agriculture, and construction activities.

Emissions from these activities generally span broad geographic areas and can be transported great distances in the air, sometimes hundreds or thousands of miles. Therefore, one single source of emissions may not have a visible impact on haze by itself, but emissions from many sources across a region can add up to cause haziness. That's why we call it "Regional Haze."

Visibility is measured by an air-monitoring network called Interagency Monitoring of Protected Visual Environments or IMPROVE, which comprises 110 sites across the nation, ten of which are located in Montana. IMPROVE sites contain equipment that samples the air and tests it for various pollutants and trace metals and calculates the light scatter effect of each pollutant. The main metric describing visibility impairment is the deciview, in which a lower value indicates visibility over a greater distance. The IMPROVE locations in Montana are shown relative to Class I Areas in Figure 1-3.

FIGURE 1-3. IMPROVE MONITORING SITES



The emissions that affect visibility are varied and complex, and come from a number of anthropogenic and natural sources. Emissions from large industrial sources can be measured directly through stack tests that measure specific species that are directly emitted from the stack, whereas other source categories, such as mobile emissions from motor vehicles or emissions from fires, are estimated and modeled. The visibility-impairing pollutants discussed in this report include: Sulfur dioxide (SO_2), Nitrogen Oxides (NO_x), Ammonia (NH_3), Volatile Organic Compounds (VOCs), Primary Organic Aerosol (POA), Elemental Carbon (EC), Fine Soil, and Coarse Mass (PMC). More information on these pollutants and their major sources is included in the following table.

Visibility-Impairing Pollutants and their Sources[8]

Emitted Pollutant	Major Sources	Notes
Sulfur Dioxide (SO_2)	Point Sources; On- and Offroad Mobile Sources	SO_2 emissions are generally associated with anthropogenic sources such as coal-burning power plants, other industrial sources such as refineries and cement plants, and diesel engines (both on- and offroad).
Oxides of Nitrogen (NO_X)	On- and Offroad Mobile Sources; Point Sources; Area Sources	NO_X emissions are generally associated with anthropogenic sources. Common sources include virtually all combustion activities, especially those involving cars, trucks, power plants, and other industrial processes.
Ammonia (NH_3)	Area Sources; Onroad Mobile Sources	Gaseous NH_3 has significant effects on particle formation because it can form particulate ammonium. Ammonium affects formation potential of ammonium sulfate and ammonium nitrate. All measured nitrate and sulfate is assumed to be associated with ammonium for reporting purposes.
Volatile Organic Compounds (VOCs)	Biogenic Sources; Mobile Sources; Area Sources	VOCs are gaseous emissions of carbon compounds, which are often converted to POM through chemical reactions in the atmosphere.
Primary Organic Aerosol (POA)	Wildfires; Area Sources	POA represents organic aerosols that are emitted directly as particles, as opposed to gases. Wildfires in the west generally dominate POA emissions. Large wildfire events are generally sporadic and highly variable from year-to-year.
Elemental Carbon (EC)	Wildfires; On- and Offroad Mobile Sources	Large EC events are often associated with large POM events during wildfires. Other sources include both on- and off-road diesel engines.
Fine soil	Windblown Dust; Fugitive Dust; Road Dust; Area Sources	Fine soil is reported here as the crustal or soil components of $PM_{2.5}$ (particulate with a diameter of 2.5 or smaller μm).
Coarse Mass (PMC)	Windblown Dust; Fugitive Dust	Coarse mass is reported by the IMPROVE Network as the difference between PM_{10} (particulate with a diameter of 10 or smaller μm) and $PM_{2.5}$ mass measurements. Coarse mass is not separated by species in the same way that $PM_{2.5}$ is speciated, but these measurements are generally associated with crustal components. Similar to crustal $PM_{2.5}$, natural windblown dust is often the largest contributor to PMC.

[8] Air Resource Specialists, Inc, "Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report" (28 June 2013), https://www.env.nm.gov/aqb/reghaz/documents/AppendixA.pdf.

Chapter 2. Status of Implementation of Control Measures

This chapter focuses on anthropogenic (manmade) emission sources. The following sections describe the status of the control measures that were included in the Montana FIP to achieve reasonable progress goals for visibility improvement at mandatory Federal Class I Areas in Montana and neighboring states.[9] Title 40 of the Code of Federal Regulations (CFR), part 51.308(g)(1) requires "[a] description of the status of implementation of all measures included in the implementation plan for achieving" reasonable progress goals at Class I Areas both within and outside the State that are influenced by emissions from Montana sources.[10]

In the Montana FIP, the Environmental Protection Agency (EPA) relied upon the implementation of the Best Available Retrofit Technology (BART) at select facilities. In addition, the Montana FIP relied on continual emissions reductions over time resulting from both federal and state measures in existence at the time the Montana FIP was developed. These additional measures have contributed to an ongoing reduction in emissions since the baseline period. They were taken into account in projecting an emissions inventory for the year 2018 to determine whether Montana was forecast to achieve reasonable progress during the initial implementation period.[11]

In the years since 2012, when the Montana FIP was promulgated, further reductions have occurred or will occur through additional federal and state programs not otherwise identified in the Montana FIP, such as periodic updates to the National Ambient Air Quality Standards (NAAQS) and plant closures. The status and associated benefits of these regulations and activities are also discussed in this chapter.

2.1. Montana's BART & Reasonable Progress Measures

For certain large industrial facilities that had the potential to contribute to visibility impairment, the Regional Haze Rule (RHR) required states, tribes, or EPA to conduct an analysis to determine whether additional pollution controls must be installed. Specifically, facilities were considered eligible for such analysis if they (1) had the potential to emit 250 tons a year or more of a visibility-impairing pollutant, (2) were in existence by August 7, 1977, but were not operating before August 7, 1962, and (3) fell into one of 26 different source categories, such as utility and industrial boilers, and large industrial plants like pulp mills, refineries, and smelters.[12] Facilities that met these definitions were considered to be "BART-eligible."

---

[9] EPA, Approval and Promulgation of Implementation Plans; State of Montana; Regional Haze Federal Implementation Plan, Final Rule, 77 Fed. Reg. 57863 (18 Sep. 2012), https://www.federalregister.gov/d/2012-20918. See also: Proposed Rule at 77 Fed. Reg. 23987 (20 Apr. 2012), https://www.federalregister.gov/d/2012-8367.

[10] EPA, 40 CFR § 51.308(g) (2016), https://www.gpo.gov/fdsys/pkg/CFR-2016-title40-vol2/xml/CFR-2016-title40-vol2-sec51-308.xml.

[11] Marty Wolf and Paula Fields, Technical Memorandum - Final, WRAP PRP18b Emissions Inventory – Revised Point and Area Source Projections (29 Apr. 2009, rev. 16 Oct. 2009), http://www.wrapair.org/forums/ssjf/documents/Pivot_Tables/PRP18b/Final_PRP18b_point_area_source_memo_erg_101609_revised.pdf.

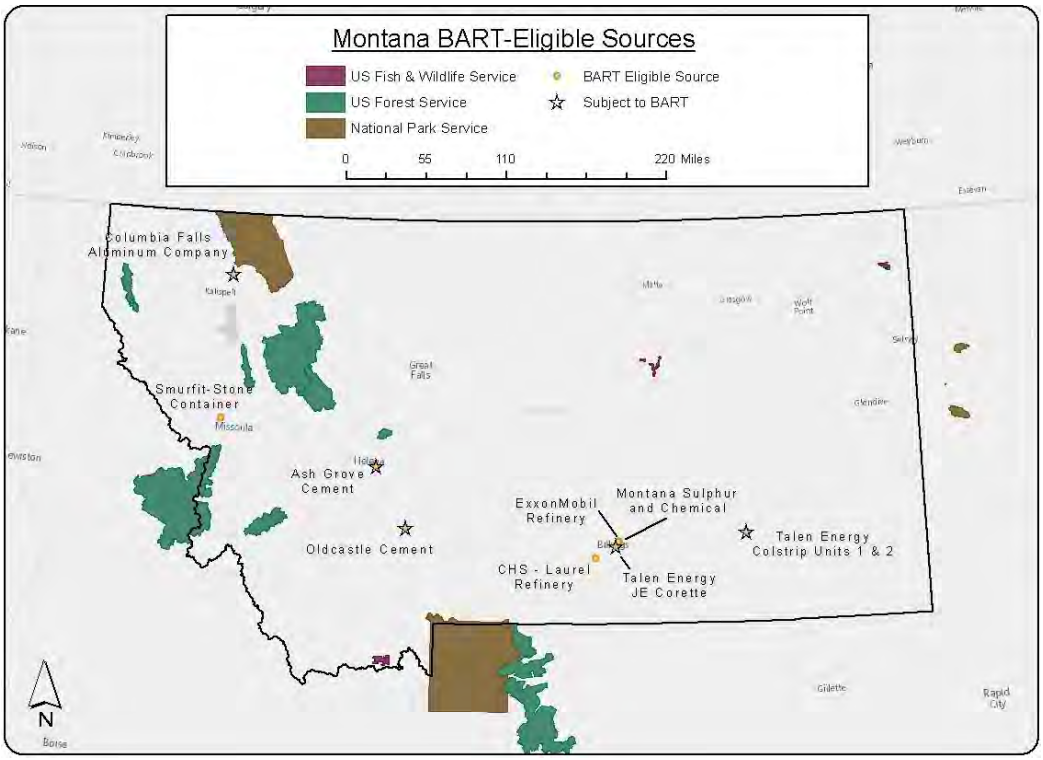
[12] These source categories are listed in section 169A(g)(7) of the federal Clean Air Act.

In the Montana FIP, EPA analyzed nine large stationary sources determined to be BART-eligible. These BART-eligible sources, listed in Table 2-1, included coal-fired electric generating units, refineries, cement plants, and other large industrial facilities. These sources are also mapped below.

TABLE 2-1. LIST OF BART-ELIGIBLE SOURCES IN MONTANA

BART-Eligible Source	BART Source Category
Ash Grove Cement Company	Portland Cement Plants
Cenex Harvest States Cooperatives, Laurel Refinery	Petroleum Refineries
Columbia Falls Aluminum Company, LLC	Primary Aluminum Ore Reduction Plants
ExxonMobil Refinery & Supply Company, Billings Refinery	Petroleum Refineries
Montana Sulfur & Chemical Company	Chemical Process Plants
Oldcastle Cement (formerly Holcim (US), Inc.)	Portland Cement Plants
Smurfit-Stone Container Enterprises Inc., Missoula Mill	Kraft Pulp Mills and Fossil Fuel Boilers of more than 250 million British Thermal Units (BTUs) per hour Heat Input
Talen Energy– Colstrip Steam Electric Station Units 1 & 2 (formerly PPL Montana, LLC)	Fossil-Fuel Fired Steam Electric Plants of more than 250 BTUs per hour Heat Input
Talen Energy – JE Corette Steam Electric Station (formerly PPL Montana, LLC)	Fossil-Fuel Fired Steam Electric Plants of more than 250 BTUs per hour Heat Input

FIGURE 2-1. MAP OF MONTANA BART-ELIGIBLE SOURCES



EPA used air quality modeling conducted by the Western Regional Air Partnership (WRAP) to estimate daily visibility impacts above natural conditions at each Class I Area within 300 kilometers (km), or about 186 miles, of these nine BART-eligible facilities. EPA used a threshold of 1.0 deciview of impact to determine which sources "cause" and a threshold of 0.5 deciview of impact to determine which sources "contribute" to visibility impairment. Following modeling, only five operating units were determined to cause or contribute to visibility impairment and thus only these five were subject to BART.

The Montana FIP included BART determinations for these units, which resulted in new emissions limits for emissions of visibility-impairing pollutants. The Montana FIP included emissions limits for Ash Grove Cement; Oldcastle Cement; Talen Energy Colstrip Steam Electric Station Units 1 and 2; and Talen Energy JE Corette Steam Electric Station. Not all of the facilities determined to be subject to BART were required to install additional controls for visibility-impairing pollutants. According to the federal Clean Air Act, five factors had to be considered in determining whether and what controls must be applied at each individual facility. These factors included:

1) cost of the controls;
2) impact of controls on energy availability or any non-air quality environmental impacts;
3) remaining useful life of the equipment to be controlled;
4) any existing pollution controls already in place; and
5) visibility improvement that would result from controlling the emissions.[13]

In some cases, the minimal visibility improvement expected to result from the use of pollutant-specific add-on controls did not justify proposing additional controls. Instead, EPA proposed emission limits that could be met within the existing operation of the unit.[14] Prior to BART, many of these facilities had not been subject to federal pollution control requirements for this particular set of pollutants.

Columbia Falls Aluminum Company (CFAC) was determined to be subject to BART; however, the facility did not receive emission limits because it was not in operation at the time the Montana FIP was published and is now permanently closed. The JE Corette plant in Billings, a coal-fired electric generating unit, was also determined to be subject to BART and received BART limits. However, the facility ceased operation in April 2015. In both of these cases, the corresponding Montana Air Quality Permits (MAQPs) have been revoked. A sixth facility (Blaine County #1 Compressor Station) also received emission limits in the Montana FIP. This facility was determined to be subject to reasonable progress controls, not BART. However, as further discussed below, the determination was in error, and the source should not have received emission limits.

Table 2-2 provides a summary of the BART emission limits, the corresponding control technology prescribed in the Montana FIP, compliance dates, and the status of each control or limit.

---

[13] EPA, 40 CFR 51.308(e) (2016), https://www.gpo.gov/fdsys/pkg/CFR-2016-title40-vol2/xml/CFR-2016-title40-vol2-sec51-308.xml.
[14] EPA, 40 CFR 52.1396(c) (2016), https://www.gpo.gov/fdsys/pkg/CFR-2016-title40-vol4/xml/CFR-2016-title40-vol4-sec52-1396.xml.

TABLE 2-2. MONTANA BART CONTROLS AND CURRENT STATUS

	Particulate Matter (PM)				Nitrogen Oxides (NO_x)				Sulfur Dioxide (SO_2)			
	Limit	Control	Compliance Date	Status	Limit	Control	Compliance Date	Status	Limit	Control	Compliance Date	Status
Colstrip (Units 1&2)	0.10 lb/mmBtu	NA	11/17/2012	In Compliance	0.15 lb/mmBtu	SOFA & SNCR	10/18/2017	*	0.08 lb/mmBtu	Lime injection	10/18/2017	*
Oldcastle Cement	0.77 lb/ton clinker	NA	11/17/2012	In Compliance	6.5 lb/ton clinker	SNCR	10/18/2017	**	1.3 lb/ton clinker	NA	4/16/2013	In Compliance
Ash Grove Cement	***	NA	11/17/2012	In Compliance	8.0 lb/ton clinker	SNCR & LNB	10/18/2017	In Compliance	11.5 lb/ton clinker	NA	4/16/2013	In Compliance

* Emission limits for Colstrip Units 1 and 2 were vacated by the U.S. Court of Appeals for the 9th Circuit, as discussed further below.

** Oldcastle installed SNCR during a plant shutdown in April 2017. However, the company contacted EPA Region 8 in mid-2016 to express concern that the existing NOx limit may not be achievable even with the successful operation of SNCR. EPA reviewed the documentation and, on April 14, 2017, proposed a revision to the NOx limit in the Montana FIP.

*** If the process weight rate of the kiln is less than or equal to 30 tons per hour, then the emission limit shall be calculated using $E = 4.10P_{0.67}$, where E = rate of emission in pounds per hour and p = process weight rate in tons per hour; however, if the process weight rate of the kiln is greater than 30 tons per hour, then the emission limit shall be calculated using $E = 55.0P_{0.11-40}$, where E = rate of emission in pounds per hour and P = process weight rate in tons per hour.

Lime Injection – Injecting limestone creates a chemical reaction with sulfur dioxide to create a calcium sulfite solid, removing the SO2 from the flue gas.

LNB – Low NOx burners are configurations intended to prevent the formation of NOx by using air staging of combustion air and fuel rich environments.

SOFA – Separated Over-Fire Air is the process where combustion air is generally staged within the combustion device. Air for combustion is initially limited to below stoichiometric conditions to prevent NOx formation, and then required remaining combustion air is "injected" above the burners. SOFA is a form of a low NOx burner design.

SNCR – Selective Noncatalytic Reduction is another process to prevent NOx formation. It uses a reagent such as ammonia or urea to react with the nitrogen oxides to form nitrogen and water byproducts.

The following sections provide further discussion of BART control technology and implementation status.

2.1.1. Colstrip Steam Electric Station Units 1 and 2

On June 9, 2015, the United States Court of Appeals for the Ninth Circuit vacated the emission limits for Talen Energy Colstrip Units 1 and 2 (and Corette), after the court found the NO_x and SO_2 limits to be arbitrary and capricious, and remanded the determination back to EPA.[15] As of this submittal, EPA has not yet acted on the remand. However, the plant operator did install separated overfire air controls on Units 1 and 2 and SmartBurn[R] technology on Unit 2 before the original BART limits were vacated.

In the summer of 2016, an agreement was reached between Sierra Club and the owners of the Colstrip facility. As part of the agreement, Colstrip Units 1 and 2 must shut down no later than July 1, 2022. In addition, the owners agreed that Units 1 and 2 would comply with the following NO_x and SO_2 emission limits until such time as the units cease operation:

- Unit 1 NO_x limit – 0.45 lb/mmBtu (30-day rolling average)
- Unit 2 NO_x limit – 0.20 lb/mmBtu (30-day rolling average)
- Units 1 and 2 SO_2 limit – 0.40 lb/mmBtu (30-day rolling average)

This Consent Decree is binding and, as such, these emission limits will continue to be beneficial for emission reductions until such time as Colstrip Units 1 and 2 cease operation, at which time all emissions associated with these units will permanently cease.[16] Emission levels currently being achieved by Colstrip Units 1 and 2 are discussed in Chapter 3.

2.1.2. JE Corette

The BART limits for the JE Corette facility were also remanded under the same court proceeding as discussed above. That remand however, has since been made moot by the shutdown of Corette and demolition of the facility. The facility ceased operation in April 2015 and it has been fully decommissioned since that time.

2.1.3. Ash Grove Cement

The Montana FIP required Ash Grove to achieve an SO_2 limit of no more than 11.5 lb/ton of clinker no later than April 16, 2013, and a NO_x limit of no more than 8.0 lb/ton of clinker no later than October 18, 2017. The NO_x limit was established assuming the application of Selective Noncatalytic Reduction (SNCR) and low NO_x burners. The facility installed an SNCR system and made modifications to the kiln burners to be able to meet the NO_x limit.

Under a Consent Decree, initiated by EPA pursuant to violations of Sections 113(b) and 167 of the Clean Air Act, Ash Grove agreed to achieve a lower SO_2 limit at the Montana City Plant. Ash Grove also agreed

---

[15] National Parks Conservation Association (NPCA) v. U.S. Environmental Protection Agency (EPA), No. 12-73710, United States Court of Appeals for the Ninth Circuit (2015), http://caselaw.findlaw.com/us-9th-circuit/1703871.html.
[16] Sierra Club v. Talen Montana, LLC et al., No. 1:13-cv-00032-DLC-JCL, D. Mon. (2016), doc. 316-1.

to achieve the NO_x limit on a faster timeline, and determine a potentially more stringent NO_x limit based on process and control equipment optimization. The settlement required the facility to achieve an SO_2 limit of no more than 2.0 lb/ton (30-day rolling average), required by April 8, 2015 (described as the 210th day after September 10, 2014), and an initial NO_x limit of no more than 8.0 lb/ton (30-day rolling average), required 30 days after September 10.[17]

Following the process optimization requirements contained in Appendix A of the Consent Decree, Ash Grove demonstrated the ability to meet an even lower NO_x emission limit of 7.5 lb/ton.[18] This permit limit was finalized by EPA on December 29, 2016, when EPA issued an acceptance letter for an Ash Grove Demonstration Report, which had been submitted by Ash Grove to EPA on August 25, 2016.[19] This new limit is now in effect and is in the process of being added to Ash Grove's Title V permit.

Although not specifically required by the Consent Decree, Ash Grove installed baghouse control technology on the kiln exhaust to comply with the Portland cement manufacturing industry National Emission Standards for Hazardous Air Pollutants (NESHAP) filterable particulate limit of 0.07 lb/ton of clinker (based on a 30-day rolling average during kiln operation).

Ash Grove is currently achieving emission levels below limits from the BART determination. The associated emission reductions are presented in Chapter 3.

2.1.4. Oldcastle Cement

Oldcastle is currently meeting both the PM and the SO_2 emissions limits. The facility has engaged a design/build contractor for the application of SNCR to achieve the NO_x limit, and has been preparing to commission and optimize the system before the limit becomes effective on October 18, 2017. A plant shutdown occurred in April 2017 to complete the SNCR installation. As of the drafting of this report, Oldcastle is in the process of integrating the system into the plant's control system and optimizing performance.

The facility entered talks with EPA in mid-2016 to revisit the BART determination based on a request submitted to the Acting Air Director of EPA Region 8. Oldcastle expressed concerns to EPA that the original NO_x limit of 6.5 lb/ton of clinker may not be able to be achieved consistently, particularly without a visible detached plume at the site.[20] Based on past experience, the facility expressed that any visible plume from the site is likely to cause significant concern from area residents. As part of the request to EPA, Oldcastle prepared a revised BART analysis in which the facility requested a revised NO_x limit of 8.3 lb/ton of clinker. EPA reviewed the submitted information and, on April 14, 2017, published a proposed

---

[17] Consent Decree, United States v. Ash Grove Cement Company, No. 2:13-cv-02299-JTM-DJW, D. Kan. (2013), doc. 27 as amended by doc. 28, https://www.courtlistener.com/docket/4267857/united-states-of-america-v-ash-grove-cement-company/.

[18] Department of Justice, Montana City NOx Demonstration Report and Data, No. 90-5-2-1-08221 Ash Grove Cement Co (25 Aug 2016 approved 29 Dec. 2016).

[19] Ibid.

[20] In the manufacture of Portland cement, clinker occurs as lumps or nodules, usually 3 millimetres (0.12 in) to 25 millimetres (0.98 in) in diameter, are produced by sintering (fusing together without melting to the point of liquefaction) limestone and alumino-silicate materials such as clay during the cement kiln stage.

revision to the Montana FIP raising the Oldcastle NO_x limit from 6.5 to 7.6 lb/ton of clinker.[21] The new limit was finalized on September 12, 2017, and is effective October 12, 2017.[22]

2.1.5. Blaine County #1 Compressor Station

At the time of the Montana FIP, the Blaine County #1 Compressor Station was operated by Devon Energy (Devon) and is now operated by Northwestern Energy. In 2012, Devon provided comments to EPA on the Montana FIP limits and four-factor analysis. In setting the Reasonable Progress portion of the Montana FIP, a Q/D analysis threshold calculation was made. In this analysis, Q represents the actual total tons of NO_x and SO_2, and D is the distance in kilometers from the facility to the nearest Class I Area. In the calculation used by EPA's contractor, a distance of 107 kilometers was used for the Blaine County facility, when in fact the distance to the nearest Class I Area is 133 kilometers. This correction would drop the calculated value to a Q/D of 8.7, well below the screening threshold of 10 used in the Montana FIP. The proper calculation would have prevented inclusion of the Blaine County #1 Compressor Station in the Montana FIP.

Additionally, the EPA contractor used emission levels from the 2002 EPA National Emission Inventory. Devon Energy has argued that year 2002 data was not representative of current conditions and over-stated the emissions, further inflating the Q/D calculation. Further, while the original engines were rich-burn engines, they were converted to lean-burn engines in the 1990s. Therefore, the Reasonable Progress determination of nonselective catalytic reduction (NSCR) for engines that are actually lean-burn is not technically feasible.

In the April 14, 2017, proposed revision to the Montana FIP, discussed above, EPA corrected the errors related to the Blaine County #1 Compressor Station. As of the September 12, 2017, final rule, the facility is no longer subject to the NO_x emission limit of 21.8 lb/hr.

2.1.6. Improvements at Other Sources Referenced in the Montana FIP

As discussed above, the main control measure included in the Montana FIP was the application of BART at large facilities where retrofit technology was expected to result in reductions of visibility-impairing emissions. However, by definition, only a narrow set of sources were considered "BART-eligible" and, of those eligible sources, only a handful were eventually given emission limits. The same is true of Reasonable Progress sources, of several that were analyzed in the Montana FIP, only the Blaine County #1 Compressor Station was prescribed emission limits. The group of sources for which the Montana FIP analysis did not result in emission limits includes the following:

- CHS, Laurel Refinery
- Colstrip Energy Limited Partnership
- Colstrip Steam Electric Station, Unit 3
- Montana-Dakota Utilities Lewis & Clark Station
- Montana Sulfur & Chemical Company
- Plum Creek Manufacturing

[21] EPA, Approval and Promulgation of Air Quality Implementation Plans; Montana; Regional Haze Federal Implementation Plan, Proposed Rule, 82 Fed. Reg. 17948 (14 Apr. 2017), https://www.federalregister.gov/d/2017-07597.
[22] EPA, Approval and Promulgation of Air Quality Implementation Plans; Montana; Regional Haze Federal Implementation Plan, Final Rule, 82 Fed. Reg. 42738 (12 Sep. 2017), https://www.federalregister.gov/d/2017-19210.

- Colstrip Steam Electric Station, Unit 4
- Columbia Falls Aluminum Company
- ExxonMobil, Billings Refinery
- Roseburg Forest Products
- Smurfit-Stone Container
- Yellowstone Energy Limited Partnership

It would be a mistake to assume that, in the absence of regulatory emission limits in the Montana FIP, these remaining sources have not installed controls or improved efficiency over the years since the Montana FIP was promulgated. Notable emissions-reducing improvements include the installation of SmartBurn[R] NO_x reduction technology on Units 3 and 4 at the Colstrip Steam Electric Station in 2016 and 2017, respectively. According to facility operator Talen Energy, these new controls are expected to improve NO_x removal from 80% to 86%.[23]

In addition, although the Montana FIP did not set reasonable progress emission limits for Montana-Dakota Utilities (MDU) Lewis & Clark Station, a coal-fired power plant located in Sidney, MT, the facility was upgraded in early 2016 to comply with other federal and state regulations. Upgrades included a mist eliminator retrofit and installation of sieve trays to reduce filterable PM, which also resulted in a significant reduction in SO_2 emissions.[24]

2.2. Adjacent States' BART Implementation

In addition to emission reductions at Montana facilities, reductions of emissions in neighboring states may affect visibility in Montana. The following summaries briefly discuss implementation of BART controls in other states in the region.

2.2.1. Idaho

Idaho has five (5) Class I Areas, including Hells Canyon Wilderness, Craters of the Moon Wilderness, Sawtooth Wilderness, and two that are shared with Montana: Selway-Bitterroot Wilderness and Yellowstone National Park. According to Idaho's Regional Haze documentation, Idaho had one BART source, Amalgamated Sugar Company, LLC (TASCO Riley Boiler located in Nampa, Idaho), which was required to install new emission controls by July 22, 2016.[25] This facility was required to install and operate low NO_x burners after it was determined that Selective Catalytic Reduction (SCR) was not technically feasible for the specific process at this facility. There are also two other boilers at this facility referred to as B&W Boilers 1 and 2 that also ended up as part of a BART Alternative Controls option that resulted in a combined NO_x limit for the three boilers. The initial performance test for the new BART limits was required by December 20, 2016.

As part of the BART determination, three non-BART pulp dryers were also shut down at the facility in an effort to provide the necessary SO_2 reductions. The rationale behind this is that the approach provided more improvement in visibility than otherwise would have occurred from the original BART

[23] Conversation with Gordon Criswell, Environmental and Compliance Director for Talen Energy (11 May 2017).
[24] Correspondence with the facility (30 May 2017).
[25] Idaho Department of Environmental Quality, "Regional Haze Plan" (8 Oct. 2010), http://www.deq.idaho.gov/air-quality/air-pollutants/haze/.

determination. A second facility in Soda Springs, Idaho, went through a BART analysis but EPA determined that no additional control was required.

2.2.2. North Dakota

North Dakota has two Class I Areas, including the Lostwood Wilderness and Theodore Roosevelt National Park, each located in the western third of the state. To make visibility progress during the first implementation period, North Dakota primarily relied on NO_x and SO_2 emission reductions resulting from controls at existing electric generating units (EGUs). These controls include BART at Coal Creek Station (2 units), Leland Olds Station (2 units), Milton R. Young Station (2 units), and Stanton Station, as well as Reasonable Progress controls at Antelope Valley Station (2 units), Coyote Station, and R.M. Heskett Station.[26] The BART emission limits were required to be met by no later than May 7, 2017. On April 6, 2012, EPA took action to partially approve and partially disapprove the state's Regional Haze SIP and finalize a FIP addressing disapproved portions.[27] On September 23, 2013, the U.S. Court of Appeals for the 8th Circuit ruled that EPA's refusal to consider the existing pollution control technology at the Coal Creek Station was arbitrary and capricious.[28] The court vacated the FIP requiring SNCR at the facility.

2.2.3. Oregon

Oregon has twelve mandatory Class I Areas. According to the Regional Haze Update Plan for Oregon, a total of five facilities were impacted by BART determinations. Four facilities chose the option of a federally enforceable permit condition exempting them from BART determinations by reducing visibility impacts below 0.5 deciviews. The PGE Boardman (Boardman) facility BART determination required controls and must cease burning coal by December 31, 2020. Boardman completed installation of BART SO_2 controls consisting of a semi-dry flue gas desulfurization system in early 2014 and is required to further reduce SO_2 emissions in 2018.[29] Boardman is being evaluated to run on biomass so its future emissions are uncertain.

2.2.4. South Dakota

EPA approved South Dakota's Regional Haze State Implementation Plan on April 26, 2012. South Dakota is home to two of the nation's 156 mandatory federal Class I Areas: Badlands National Park and the Wind Cave National Park. Each is located in the southwest corner of South Dakota. South Dakota has only one BART source, which is the Big Stone I coal-fired power plant located in the northeastern corner of South Dakota. Air pollution controls and limits for this source, established under the BART determination, must be installed and implemented within five years of EPA's approval of South Dakota's Regional Haze SIP (April 26, 2017).

---

[26] State of North Dakota, "Regional Haze State Implementation Plan Periodic Progress Report" (Jan. 2015).

[27] EPA, Approval and Promulgation of Implementation Plans; North Dakota; Regional Haze State Implementation Plan; Federal Implementation Plan for Interstate Transport of Pollution Affecting Visibility and Regional Haze, 77 Fed. Reg. 20894 (06 Apr. 2012), https://www.federalregister.gov/d/2012-6586.

[28] State of North Dakota v. U.S. Environmental Protection Agency (EPA), Nos. 12-1844, 12-1961, 12-2331, United States Court of Appeals for the Eighth Circuit (2013).

[29] Oregon Department of Environmental Quality, "Oregon Regional Haze Plan 5-Year Progress Report and Update" (Feb. 2016), http://www.deq.state.or.us/aq/haze/docs/2016ORRegHazeUpdate.pdf.

The BART determination made in 2010 required selective catalytic reduction (SCR) and separated over-fire air for NO_X control, a dry flue gas desulfurization system for SO_2 control, and a fabric filter for PM control. The control system was completed in December 2015, well ahead of the 2017 deadline. Emission reductions for SO_2 and NO_x associated with the control equipment are expected to result in approximately an 86% and 89%, reduction in NO_x and SO_2, respectively.[30]

2.2.5. Wyoming

Wyoming has seven Class I Areas including Yellowstone National Park, a portion of which is located in Montana. On Janaruy 30, 2014, EPA published a Regional Haze FIP for Wyoming, approving the state-proposed BART limits for PM and/or NO_x for 17 units. The majority of these limits do not take effect until future years, extending as late as December 31, 2022. EPA also disapproved the State's proposed NO_x limits for five units and developed new BART limits as part of the FIP for these sources. The compliance date for these five sources is March 4, 2019. Portions of EPA's final action were appealed and are still pending a final determination. Most of the BART derminations require SCR and Continuous Emission Monitoring Systems (CEMS) for NO_x control.[31]

2.3. State & Federal Programs relied on in the Montana FIP

EPA's 2013 guidance for the five-year progress report requests that, in addition to describing the status of specific control measures that were applied in the Montana FIP, the state should also describe additional measures that were relied upon to meet the requirements of the Regional Haze program.[32] This section describes the existing SIP-approved state programs and federal programs that were included in the projected 2018 future year emissions estimate and that have contributed to emissions reductions required to meet BART limits and Reasonable Progress Goals (RPGs).

There are numerous existing programs that are responsible for a continual decline in emissions from industrial sources. Most of the existing federal measures were incorporated into the WRAP's 2018 projected emission inventory. These measures should continue to reduce visibility-impairing pollutants over time and are part of Montana's long-term strategy for reaching its progress goals.

2.3.1. Minor Source Permitting Program

EPA granted authority to the State to implement the state's minor source permitting program, located in the Administrative Rules of Montana Chapter 17.8, Subchapter 7 – Permit, Construction and Operation of Air Contaminant Sources. The primary purpose of the permitting program is to assure compliance with

---

[30] South Dakota Department of Environment and Natural Resources, "South Dakota's Regional Haze State Implementation Plan" (rev. 18 Aug. 2011), http://denr.sd.gov/des/aq/aqnews/RegionalHaze.aspx.

[31] EPA, Approval, Disapproval and Promulgation of Implementation Plans; State of Wyoming; Regional Haze State Implementation Plan; Federal Implementation Plan for Regional Haze, 79 Fed. Reg. 5031 (30 Jan. 2014) https://www.federalregister.gov/d/2014-00930.

[32] EPA, "General Principles for the 5-Year Regional Haze Progress Reports" (Research Triangle Park, North Carolina, April 2013), https://www.epa.gov/sites/production/files/2016-03/documents/haze_5year_4-10-13.pdf.

ambient air standards set to protect public health, assure that Best Available Control Technology (BACT) is utilized to reduce or eliminate air pollution emissions, and to prevent deterioration of clean air areas.

As part of Montana's SIP, all new emission sources that are required to obtain a Montana Air Quality Permit (MAQP) must use BACT. According to Administrative Rules of Montana (ARM) 17.8.752, the owner or operator of a new or modified emitting unit or emitting unit for which a Montana air quality permit is required shall install on the new or modified facility or emitting unit the maximum air pollution control capability that is technically practicable and economically feasible.[33] This provides that permitted emission rates are generally consistent across source categories and that emission rates are minimized.

By requiring BACT even on minor sources, lower emission levels associated with newer equipment, which replaces older equipment over time, serves to provide emission reductions on a continuing and long-term basis. While the Minor Source Permitting Program did not directly influence the 2018 project emission inventory, use of BACT limits emissions increases from modifications as new permitted equipment (such as engines) will generally have lower emission rates than the older units being replaced.

2.3.2. Prevention of Significant Deterioration

In addition to serving other air quality priorities, Montana's Prevention of Significant Deterioration (PSD) program also serves to limit visibility impairment from proposed major stationary sources or major modifications to existing facilities. Montana's PSD program has been successfully implemented since 1983 and is fully approved by EPA.[34] The PSD program requires sources (that meet the definition of new or major modifications) to model the emissions impacts on Class I Areas within 10 km of the source to determine if the change in emissions would exceed maximum allowable increases over the minor source baseline concentrations for $PM_{2.5}$, PM_{10}, SO_2 and NO_2. The PSD New Source Review (NSR) permitting program is described in ARM Chapter 17.8, Subchapter 8. The PSD program also did not directly influence the projected 2018 emission inventory but served to reduce the growth in new emissions by preventing large increases that could cause significant decline in the Class I Areas.

2.3.3. New Source Performance Standards – 40 CFR Part 60 and National Emission Standards for Hazardous Air Pollutants – 40 CFR Part 63

Montana administers a delegated Clean Air Act Part 70, or Title V, Operating Permit Program, thereby providing Montana with a mechanism to receive automatic delegation to implement the New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) programs in the State.[35] Annually, the State undergoes rulemaking to incorporate by reference the most recent versions of these standards. Within the NSPS and NESHAP programs are numerous measures that have reduced visibility-impairing emissions nationally over time. As new standards continue

---

[33] All Administrative Rules of Montana discussed in this report can be accessed through the Montana Secretary of State web portal at http://www.mtrules.org/gateway/ChapterHome.asp?Chapter=17%2E8

[34] EPA, Approval and Promulgation of State Implementation Plans – Revision to the Montana Prevention of Significant Deterioration Regulations, 48 Fed. Reg. 20231 (5 May 1983), http://www.heinonline.org/HOL/Page?handle=hein.fedreg/048088&size=2&collection=fedreg&id=23.

[35] EPA, Clean Air Act Full Approval of Operating Permit Program; State of Montana, 65 Fed. Reg. 37049 (13 Jun. 2000), https://www.federalregister.gov/d/00-14768.

to be developed, additional emission decreases will be realized. Although in some source categories, Montana does not have many affected facilities, sources in neighboring states that contribute to visibility impairment in Montana may be affected, resulting in some visibility benefit.

2.3.4. Montana Smoke Management Program

Montana implements an EPA-approved Smoke Management Plan (SMP) to regulate open burning and prescribed fire activities. The SMP consists of Montana's official open burning rules, as written in the Administrative Rules of Montana, Title 17, Chapter 8, Subchapter 6.[36] The SMP considers smoke management techniques and the visibility impacts of smoke when developing, issuing or conditioning permits, and when making dispersion forecast recommendations. The SMP incorporates BACT as the visibility control measure to meet the requirements of the RHR. The State works closely with the Montana/Idaho Airshed group to coordinate burning activities conducted by the large, major open burners and federal land managers.[37] Major burners in Montana are defined as "any person, agency, institution, business, or industry conducting any open burning that, on a statewide basis, will emit more than 500 tons per calendar year of carbon monoxide or 50 tons per calendar year of any other pollutant."[38] Examples of major open burners in Montana include the U.S. Forest Service and the Bureau of Land Management.

During the fall and winter burn seasons, Montana's open burn coordinator and meteorologist are actively involved in day-to-day burn decisions, and evaluate burn type, size, and location using dispersion forecasts. Through this coordination and the required minor burn permitting included in the SMP, anthropogenic smoke emissions are closely monitored and regulated. In addition, as mentioned above, burners must follow BACT, which aims to limit smoke impacts due to burning. A full list of BACT requirements for burners can be found in ARM 17.8.601. During open burn season (March through August) Montana is not involved in the day-to-day decisions of burners, although all other aspects of the Montana open burning rules still apply, including BACT. The SMP, as represented by our open burning rules, is included as Appendix A of this document.

2.3.5. National Petroleum Refinery Initiative

EPA's national Petroleum Refinery Initiative is an enforcement and compliance strategy to address air emissions from the nation's petroleum refineries.[39] Since 2000, EPA has entered into 17 settlements with U.S. companies that refine over 75% of the nation's petroleum.

The initiative has resulted in emission decreases at Montana refineries, including Calumet, Phillips66, CHS, Inc., and ExxonMobil. Emission reductions projected to be achieved at these sources were taken into

---

[36] Montana Department of Environmental Quality (DEQ), ARM Title 17, Chapter 8, Subchapter 6 – Open Burning, http://deq.mt.gov/Portals/112/DEQAdmin/DIR/Documents/legal/Chapters/CH08-06.pdf.
[37] Montana/Idaho Airshed Group, Airshed Management System: http://www.smokemu.org/.
[38] ARM 17.8.601(5), www.mtrules.org/gateway/RuleNo.asp?RN=17%2E8%2E601.
[39] EPA, Petroleum Refinery National Case Results, https://www.epa.gov/enforcement/petroleum-refinery-national-case-results.

account in the projected 2018 emission inventory and will continue to provide for emissions reductions going forward.

2.3.6. Federal Mobile Source Regulations

The Federal Motor Vehicle Control Program has already realized large emissions reductions in NO_x, SO_x, volatile organic compounds (VOCs), and particulate matter (PM). The Federal Tier II vehicle emissions and fuel standards reduced the sulfur content of diesel fuel from 500 to 15 parts per million (ppm) (Ultra Low Sulfur Diesel) in 2006.[40] The reduction in sulfur content allowed diesel engines to be fitted with diesel oxidation chambers to reduce particulates. Fuel standards for offroad diesel similarly reduced allowable sulfur content. In 2007, offroad diesel was required to meet a maximum sulfur content of 500 ppm, which was further reduced to 15 ppm in 2010. Additional programs include the following:

Federal onroad measures

- Tier 3 vehicle emission standards and federal low-sulfur gasoline
- National low-emission vehicle standards
- Heavy-duty diesel standards

Federal offroad measures

- Lawn and garden equipment
- Tier 3 heavy-duty diesel equipment
- Locomotive engine standards
- Compression ignition standards for vehicles and equipment
- Recreational marine engine standards

2.4. Additional Federal Measures

In addition to the state and federal measures that were anticipated in the Montana FIP, new measures have been promulgated and implemented, in whole or in part, since the development of the Montana FIP and the projected 2018 emissions inventory. Any reduction that will occur or has already occurred as a result of these new measures will further reduce emissions beyond what was projected toward Montana's reasonable progress goals. This section details several new federal measures.

2.4.1. Mercury and Air Toxics Rule

On February 16, 2012, EPA finalized national standards to reduce mercury and other toxic air pollution from coal and oil-fired power plants as part of 40 CFR 63, Subpart UUUUU – National Emissions Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units, also

[40] EPA, Diesel Fuels Standards and Rulemakings, https://www.epa.gov/diesel-fuel-standards/diesel-fuel-standards-rulemakings.

referred to as the Mercury and Air Toxics Standards (MATS).[41] The final rule established power plant emission standards for mercury, acid gases, and non-mercury metallic toxic pollutants. EPA projected 2015 emissions with the standards in place – emissions of mercury, $PM_{2.5}$, SO_2, and acid gas will be reduced by 75, 19, 41, and 88%, respectively, from coal-fired EGUs greater than 25 megawatts (MW).[42] Compliance with MATS was required by April 16, 2015. Emission reductions that occur as a result of MATS, both in the form of particles and gases that may form aerosols, will reduce the amount of light extinction and reduce anthropogenic causes of haze.

Montana had previously adopted rules to control mercury in response to the proposed federal rulemaking known as the Clean Air Mercury Rule (CAMR), under which states were originally required to adopt a set of federal market trading standards for mercury or develop their own "equivalent" standard. Montana adopted its own mercury standard referenced as the Montana Mercury Rule.[43] The Montana Mercury Rule (ARM 17.8.771) was adopted effective October 27, 2006, and required compliance with mercury emission limits by January 1, 2010.[44] Although CAMR was vacated by the District of Columbia Court of Appeals in 2008, the Montana Mercury Rule was already in place by the time MATS was finalized.

There were five affected coal-fired facilities under the Montana Mercury Rule and MATS. These included the Colstrip Steam Electric Station, J.E. Corette Steam Electric Station, Montana-Dakota Utilities (MDU) Lewis & Clark Plant, Colstrip Energy Limited Partnership, and Rocky Mountain - Hardin.

Colstrip Steam Electric Station

Colstrip's four electric generating units use subbituminous coal and its mercury limit under the Montana Mercury Rule is 0.9 pounds per trillion British thermal units (lb/TBtu) on a 12-month rolling average. Colstrip is required to meet a MATS limit of 1.2 lbs/TBtu on a 30-day rolling average. The compliance date for Colstrip was April 16, 2015, but the facility was granted a one-year extension to April 16, 2016. The extension provided a full one year grace period for all required MATS limits, but upgrades were completed for particulate on Colstrip scrubbers to improve particulate removal.

Particulate matter (PM) emissions may be used as a surrogate for actual heavy metal emissions to meet the heavy metal limits in the MATS rule. Reductions in PM emissions reflect a broad category of particulate and gaseous species that contribute to the PM category. The mercury control system installed at Colstrip to meet Montana's Mercury Rule also allowed Colstrip to meet the MATS requirements for mercury capture and removal. In addition, existing controls on all four units adequately remove acid gases covered by the MATS rule (using SO_2 as a surrogate). Upgrades were done on the Unit 1 and 2 scrubbers (sieve trays installed) for additional PM control and resulted in the secondary benefit of significant SO_2 reduction. Theses controls at Colstrip have resulted in significant emission reductions from the facility.

---

[41] EPA, National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units, 77 FR 9304 (16 Feb. 2012), https://www.gpo.gov/fdsys/pkg/FR-2012-02-16/pdf/2012-806.pdf.
[42] Ibid. p. 9424.
[43] EPA, Clean Air Mercury Rule, https://www3.epa.gov/airtoxics/utility/utiltoxpg.html.
[44] ARM 17.8.771 Mercury Emission Standards for Mercury-Emitting Generating Units, http://www.mtrules.org/gateway/RuleNo.asp?RN=17%2E8%2E771.

J.E. Corette Steam Electric Station

The J.E. Corette facility was also subject to MATS, but opted not to install the required control equipment, resulting in its shutdown in April 2015.

MDU Lewis & Clark Plant

The MDU Lewis & Clark Plant burns lignite coal, a different type of coal than the Colstrip Steam Electric Station, and therefore has different limits than Colstrip. For this facility, the Montana Mercury Rule requires a limit of 1.5 lb/TBtu on a rolling 12-month average, and MATS requires 4.0 lb/TBtu on a rolling 30-day average. MDU Lewis & Clark upgraded the existing scrubber and installed sieve trays to satisfy the non-mercury metals emission standard of 0.03 lbs/MMBtu for filterable PM in 2015. The system was fully operational in early 2016. These additional controls have resulted in further particulate reductions plus a co-benefit of significant SO_2 emission reductions.

Rocky Mountain Power – Hardin

Also known as the Hardin Generating Station, this facility consists of a single coal-fired boiler with single steam turbine rated at 116 gross megawatts. Hardin must achieve a 0.9 lb/TBu mercury limit on a 12-month rolling average to comply with the Montana Mercury Rule, and a limit of 1.2 lb/TBtu on a 30-day average to comply with MATS. Hardin installed carbon injection controls to meet the limit in the Montana Mercury Rule.

Colstrip Energy Limited Partnership (CELP)

This facility often is referred to as the Rosebud Power Plant and also uses coal from the same geographic area as the Colstrip Steam Electric Station but is able to utilize a lower grade coal sometimes referred to as "waste coal". The facility has a single coal-fired boiler rated for 39 gross megawatts. CELP began planning for their compliance with the Montana Mercury Rule as early as December 2008, when Montana DEQ received an application to modify their Montana Air Quality Permit. CELP is meeting the same limits as Hardin, 0.9 lb/TBtu mercury limit on a 12-month rolling average and a MATS limit of 1.2 lb/TBtu on a 30-day average.

2.4.2. Revised National Ambient Air Quality Standards

According to EPA, the primary NAAQS serve to protect public health, including "the health of 'sensitive' populations such as asthmatics, children, and the elderly." In addition, secondary NAAQS protect public welfare, "including protection against decreased visibility and damage to animals, crops, vegetation, and buildings."[45] As EPA continues to revise NAAQS, the standards put pressure on states to manage pollution sources, often resulting in emissions decreases, including of pollutants responsible for visibility impairment.

---

[45] EPA, "NAAQS Table" (last updated 20 Dec. 2016), https://www.epa.gov/criteria-air-pollutants/naaqs-table (accessed 14 Apr. 2017).

The following NAAQS revisions have occurred since the baseline period (2000-2004) for the Regional Haze program. Each of these standards must be taken into account when permitting new or modified major sources, including fossil fuel-fired power plants, boilers, and a variety of other operations. Any reductions in SO_2, NO_x, or $PM_{2.5}$ brought about by these revised standards will enhance protection of visibility in Montana Class I Areas.

2010 SO_2 NAAQS

On June 2, 2010, EPA strengthened the SO_2 NAAQS by revising the primary SO_2 standard to 75 parts per billion (ppb) 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum SO_2 concentrations. This short-term standard is significantly more stringent than the revoked standards of 0.140 parts per million (ppm) averaged over 24-hours and 0.030 ppm averaged over a calendar year.

On August 21, 2015, EPA released the 2010 SO_2 Data Requirements Rule (DRR), which instructs states to evaluate areas surrounding facilities with 2000 tons/year or more SO_2 emissions.[46] In Montana, all units at the Colstrip Steam Electric Station were modeled under the DRR since the facility exceeds the 2000 ton/year threshold. As a result, Montana requested to designate Rosebud County as "attainment" for SO_2. Montana had one area in Yellowstone County that was designated as nonattainment. The area was redesignated to attainment under a maintenance plan effective on June 9, 2016.[47]

2010 NO_2 NAAQS

Effective on April 12, 2010, EPA established a new 1-hour primary standard to supplement the existing annual standard. This 1-hour standard was set at a level of 100 ppb**,** based on the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum concentrations.[48] Along with the new standard, EPA set new requirements to monitor NO_2 levels near major roadways. Montana does not have a population center with a density high enough to warrant or trigger the near-roadway monitoring requirement. In 2012, EPA designated every county in Montana as Unclassifiable/Attainment for the 2010 NO_2 NAAQS.[49]

2012 $PM_{2.5}$ NAAQS

On January 15, 2013, EPA published a final rule strengthening the annual NAAQS for fine particles ($PM_{2.5}$) from 15.0 micrograms per cubic meter ($\mu g/m^3$) to 12.0 $\mu g/m^3$.[50] According to EPA, "Emission

---

[46] EPA, Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO2) Primary National Ambient Air Quality Standard (NAAQS); Final Rule, 80 FR 51052 (21 Aug. 2015), https://www.gpo.gov/fdsys/pkg/FR-2015-08-21/html/2015-20367.htm.
[47] EPA, Designation of Areas for Air Quality Planning Purposes; Redesignation Request and Associated Maintenance Plan for Billings, MT 2010 SO2 Nonattainment Area, 81 FR 28718 (10 May 2016), https://www.gpo.gov/fdsys/pkg/FR-2016-05-10/html/2016-10451.htm.
[48] EPA, Primary National Ambient Air Quality Standards for Nitrogen Dioxide; Final Rule, 75 FR 6474 (9 Feb. 2010), https://www.gpo.gov/fdsys/pkg/FR-2010-02-09/pdf/2010-1990.pdf. See also EPA, "Nitrogen Dioxide (NO2) Pollution," last updated 23 Dec. 2016, https://www.epa.gov/no2-pollution/2010-primary-national-ambient-air-quality-standards-naaqs-nitrogen-dioxide.
[49] EPA, Air Quality Designations for the 2010 Primary Nitrogen Dioxide (NO2) National Ambient Air Quality Standards; Final Rule, 77 FR 9532 (17 Feb. 2012), https://www.federalregister.gov/d/2012-3150.
[50] EPA, National Ambient Air Quality Standards for Particulate Matter, 78 FR 3086 (15 Jan. 2013), https://www.gpo.gov/fdsys/pkg/FR-2013-01-15/pdf/2012-30946.pdf.

reductions from EPA and states rules already on the books will help 99 percent of counties with monitors meet the revised $PM_{2.5}$ standards without additional emission reductions."[51] These rules include many of the regulations discussed above, such as clean diesel rules for vehicles and fuels, and rules to reduce pollution from power plants.

2.5. Additional State Measures

In addition to BART and the federal and state programs discussed previously, there are other state measures and noteworthy changes that will influence the achievement of Montana's 2018 RPGs. As set forth in detail below, some noteworthy changes in Montana since the Montana FIP submittal include a power plant closure, two previously planned coal-fired facilities that were not constructed, stronger renewable energy portfolio requirements, and attainment of the NAAQS throughout the state.

2.5.1. Closure/Cancellations & Derating

The WRAP projected 2018 emissions estimate included emissions from a number of large sources that have closed, were never built, or are operating at different levels than originally planned. These sources include a power plant that has been closed (Corette, discussed in Section 1.1.2), a power plant that was constructed but at a smaller size than originally planned (Rocky Mountain Power - Hardin), and two coal-fired power plants that were planned but never constructed (Bull Mountain/Roundup Power Project and Southern Montana Electric, or SME). The latter two permits were eventually permanently revoked.

The Hardin facility was originally designed as 160 megawatts (MW), but was eventually permitted at 113 MW; therefore, emissions associated with this facility were over-stated by the equivalent of 47 MW. The Bull Mountain/Roundup plant, with a capacity of around750 MW per the WRAP inventory, was never constructed, and SME was permitted and constructed but never came on-line. Adjusting the 2018 projected emissions inventory to reflect these changes will further reduce emissions toward the RPGs.

2.5.2. Montana Renewable Portfolio Standard

The Montana Renewable Power Production and Rural Economic Development Act or the Montana Renewable Portfolio Standard (RPS), was approved by the Montana Legislature in 2005. The RPS required public utilities to obtain a percentage of their retail customer sales from renewable resources. Starting in 2008, a public utility was required to acquire renewable energy equal to 5% of its retail sales of electricity in Montana. That percentage increased to 10% in 2010 and to 15% in 2015.[52] While new sources of renewable energy do not directly replace electricity from fossil fuel-fired electric generating plants, they accommodate growth in electricity demand without increasing emissions.

---

[51] EPA, "Overview Of EPA's Revisions to the Air Quality Standards for Particle Pollution (Particulate Matter)," https://www.epa.gov/sites/production/files/2016-04/documents/overview_factsheet.pdf (accessed 24 Apr. 2017).

[52] Montana Code Annotated 2015, Title 69, Chapter 3, Part 20, Renewable Power Production and Rural Economic Development, http://leg.mt.gov/bills/mca_toc/69_3_20.htm.

The new sources of generation in Montana are shown in Table 2-3, although not all of the power generated is consumed in Montana. Many of the projects are able to help meet the RPS, but not all were constructed specifically to meet the requirements of this Act.

TABLE 2-3. NEW AND PROPOSED RENEWABLE GENERATION IN MONTANA AS OF NOVEMBER 2016[53]

COMPANY	PLANT	COUNTY	SOURCE	INITIAL OPERATION	CAPACITY (MW)
NWE Portfolio (winter) - Tiber Montana, LLC	Tiber Dam	Liberty	Water	2004	7.5
NWE QF - Two Dot Wind	Martinsdale Colony	Wheatland	Wind	2004	0.8
NWE Portfolio - Invenergy Wind	Judith Gap	Wheatland	Wind	2005	135.0
NWE QF - United Materials of Great Falls, Inc.	UMGF	Cascade	Wind	2006	9.0
Montana-Dakota Utilities	Diamond Willow	Fallon	Wind	2007	30.0
NWE QF - Two Dot Wind	Martinsdale Colony S.	Wheatland	Wind	2007	2.0
NaturEner	Glacier 1 & 2	Toole	Wind	2008	210.0
Flathead Electric Cooperative	Landfill Gas to Energy	Flathead	Landfill Methane	2009	1.6
NWE Portfolio - Turnbull Hydro LLC	Turnbull Hydro	Teton	Water	2011	13.0
NaturEner	Rimrock	Toole	Wind	2012	189.0
NorthWestern Energy (NWE)	Spion Kop	Judith Basin	Wind	2012	40.0
NWE QF - Oversight Resources	Gordon Butte	Meagher	Wind	2012	9.6
F.H. Stoltze	Land & Lumber Co-Gen	Flathead	Biomass	2013	2.5
NWE QF - Granite County	Flint Creek Dam	Granite	Water	2013	2.0
NWE QF - Goldwind Global	Mussellshell 1 & 2	Wheatland	Wind	2013	20.0
NWE Portfolio - NJR Clean Energy Ventures	Two Dot Wind Farm	Wheatland	Wind	2014	9.7
NWE QF - WINData LLC	Fairfield Wind	Teton	Wind	2014	10.0
GreenField Wind	Greenfield Wind	Teton	Wind	2017	25.0
				Total	**716.7**

2.5.3. State Implementation Plans

The State Implementation Plans (SIPs) for nonattainment and maintenance areas contain control measures that may also contribute to the reduction of visibility-impairing pollution. Table 2-4. Existing Montana Nonattainment Areas shows the status of all of the existing nonattainment areas and maintenance areas in the state of Montana. For each nonattainment area, the State has drafted a SIP with control measures to bring the area back into attainment with the associated NAAQS. Currently, most nonattainment areas (primarily PM_{10}) in Montana are meeting the NAAQS standards based on ambient monitoring data. A few of these areas have been redesignated to attainment and are now in compliance with maintenance plans. Others have been granted a "determination of attainment," indicating that the area is attaining the standard even though it has not yet been redesignated.

In these areas, control measures (such as fugitive dust regulations, oxygenated fuel programs, transportation control measures, residential wood burning regulations, woodstove replacement programs, and winter sanding and sweeping regulations) ensure there are no large emission increases (without

[53] Montana DEQ, Energy Bureau, "Table E1. Electric Power Generating Capacity by Company and Plant as of August 2016." Received 7 Nov. 2016.

emissions offsets) and serve to return the areas to attainment/unclassifiable. These measures often also reduce pollutants that contribute to haze.

TABLE 2-4. EXISTING MONTANA NONATTAINMENT AREAS

Pollutant	Standard Violated	Community	Current Standard	2016 Design Value (With EE)ǂ	2016 Design Value (Without EE)ǂ	Nonattainment	Attainment/ Maintenance
Sulfur Dioxide	1971 (24-hr)	Laurel	75 ppb	38*	NA	3/3/1978	
		East Helena		No Monitor	NA	11/15/1990	
	2010 (1-hr)	Billings		53	NA		6/9/2016[54]
Particulate (PM2.5)	1997 (Annual)	Libby	12 μg/m³	9.8	NA	4/5/2005	
Particulate (PM10)**	1987 (24-hr)	Kalispell	150 μg/m³	87, 84	87, 84	11/15/1990	
		Columbia Falls		45, 44	45, 44	11/15/1990	
		Whitefish		106, 98	106, 98	10/19/1993	
		Libby		58, 57	45, 45	11/15/1990	
		Missoula		74, 65	74, 65	11/15/1990	
		Thompson Falls		135, 97	97, 89	1/20/1994	
		Butte		52, 51	52, 45	11/15/1990	
Carbon Monoxide	1971 (8-hour)	Billings	9 ppm	NA	NA		4/22/2002[55]
		Great Falls		NA	NA		7/8/2002[56]
		Missoula		NA	NA		9/17/2007[57]
Lead	1978 (Cal. Qtr.)	East Helena	0.15 μg/m³	0.06		1/6/1992	

* 2014 Design Value, monitoring ceased in June 2015.
** PM_{10} Design Values are the 2016 1st and 2nd high values, only PM_{10} flagged events removed above 150.
ǂ Exceptional Events (EE) – EE are natural or unusual events that can affect air quality but that are not reasonable controllable using the techniques that air agencies use to attain or maintain the NAAQS. Additional information on Montana nonattainment areas, including designation references and current EPA status of areas, can be found at https://www3.epa.gov/airquality/urbanair/sipstatus/reports/mt_areabypoll.html

2.6. Conclusion

In summary, this chapter has described the implementation status of measures from the Montana FIP, including the status of control measures to meet BART requirements, the status of significant measures resulting from EPA and state regulations, as well as measures and facility changes that have occurred since the WRAP analyses were completed for the Montana FIP. Since the Montana FIP was promulgated in 2012, further reductions have already occurred or will occur as a result of additional federal and state programs not otherwise identified in the Montana FIP, such as periodic updates to the NAAQS and plant closures. As discussed in this chapter, these actions and others have led to substantial reductions in both

[54] EPA, Designation of Areas for Air Quality Planning Purposes; Redesignation Request and Associated Maintenance Plan for Billings, MT 2010 SO2, 81 Fed. Reg. 28718 (10 May 2016), https://www.federalregister.gov/d/2016-10451.
[55] EPA, Approval and Promulgation of Air Quality Implementation Plans; State of Montana; Billings Carbon Monoxide Redesignation to Attainment and Designation of Areas for Air Quality Planning Purposes, 67 Fed. Reg. 7966 (21 Feb. 2002), https://www.federalregister.gov/d/02-4062.
[56] EPA, Approval and Promulgation of Air Quality Implementation Plans; State of Montana; Great Falls Carbon Monoxide Redesignation to Attainment and Designation of Areas for Air Quality Planning Purposes, 67 Fed. Reg. 31143 (9 May 2002), https://www.federalregister.gov/d/02-11448.
[57] EPA, Approval and Promulgation of Air Quality Implementation Plans; State of Montana; Missoula County Carbon Monoxide Redesignation to Attainment, Designation of Areas for Air Quality Planning Purposes, and Approval of Related Revisions, 72 Fed. Reg. 46161 (17 Aug. 2007), https://www.federalregister.gov/d/E7-15784.

the actual and projected emissions of visibility-impairing pollutants from Montana sources. The following chapter further assesses emissions reductions resulting from these measures.

Chapter 3. Changes in Emissions of Visibility-Impairing Pollutants

40 CFR 51.308(g)(2) requires "[a] summary of the emissions reductions achieved throughout the State through implementation of the measures described in paragraph (g)(1)." To address this requirement, this chapter discusses emission reductions that have resulted due to the control measures discussed in Chapter 1. In addition, 40 CFR 51.308(g)(4) requires "[an] analysis tracking the change over the period since the period addressed in the most recent plan required under paragraph (f) of this section in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity." Therefore, this chapter also contains a broad analysis of emission trends in Montana, specifically focusing on the reduction of controllable anthropogenic emissions. EPA's guidance for periodic progress reports explains that states should focus on the visibility-impairing pollutants that were considered in the Montana FIP and no other pollutants such as ammonia or volatile organic compounds (VOCs).[58]

As previously discussed, the emissions that affect visibility are varied and complex, and come from a number of anthropogenic and natural sources. Emissions from large industrial sources can be measured directly through stack tests that measure specific species that are directly emitted from the stack, whereas other source categories, such as mobile emissions from cars and trucks or emissions from fires, are estimated and modeled. Sources of both anthropogenic and natural emissions are grouped into source categories, described in Table 3-1. Emission Source Categories. These source categories are used to organize emission inventories to give regulators and stakeholders a snapshot of the relative amounts of emissions coming from different types of activities. Methods for estimating emissions from certain source categories have improved greatly over the years. This will be an important consideration when evaluating emission trends as changes may be a result of updated emission inventory methodology rather than actual changes in emissions.

Table 3-1. Emission Source Categories

Source Category	Description
Point	Larger, industrial facilities that are located at a fixed, stationary location, where emissions are measured and controls often required.
Nonpoint	Sources that individually are too small in magnitude to report as point sources; sources that are spread over a spatial extent where emissions are estimated.
Onroad Mobile	Onroad vehicles that use gasoline, diesel, and other fuels. These sources include light-duty and heavy-duty vehicles operating on roads, highway ramps, and during idling.
Offroad (Nonroad) Mobile	Offroad (also referred to as Nonroad) mobile sources that use gasoline, diesel, and other fuels. Source types include construction equipment, lawn and garden equipment, aircraft and aircraft ground support equipment, locomotives, marine vessels, and agricultural equipment.

[58] EPA, "General Principles for the 5-Year Regional Haze Progress Reports."

Source Category	Description
Oil and Gas Sources	Consist of a number of different types of activities from engines for drill rig and compressor operation, to sources such as condensate tanks and fugitive gas emissions. The variety of emissions types for sources specific to oil and gas activity can, in some cases, overlap with mobile, area or point sources.
Biogenic	Emissions based on the activity fluxes modeled from biogenic land use data, which characterizes the types of vegetation that exist in particular areas.
Event	Wildfires, prescribed burns, and fugitive emissions from dust storms.

3.1. Emission Reductions Resulting from Controls in the Federal Implementation Plan

Since the Montana FIP was published in 2012, several factors have contributed to reducing emissions in Montana. As discussed in the previous chapter, some of these factors were included in the Montana FIP and others were not anticipated when the Montana FIP was published in 2012.

3.1.1. Emissions Reductions at BART Facilities

Montana collects annual actual emissions inventory data from all sources requiring a state air quality permit, including the BART sources. The graphs on the following pages show emitting unit-level emissions data for Montana's BART sources, reported to the State of Montana through the annual emissions inventory.[59]

As mentioned previously, in 2015, the BART limits for Colstrip Units 1 and 2, as well as for J.E. Corette, were vacated and remanded back to EPA for a new determination. Despite the remand, the plant operator continued to install separated overfire air and sieve tray controls on Units 1 and 2, and smart burn technology on Unit 2. Also discussed in the previous chapter, the J.E. Corette Plant ceased operation in the spring of 2015 and has since been completely decommissioned. As the following graphs show, these events have led to emission decreases at the BART-affected Electric Generating Units (EGUs), even in the absence of the associated BART-related emission limits.

The two cement plants that were subject to BART have also seen emissions changes during the progress period. As a result of the settlement discussed previously, Ash Grove Cement has been achieving lower emissions than those prescribed in the BART determination, and has achieved these emission reductions on a faster timeline by installing controls prior to the BART compliance date. The graphs on the following pages show decreasing NO_x and SO_2 emissions over time at that plant. The BART emission limits at Oldcastle do not take effect until October 18, 2017. As previously discussed, the facility installed controls in the spring of 2017, and received a revision of the original BART determination in September 2017. Absent the early installation of control technology, NO_x emissions from the kiln have increased over the last several years, following production trends. However, with the anticipated installation of controls, emissions should decrease prior to the end of the implementation period in 2018.

[59] Montana DEQ, Air Quality Bureau, Workflow Annual Emission Inventory Database, accessed 9 May 2017.

FIGURE 3-1. NO_x EMISSIONS CHANGES AT BART SOURCES - EGUS

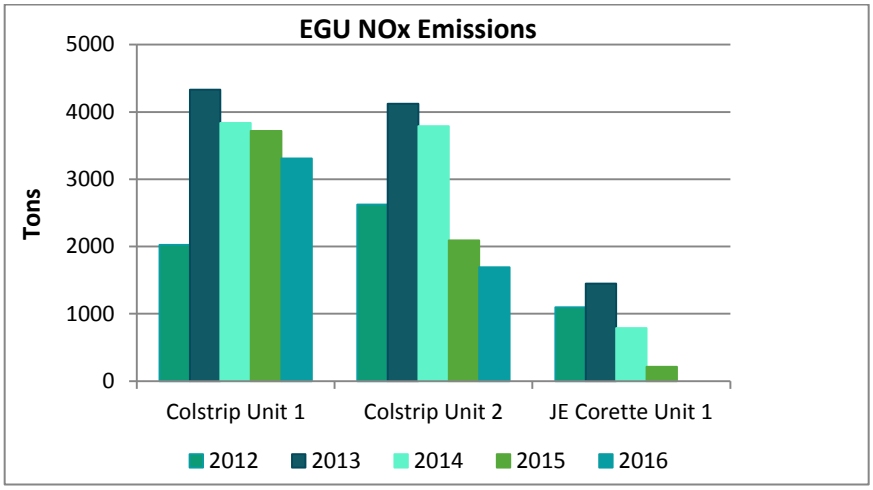


FIGURE 3-2. SO_2 EMISSIONS CHANGES AT BART SOURCES - EGUS

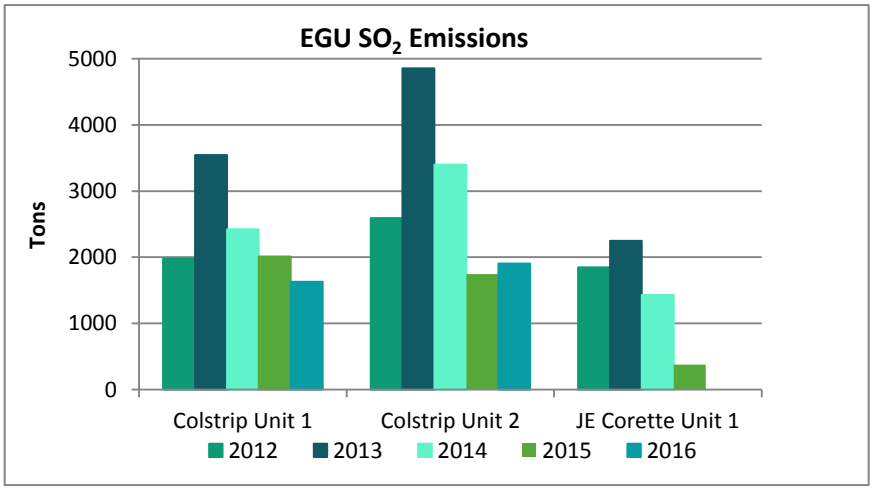


FIGURE 3-3. $PM_{2.5}$ EMISSIONS CHANGES AT BART SOURCES - EGUS

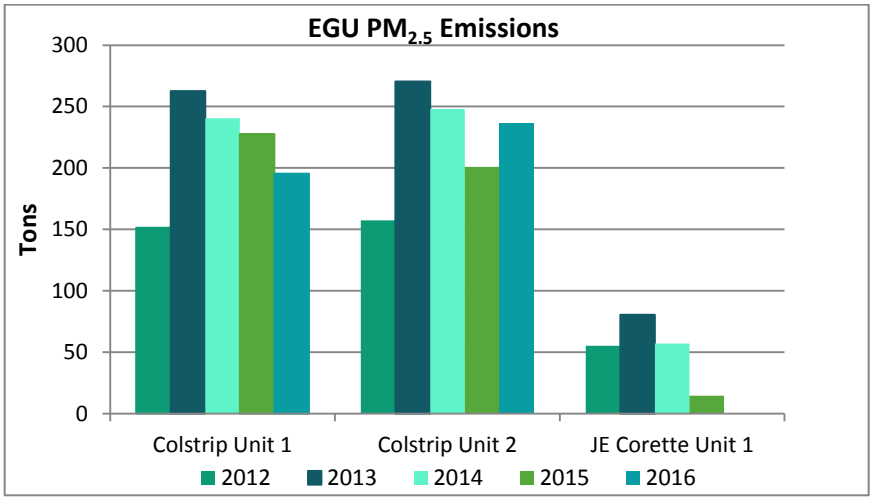


FIGURE 3-4. NO_x EMISSIONS CHANGES AT BART SOURCES – CEMENT KILNS

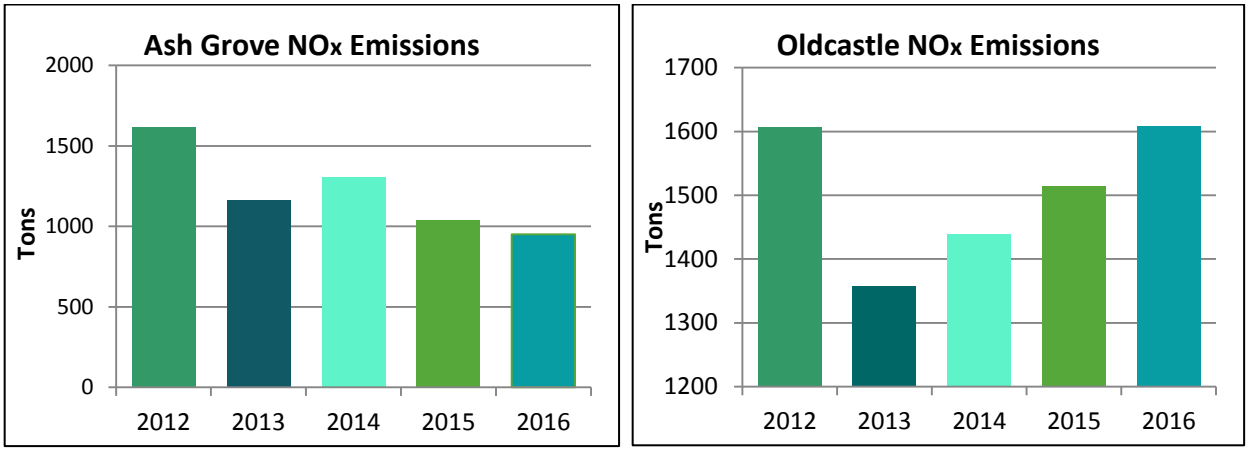


FIGURE 3-5. SO_2 EMISSIONS CHANGES AT BART SOURCES – CEMENT KILNS

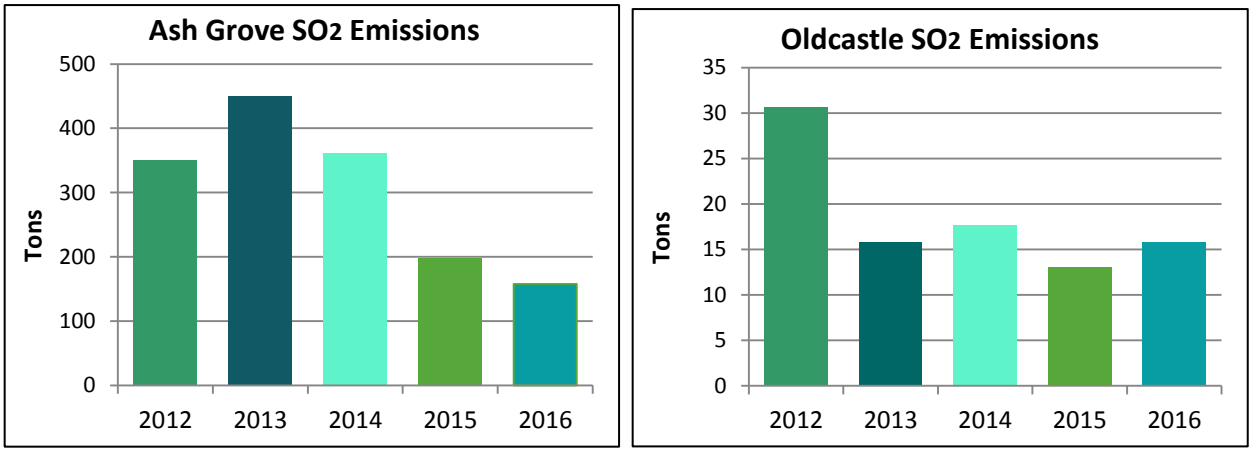
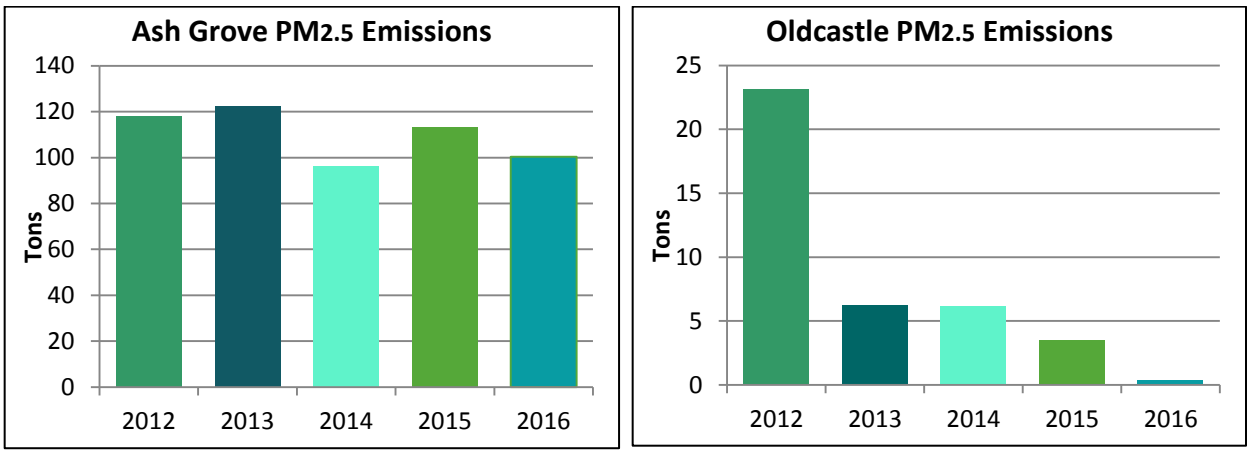


FIGURE 3-6. $PM_{2.5}$ EMISSIONS CHANGES AT BART SOURCES – CEMENT KILNS



As discussed in the previous chapter, the Montana FIP anticipated additional emission reductions from a handful of other regulatory measures. Further regulatory actions in the years since the Montana FIP was published have also contributed to reducing emissions across Montana. It is more difficult to

quantify the emission reductions that have resulted from more general programs and regulations. However, statewide emission inventories can be used to assess general trends in emissions from different source categories. These trends are discussed in the following section.

3.2. Emissions Changes between the Baseline and Progress Periods, by Source Category

As referenced in Table 3-1. Emission Source Categories, the numerous sources that contribute to haze are grouped into emission source categories. These include point sources, area sources, mobile sources, onroad and offroad sources, biogenic sources, wildfires, and windblown dust. The emissions from these sources during the baseline years (2000-2004) are represented by a 2002 inventory, which was developed with support from the Western Regional Air Partnership (WRAP) for use in the original regional haze strategy development (termed "plan02d").

The 2002 baseline inventory was also used to project a picture of what emissions might look like in Montana in 2018, at the end of the first ten-year Regional Haze implementation period (this projection is called "prp18b"). In this report, trends between inventories are represented as the difference between the 2002 inventory and the 2014 National Emissions Inventory (NEI), which is the most current inventory available for use since the promulgation of the Montana FIP in 2012. For more information regarding the development of these inventories, see Appendix B.

At the time the WRAP developed the 2002 baseline and the 2018 projection, it was expected that Montana would see a reduction in NO_x emissions by 26%, SO_2 emissions by 12%, and an increase in PM emissions by 8-9%.[60] Examining the 2014 NEI as a midpoint between the two WRAP inventories shows that, generally speaking, Montana is on track to achieve the projected decreases. Anthropogenic fire emissions are the exception, showing emission increases in all pollutants when comparing the baseline and projected inventories to the 2014 NEI. However, the methodology for calculating fire emissions has been updated over the years to better reflect actual emissions; therefore, the 2014 NEI data is likely more reflective of actual annual emissions. Therefore, it is very difficult to conduct trend analysis on fire (both prescribed and natural) because of the changes in methodology and the inherent variability of the activity. Year to year prescribed fire activity can change due to weather and available resources, which in turn greatly affects emissions. Emissions changes in the generalized source categories are displayed in the tables on the following pages.

3.2.1. Oxides of Nitrogen

Table 3-2 shows that between 2002 and 2014, emissions of NO_x have decreased. In most cases, the percent change that occurred from 2002 to 2014 is greater than what was expected by 2018. For example, the Montana FIP projected NO_x emissions from Area Oil and Gas sources would increase by

[60] EPA, Approval and Promulgation of Implementation Plans; State of Montana; State Implementation Plan and Regional Haze Federal Implementation Plan, Proposed Rule, Table 141, 77 Fed. Reg. 23987 (20 Apr. 2012) https://www.federalregister.gov/d/2012-8367.

84%. However, as of the 2014 NEI, Area Oil and Gas emissions have increased by only 32%. Similarly, point source emissions were projected to decrease by 37% by 2018 but, as of 2014, point source emissions have already decreased by 45%.

In some cases, these differences may be due in part to the snapshot nature of a single year NEI that may not be a representative year for some industries. Additionally, the over-prediction of growth in the Area Oil and Gas sector may be a result of the fact that the projection would not have accounted for the recent drop-off in production resulting from the economic downturn that affected that sector.

Some sectors saw changes to the methods of emission estimates or updates to emissions modeling in the last few years. This is apparent in the Onroad Mobile and Offroad Mobile sectors, where the 2014 NEI used the Motor Vehicle Emissions Simulator (MOVES) model to estimate emissions. The 2002 baseline used a different model, the Mobile Source Emission Factor Model version 6 (MOBILE6), for these data categories. These changes result in a small increase in NO_X emissions in some locations and introduce uncertainty when comparing the 2014 NEI to past inventories.

When compiling the data from the 2014 NEI for this report, emissions from mining were included in the Fugitive and Road Dust sector. These emissions make up the entirety of NO_x emissions for this category. It is possible that the 2002 baseline inventory, and thus the 2018 projection, did not account for fugitive NO_x emissions from mining and thus this sector was underrepresented.

TABLE 3-2. NO_X EMISSION CHANGES

Source Category	Oxides of Nitrogen, particle + gas phase (tons/year)			Change Plan02d – PRP18b (%)	Change Plan02d - 2014 NEI (%)
	2002 baseline (Plan02d)	2014 NEI	2018 projected (PRP18b)		
Anthropogenic Sources					
Point (incl. Oil & Gas)	53,416.39	29,168.09	33,507.51	-37%	-45%
Area	4,291.54	6,649.55	5,535.04	29%	55%
WRAP Area O&G	7,557.12	9,940.00	13,880.05	84%	32%
Onroad Mobile	53,596.61	31,951.74	22,036.29	-59%	-40%
Offroad Mobile	50,604.15	38,036.32	32,054.49	-37%	-25%
Fugitive + Road Dust	39.08	703.00	44.75	15%	1699%
Subtotal	***169,504.89***	***116,448.70***	***107,058.13***	***-37%***	***-31%***
Natural Sources					
Biogenic	58,353.53	45,558.29	58,353.53	0%	-22%
Wind Blown Dust	-	-	-	-	-
Fire					
Anthropogenic Fire	1,513.14	3,044.63	861.11	-43%	101%
Natural Fire	13,770.19	621.79	13,770.48	0%	-95%
TOTAL EMISSIONS	**243,141.75**	**165,673.41**	**180,043.25**	**-26%**	**-32%**

* WRAP Area O&G emissions taken from 2015 Projections Emissions Data (https://www.wrapair2.org/PhaseIII.aspx)

3.2.2. Oxides of Sulfur

Table 3-3 shows that between the 2002 inventory and the 2014 NEI, emissions of SO_x have decreased. In most cases, the percent change that occurred from 2002 to 2014 is greater than what was expected to occur by 2018. For example, the Montana FIP projected that the 2018 SO_x emissions from point sources would not differ much from the 2002 baseline inventory. However, the 2014 NEI shows that point source emissions have actually decreased by 48%. The large difference may be the result of changes in the universe of point sources. For example, the Bull Mountain – Roundup Plant, a planned large coal-fired facility, was included in the 2002 inventory (and thus the 2018 projection) but was never built. Overall, SO_2 emissions have decreased by 51% from the 2002 baseline inventory to 2014. The Montana FIP had anticipated a 12% decrease by 2018.[61]

As above, 2014 NEI emissions from mining were included in the Fugitive and Road Dust sector and make up the entirety of SO_2 emissions for this category. It is possible that the 2002 baseline inventory did not account for fugitive SO_2 emissions from mining and thus this sector was underrepresented.

TABLE 3-3. SO_X EMISSION CHANGES

Source Category	Oxides of Sulfur, particle + gas phase (tons/year)			Change Plan02d – PRP18b (%)	Change Plan02d - 2014 NEI (%)
	2002 baseline (Plan02d)	2014 NEI	2018 projected (PRP18b)		
Anthropogenic Sources					
Point (incl. Oil & Gas)	36,887.63	19,211.52	36,749.45	0%	-48%
Area	3,236.47	3,201.71	3,580.16	11%	-1%
WRAP Area O&G	225.20	203.00	6.43	-97%	-10%
Onroad Mobile	1,863.12	128.35	233.92	-87%	-93%
Offroad Mobile	4,552.42	316.61	282.14	-94%	-93%
Fugitive + Road Dust	23.60	67.17	29.92	27%	185%
Subtotal	***46,788.44***	***23,128.36***	***40,882.03***	***-13%***	***-51%***
Natural Sources					
Biogenic	-	-	-		-
Wind Blown Dust	-	-	-	-	-
Fire					
Anthropogenic Fire	499.93	1,758.48	277.93	-44%	252%
Natural Fire	4634.33	434.07	4634.80	0%	-91%
TOTAL EMISSIONS	**51,922.70**	**25,320.91**	**45,794.76**	**-12%**	**-51%**

* WRAP Area O&G emissions taken from 2015 Projections Emissions Data (https://www.wrapair2.org/PhaseIII.aspx)

[61] EPA, Approval and Promulgation of Implementation Plans; State of Montana; State Implementation Plan and Regional Haze Federal Implementation Plan, Proposed Rule, Table 140, 77 Fed. Reg. 23987 (20 Apr. 2012) https://www.federalregister.gov/d/2012-8367.

3.2.3. Particulate Matter – Coarse and Fine

Changes in particulate matter emissions in Montana are difficult to quantify. Impacts from updated emissions estimation methods are most apparent in particulate matter emissions from fire, particularly prescribed fire. The Montana FIP projected that coarse and fine particulate emissions from anthropogenic fire would decrease by 56% and 51%, respectively, by 2018. However, prescribed fire emissions detailed in the NEI are much higher than those described in the Montana FIP.

The area source category also showed a significant increase from 2002 to 2014. One particular change to note is that emission factors for residential wood combustion were updated to be more reflective of actual emissions.[62] Despite these differences from sector to sector, total coarse particulate matter emissions in Montana have decreased 10% since 2002. In contrast, the Montana FIP anticipated an increase of 8% by 2018.[63]

Fine particulate matter emissions have increased 47% from 2002 to 2014. The Montana FIP had anticipated an 8% growth in the emissions of fine particulates from 2002 to 2018, so the increase is more than expected. However, it could be partially explained by the different methodologies used in the NEI and a large percentage of emissions coming from both anthropogenic and natural fire.

TABLE 3-4. COARSE PARTICULATE MATTER EMISSION CHANGES

Source Category	Coarse Particulate Matter (tons/year)			Change Plan02d – PRP18b (%)	Change Plan02d - 2014 NEI (%)
	2002 baseline (Plan02d)	2014 NEI	2018 projected (PRP18b)		
Anthropogenic Sources					
Point (incl. Oil&Gas)	7,818.48	5,694.77	11,384.13	46%	-27%
Area	706.20	5,573.92	789.84	12%	689%
WRAP Area O&G	-		-	-	-
Onroad Mobile	270.09	1,625.10	328.77	22%	502%
Offroad Mobile	-	2,107.77	-	-	-
Fugitive + Road Dust	275,235.38	285,953.69	326,637.90	19%	4%
Subtotal	***284,030.15***	***300,955.25***	***339,140.64***	***19%***	***6%***
Natural Sources					
Biogenic	-	-	-	-	-
Wind Blown Dust	328,036.34	222,080.73	328,036.34	0%	-32%
Fire					
Anthropogenic Fire	713.24	26,684.36	311.84	-56%	3641%
Natural Fire	8,496.38	7,089.94	8,496.43	0%	-17%
TOTAL EMISSIONS	**621,276.11**	**556,810.28**	**675,985.25**	**9%**	**-10%**

[62] EPA, 2014 National Emissions Inventory, version 1, Technical Support Document Draft (22 Dec. 2016), https://www.epa.gov/sites/production/files/2016-12/documents/nei2014v1_tsd.pdf.
[63] EPA, Approval and Promulgation of Implementation Plans; State of Montana; State Implementation Plan and Regional Haze Federal Implementation Plan, Proposed Rule, Table 145, 77 Fed. Reg. 23987 (20 Apr. 2012) https://www.federalregister.gov/d/2012-8367.

TABLE 3-5. FINE PARTICULATE MATTER EMISSION CHANGES

Source Category	Fine Particulate Matter (tons/year)			Change Plan02d - 2018 Proj. (%)	Change Plan02d - 2014 NEI (%)
	2002 baseline (Plan02d)	2014 NEI	2018 projected (PRP18b)		
Anthropogenic Sources					
Point (incl. Oil&Gas)	181.86	3,332.63	293.81	62%	1733%
Area	2,472.45	3,910.54	2,753.81	11%	58%
WRAP Area O&G	0.00	-	0.00	0%	-
Onroad Mobile	0.00	1,015.64	0.00	0%	0%
Offroad Mobile	0.00	1,981.99	0.00	0%	0%
Fugitive + Road Dust	34,947.17	30,563.11	40,503.22	16%	-13%
Subtotal	***37,601.48***	***40,807.73***	***43,550.84***	***16%***	***9%***
Natural Sources					
Biogenic	-	-	-	-	-
Wind Blown Dust	36,448.48	44,416.15	36,448.48	0%	22%
Fire					
Anthropogenic Fire	278.95	22,423.25	136.57	-51%	7,938%
Natural Fire	2,910.55	6,008.42	2,910.82	0%	106%
TOTAL EMISSIONS	**77,239.46**	**113,655.55**	**83,046.71**	**8%**	**47%**

3.3. Statewide Emission Trends

A different way to view general emission trends for NO_x, SO_x, and PM in the state of Montana is to only use the NEI. For this analysis, $PM_{2.5}$ Primary ($PM_{2.5}$ Filterable and $PM_{2.5}$ Condensable) was used because this subset of particulate matter is of the most concern for visibility.

The data in the graphs below is taken from the 2002, 2005, 2008, 2011, and 2014 NEI years and summarized by the 14 major Tier 1 categories shown in Table 3-6.[64] The NEI summarizes data in two distinct ways: by source categories (as discussed above) and by Tier 1 categories. Tier 1 categories are best used for evaluating emission trends over multiple years. These tiers include both anthropogenic and natural sources of emissions. Montana collects actual emissions data from the large point sources and reports that data to the NEI. The remaining source categories, including Nonpoint, Offroad, Onroad, and Event are modeled, as further described in Appendix B.

[64] More detail on Air Emissions Inventories can be found at https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-documentation.

TABLE 3-6. NEI TIER 1 CATEGORIES

National Emissions Inventory – 14 Major Tiers	
Fuel Combustion – Electric Utility	Fuel Combustion – Industrial
Fuel Combustion – Other	Chemical & Allied Product Manufacturing
Metals Processing	Petroleum & Related Industries
Other Industrial Processes	Solvent Utilization
Storage & Transport	Waste Disposal & Recycling
Highway Vehicles	Off-Highway
Miscellaneous	Natural Resources

The methodologies and inputs for modeling emissions have become much more detailed since the 2002 baseline was established. For example, EPA's latest mobile source emissions model, MOVES, has been updated several times since 2002. Additionally, methods for calculating fire and biogenic emissions have improved substantially. Therefore, it is difficult to discern emission trends when including highly variable events, such as fires, and when including emissions from source categories in which updated methods cause emissions to vary, at least on paper.

These discrepancies are apparent in the data graphs. Of particular note, the 'Natural Resources' tier, which consists of Biogenics – Vegetation and Biogenics – Vegetation/Agriculture, was not included in the 2002 and 2005 inventories. This tier addresses NO_x emissions from the biogenic sector and is the cause of the apparent increase in NO_x emissions in Montana starting in 2008. Additionally, data from prescribed fire, wildfire, and agricultural burning was included in the 'Miscellaneous' tier in all years except 2014, when it was taken out.

Figure 3-7 shows emission data from all 14 tiers and Figure 3-8 shows emission data with the Natural Resource tier and Miscellaneous tier removed to better represent anthropogenic sources. However, while removing the Miscellaneous tier effectively removes emissions from wildfire, it also removes additional emissions from anthropogenic fire and from sectors not elsewhere classified that fall into the Miscellaneous tier. Examples of these emissions include emissions from agricultural field burning, prescribed burning, fugitive dust from residential and road construction, dust from crops and livestock, emissions from miscellaneous area sources such as automotive repair and welding shops, fertilizer applications, and agricultural livestock waste.

FIGURE 3-7. NO_X, SO_2 AND $PM_{2.5}$ PRI EMISSIONS IN MONTANA, INCLUDING BIOGENICS AND MISC. TIERS

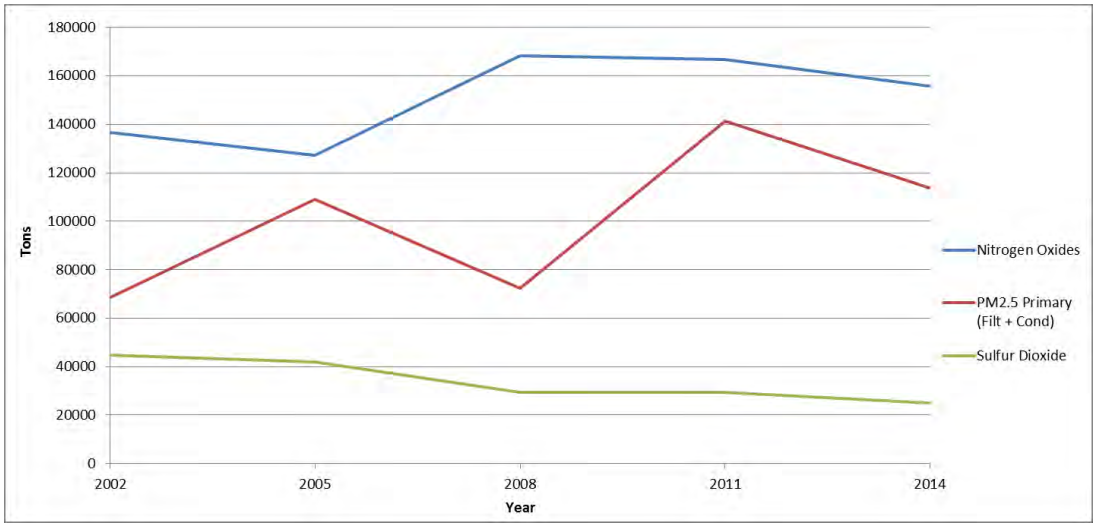
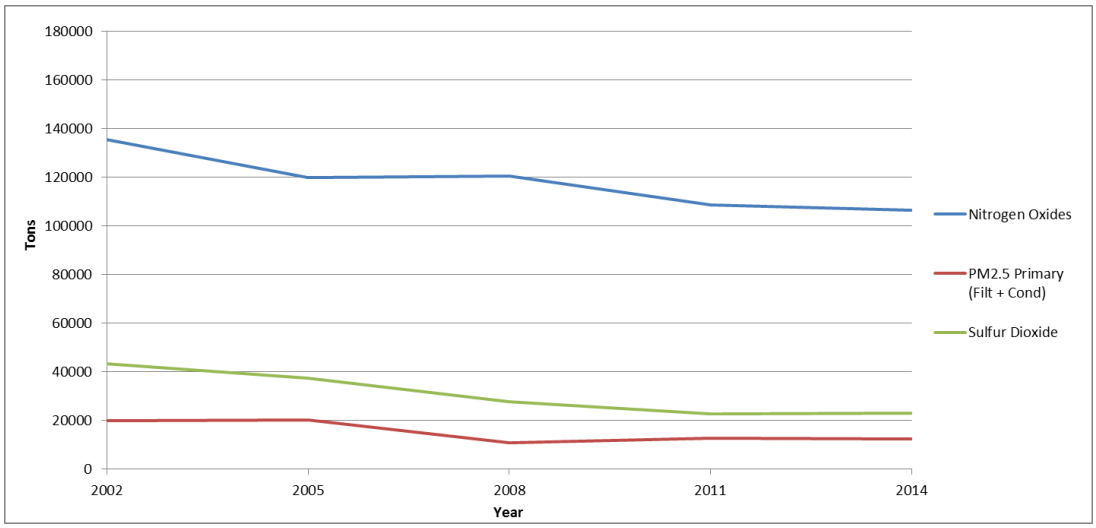


FIGURE 3-8. NO_X, SO_2 AND $PM_{2.5}$ PRI EMISSIONS IN MONTANA, REMOVING BIOGENICS AND MISC. TIERS



As indicated throughout this chapter, emissions of NO_x, $PM_{2.5}$, and SO_2 in Montana are currently lower than they were during the baseline years (2000-2004) and even lower than they were projected to be in 2018. Figure 3-8 also shows that, in general, emissions of the most important haze precursors, nitrogen and sulfur oxides, from anthropogenic sources (fire and biogenic sources removed) are declining. These decreases can be attributed, in part, to the control measures discussed in this report, although for most measures is it difficult to correlate the amount of emission reductions to a specific measure.

3.4. Additional Reductions in Anthropogenic Emissions

The Regional Haze program relies on projected emissions inventories that attempt to take into account changes in emissions that can reasonably be anticipated over the course of the ten-year implementation period following the baseline period of 2000-2004. As discussed above, the projected 2018 inventory

(termed the "PRP18b") was based on the 2002 inventory with adjustments made for new facilities, retiring facilities, implementation of control measures (such as BART), and growth factors.

This projected 2018 inventory included around 8,000 tons of NO_x and 9,000 tons of SO_2 from large Montana facilities whose operations have changed significantly (closures, etc.) since emissions were projected. There have been five significant changes related to coal-fired electrical generation units (EGUs) since the PRP18b emission inventory.

First, as described earlier in this report, the JE Corette plant ceased operation in 2015 resulting in a significant reduction in NO_x, SO_2, and PM emissions. Second, a large coal-fired plant, known as the Bull Mountain – Roundup Plant, was proposed at the time of the inventory but was never constructed and the permit was revoked. The emissions that would have occurred at this plant, and that are still included in the projected 2018 inventory, were of the same magnitude as the emissions from the JE Corette facility. These two changes together provide for a very large decrease from the 2018 projected emissions, as can be seen in Table 3-7, below.

In addition, three other coal-fired facilities, projected to be in operation in 2018, have since changed in ways that reduce their emissions. Two of these facilities appear to be duplicate records, likely the result of the fact that the exact location of the project changed by about 2,000 feet from permit application to final plans. One is identified as "Rocky Mountain Power – Hardin Generating Station," and the second is identified as "Hardin Generator Project." The former began operation around 2004 and the facility continues to operate today, but the duplicative emissions associated with the latter should be removed from the projected emission totals. Finally, the facility known as the Highwood/Southern Montana Electric Plant was planned as a coal-fired EGU. Plans later changed to a gas-fired plant, but the facility ultimately did not come on-line at all.

TABLE 3-7. EMISSIONS REDUCTIONS FROM 2018 PROJECTED INVENTORY (TONS PER YEAR)

Facility	NO_x		SO_2		PM_{10}	
	PRP18b	Revised	PRP18b	Revised	PRP18b	Revised
Future Bull Mountain Roundup Plant	2,033	0	2,904	0	348	0
PPL Montana JE Corette	1,796	0	3,275	0	579	0
Future Highwood/ Southern MT Elec.	704	0	382	0	121	0
Hardin Generator Project	530	0	444	0	107	0
Rocky Mountain Power – Hardin	429	283*	465	324*	83	42*
Mill Creek (Dave Gates)	234	46*	17	2*	184	10*
Montgomery Great Falls Energy	79	0	12	0	2	0
Basin Creek Electric- Culbertson	134	35*	2	1*	10	2*
Stone Container	1,219	0	194	0	274	0
Stimson Lumber – Bonner	0	0	0	0	50	0
Plum Creek Columbia Falls	1,164	972	28	15	384	195
Columbia Falls Aluminum Plant	7	0	1,645	0	240	0
Totals	8,329	1,336	9,368	342	2,382	249
Emission Reductions		**6,993**		**9,026**		**2,133**

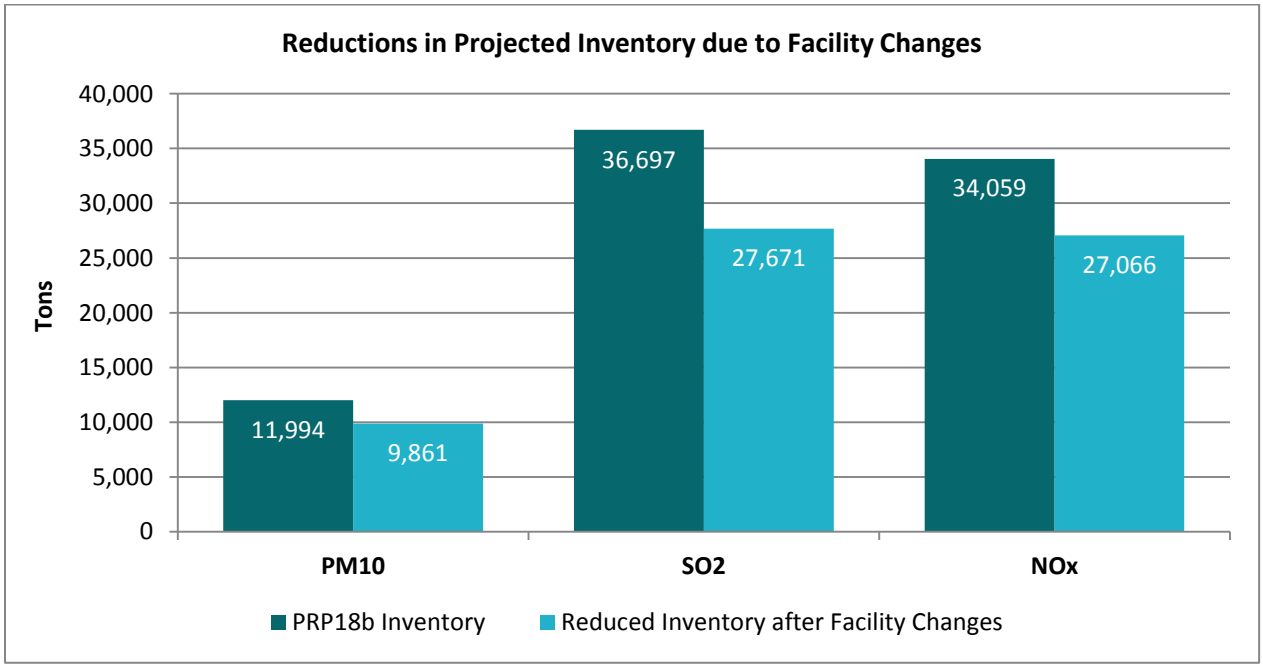
* Rocky Mountain Power, Dave Gates, and Basin Creek emissions are averaged emission inventories for 2012-2016.
Unless otherwise indicated, revised emissions are the emissions reported to the state for the year 2015.

There have also been changes at three natural gas-fired facilities projected to be in operation in 2018. These were identified as the "Mill Creek Generating Station," the "Montgomery Great Falls Energy Partners LP," and the "Basin Electric Power Coop-Culbertson Generation Station." Both the Mill Creek Generating Station and the Basin Electric station were constructed, built, and continue to operate today, although at different levels than projected. The Montgomery Great Falls Energy Partners LP, on the other hand, was not constructed and associated emissions never occurred.

In addition, Montana's wood products industry has undergone a decline similar to other Western states that has resulted in changes to the projected inventory. A number of facilities have ceased operation in the last decade. Specifically, Stone Container, a cardboard manufacturer located just outside of Missoula, closed its doors in late 2009. This shutdown resulted in large emissions decreases. Similarly, the Stimson Lumber facility in Bonner and portions of the Plum Creek Columbia Falls plant closed in 2007 and 2016, respectively.

Finally, the Columbia Falls Aluminum Company suspended operation in 2009, and announced permanent closure in 2015. This facility had large emissions of carbon monoxide, which is not a visibility-impairing pollutant, but also had significant SO2 and PM10 emissions.

FIGURE 3-9. EMISSION REDUCTIONS ATTRIBUTABLE TO CHANGES IN PROJECTED INVENTORY



As a result of operational changes, closures, and cancellations, there have been actual reductions of 6,993 tons of NO_x, 9,026 tons of SO_2, and 2,133 tons of PM_{10} since the projected 2018 emissions inventory was prepared.

3.5. Conclusion

In summary, emissions of the visibility-impairing pollutants addressed in the Montana FIP are decreasing across the state. As discussed in this chapter and the previous chapter, these trends are the result of quantifiable emissions reductions at sources subject to BART controls, operational changes at large facilities since the baseline period and projected inventories, and more general emissions reductions due to more stringent regulations and advancements in control technology over time.

Chapter 4. VISIBILITY CONDITIONS AND TRENDS

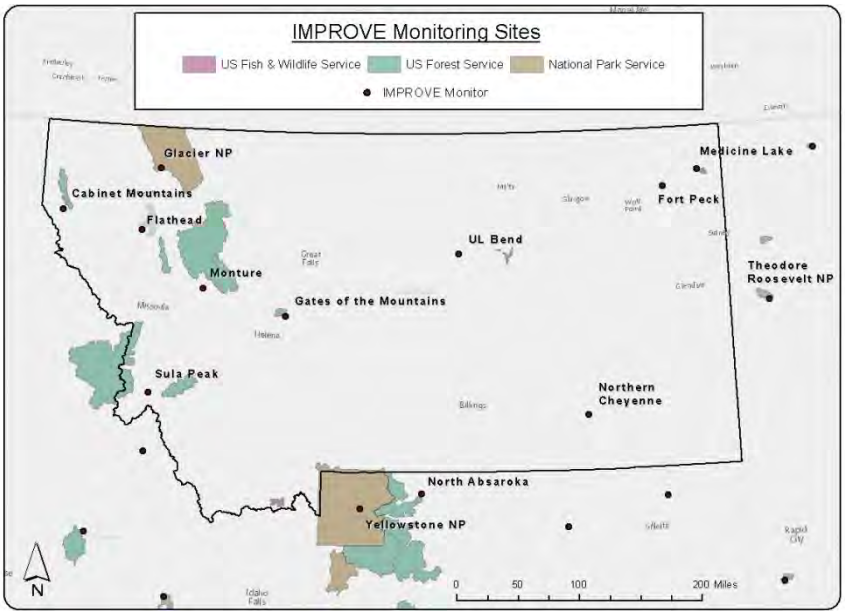
This chapter documents changes in visibility conditions between the baseline and current time periods for each of Montana's 12 mandatory Class I Areas plus two Class I Areas outside of Montana that the Montana FIP identified as being influenced by Montana sources. Title 40 of the Code of Federal Regulations, part 51.308(g)(3) requires an assessment of visibility conditions and changes using five-year averages. The assessment must include three time periods: Baseline, Current, and Past 5 Years.

The baseline period is defined as 2000-2004, which is the period used for the initial analysis in the Montana FIP. For the purpose of this progress report, "current visibility conditions" are defined as the period of 2011-2015.[65] The "past 5 years" is defined as the period of 2006-2010, or the five years prior to the current visibility period.

4.1. IMPROVE Monitoring Network

Montana relied on a network of air monitors operated by the IMPROVE (Interagency Monitoring of Protected Visual Environments) program to assess visibility at mandatory Class I Federal areas across the state. Figure 4-1 shows the locations of IMPROVE monitors. The Flathead, Fort Peck, and Northern Cheyenne monitors are located on tribal land, outside of the State of Montana's jurisdiction.

FIGURE 4-1. MONTANA IMPROVE MONITOR LOCATIONS



[65] This period is currently not available from WESTAR/WRAP Regional Haze tools, so data was extracted directly from the IMPROVE Data Wizard and analyzed independently. WRAP, Technical Support System, Haze Planning, http://vista.cira.colostate.edu/tss/Results/HazePlanning.aspx, and Federal Land Manager Environmental Database, Database Query Wizard, http://views.cira.colostate.edu/fed/DataWizard/.

IMPROVE monitors are not available in all of Montana's 12 Class I Areas. For Class I Areas without IMPROVE monitors, the closest representative monitor was selected as a surrogate as per EPA guidance. These representative monitors were also used in the analysis completed by the Western Air Resources Partnership, or WRAP, in planning for the first implementation period. A crosswalk of Class I Area to representative IMPROVE monitor is shown in Table 4-1. Because visibility conditions will be the same for all Class I Areas sharing a monitor, in this report visibility will be discussed by IMPROVE site, not Class I Area.

TABLE 4-1. REPRESENTATIVE IMPROVE MONITORING SITES

Class I Area Name	Representative IMPROVE Site
Anaconda-Pintler Wilderness Area	Sula Peak (SULA1)
Bob Marshall Wilderness Area	Monture, MT (MONT1)
Cabinet Mountains Wilderness Area	Cabinet Mountains (CABI1)
Gates of the Mtn Wilderness Area	Gates of the Mtn (GAM01)
Glacier National Park	Glacier (GLAC1)
Medicine Lake Wilderness Area	Medicine Lake (MELA1)
Mission Mountain Wilderness Area	Monture, MT (MONT1)
Red Rock Lakes Wilderness Area	Yellowstone (YELL2)
Scapegoat Wilderness Area	Monture, MT (MONT1)
Selway-Bitterroot Wilderness Area	Sula Peak (SULA1)
UL Bend Wilderness Area	U. L. Bend (ULBE1)
Yellowstone National Park	Yellowstone (YELL2)
North Absaroka Wilderness Area (WY)	North Absaroka (NOAB1)
Theodore Roosevelt National Park (ND)	Theodore Roosevelt (THRO1)

This chapter includes a summary of visibility conditions at each of Montana's seven IMPROVE monitors, plus the Yellowstone National Park and North Absaroka Wilderness Area sites in Wyoming, and Theodore Roosevelt National Park site in North Dakota. In order to meet the requirements of 40 CFR 51.308(g)(3), further detail on the three aspects of visibility conditions at each site is included in Appendix C.

4.1.1. Data Completeness

Data completeness is an issue at some of the IMPROVE sites listed in Table 4-1. Appendix C includes a review of data completeness requirements and a summary of what years are missing at each IMPROVE site. All IMPROVE monitors included enough data to provide a "current" visibility value. One site, North Absaroka, did not have complete data for the "past 5 years." Reasons for missing data include equipment failure, accessibility to remote locations, and power fluctuations.

4.1.2. Review of State's Monitoring Strategy

As discussed above, Montana relied on the IMPROVE monitoring network to assess visibility at Class I Areas across the state. 40 CFR 51.308(g)(7) requires the state to review and, if necessary, propose modifications to the state's monitoring strategy; at this time, no modifications are proposed or expected. Montana intends to continue to rely on data from IMPROVE in the future. While changes to the IMPROVE network are not necessary for Montana to meet the requirements of the Regional Haze Program, there are two areas of weakness to address.

The first area of concern is data completeness at Montana's IMPROVE sites. Of the ten IMPROVE sites analyzed in this progress report, 6 of these sites were missing at least 1 year of data, as seen in Appendix A. Gates of the Mountain (GAMO1) has 5 years of incomplete data between 2000-2015, with three consecutive years missing between 2010 and 2012. North Absaroka has 6 years of incomplete data during this time, with three consecutive years missing from 2009-2011. Gaps in visibility measurements hurt Montana's ability to track visibility changes over time. At Gates of the Mountain, 5-year averaging periods from 2007-2011 through 2010-2014 could not be reported due to missing data. Missing data at this site is, in part, due to accessibility during the winter months, when the very remote site can only be accessed via snow mobile. For North Absaroka, the "past 5 years" visibility measurement could not be reported for 2006-2010 due to missing data in 2007 and 2009-2010. Glacier National Park (GLAC1) and Sula Peak (SULA1) also experienced three and four years of missing data since the monitoring network began, respectively.

The other potential area of weakness is that the Red Rock Lakes National Wildlife Refuge is currently represented by the Yellowstone National Park IMPROVE site (YELL2). While Yellowstone is the closest monitoring site to Red Rock Lakes, the mountainous terrain in Yellowstone may not be representative of the conditions at Red Rock Lakes.

The Yellowstone monitoring site is located on the northern end of Yellowstone Lake, within the Yellowstone Caldera, at an elevation of 7,956 feet. It is surrounded by peaks that range from 10,000 to 14,000ft in elevation. The entire Yellowstone ecosystem rests at a higher elevation than the surrounding area due to the hotspot that gives the Park its many geological features. The high elevation and caldera geology serve as a natural barrier to atmospheric flow. In addition, the increased elevation of the park causes extreme temperatures in the winter that are not seen at lower elevations.

By contrast, Red Rock Lakes National Wildlife Refuge is located in a relatively flat basin at an elevation of 6,600 feet. There are mountains ranging from 8,000 to 9,000 feet located to the north and south, with Yellowstone National Park rising to its east. The IMPROVE monitor is located roughly 70 miles to the east of Red Rock Lakes. Due to the significant terrain barriers that exist between Red Rock Lakes and Yellowstone National Park, Montana believes Yellowstone National Park may not be representative of visibility conditions at Red Rock Lakes.

4.2. Assessment of Visibility Conditions at IMPROVE Sites

This section provides a summary of visibility conditions at each IMPROVE site. The discussion provides a comparison of current visibility conditions to baseline visibility conditions and indicates which pollutants contribute the majority of the light extinction at each site.

The original RHR defined "most impaired days" as "the average visibility impairment (measured in deciviews) for the twenty percent of monitored days in a calendar year with the highest amount of visibility impairment."[66] In other words, for the purposes of the RHR and this progress report, the most impaired days in a given year are the 20% of days with the worst visibility, or the haziest days. On the other end of the spectrum, the "least impaired days" were defined in the original RHR as "the twenty percent of monitored days in a calendar year with the lowest amount of visibility impairment," or the 20% of days with the best, clearest visibility.[67] To avoid confusion with terminology used in the recent revisions to the RHR, this progress report uses the phrases "worst days" or "20% worst days" in lieu of "most impaired days" and "best days" or "20% best days" in lieu of "least impaired days."

Table 4-2 shows the overall current (2011-2015) visibility impairment, reported in deciviews, at the 10 IMPROVE sites representing Montana's 12 Class I Areas and the two additional monitors in nearby states. The percent contribution from sulfates (SO4), nitrates (NO3), organic carbon (OMC), elemental carbon (EC), soil, coarse mass (CM), and sea salt are also displayed for each site.

As shown in the table, organic carbon is the largest contributor to light extinction at nearly all sites on the worst days, while sulfates are the largest contributor on the best days (indicated in bold in Table 4-2). The large contribution of organic carbon is likely due to summer wildfire activity, which will be discussed in more detail in Section 4.3.

---

[66] EPA, 40 CFR 51.301 (2016). See also: EPA, "Guidance for Tracking Progress under the Regional Haze Rule," EPA-454/B-03-004, (Research Triangle Park, NC, Sep. 2003). "Most impaired days - Data representing a subset of the annual measurements that correspond to the dirtiest, or haziest, days of the year."
[67] Ibid.

TABLE 4-2. CONTRIBUTION TO CURRENT LIGHT EXTINCTION (2011-2015)

Site	Deciviews (dv)	2011-2015 Percent Contributions of Light Extinction (Mm-1)						
		SO4	NO3	OMC	EC	Soil	CM	Sea Salt
20% Worst Days								
CABI1	14.5	11%	4%	**66%**	8%	3%	7%	0%
GAMO1	11.7	11%	3%	**69%**	8%	2%	7%	0%
GLAC1	17.0	13%	8%	**59%**	9%	2%	9%	0%
MELA1	17.9	27%	27%	**29%**	5%	2%	10%	0%
MONT1	15.7	8%	2%	**70%**	7%	4%	10%	0%
SULA1	16.3	5%	2%	**80%**	8%	1%	3%	0%
ULBE1	14.5	22%	10%	**48%**	6%	2%	12%	0%
YELL2	12.4	12%	5%	**63%**	9%	2%	8%	1%
NOAB1	11.8	14%	4%	**63%**	8%	3%	8%	0%
THRO1	16.4	**29%**	21%	28%	6%	2%	13%	0%
20% Best Days								
CABI1	2.6	**41%**	14%	22%	5%	4%	9%	5%
GAMO1	0.6	**38%**	15%	25%	4%	3%	12%	2%
GLAC1	5.4	**32%**	10%	32%	14%	2%	8%	2%
MELA1	6.5	**36%**	17%	18%	6%	4%	18%	1%
MONT1	2.6	**38%**	8%	35%	8%	2%	7%	2%
SULA1	1.6	**46%**	10%	21%	5%	3%	14%	2%
ULBE1	3.7	**37%**	9%	25%	6%	4%	19%	1%
YELL2	1.5	**42%**	17%	23%	5%	3%	10%	1%
NOAB1	1.2	**40%**	10%	19%	3%	4%	23%	0%
THRO1	6.2	**33%**	12%	20%	8%	3%	23%	1%

Table 4-3 shows the current visibility conditions compared to the 2000-2004 baseline conditions for all sites. All Montana IMPROVE sites show improvement on the best days compared to baseline. This satisfies one of the long-term goals of the Regional Haze program: no degradation of visibility conditions on the best days.

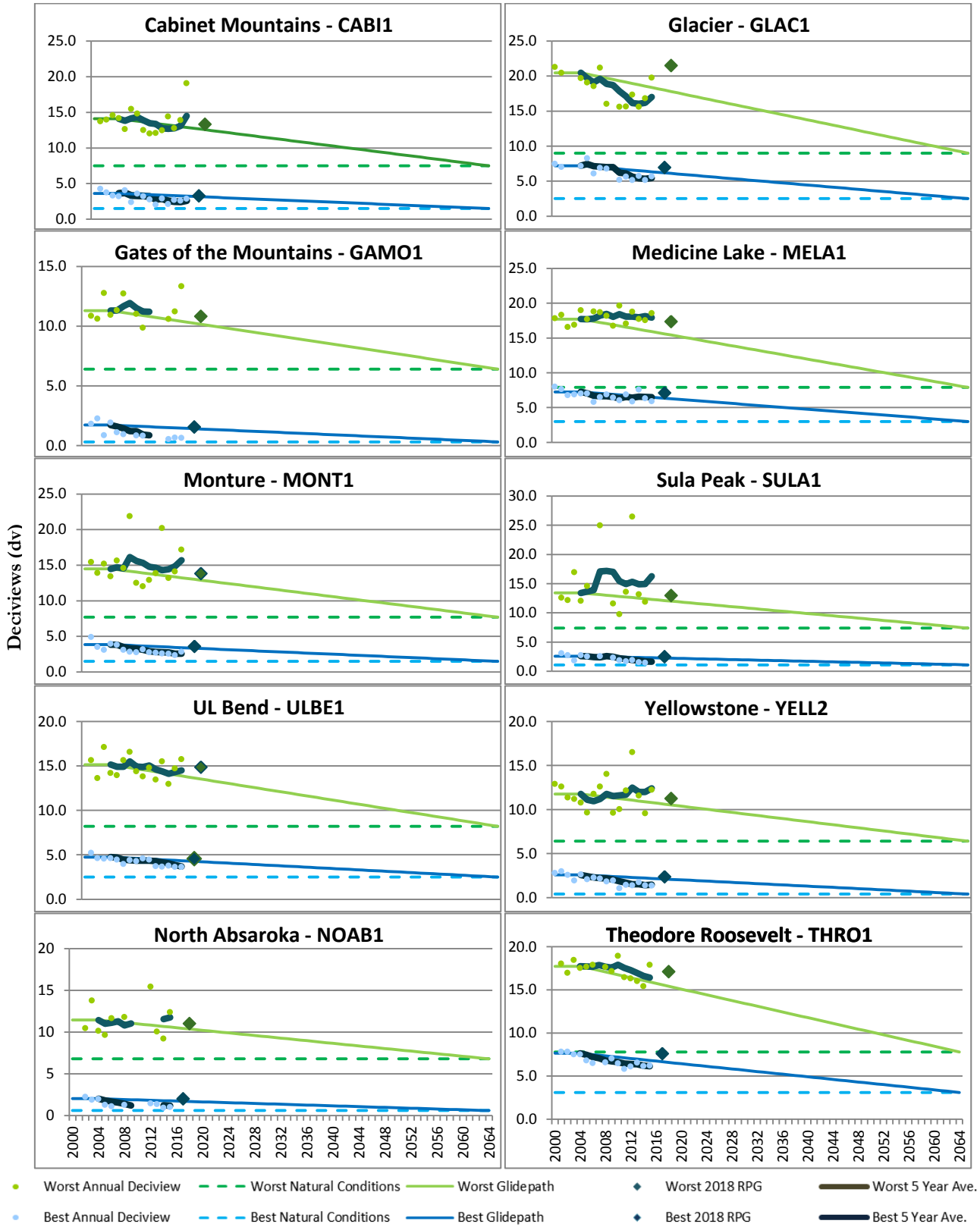
Only three of the ten sites have seen improvement in visibility impairment on the worst days for the 2011-2015 period compared to baseline. As seen in this table, on the worst days, organic carbon contributed the largest increases in light extinction at most sites. Organic carbon is associated with fire (whether anthropogenic or natural). By contrast, at all but one site (SULA1), sulfate and nitrate contributions decreased on the worst days. The small increase in nitrate at SULA1 may be related to the very large increase in organic carbon, another possible result of wildfire impacts.

TABLE 4-3. CHANGE IN VISIBILITY BETWEEN BASELINE AND CURRENT CONDITIONS

Site	Current Period Deciviews (dv)	Baseline Period Deciviews (dv)	Difference in Deciviews (dv)	Difference between Current and Baseline for Annual Average Light Extinction (Mm-1)						
				SO4	NO3	OMC	EC	Soil	CM	Sea Salt
20% Worst Days										
CABI1	14.5	14.1	0.4	-1.63	-0.23	11.16	0.46	0.04	0.23	0.05
GAMO1	11.7	11.3	0.4	-1.72	-0.73	11.94	0.93	-0.16	0.58	-0.04
GLAC1	17.0	20.5	-3.4	-4.35	-5.98	-7.11	-2.07	-0.47	-0.81	-0.31
MELA1	17.9	17.7	0.2	-2.09	-1.25	6.74	0.52	0.27	1.11	0.18
MONT1	15.7	14.5	1.2	-1.10	-0.52	14.49	1.10	0.56	1.44	0.03
SULA1	16.3	13.4	2.8	-0.66	0.15	41.57	3.94	-0.32	0.17	-0.19
ULBE1	14.5	15.1	-0.7	-1.51	-4.28	5.36	0.22	0.10	0.38	0.03
YELL2	12.4	11.8	0.6	-0.45	-0.18	6.65	0.26	-0.23	0.08	0.16
NOAB1	11.8	11.5	0.3	-1.02	-0.46	6.25	0.35	0.11	-0.56	0.03
THRO1	16.4	17.7	-1.3	-5.01	-4.83	1.75	-0.08	0.02	1.11	0.07
20% Best Days										
CABI1	2.6	3.6	-1.0	-0.53	-0.34	-0.35	-0.17	0.02	-0.05	0.03
GAMO1	0.6	1.7	-1.1	-0.38	-0.23	-0.31	-0.13	-0.03	-0.19	-0.01
GLAC1	5.4	7.2	-1.8	-1.04	-0.18	-1.32	-0.42	-0.08	-0.38	0.09
MELA1	6.5	7.3	-0.7	-0.50	0.26	-0.44	-0.14	-0.05	-0.62	0.06
MONT1	2.6	3.9	-1.3	-0.36	-0.28	-0.77	-0.28	-0.05	-0.10	0.02
SULA1	1.6	2.6	-0.9	-0.27	-0.16	-0.55	-0.19	-0.05	0.03	0.00
ULBE1	3.7	4.8	-1.1	-0.47	-0.21	-0.35	-0.28	-0.06	-0.26	-0.02
YELL2	1.5	2.6	-1.1	-0.39	-0.29	-0.53	-0.17	-0.03	0.01	0.01
NOAB1	1.2	2.0	-0.9	-0.20	-0.14	-0.37	-0.09	-0.03	-0.18	-0.01
THRO1	6.2	7.6	-1.5	-1.05	-0.57	-0.47	-0.23	-0.16	-0.48	0.02

Figure 4-2 displays the annual visibility, rolling 5-year average visibility, 2018 reasonable progress goals, uniform rate of progress glidepath to 2064, and natural conditions for both best and worst visibility days at each IMPROVE site. Additional analysis of visibility conditions at each IMPROVE monitor can be found in Appendix C.

FIGURE 4-2. MEASURED VISIBILITY AND EXPECTED RATE OF PROGRESS AT EACH IMPROVE SITE.



4.3. Analysis of Wildfire Contribution

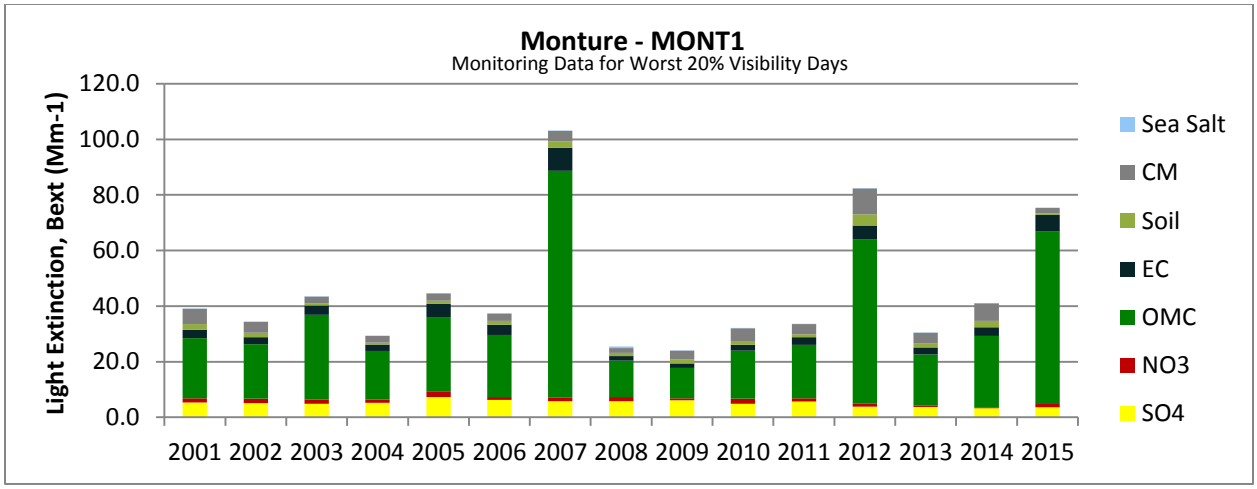
In the original Regional Haze Rule, which informs this progress report, visibility impairment on the worst days was represented by the haziest days within a year. In the western U.S., including Montana, wildfires contribute to the large majority of the haziest days in a year. Wildfire activity in Montana, Washington, Oregon, Idaho, and Canada all contribute to significant haze over Montana during the summer and early fall. Although the selection of "worst days" has changed with the revised Regional Haze Rule, this progress report still uses the haziest days to report current visibility.[68] This is in an effort to compare current conditions to baseline conditions using the same selection of worst days. Therefore, as seen above and described further in this section, the impacts of wildfire activity are the main impediment to visibility improvement on the 20% worst days.

This section provides an overview of how variable the wildfire contribution can be year to year and how significantly wildfire activity influences the selection of worst days.

4.3.1. Impacts of Wildfire Contribution on Worst Visibility Days

Wildfire impacts on visibility vary from year to year depending on the location, intensity, and duration of wildfires in and around Montana. This section uses the Monture IMPROVE site (MONT1) as an example to show just how variable and significant wildfire impacts can be. Figure 4-3 shows the variation of average particulate species at the MONT1 from 2001-2015 on the 20% worst days. This graph shows that while sulfates, nitrates, coarse mass, sea salt, and soil remain fairly constant year to year, the carbon contribution, especially organic carbon, can vary significantly.

FIGURE 4-3. ANNUAL AVERAGE CONTRIBUTION ON THE 20% WORST DAYS - MONTURE IMPROVE SITE

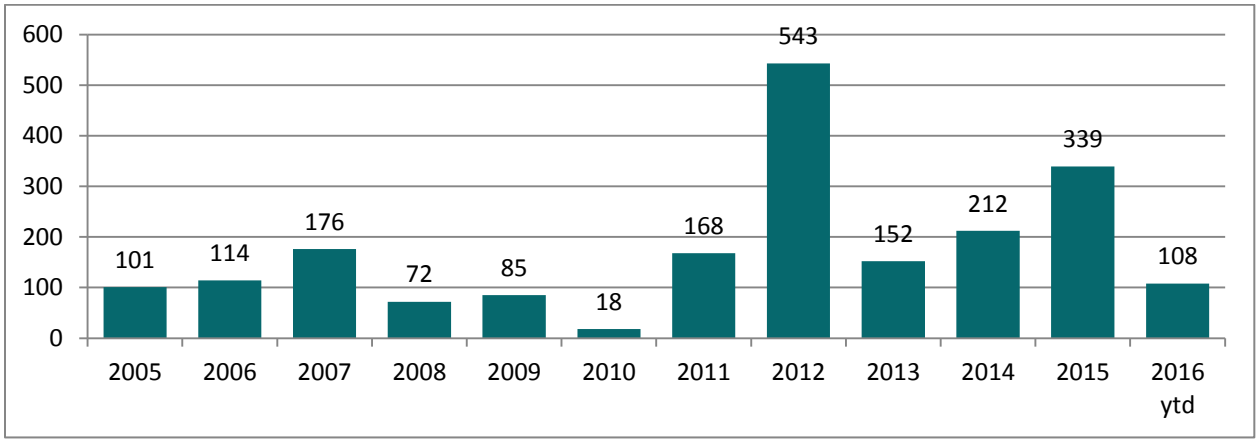


In the graph above, three years stand out as having noticeably higher organic carbon contributions, 2007, 2012, and 2015. These years also stand out in Figure 4-4, which shows the total number of

[68] EPA, Protection of Visibility: Amendments to Requirements for State Plans, 82 Fed. Reg. 3078 (10 Jan. 2017), https://www.gpo.gov/fdsys/pkg/FR-2017-01-10/pdf/2017-00268.pdf.

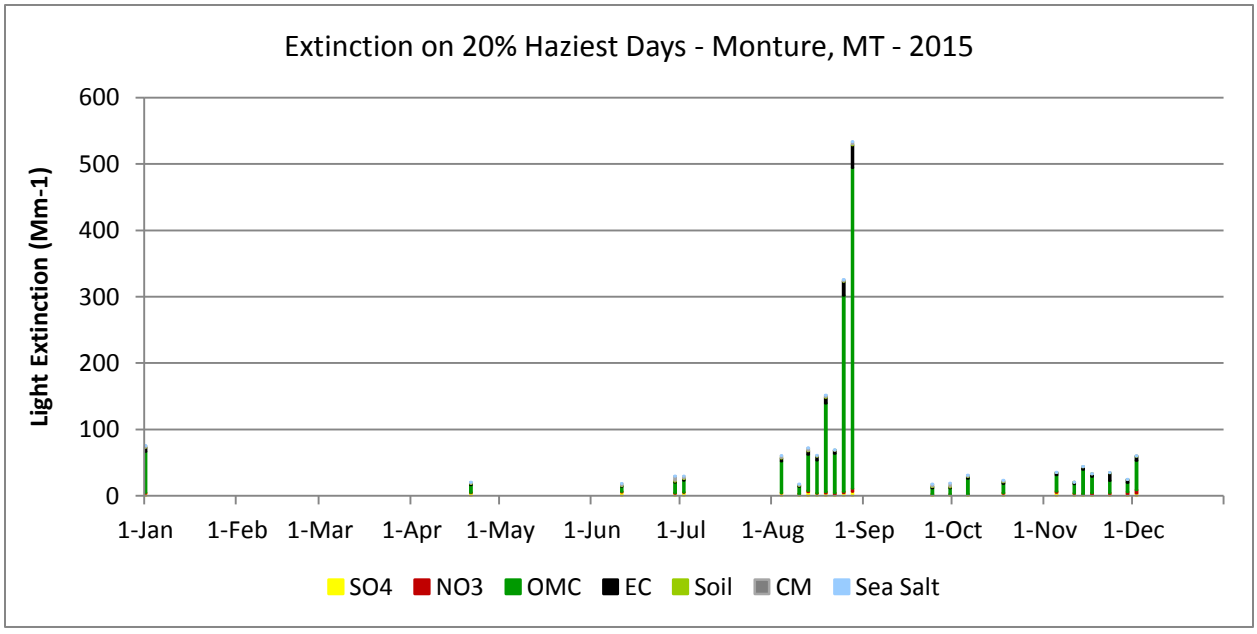
flagged events at the state of Montana's regulatory $PM_{2.5}$ monitors. A flagged monitoring day could include data from any/all regulatory monitors that have been documented as being impacted by smoke from wildfires on the given day. This only includes NAAQS compliance monitors and not special purpose monitors.

FIGURE 4-4. TOTAL FLAGGED MONITORED DAYS BY YEAR



To see how wildfire impacts affect the selection of the 20% worst days, we can use 2015 as an example. Figure 4-5 shows only the 20% worst days in 2015 for the Monture, MT, IMPROVE site (MONT1). You can see that of the 25 days used to calculate the 20% worst days for this site, 17 occurred during the typical wildfire season between June and October. This pattern repeats itself for almost all IMPROVE sites in Montana, with the majority of the haziest days occurring during the wildfire season.

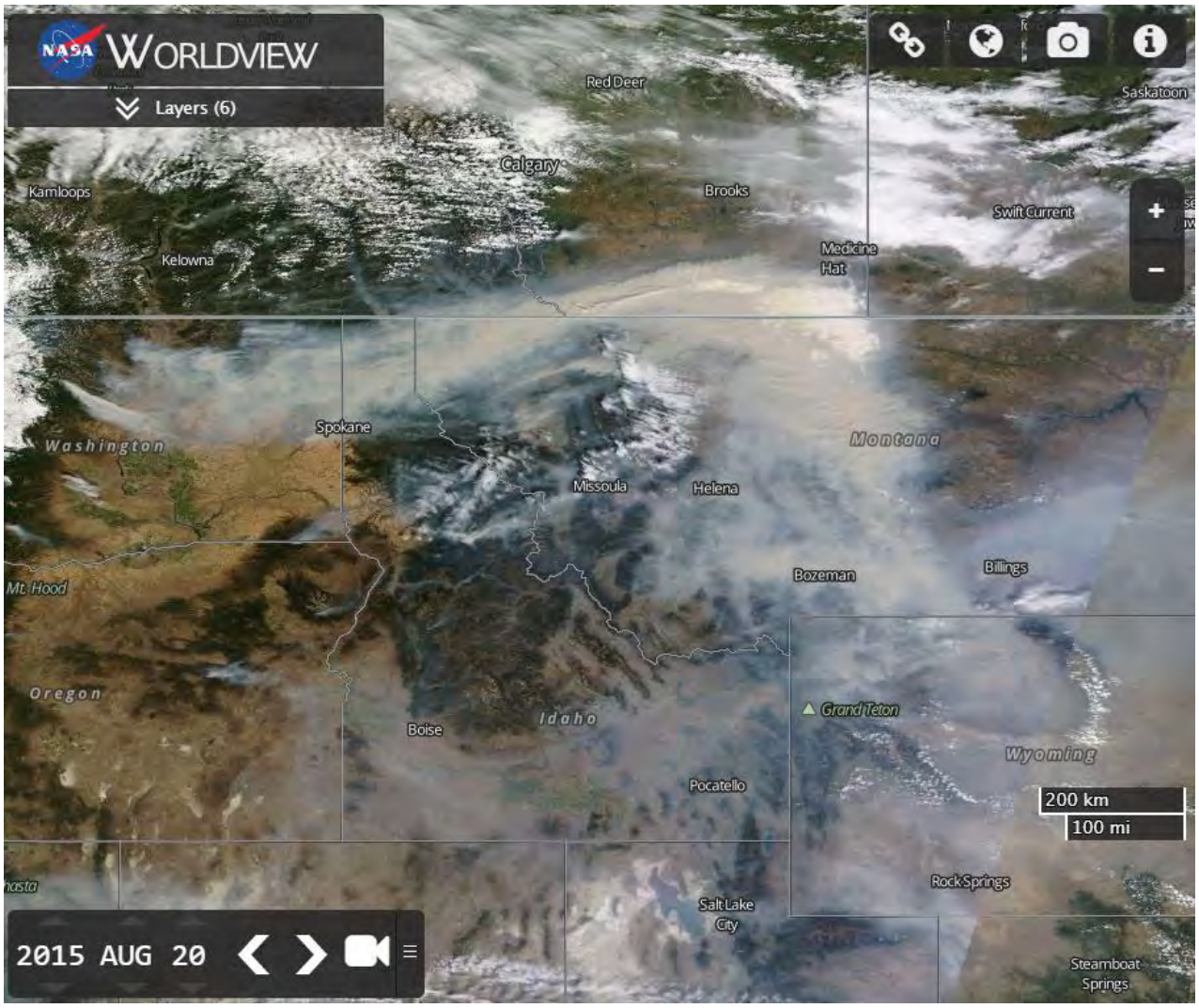
FIGURE 4-5. LIGHT EXTINCTION ON 20% HAZIEST DAYS – MONTURE, MT – 2015



4.3.2. Visualizing Wildfire Impacts in Montana

As discussed above, the year 2015 had significant wildfire activity that affected the 20% worst visibility days (high contributions from organic carbon). Satellite imagery can further inform the story because it helps us visualize the dispersion of smoke from wildfires across Montana and the region. Imagery from August 2015 clearly shows wildfire smoke originating from in and around Montana affecting Montana skies. Below, on August 20, 2015, a river of smoke can be seen moving across northern Idaho and through Montana from massive fires in Washington.

FIGURE 4-6. WILDFIRE ACTIVITY AS SEEN ON SATELLITE IMAGERY ON AUGUST 20, 2015[69]

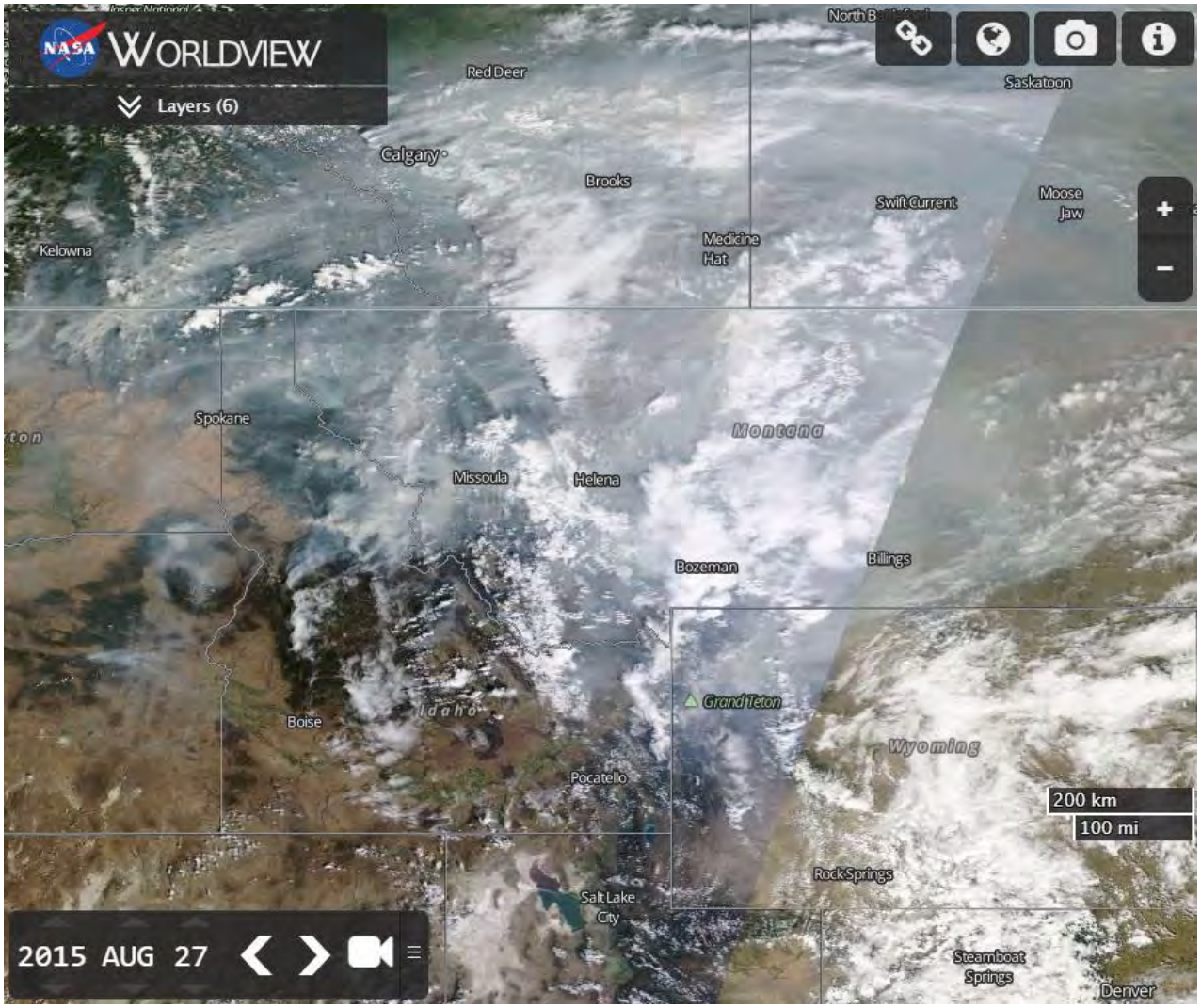


Similarly, Figure 4-7 shows a satellite image from August 27, 2015. This image shows smoke originating from fires in Washington, Idaho, Oregon, and Montana covering almost the entire state.

---

[69] National Aeronautics and Space Administration (NASA), EOSDIS Worldview, 20 Aug. 2015, http://go.nasa.gov/2ifG7G0.

FIGURE 4-7. WILDFIRE ACTIVITY AS SEEN ON SATELLITE IMAGERY ON AUGUST 27, 2015[70]

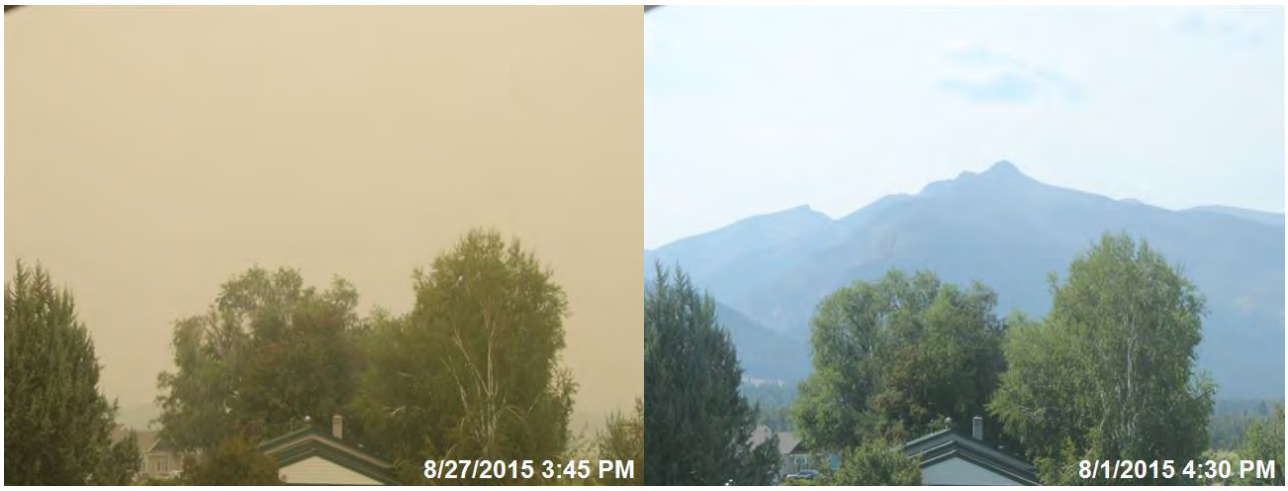


Satellite imagery is helpful to identify sources of wildfire smoke affecting Montana, but it doesn't show the impacts at the ground level and on visibility. For that, webcams can be more informative. For example, Figure 4-8 and Figure 4-9, on the following page, clearly show degraded visibility in two locations in western Montana on the dates noted. For comparison, Figure 4-9 also shows a relatively clear day at the same webcam.

[70] NASA, EOSDIS Worldview, 27 Aug. 2015, http://go.nasa.gov/2ilcBMR.

FIGURE 4-8. WEBCAM ON AUGUST 20, 2015, IN BUTTE, MONTANA

FIGURE 4-9. WEBCAM IN THE BITTERROOT VALLEY, MONTANA, ON SMOKY AND CLEAR DAYS[71]



4.4. Conclusion

In summary, visibility in Montana's Class I Areas from 2011-2015 has improved on the 20% best days at all sites compared to the 2000-2004 baseline. On the 20% worst days, visibility has worsened at all

[71] U.S. Forest Service, 2017 Air Quality Images, Location: Bitterroot Valley (1 Aug. 2015 and 27 Aug. 2015), https://www.fsvisimages.com/fstemplate.aspx?site=biva1.

but three sites. A closer look reveals that wildfire activity in the summer and fall makes up the majority of days selected as the 20% worst days at almost all sites. The influence of wildfire activity is further confirmed by the high variability of organic and elemental carbon concentrations from year to year. By contrast, sulfates and nitrates have generally decreased on the 20% worst days. On the 20% best days, only the Medicine Lake Class I Area had an increase in nitrates since the baseline period. Appendix C includes a more detail on how visibility has changed since the baseline period at each Montana IMPROVE site.

Chapter 5. Significant Changes in Anthropogenic Emissions Possibly Impeding Progress

Although emissions are generally decreasing across the state, measuring progress under the Regional Haze program relies on a comparison of actual progress to expected/anticipated progress. As such, 40 CFR 51.308(g)(5) requires "[an] assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility."[72] The following sections provide a discussion of (1) anticipated emissions decreases that may not have occurred and (2) possible unanticipated emissions increases. Taken together, all factors may have impeded the rate of progress even if emissions have generally been reduced.

5.1. Incomplete Implementation of BART Controls

As previously discussed, in developing the Montana FIP, EPA analyzed large industrial facilities that had the potential to be affecting visibility in Class I Areas and at which retrofit controls (best available retrofit technology, or BART) could be installed to reduce emissions. At the facilities determined to be subject to BART, EPA developed emission limits for the major visibility-impairing pollutants: NO_x, PM, and SO_2.

As part of the implementation and enforcement of the emission limits, EPA set dates by which each source must comply with the limits. At the time analysis was completed for this progress report, not all of the compliance dates had occurred and not all BART sources had installed the controls relied upon in the Montana FIP to improve visibility conditions. The sections below provide more detail on individual facilities.

5.1.1. Oldcastle Cement

First, the compliance date set by EPA for NO_x emission limits at the Portland cement plants is October 18, 2017, around the same time this report is due to be submitted EPA. At this time, only one of the kilns, Ash Grove, has installed controls and is meeting the prescribed emission limits. As discussed previously, EPA recently revised the Oldcastle NO_x emission limit. The facility installed controls in spring 2017 and expects lower emissions by the compliance date.

The modeling used by EPA in the Montana FIP identified a baseline impact of 0.98 deciviews from the Oldcastle facility at the Gates of the Mountains Class I Area. According to the EPA analysis, a modeled contribution of 0.50 deciviews or more at a single Class I Area indicated that a facility was contributing to visibility impairment at that area. The NO_x controls and emission limit at Oldcastle were anticipated to improve visibility at Gates of the Mountains by 0.424 deciviews. Despite the regional character of

[72] EPA, 40 CFR 51.308(g)(5) (2016).

haze, Class I Areas closer to Oldcastle may be more affected by emissions changes in their immediate vicinity than by trends in the state as a whole. In other words, the fact that controls have not yet been implemented at Oldcastle may have impeded progress toward reasonable progress goals during this progress period at the Gates of the Mountains site and, to a lesser degree, other Class I Areas affected by emissions from Oldcastle. However, the NO_x emission limit prescribed in the Montana FIP has not yet become effective.

5.1.2. Colstrip Units 1 and 2

The compliance dates for SO_2 and NO_x limits at Colstrip Units 1 and 2 were also set as October 18, 2017, and thus would not yet be effective at this time. However, these limits were vacated in 2015 and remanded back to EPA for reconsideration.[73] At the time of this progress report, EPA has not published revised BART determinations for these two coal-fired generating units. As discussed above, a 2016 consent decree requires that the units cease operation by 2022, after which emissions from the units will be nonexistent.

The modeled baseline visibility impacts from Colstrip Units 1 and 2 were greatest at Theodore Roosevelt National Park in North Dakota and the UL Bend Class I Area in central Montana. Although emissions of both SO_2 and NO_x have decreased across the state as a whole and emissions data reported to the state shows decreases in emissions at both units, potential additional decreases resulting from the implementation of BART controls at Colstrip Units 1 & 2 have not been fully realized.

5.1.3. Comparison of Reported Emissions to Projected Emissions

The effects of the as yet incomplete BART implementation can easily be seen by comparing reported current emissions from these sources to where they were projected to be following installation of BART in the 2018 inventory. The graphs on the following pages compare recent reported annual emissions to the emission levels projected for 2018. [74]

Ash Grove Cement is the only facility at which BART has been fully implemented. The graphs show that the facility is currently reporting emissions well below 2018 projections. Despite the incomplete implementation of BART controls at Oldcastle and the fact that NO_x emissions have increased over the last few years at the facility, it is important to note that Oldcastle is already reporting emissions of all three visibility-impairing pollutants below the 2018 projections. Colstrip Units 1 and 2, on the other hand, are still emitting higher amounts of both $PM_{2.5}$ and NO_x than were projected for 2018, despite the reductions in recent years discussed earlier in this report.

---

[73] NPCA v. EPA, No. 12-73710, U.S. 9th Cir. (2015), http://caselaw.findlaw.com/us-9th-circuit/1703871.html.
[74] WRAP, Point and Area Source Pivot Tables for Regional Haze Planning Emissions Scenarios, https://www.wrapair.org/forums/ssjf/pivot.html (accessed 9 May 2017).

FIGURE 5-1. NO_x REPORTED VS. PROJECTED EMISSIONS AT BART SOURCES

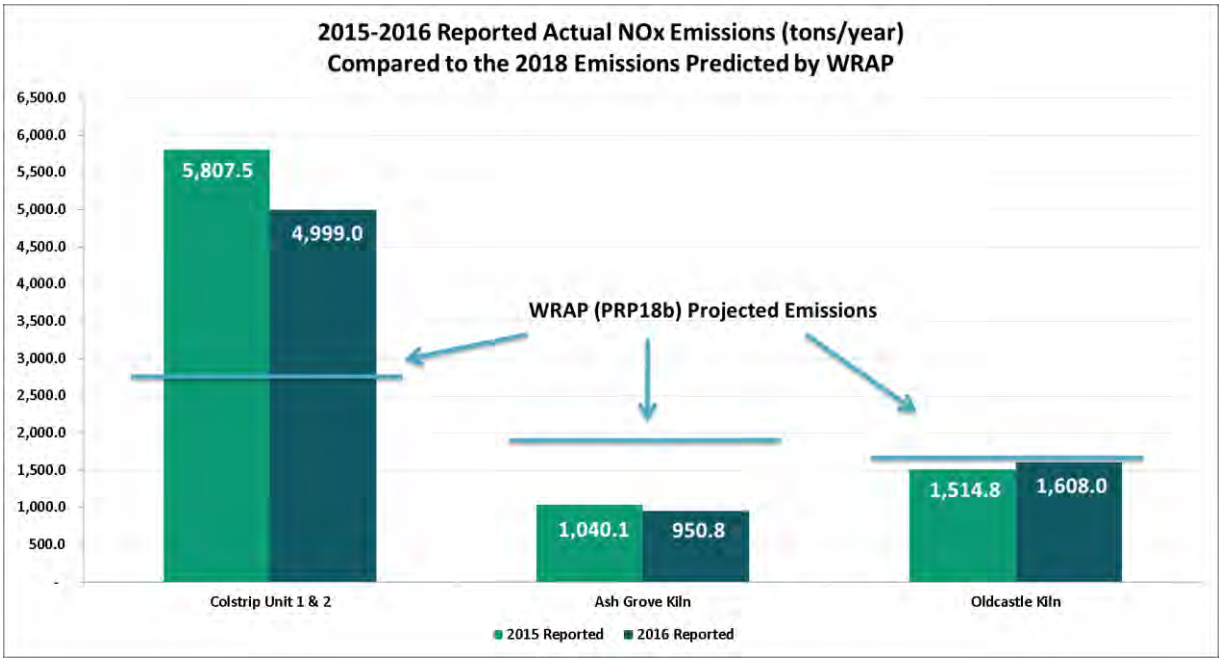


FIGURE 5-2. SO_2 REPORTED VS. PROJECTED EMISSIONS AT BART SOURCES

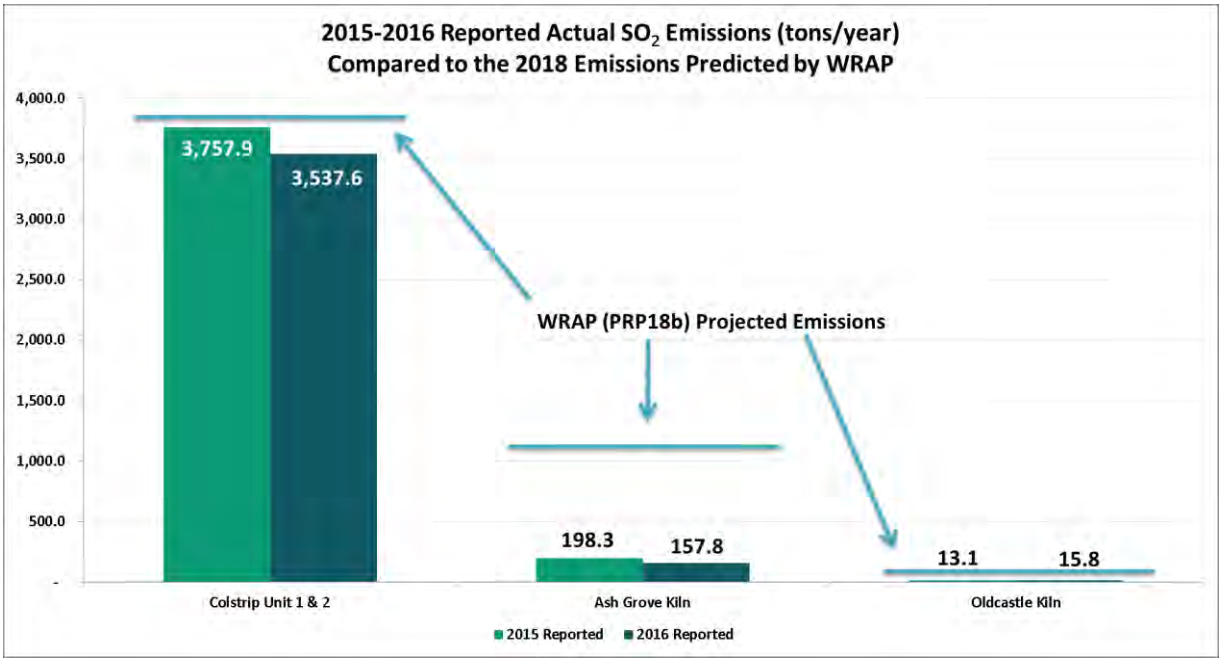
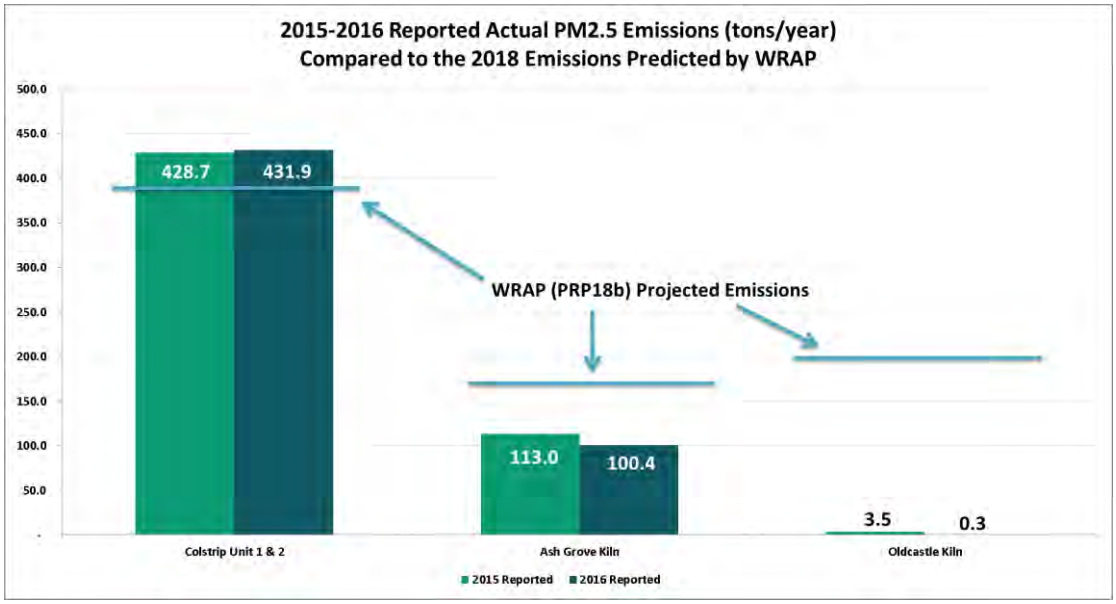


FIGURE 5-3. $PM_{2.5}$ REPORTED VS. PROJECTED EMISSIONS AT BART SOURCES



In summary, the impacts on emissions from BART controls have yet to be fully realized. Although BART was a one-time requirement in the RHR, BART-eligible sources may require further analysis in future implementation periods to determine whether additional controls are necessary and available. As Montana moves forward in planning for the next implementation period, the facilities discussed above may need to be reassessed to determine the extent of their ongoing impacts on visibility in the region.

5.2. Oil & Gas Development in Montana, North Dakota, and Wyoming

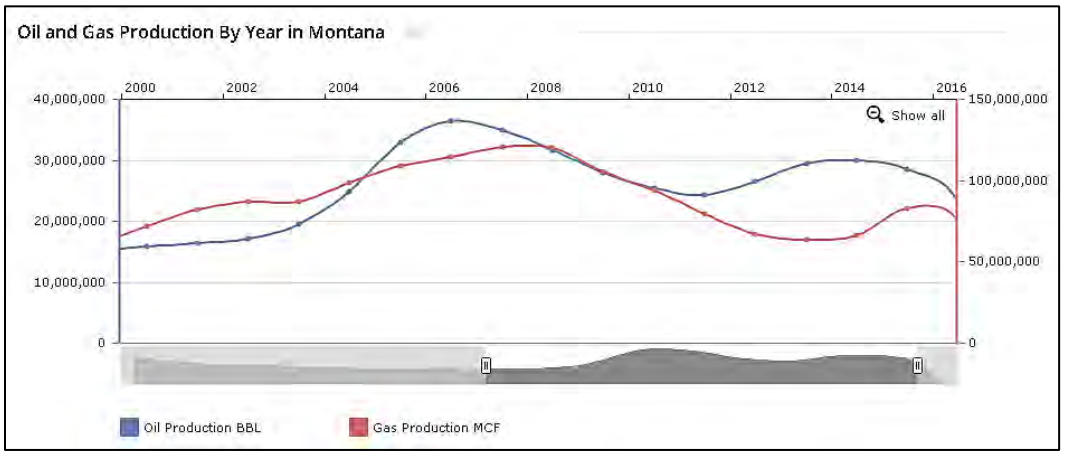
In the years since the baseline period of 2000-2004, Montana and North Dakota both experienced significant growth in oil and gas production. This growth occurred in the "Bakken," an oil and gas formation or "play" mostly located in North Dakota but including areas of eastern Montana. Natural gas production in Wyoming has remained consistently high during the same time period relative to both Montana and North Dakota, but the state has seen growth in oil production over the last decade. Increases in production are important because oil and gas wells and related infrastructure often produce fugitive emissions. The emission factors for these various oil and gas activities are not well documented, but they are becoming a larger issue as oil and gas production increases.

5.2.1. Montana

Montana's increase in both oil and gas production began in about 2000, nearly doubling by 2005. Due to the timing of the beginning of the boom, the baseline period, on average, accounted for a good portion of the fugitive emission increases that would have occurred in the areas of production. Since the peak of the boom, which occurred in Montana over the 2006-2008 period, the production of both oil and gas has declined to the point that gas production in the current period (2011-2015) is actually

lower than the baseline period (2000-2004) by approximately 15 percent. Oil production, on the other hand, remains fairly high in the current period, nearly 50 percent higher than the baseline period.[75] In the graphs, gas production is shown in million cubic feet (MCF) and oil production in barrels (BBL).

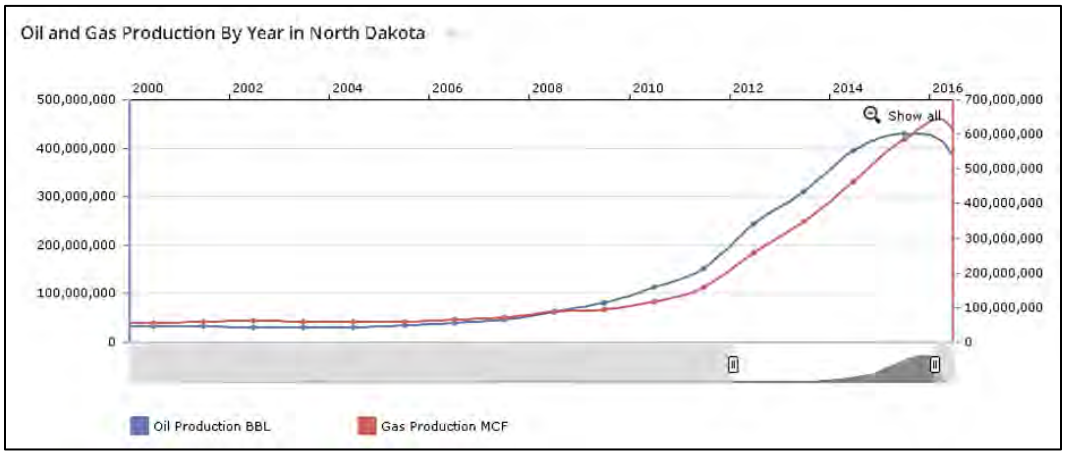
FIGURE 5-4. CHANGES IN MONTANA OIL & GAS PRODUCTION



5.2.2. North Dakota

Total oil and gas production in North Dakota is significantly higher than in Montana. North Dakota also experienced a boom in oil and gas development during the years since the baseline period, but the growth did not begin to occur in North Dakota until approximately 2008. Therefore, the baseline period for North Dakota would not have reflected the new emissions associated with the boom. North Dakota reached peak production in 2015 and 2016, at which time economic conditions resulted in a production decrease as natural gas and oil prices were not considered worth the cost of recovery.[76]

FIGURE 5-5. CHANGES IN NORTH DAKOTA OIL & GAS PRODUCTION



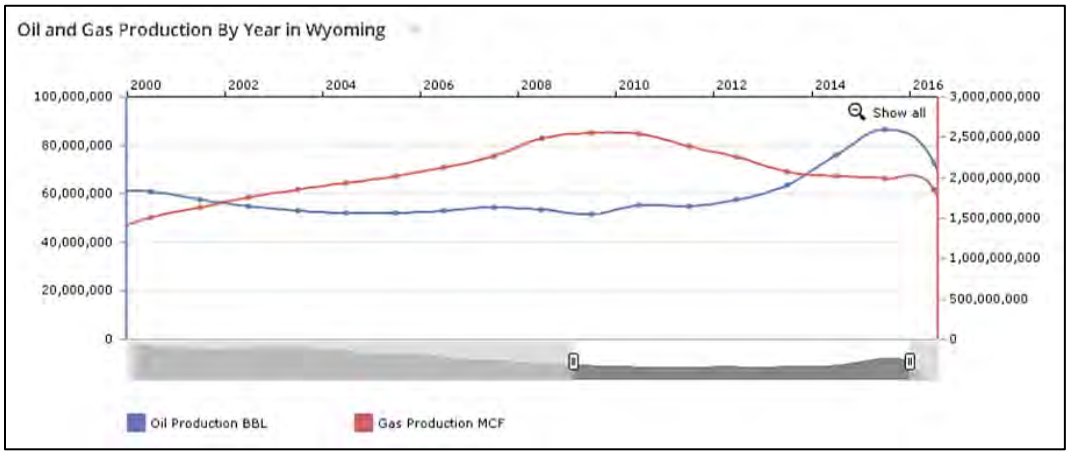
[75] All production data and charts from Drilling Edge, Oil and Gas Data across the United States, www.drillingedge.com (accessed 4/3/2017).
[76] Drilling Edge, North Dakota, www.drillingedge.com/north-dakota.

In North Dakota, total production of gas is more than six times higher and total production of oil is nearly 10 times higher in the current period than in the baseline period. Therefore, related emissions from North Dakota were more likely to be affecting Montana's Class I Areas (such as Medicine Lake and UL Bend) during the current period.

5.2.3. Wyoming

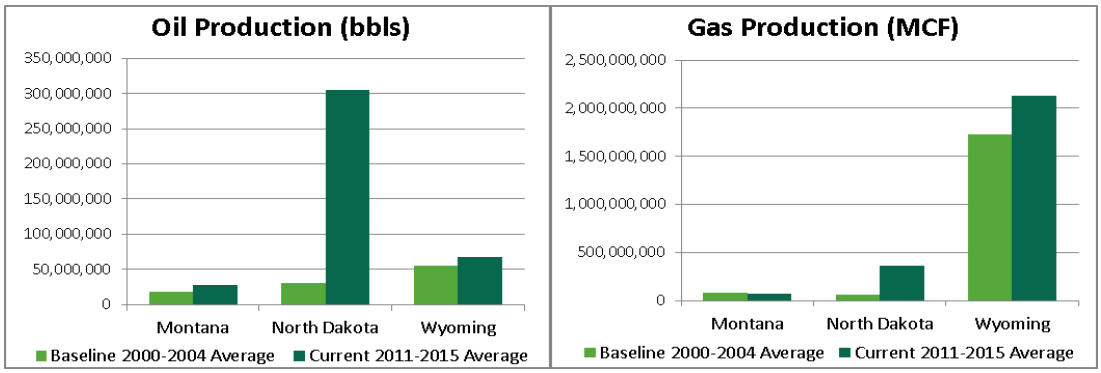
Wyoming also experienced a change in oil and gas production during the time of interest but its production did not reflect a boom but rather minor increases and decreases. Wyoming's gas production was twenty times higher than Montana's during the baseline period and almost 30 times higher for the current period. This increase in gas production far outweighed the increases that occurred in both Montana and North Dakota combined. In addition, Wyoming experienced oil production increases from the baseline period to the current period of just over 21 percent.[77]

FIGURE 5-6. CHANGES IN WYOMING OIL & GAS PRODUCTION



The following figures show production data for the three states averaged over the baseline period (2000-2004) and the current period (2011-2015).

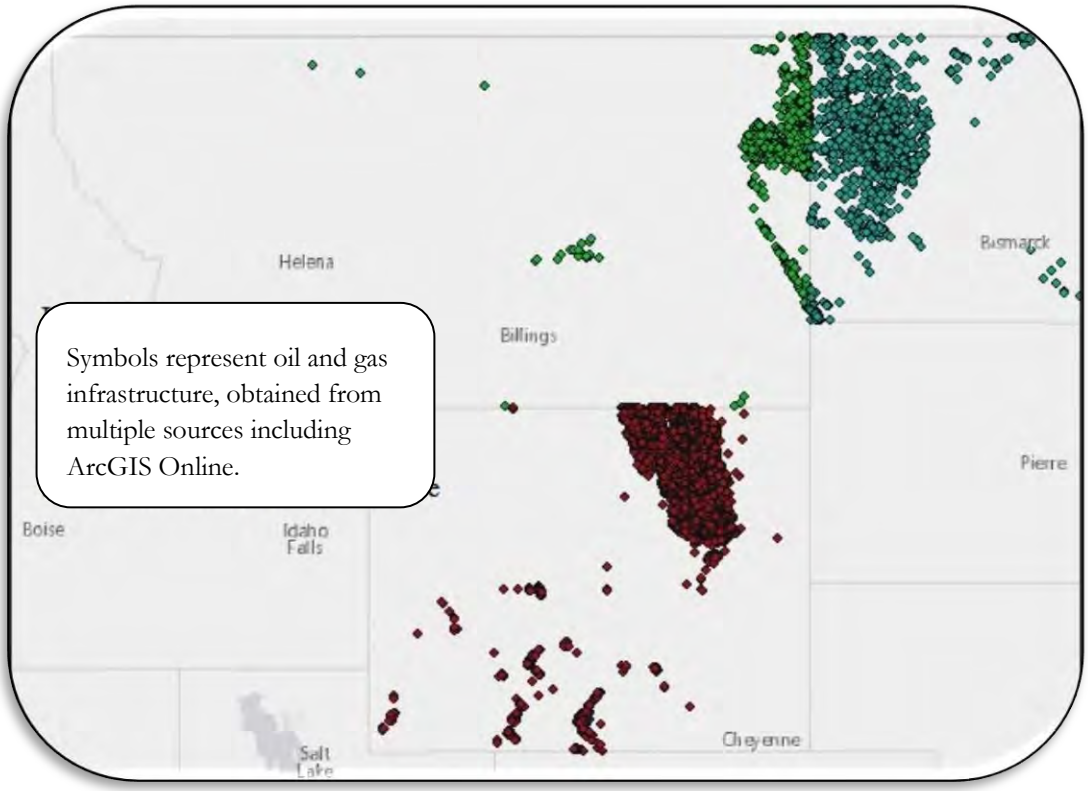
FIGURE 5-7. CHANGE IN OIL & GAS PRODUCTION – BASELINE TO CURRENT[78]



[77] Ibid., Wyoming, www.drillingedge.com/wyoming.
[78] Ibid., www.drillingedge.com.

The map below is an approximation of the most recent oil and gas infrastructure in Montana, North Dakota, and Wyoming. It is intended to provide a snapshot of the general geographic area affected by oil and gas development. In North Dakota, the points represent mostly oil and gas wells. Points in Montana indicate sites that are registered with the Air Quality Bureau due to emissions from oil and gas infrastructure.[79]

FIGURE 5-8. MAP OF OIL & GAS INFRASTRUCTURE IN MONTANA & NORTH DAKOTA



For the three states combined, gas production increased by over 37 percent and oil production increased by 281 percent from baseline to current periods. Although it is difficult to quantify the actual changes in related emissions and resulting visibility impacts, it is likely that these trends have increased emissions from the oil and gas sector, and may have impeded progress in improving visibility.

In fact, recent photochemical grid modeling supported by the United States Bureau of Land Management (BLM) studied the future air quality impacts of oil and gas activities in Montana, North Dakota, and South Dakota.[80] The modeling specifically looked at the contribution to visibility impairment at Class I Areas that is expected to result from oil and gas activity. The study projected visibility impacts out to future year 2032 and indicated that emissions resulting from oil and gas activity

[79] Montana DEQ, Air Quality Bureau, Oil & Gas Registration Program. See also, www.ArcGIS.com.
[80] Ramboll Environ US Corporation and Kleinfelder, Inc., "Bureau of Land Management Montana/Dakotas State Office PGM Modeling Study Air Resource Impact Assessment," 06-632912, September 2016.

contribute to visibility impairment in the area now and into the future. This study is of particular interest for Class I Areas in eastern Montana, including both the Medicine Lake and UL Bend National Wildlife Refuges. The modeling indicated that the close proximity of oil and gas wells to these and other Class I Areas will make it challenging for states to achieve significant visibility improvements. Montana and neighboring states will have to further study these impacts in the process of preparing SIP revisions for the 2018-2028 implementation period.

5.3. Emissions from International Sources

In the process of reviewing visibility data for Montana's Class I Areas, one site stood out as having significantly different contributions to light extinction. The Medicine Lake Class I Area (Medicine Lake) in northeast Montana is the only site at which sulfates and nitrates, those pollutants typically associated with anthropogenic emissions, contributed more than 50% to light extinction on the worst days. Across most of Montana, the worst visibility days occur during wildfire season and experience significant impacts from smoke, as shown by the fact that organic carbon is the primary contributor to light extinction on these days. However, Medicine Lake has a much different profile.

Medicine Lake is less than 40 miles south of the Canadian border, just less than 20 miles west of North Dakota, and only about 5 miles east of the Fort Peck Indian Reservation. With the exception of Williston, across the border in North Dakota, and recent oil and gas activity in the Bakken, the area surrounding Medicine Lake is rural with few large sources of emissions. However, the area currently has the worst visibility in the state on both the clearest and haziest days. It is also the only area in the state that showed an increase in contribution from nitrates on the clearest days. In this section, we look at weather patterns, emissions data, and modeling provided by WRAP to show that emissions from Canadian sources are likely the primary contributors to light extinction at Medicine Lake.

It is possible that increased oil and gas development has contributed to visibility impairment and slowed the rate of progress at Medicine Lake. As discussed above, eastern Montana has experienced a boom in oil and gas development since the time of the Regional Haze baseline period. Although the boom was never on the scale of the North Dakota boom and has dropped off to the point where production is currently only slightly above baseline levels, emissions associated with the oil and gas sector may continue to contribute to light extinction at a higher rate than during the baseline period. However, these small sources of fugitive emissions are likely not the main contributor to anthropogenic visibility impairment in the area.

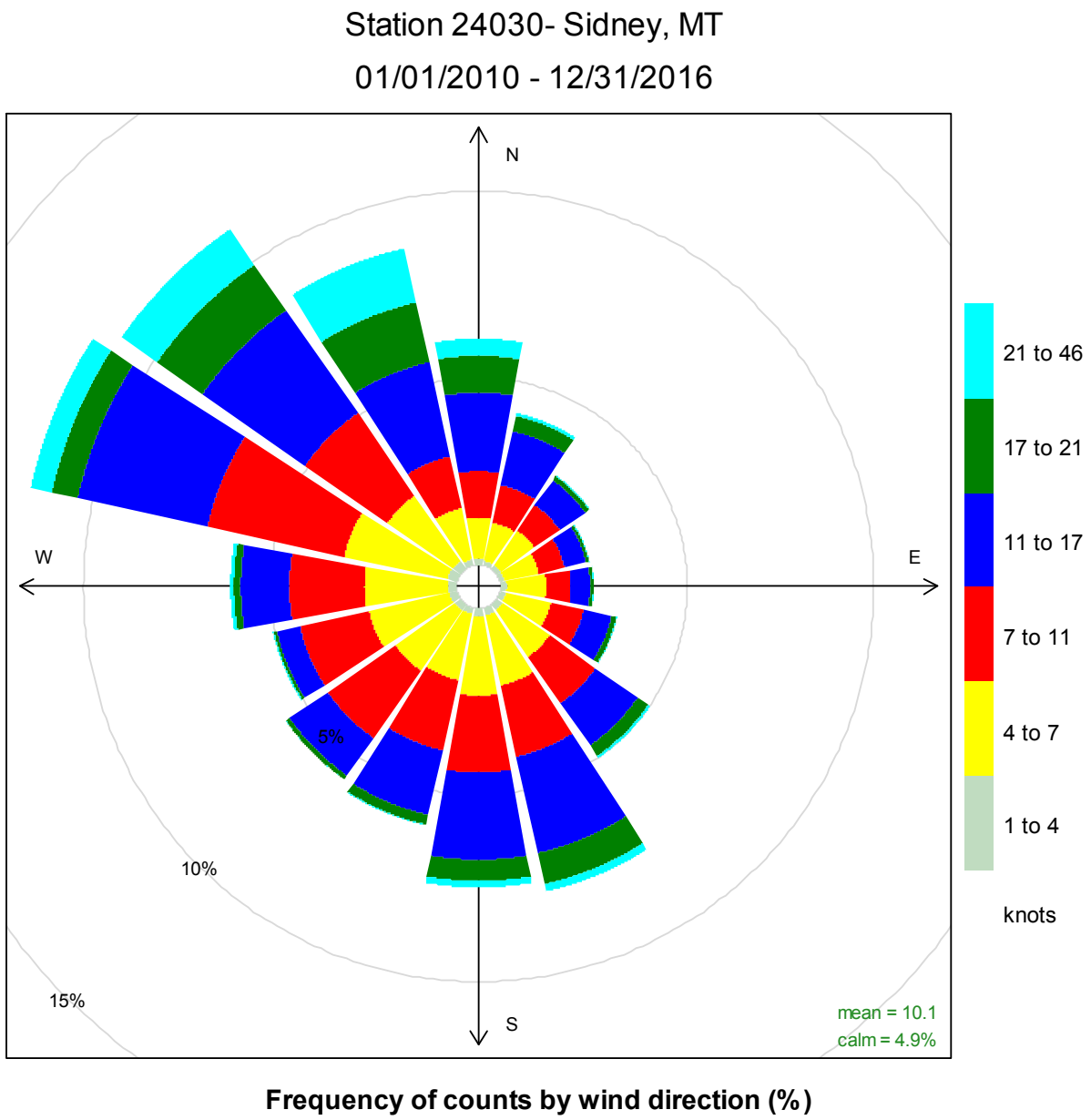
5.3.1. Analysis of Weather Patterns

Weather patterns in the area make it extremely unlikely that emissions from North Dakota or oil production to the east would be affecting visibility at Medicine Lake. Weather patterns in far northeast Montana are influenced by predominant northwest winds as well as large-scale weather systems affecting the central United States. Northeast Montana is part of the upper Great Plains of the U.S., with limited terrain features to influence weather patterns. The flat terrain extends from the Rocky Mountain Front east to the Great Lakes and south through the Mississippi River Basin. Weather in this

area is categorized by strong winds, cold winters, and severe weather in the summer. Weather systems from Canada can easily flow down into the upper Great Plains, especially in the winter when cold air masses pour into the U.S. In the summer, when the arctic air mass retreats back up into Canada, the upper Great Plains can see severe episodes of thunderstorms and tornados, with moist air moving up from the southwest and strong winds streaking across the Plains.

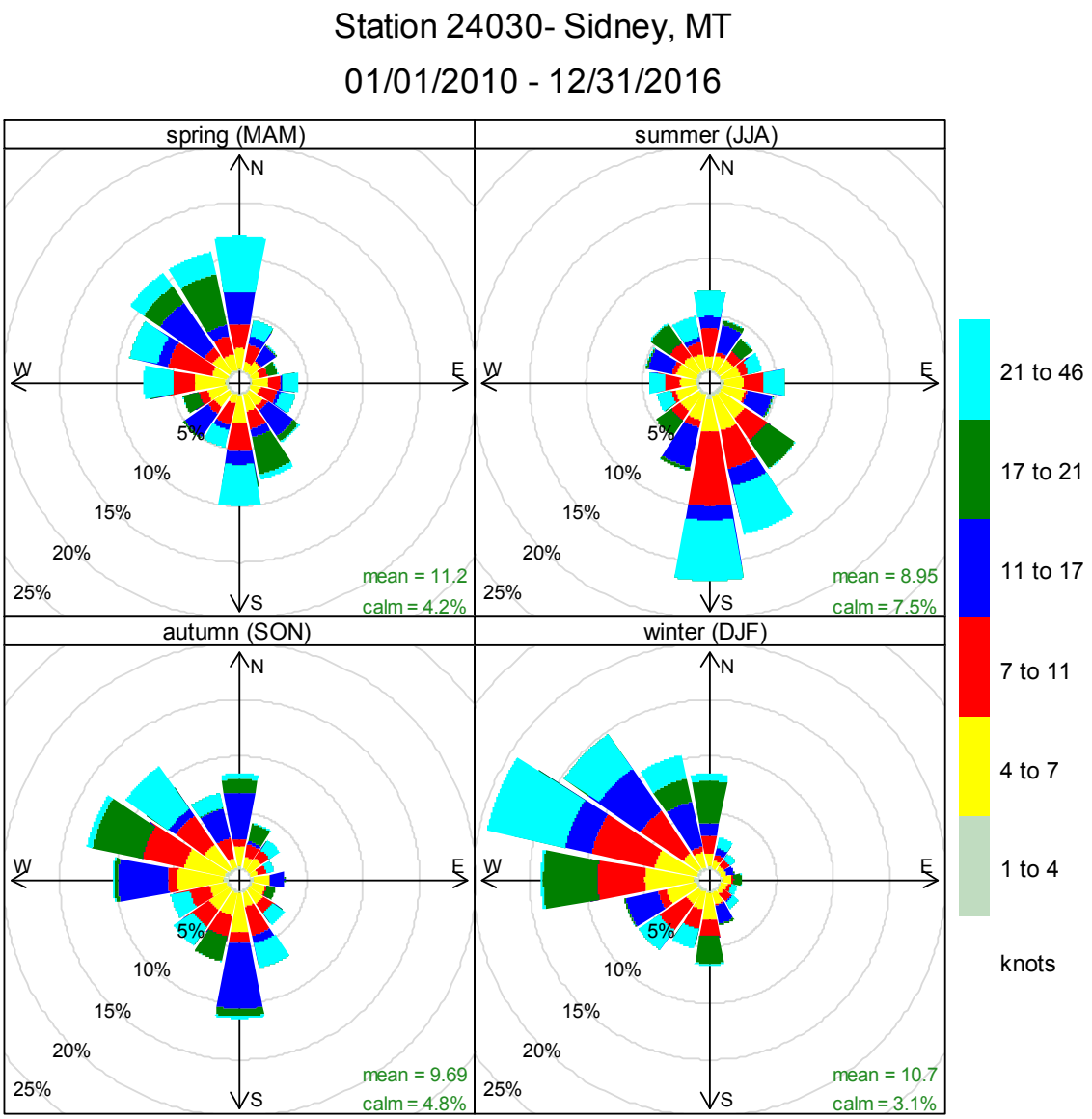
Wind roses from Sidney, MT, were used to analyze the weather patterns influencing Medicine Lake. Sidney is located 56 miles south of Medicine Lake. Halfway between Sidney and Medicine Lake, the Missouri River flows from west to east, otherwise there are no large terrain features to influence weather patterns in that area. Figure 5-9 shows that the predominant wind direction in Sidney over the last several years is from the northwest, generally with stronger wind speed. A closer analysis of seasonal variations in Figure 5-10 shows that northwest winds dominate in winter and spring, while southerly flow dominates the summer. A mix of northwest and southerly flow is present in the fall, when summer and winter weather patterns frequently oscillate.

FIGURE 5-9. WIND DIRECTION AND SPEED IN SIDNEY, MT FROM 2010-2016[81]



[81] National Atmospheric and Oceanic Administration (NOAA), National Centers for Environmental Information, ISH Hourly Weather Data, ftp://ftp.ncdc.noaa.gov/pub/data/noaa/ (accessed 4 Apr 2017).

FIGURE 5-10. WIND DIRECTION AND SPEED IN SIDNEY, MT BY SEASON FROM 2010-2016[82]

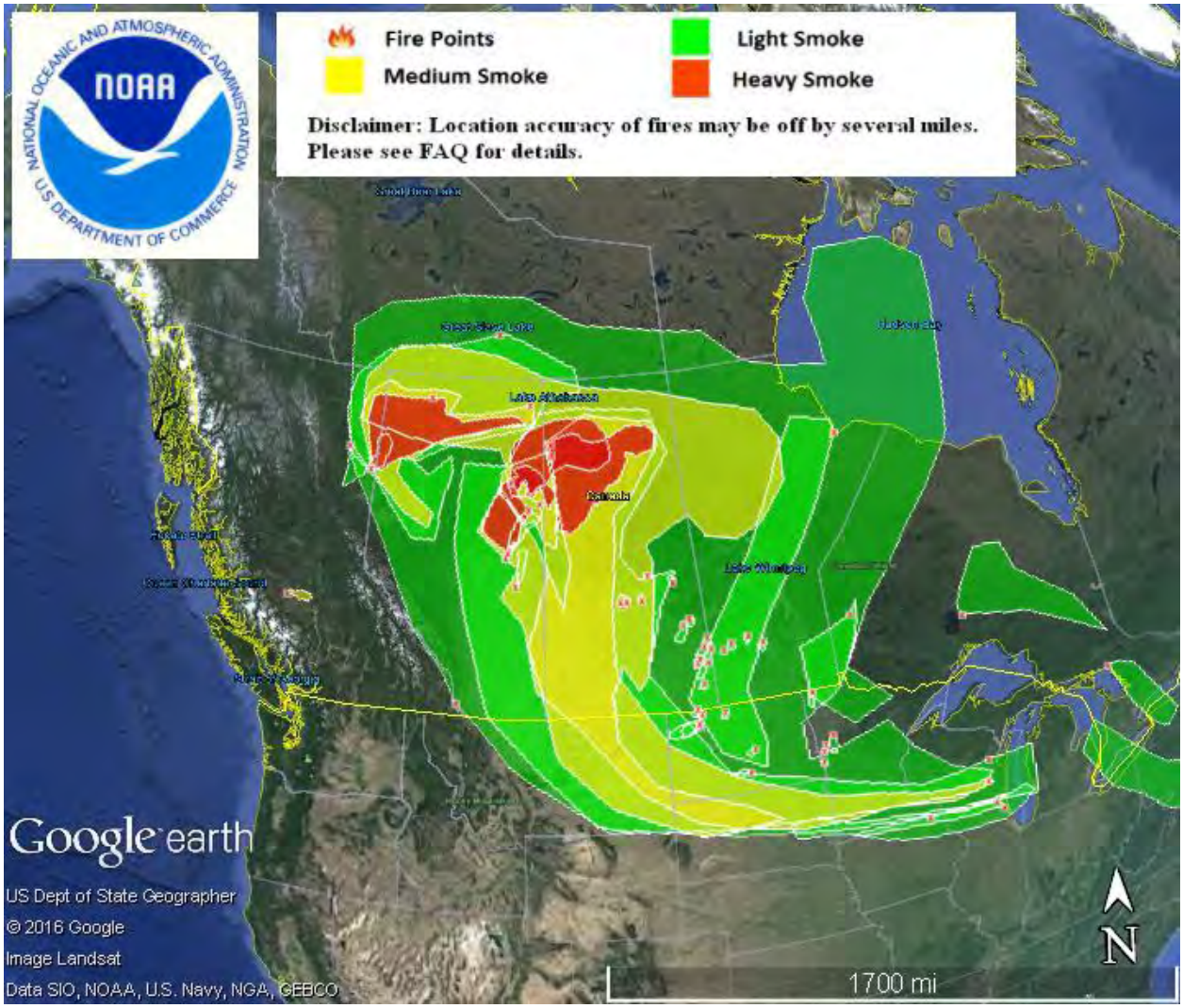


This analysis shows that influence from Canada on Medicine Lake is likely in the winter and spring, when air masses frequently spill into the upper U.S. In fact, eastern Montana sometimes sees spring season wildfire impacts from Canadian fires. For example, Figure 5-11 shows smoke detected on satellite moving into northwest Montana from large fires in central Canada on May 17, 2016. The image reflects the predominant spring wind direction in the area.

---

[82] Ibid.

FIGURE 5-11. SMOKE MOVEMENT DETECTED ON SATELLITE ON MAY 17, 2016[83]



5.3.2. Analysis of Nearby Canadian Sources

Given the predominant weather patterns in the area, emissions from Canadian sources have the potential to affect visibility in northeastern Montana, specifically at Medicine Lake. In fact, emission inventories put together by WRAP do show significant contributions to sulfate and nitrate at Medicine Lake coming from sources in Canada.[84] Figure 5-12 and Figure 5-13 show regional contributions to sulfate and nitrate, respectively, on the worst days in the baseline inventory.

---

[83] NOAA, Hazard Mapping System Fire and Smoke Product, http://www.ospo.noaa.gov/Products/land/hms.html (accessed 17 May 2016).

[84] WRAP used the Community Multiscale Air Quality (CMAQ) modeling system, which has a domain that extends well across the border into Canada.

FIGURE 5-12. BASELINE REGIONAL CONTRIBUTION TO SULFATE AT MEDICINE LAKE[85]

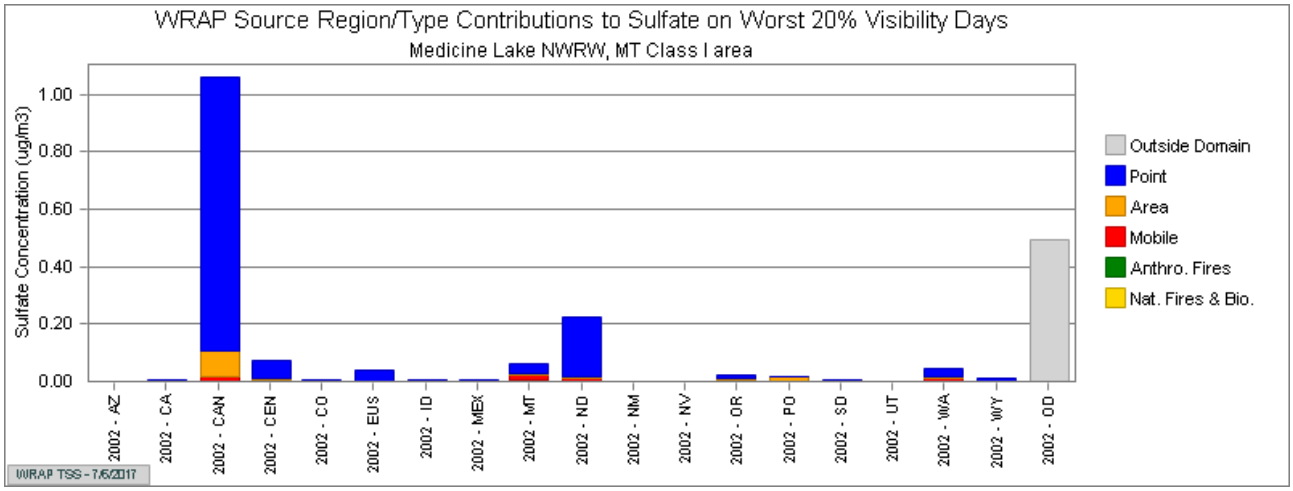
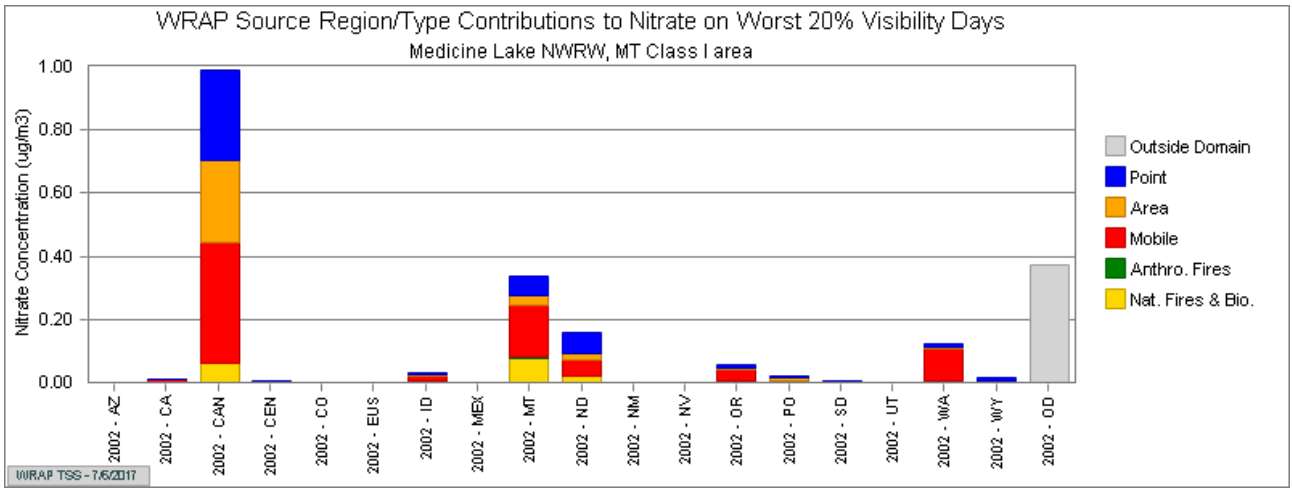


FIGURE 5-13. BASELINE REGIONAL CONTRIBUTION TO NITRATE AT MEDICINE LAKE



In the figures above, it is evident that emissions from Canada far outweigh contributions from other areas, including Montana and neighboring North Dakota. Sulfate contributions from Canadian point sources especially stand out in the inventory. Information published online by the Canadian government allows further research into the possible sources of these impacts. Figure 5-14, Figure 5-15, and Figure 5-16 show the relative emissions of sulfur oxides, nitrogen oxides, and particulate matter from point sources north of the border.[86]

---

[85] WRAP, TSS, http://vista.cira.colostate.edu/tss/Results/HazePlanning.aspx.

[86] Government of Canada, Environment and Climate Change Canada, Interactive Indicator Maps, http://maps-cartes.ec.gc.ca/indicators-indicateurs/ (accessed 5 Apr. 2017). These maps are provided using 2014 data only.

FIGURE 5-14. RELATIVE SOX EMISSIONS BY FACILITY - CANADA

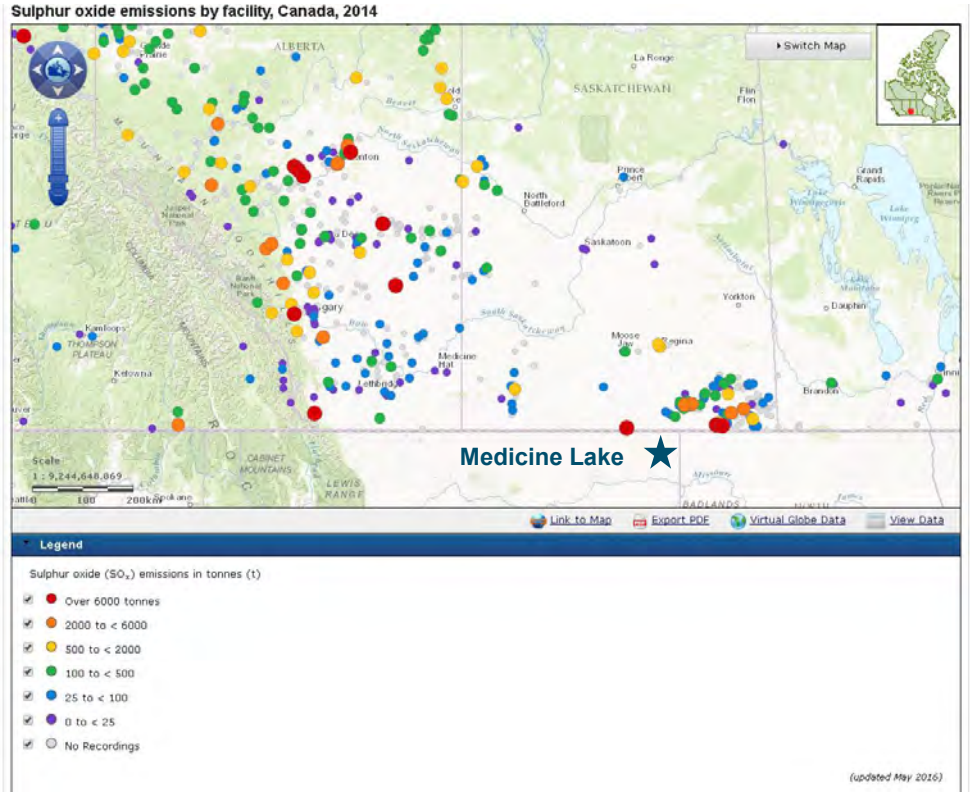


FIGURE 5-15. RELATIVE NO_X EMISSIONS BY FACILITY - CANADA

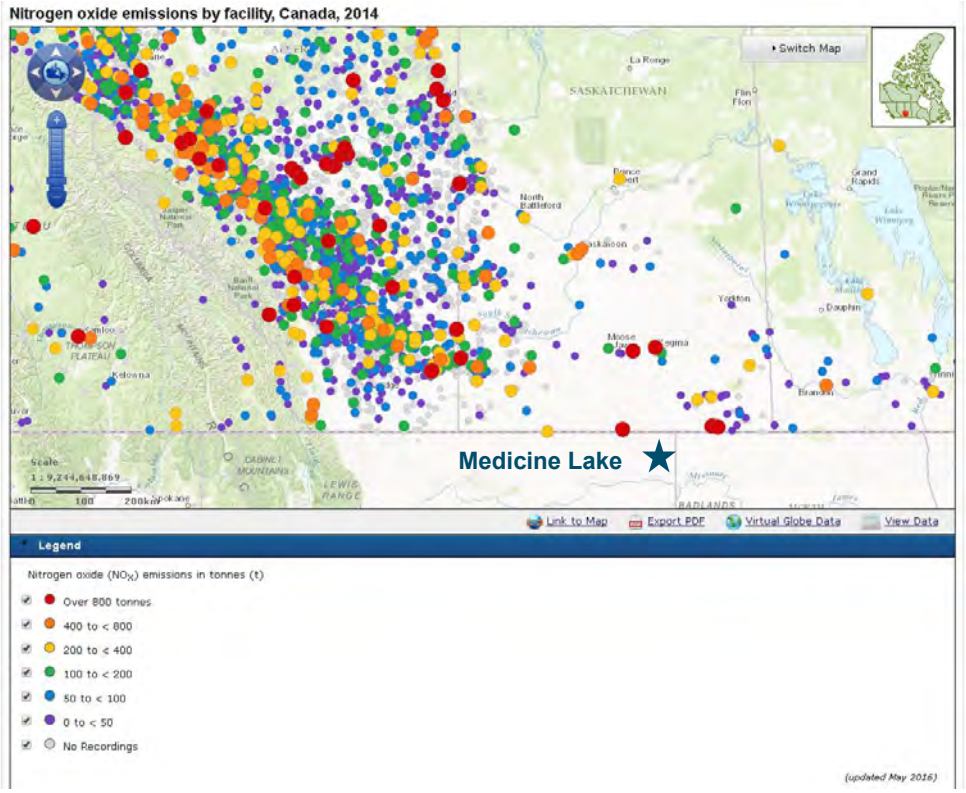
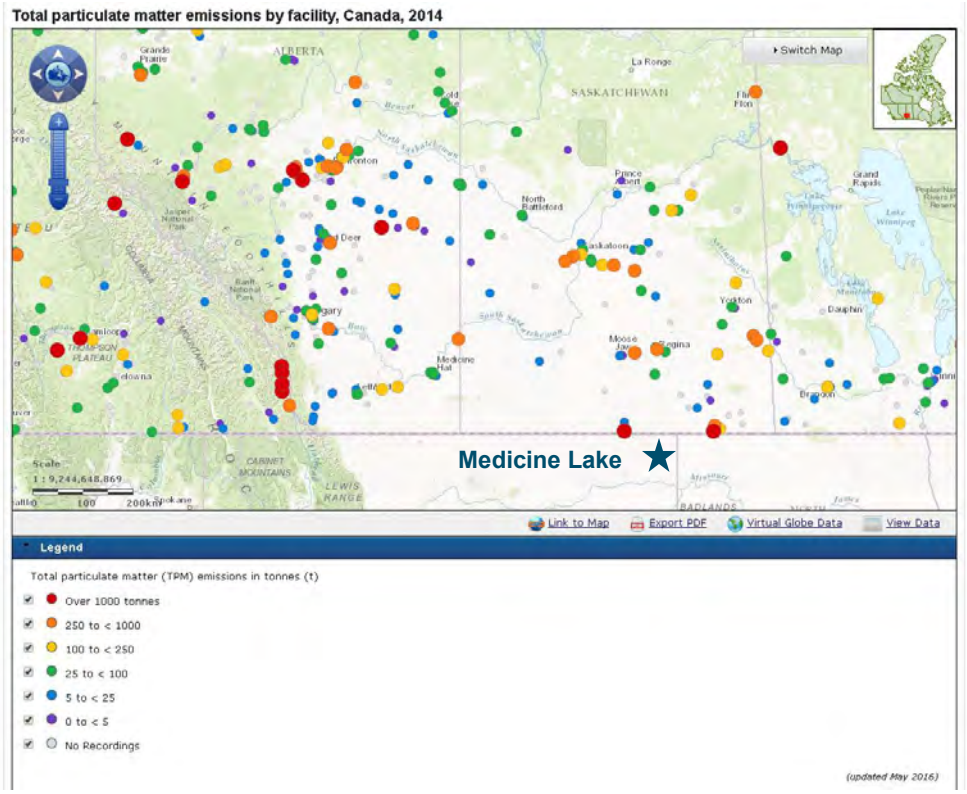


FIGURE 5-16. RELATIVE PM EMISSIONS BY FACILITY - CANADA



One large source located northwest of Medicine Lake stands out in all three figures. The Poplar River Power Station is a two-unit 582 MW coal-fired electric generating unit located in southern Saskatchewan Province, about five miles from the Montana/Canada border.[87]

In 2015, the Poplar River Power Station reported emissions of over 45,000 U.S. tons of SO_2, approximately 15,000 tons of NO_x, and just over 7,000 tons of total particulate matter.[88] Figure 5-17

---

[87] SaskPower, "Poplar River Power Station," http://www.saskpower.com/our-power-future/our-electricity/our-electrical-system/poplar-river-power-station/ (accessed 18 Apr. 2017).
[88] Government of Canada, Environment and Climate Change Canada, National Pollutant Release Inventory, http://ec.gc.ca/inrp-npri/default.asp?lang=En&n=4A577BB9-1, (accessed 5 Apr. 2017).

and Figure 5-18, below, show annual SO_x and NO_x emissions from the source in metric tons. This facility is upwind, emits significant levels of visibility-impairing pollutants that do not appear to be decreasing, and certainly has the potential to affect northeastern Montana and Medicine Lake.

FIGURE 5-17. NITROGEN OXIDE EMISSIONS (TONNES), 2005-2014 – POPLAR RIVER[89]

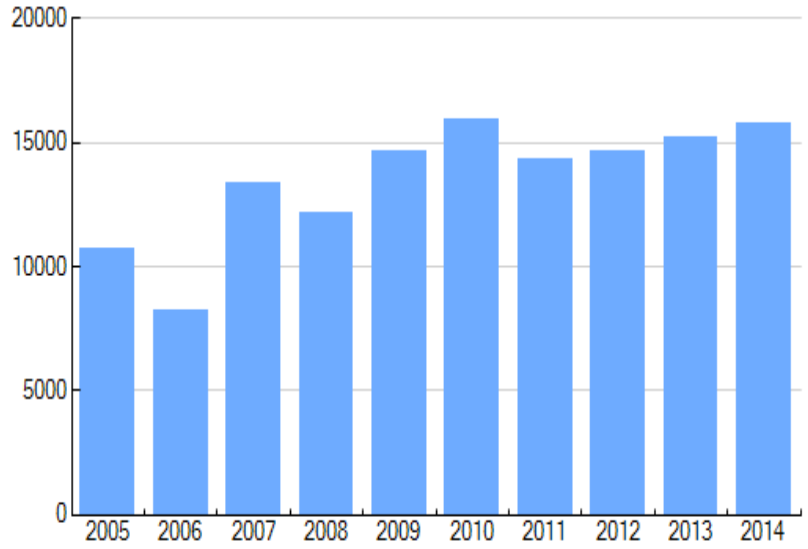
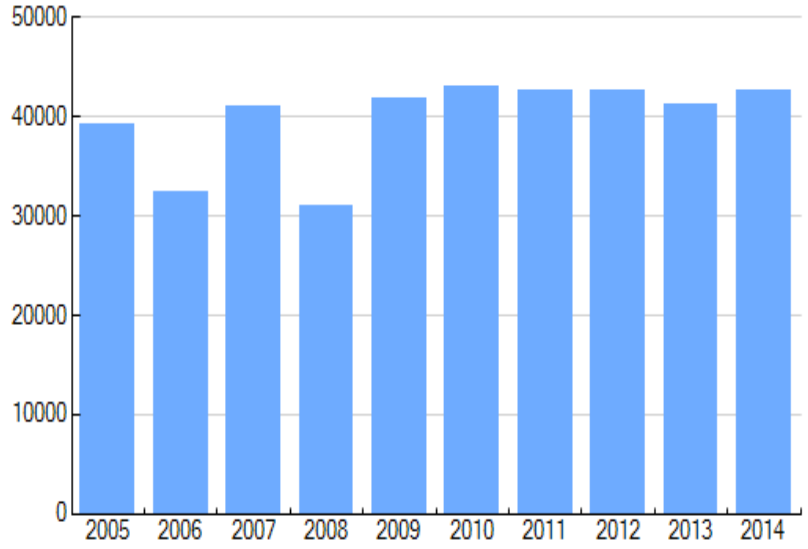


FIGURE 5-18. SULFUR OXIDE EMISSIONS (TONNES), 2005-2014 – POPLAR RIVER



[89] Government of Canada, Environment and Climate Change Canada, http://maps-cartes.ec.gc.ca/indicators-indicateurs/detailPage.aspx?lang=en&type=air_emissions_tpm&objectid=0000002079 (accessed 5 Apr. 2017). Graphs are intended to provide overview of emission trends.

In addition to Poplar River Power Station, Table 5-1 provides a summary of other large point sources within about 100 miles of the Montana border that emitted more than 150 tons per year of sulfur oxides in 2014 with corresponding NOx and PM emissions.

TABLE 5-1. CANADIAN FACILITIES EMITTING >150 TPY OF SOX, NEAR THE MT BORDER (~100MI) (N.D. = NO DATA)[90]

		2014 Emissions (U.S. Tons)			
Facility Name	**NAICS**	**SO_x**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
Poplar River Power Station	Fossil-Fuel Electric Power Generation	46,923.13	17,403.27	165.90	578.16
Boundary Dam Power Station	Fossil-Fuel Electric Power Generation	28,182.76	14,305.78	60.36	210.39
Shand Power Station	Fossil-Fuel Electric Power Generation	12,567.44	2,203.52	18.83	65.63
Waterton Complex	Conventional Oil & Gas Extraction	7,575.64	470.84	4.72	9.22
Trail Operations	Non-Ferrous (ex. Al) Smelting/Refining	4,331.24	324.21	94.20	125.13
Steelman Gas Plant	Conventional Oil & Gas Extraction	3,828.88	25.73	16.69	16.69
Nottingham Gas Plant 07-17-005-32-W1	Conventional Oil & Gas Extraction	3,440.86	26.28	20.68	20.68
Lougheed Sour Gas Plant 11-12	Conventional Oil & Gas Extraction	2,521.64	n.d.	0.80	0.80
Weyburn Oil Battery	Conventional Oil & Gas Extraction	2,233.00	44.80	12.51	12.51
Glen Ewen Sour Gas Plant 05-14	Conventional Oil & Gas Extraction	2,055.84	n.d.	0.34	n.d.
Leitchville Sour Gas Plant	Conventional Oil & Gas Extraction	1,140.21	227.80	4.41	4.41
Kisbey	Conventional Oil & Gas Extraction	706.58	47.37	11.86	11.86
Beinfait Mine - Char Plant	Lignite Coal Mining	670.42	229.17	0.34	2.23
Glen Ewen Gas Plant	Conventional Oil & Gas Extraction	576.42	n.d.	0.54	n.d.
Border Chemical Company Ltd	All Other Basic Inorganic Chemical Mfg	544.17	n.d.	n.d.	n.d.
Steelman Unit No. 2 03-15-004-06-W2	Conventional Oil & Gas Extraction	541.04	n.d.	13.10	13.10
Burnaby Refinery	Petroleum Refineries	447.32	279.10	76.06	129.52
Colgate Oil Battery 04-24	Conventional Oil & Gas Extraction	375.15	n.d.	3.67	3.67
Viewfield Sour Gas Plant 13-05	Conventional Oil & Gas Extraction	337.68	414.14	25.82	25.82
Torc Hz Amelia 1-29-10-27w4	Conventional Oil & Gas Extraction	269.38	n.d.	2.41	2.41
Travers Gas Plant	Conventional Oil & Gas Extraction	262.42	294.66	0.35	n.d.
Neptune Oil Battery 05-31	Conventional Oil & Gas Extraction	211.99	n.d.	11.03	11.03
Midale Complex	Conventional Oil & Gas Extraction	201.72	n.d.	7.40	7.40
Froude Oil Battery 13-20	Conventional Oil & Gas Extraction	171.35	n.d.	9.39	9.39
Tatagwa Oil Battery 07-24	Conventional Oil & Gas Extraction	170.69	n.d.	1.84	1.84
Handsworth Oil Battery 13-18	Conventional Oil & Gas Extraction	167.47	n.d.	3.75	3.75
	Totals	**121,701.60**	**38,938.56**	**677.56**	**1,434.22**

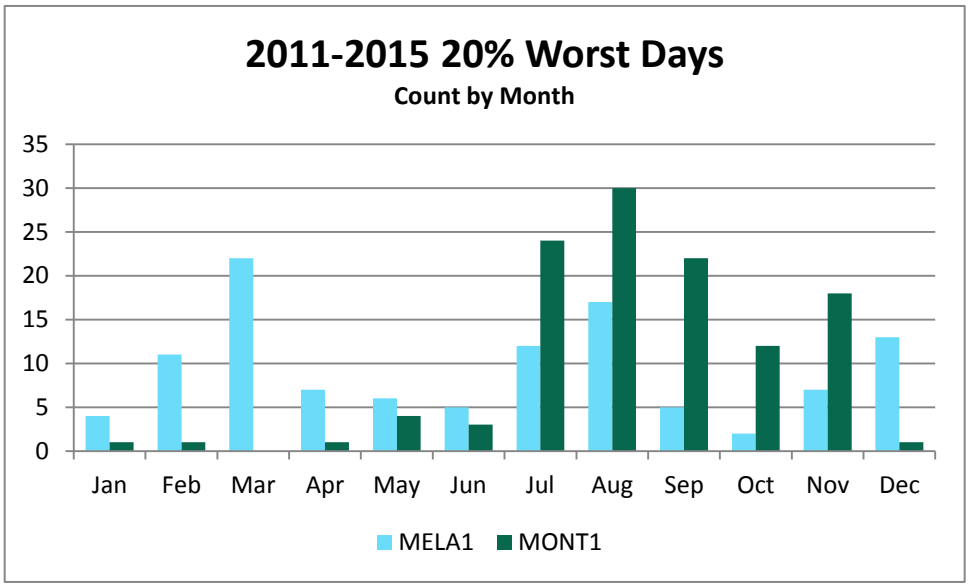
5.3.3. Contribution to Light Extinction at Medicine Lake

Indeed, when looking at the individual days that make up the 20% worst days at the Medicine Lake IMPROVE site (MELA1) between 2011 and 2015, the winter and spring Canadian influence becomes

[90] Government of Canada. Environment and Climate Change Canada, http://maps-cartes.ec.gc.ca/indicators-indicateurs/detailPage.aspx?lang=en&type=air_emissions_tpm&objectid=0000002079 (accessed 5 Apr. 2017).

even clearer. During the current progress period, the majority (56%) of the worst days occurred between December and May, when the wind is predominately blowing out of the northwest. By contrast, at the Monture IMPROVE site (MONT1), where summer wildfire impacts are a much larger contributor to the 20% worst days, only 7% of the worst days occur during this period. Figure 5-19 compares the distribution of 20% worst days throughout the year between 2011 and 2015 at MELA1 and MONT1. The graph clearly shows the difference in visibility impacts between Medicine Lake in northeastern Montana and sites predominantly impacted by wildfire smoke in western Montana.

FIGURE 5-19. DISTRIBUTION OF WORST DAYS (2011-2015)



While Figure 5-19 shows a high winter and spring contribution to the worst visibility days at MELA1, it also shows that the summer season contributes as well. A closer look at the data reveals that wildfire smoke impacts are a large contributor in these summer months, just as they are in western Montana. At most sites in Montana, wildfire impacts are the cause of the highest visibility impacts year after year. At MELA1, however, the wildfire impacts are much more variable. In some years, wildfires have little to no influence on the worst days, and in other years, smoke during the summer months dominates visibility impairment at MELA1. Figure 5-20 and Figure 5-21 show this variability. In Figure 5-20, which shows the daily light extinction contribution at MELA1 in 2011, winter and spring peaks dominate and extinction on those peaks is driven by sulfates and nitrates. As discussed above, these are also the two seasons of the year when the predominant wind direction is from the northwest and MELA1 is downwind of the large Poplar River Power Plant in Canada.

On the other hand, during a bad wildfire year such as 2015, as seen in Figure 5-21, a handful of days in July and August contribute to extremely high extinction values even at MELA1, with the majority of the contribution coming from organic carbon. It is important to note in Figure 5-21 that winter and spring sulfate and nitrate contributions are still elevated compared to the rest of the year. However,

these values are dwarfed by the summertime smoke impacts. This demonstrates how a bad wildfire year can 'mask' anthropogenic impacts on visibility due to the extremely high levels of organic carbon.

With the above discussion of wind patterns, the graphs below also help show that a seasonal relationship exists at MELA1 between predominant northwest winds in the winter and spring, and elevated levels of sulfates and nitrates during those seasons.

FIGURE 5-20. 2011 LIGHT EXTINCTION ON 20% WORST DAYS AT MELA1[91]

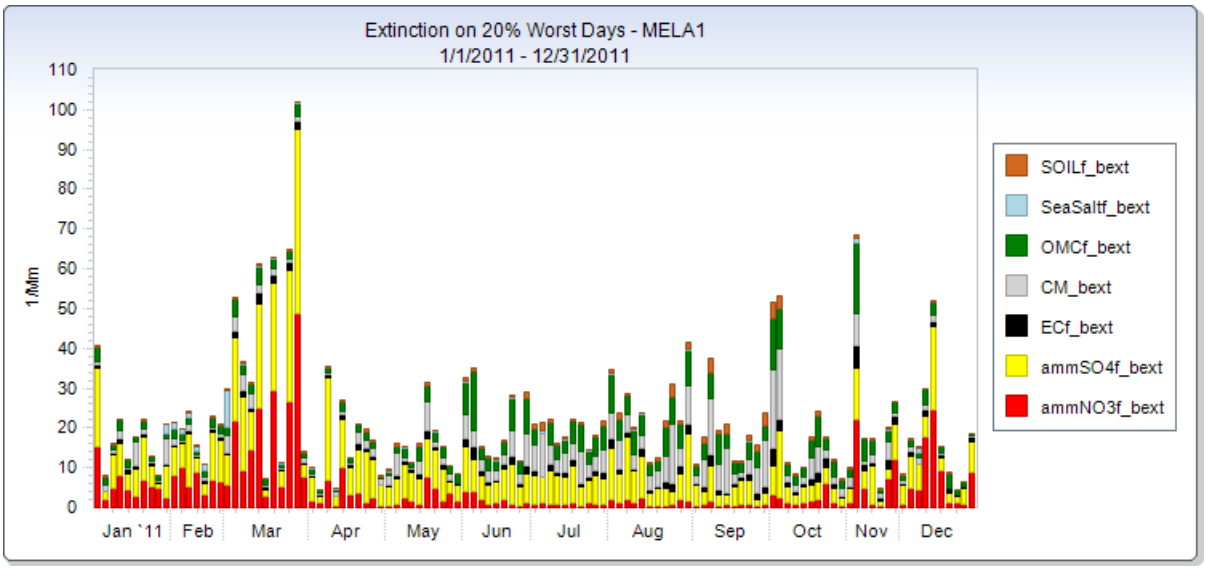
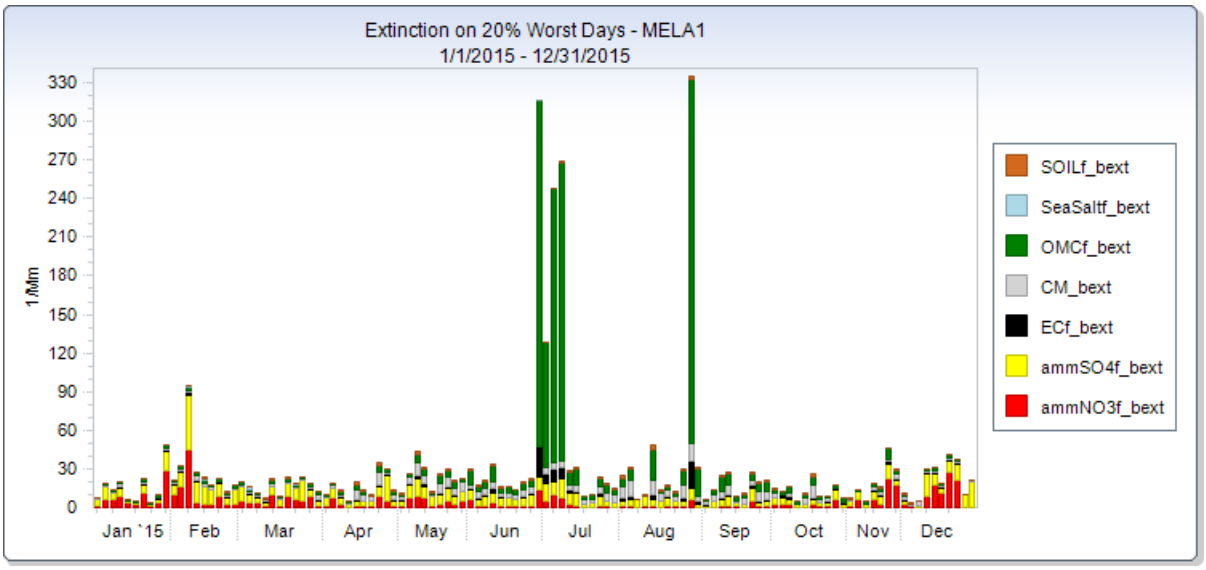


FIGURE 5-21. 2015 LIGHT EXTINCTION ON 20% WORST DAYS AT MELA1



[91] WRAP, TSS, http://vista.cira.colostate.edu/tss/Results/HazePlanning.aspx.

5.4. Conclusion

In conclusion, several factors may have influenced progress toward meeting visibility goals at Montana's Class I Areas. First, the timing of publication of the Montana FIP, and the compliance dates of controls contained therein, means that not all control measures have been completely implemented at this time. Therefore, not all emissions reductions that were assumed in the Montana FIP have been realized. Legal challenges and ongoing reconsideration on the part of EPA have also stalled implementation of controls at several facilities.

In addition, an unanticipated boom in oil and gas development in Montana and surrounding states may have contributed emissions that could not have been foreseen at the time the Montana FIP was being developed. Finally, visibility modeling performed by regional organizations identified a significant contribution from Canadian emissions to light extinction at several of Montana's Class I Areas. Analysis of seasonal weather patterns and anthropogenic light extinction suggests that Canadian emissions may be impeding progress in these areas. Emissions from Canadian facilities are not addressed in the Montana FIP and are outside the control of the state of Montana.

Chapter 6. Assessment of Current Strategy

In assessing visibility changes since promulgation of the Montana FIP, Montana looked at emissions trends and overall visibility impairment at each Class I Area affected by sources in the state. 40 CFR 51.308(g)(6) requires, as part of a progress report, "[an] assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Federal Class I Areas affected by emissions from the State, to meet all established reasonable progress goals." To meet this requirement, this final chapter draws on the earlier emissions and visibility data analysis to make conclusions about whether Class I Areas are on track to meet their 2018 reasonable progress goals and to examine the reasons behind any deficiencies.

In general, the following conclusions are discussed below:

- Visibility has improved at all Montana IMPROVE sites on the 20% best days
- Impacts from anthropogenic components have decreased, almost across the board
- Visibility has only improved at two of Montana's sites on the 20% worst days
- Natural fires are driving impairment on the 20% worst days
- On the worst days, decreases in anthropogenic impacts are obscured by huge wildfire impacts
- Anthropogenic emissions are likely to continue to decrease into the future
- Anthropogenic emissions from international sources have a large impact on Medicine Lake WA

6.1. Visibility has Improved at all Sites on the Best Days

As discussed in this report and summarized in Table 6-1, all IMPROVE monitors have shown improved visibility on the 20% best days. In other words, as Table 6-1 shows, every Montana Class I Area is currently meeting its 2018 reasonable progress goal for the best days. This suggests that the elements in the Montana FIP, discussed throughout this report, were sufficient to not only protect visibility on the best, clearest days, but also improve it.

Table 6-1. Visibility Changes on 20% Best Days

IMPROVE Site	Montana Class I Area(s)	Visibility Conditions on 20% Best Days (deciview)				Current as % of RPG
		Baseline 2000-2004	Past 5 Years 2006-2010	Current 2011-2015	WRAP RPG (2018)	
CABI1	Cabinet Mountains	3.6	2.8	2.6	3.27	80%
GAMO1	Gates of the Mountains	1.7	0.9	0.6	1.54	39%
GLAC1	Glacier National Park	7.2	6.2	5.4	6.92	79%
MELA1	Medicine Lake	7.3	6.3	6.5	7.11	92%
MONT1	Bob Marshall, Mission Mountain, Scapegoat	3.9	2.9	2.6	3.60	72%
SULA1	Anaconda-Pintler, Selway-Bitterroot	2.6	2.2	1.6	2.48	66%
ULBE1	U.L. Bend	4.8	4.3	3.7	4.57	81%
YELL2	Red Rock Lakes, Yellowstone National Park	2.6	1.8	1.5	2.36	62%

6.2. Anthropogenic Components have Decreased

Visibility monitoring data discussed earlier in this report showed that the contribution to light extinction from sulfates and nitrates, generally considered the anthropogenic components, has decreased across nearly all sites since the baseline period. Indeed, on both the best and the worst days, the annual average light extinction from sulfate components decreased across the board between the 2000-2004 and 2011-2015 periods. Only two Montana IMPROVE sites experienced slight increases in extinction from nitrate components over the same period. One of these two sites, Sula Peak, also experienced a huge increase in extinction from organic carbon, which suggests massive wildfire impacts that may have also contributed nitrates. The other site, Medicine Lake, was discussed in more depth in the previous chapter. Despite experiencing a nitrate increase on the 20% best days, Medicine Lake did experience a nitrate decrease on the 20% worst days.

Figure 6-1 and Figure 6-2 show the trends of 5-year average extinction from sulfates and nitrates on the 20% worst days.

FIGURE 6-1. TRENDS IN SOX CONTRIBUTION TO LIGHT EXTINCTION

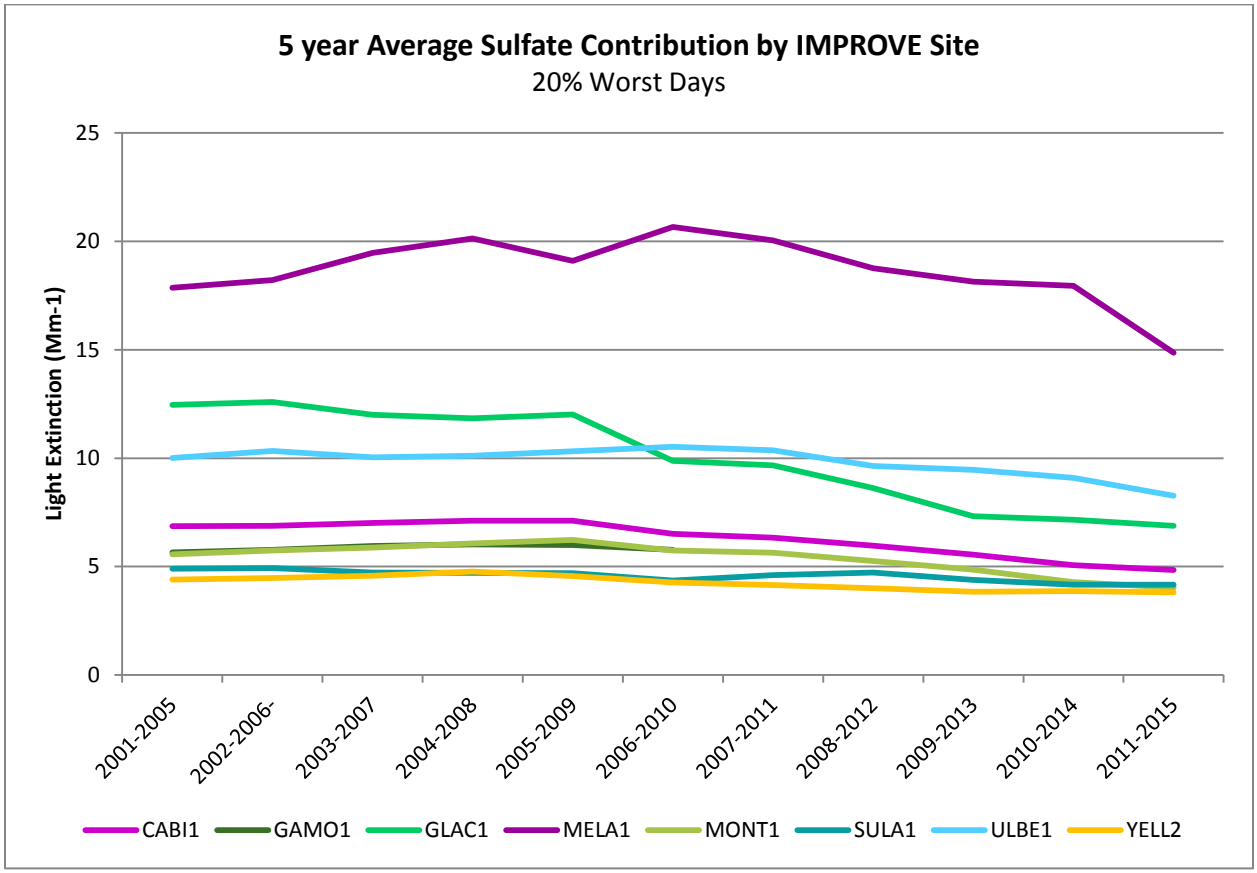
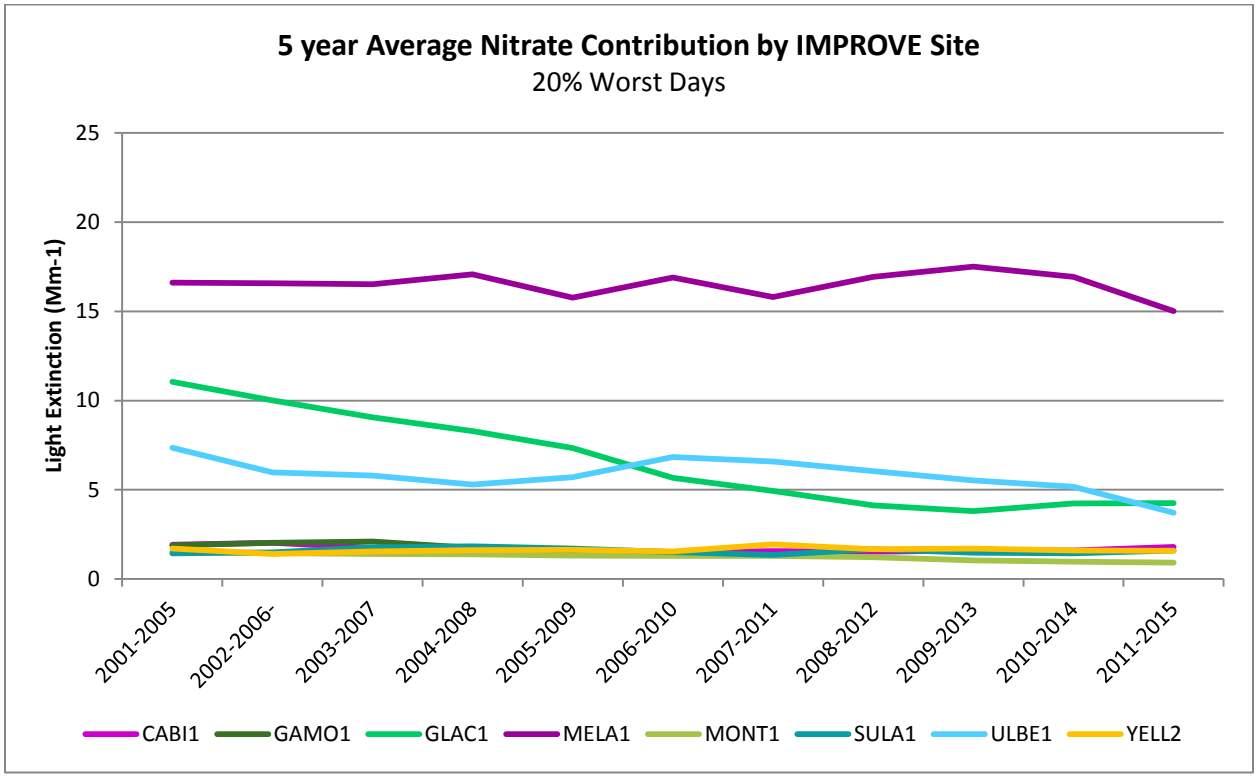


FIGURE 6-2. TRENDS IN NO_x CONTRIBUTION TO LIGHT EXTINCTION



6.3. Visibility has Not Improved at most Sites on the Worst Days

Despite seeing improvements in visibility on the best days, most Montana IMPROVE sites did not see improvement on the worst days. In fact, only two Montana sites improved visibility on the worst days between baseline and current periods. Both of these two sites, and the Class I Areas they represent, are already meeting their 2018 reasonable progress goals. Table 6-2 provides a comparison of baseline and current visibility to the reasonable progress goals on the worst days.

The conclusion that visibility did not improve at six of eight IMPROVE sites does not necessarily mean that the Montana FIP was insufficient. As discussed at length in this report, many factors contribute to visibility impairment. In addition, the initial Regional Haze implementation period covers the years 2008-2018, with progress goals set for the end of the ten-year period. The Montana FIP was not published until late 2012 and BART sources were given five years to install controls and comply with the prescribed emission limits.

Despite the timing of the Montana FIP, the delay in meeting emission limits, and the vacated status of some emission limits, anthropogenic emissions have decreased across Montana from the baseline period. Indeed, the emissions decreases resulted in reduced anthropogenic impacts at IMPROVE sites. The fact that these reductions were not enough to show visibility improvement on the 20% worst days is discussed further in the sections below.

TABLE 6-2. VISIBILITY CHANGES ON 20% WORST DAYS

IMPROVE Site	Montana Class I Area(s)	Visibility Conditions on 20% Worst Days (deciview)				Current as % of RPG
		Baseline 2000-2004	Past 5 Years 2006-2010	Current 2011-2015	WRAP RPG (2018)	
CABI1	Cabinet Mountains	14.1	13.4	14.5	13.31	109%
GAMO1	Gates of the Mountains	11.3	11.2	11.7	10.82	108%
GLAC1	Glacier National Park	20.5	17.8	17.0	21.48	79%
MELA1	Medicine Lake	17.7	18.4	17.9	17.36	103%
MONT1	Bob Marshall, Mission Mountain, Scapegoat	14.5	14.8	15.7	13.83	114%
SULA1	Anaconda-Pintler, Selway-Bitterroot	13.4	15.4	16.3	12.94	126%
ULBE1	U.L. Bend	15.1	15.0	14.5	14.85	98%
YELL2	Red Rock Lakes, Yellowstone National Park	11.8	11.6	12.4	11.23	111%

6.4. Natural Fires are Driving Impairment on the Worst Days

Earlier sections of this report analyze how individual components of visibility-impairing pollutants have changed over time. As reported, overall visibility impairment on the worst days at many of Montana's IMPROVE sites was worse in the 2011-2015 period compared to baseline values. While this would initially indicate considerable deficiencies in the Montana FIP, a closer analysis suggests that the cause of the increased visibility impairment is significant year-to-year variability in organic and elemental carbon. This assessment is supported by the earlier analysis showing that the majority of the days selected as the 20% worst in a given year fall during typical wildfire season, June-October.

As discussed in the Montana FIP, most of the organic and elemental carbon emissions in Montana are from fires, with wildfires contributing significantly more than anthropogenic fire. In other words, the reported lack of improvement in visibility conditions on the worst days was caused by emissions from natural sources and was not due to deficiencies in controlling anthropogenic sources. The Montana FIP included no controls to address the impacts of natural fires.[92]

[92] EPA, Approval and Promulgation of Implementation Plans; State of Montana; State Implementation Plan and Regional Haze Federal Implementation Plan, Proposed Rule, 77 Fed. Reg. 23987 (20 Apr. 2012), https://www.federalregister.gov/d/2012-8367. See pp. 24047-24050 for discussion of PM impacts.

FIGURE 6-3. TRENDS IN CARBON CONTRIBUTION TO LIGHT EXTINCTION

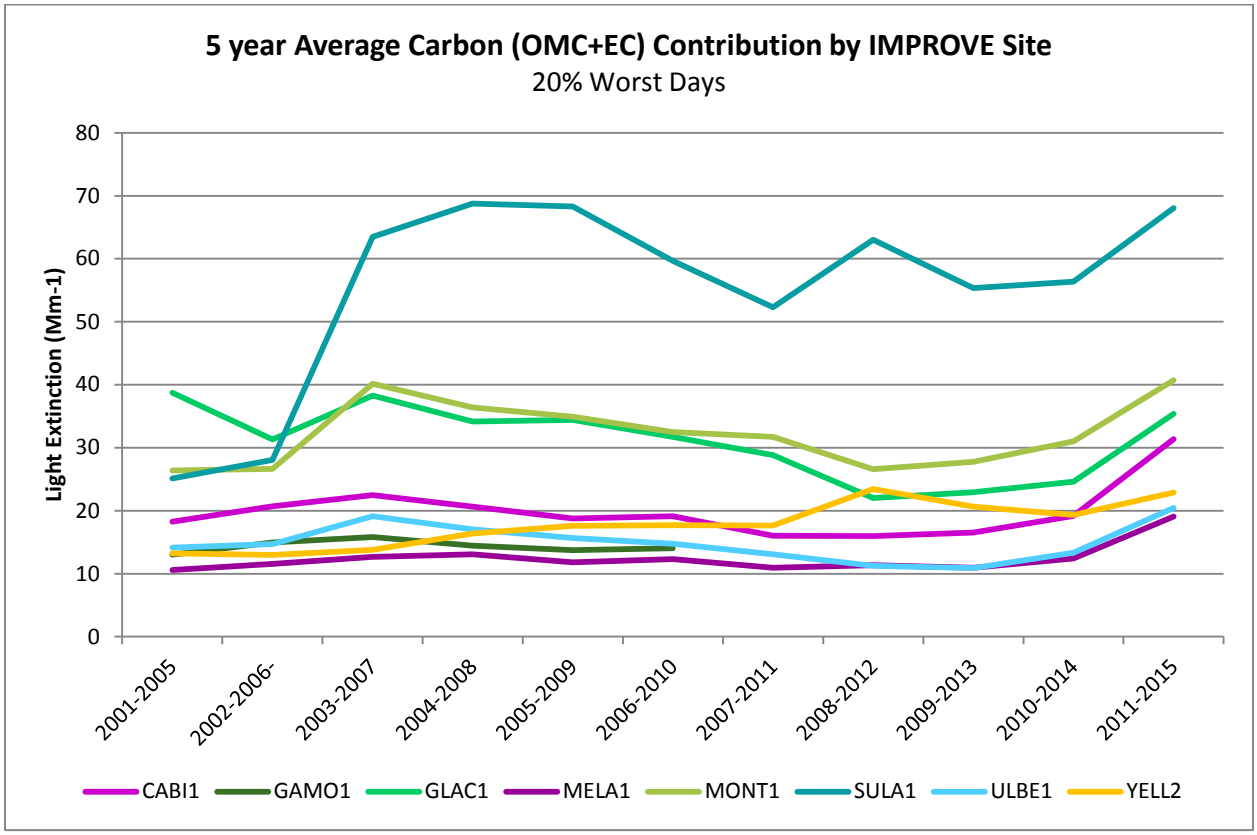


Figure 6-3 shows that the carbon contribution on the worst days increased between the baseline and current periods at nearly every site. Only Glacier National Park (GLAC1) saw a decrease, but that site also started with the highest carbon contribution of any site in Montana.

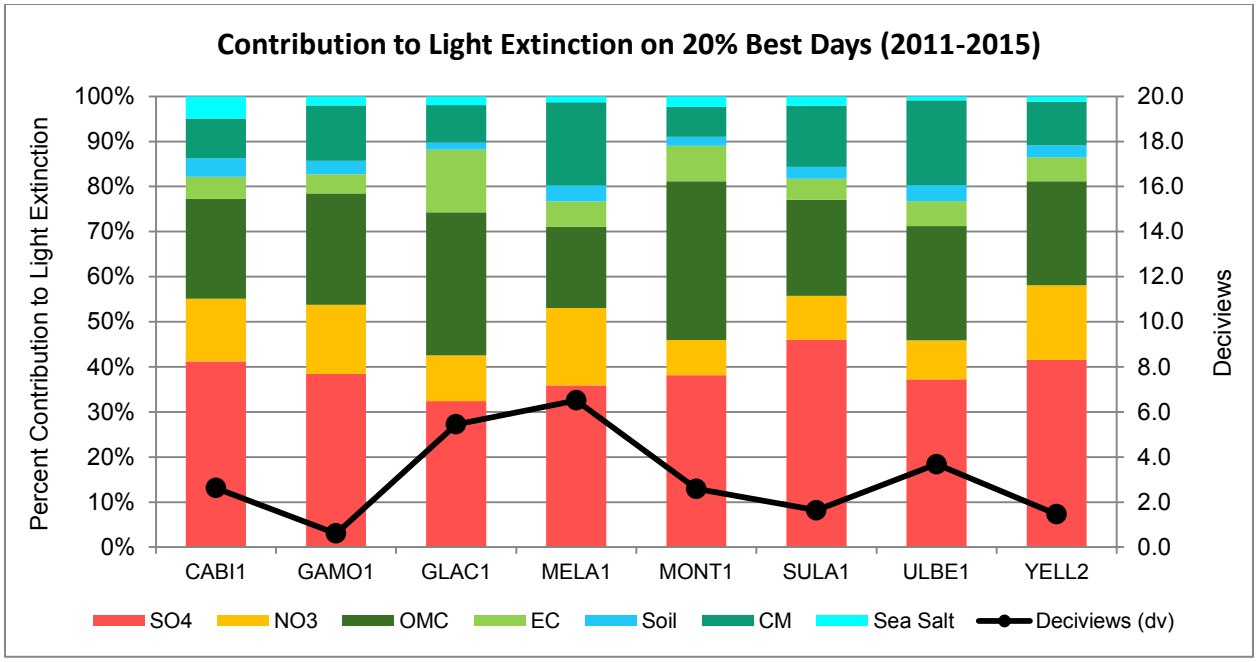
6.5. Wildfires Obscure Reductions in Anthropogenic Impacts

Despite the lack of improvement on the worst days at most IMPROVE sites, an analysis of the contribution from individual components of light extinction tells a slightly different story. This report discussed the huge impact of wildfires on visibility on the 20% worst days as well as the fact that anthropogenic emissions and their contribution to light extinction have decreased. In fact, the wildfire contribution is so large on the 20% worst days that it completely obscures any improvements from reductions in anthropogenic contribution. This is especially true when we consider that nearly all sites saw an increase in organic and elemental carbon in the current period.

A good way to see the difference between what causes visibility impairment on the best days compared to the worst days is to graph the percent contribution to light extinction. IMPROVE data from all periods discussed in this report shows that sulfates are the largest contributor to visibility impairment on the clearest (20% best) days. Figure 6-4, on the following page, shows the percent contribution to

light extinction on the 20% best days in the current period. For all sites, sulfates and nitrates combined contribute 40-60% of light extinction on these very clear days.

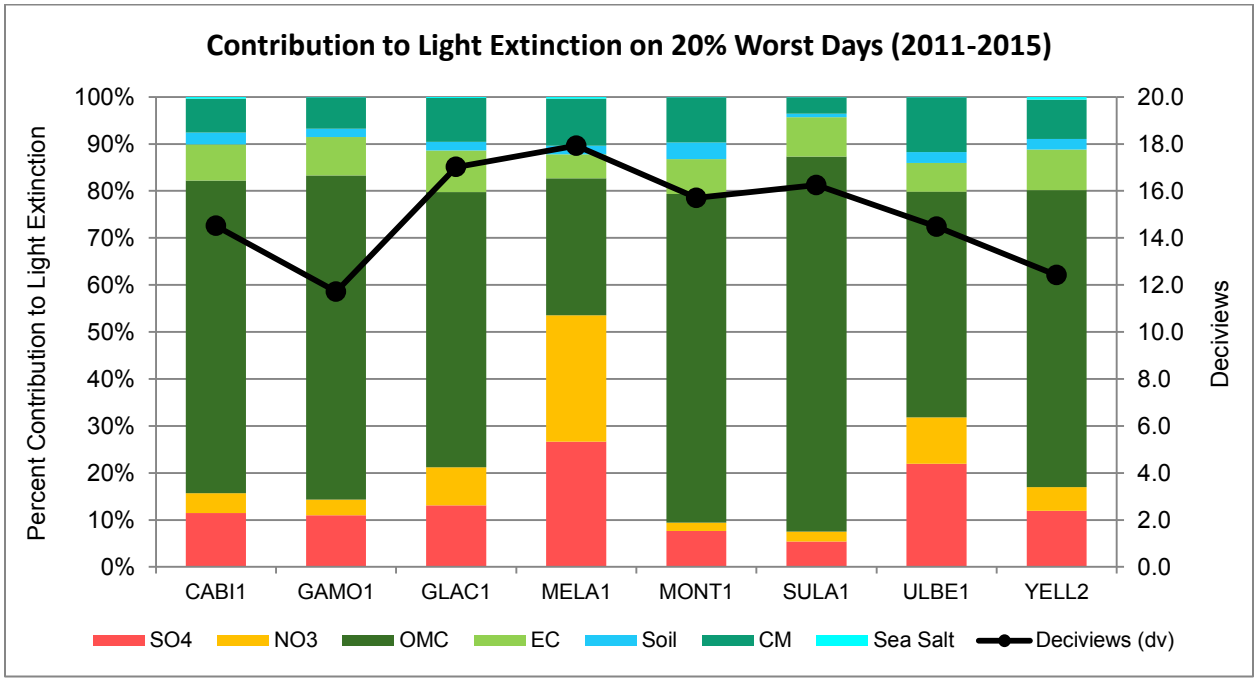
FIGURE 6-4. CONTRIBUTION TO LIGHT EXTINCTION ON THE 20% BEST DAYS



The right axis shows that deciviews are quite low on these days, meaning visibility is very good and the measured amounts of each component are very small (the largest single contribution is sulfate at 2.99 Mm^{-1} at MELA1).

The monitored contributions from sulfates and nitrates on the 20% worst days are also quite low (averaging around 6.3 Mm^{-1} and 3.7 Mm^{-1}, respectively), but this fact is obscured by very high contribution from organic carbon at nearly all sites. This is shown in Figure 6-5, on the following page. With the exception of three sites, sulfate and nitrate contributions combined make up less than 20% of light extinction on the worst days. Figure 6-5 clearly shows that any small decrease in the contribution from sulfates or nitrates would be hidden or negated by increases from the organic carbon component. Indeed, as previously mentioned, sulfates decreased at every site and nitrates decreased at all but one site; however, these reductions were not enough to offset the year-to-year swings in wildfire activity and the resulting carbon contribution.

FIGURE 6-5. CONTRIBUTION TO LIGHT EXTINCTION ON THE 20% WORST DAYS



6.6. Anthropogenic Emissions will Continue to Decrease

The continued implementation of air pollution control measures, many of which were discussed in this report, make it likely that anthropogenic emissions of visibility-impairing pollutants will continue to decrease with time. For example, on- and offroad fuel standards as well as fleet turnover are likely to continue to reduce NO_x emissions from mobile sources. In addition, pollution control technology is constantly evolving as research, new emission standards, and litigation push for further reductions from point sources.

Class I Areas affected by emissions from Montana sources will also continue to benefit from controls that have yet to take full effect due to the timing of publication of the Montana FIP (2012) and the compliance dates prescribed therein (some as late as the fall of 2017). For example, the BART NO_x emission limits at the Oldcastle Cement facility do not take effect until October 2017 and the associated controls have not yet been optimized. In addition, the emission limits at Colstrip Units 1 and 2 were vacated and remanded back to EPA. Although EPA has yet to publish a revised BART determination for these units, both units are scheduled to cease operation by 2022, which will lead to considerable reductions in point source emissions.

6.7. Visibility Impacts from International Sources

Despite the likely continued reductions of anthropogenic emissions in Montana and across the United States, international sources are not subject to the controls discussed in this report and emissions from these sources therefore remain a question. As discussed in this report, it seems clear that emissions

from Canadian sources are affecting visibility in at least one Class I Area in the state. Analysis of seasonal weather patterns in northeastern Montana and light extinction at the Medicine Lake Class I Area shows a relationship between anthropogenic extinction (sulfates and nitrates) and times when the wind is blowing from the northwest.

As discussed, reports from the Government of Canada show that emissions of NO_x and SO_x from a large coal-fired power plant, located northwest of Medicine Lake just five miles over the border, have remained fairly constant over the last decade. It therefore seems likely that, barring any future improvements or closures, emissions from international sources will continue to affect visibility at Medicine Lake.

6.8. Conclusion: Determination of Adequacy

This chapter has presented a series of conclusions that can be drawn from the emissions and visibility analyses discussed throughout this report. To conclude this progress report, 40 CFR 51.308(h) requires that states take one of four actions:

(1) Submit a negative declaration stating that a revision of the plan is not needed at this time to achieve established goals;
(2) Notify EPA and other State(s) if the SIP is inadequate to meet goals due to emissions from another State(s);
(3) Notify EPA if the SIP is inadequate to meet goals due to international emissions; or
(4) Revise the SIP within one year to address deficiencies due to emissions from sources within the State.

Because all Montana Class I Areas are meeting their reasonable progress goals on the 20% best days, Montana concludes that a revision of the plan is not needed at this time to achieve established goals for those days.

For the two Class I Areas (Glacier NP and UL Bend) that are currently meeting their reasonable progress goals on the 20% worst days, Montana concludes that a revision of the plan is not needed to achieve progress.

For Medicine Lake WA, the sole site at which anthropogenic contributions account for more than half of the light extinction on the 20% worst days, Montana hereby notifies EPA that the plan may be inadequate due to emissions from international sources. The reasons for this conclusion are discussed above and in the previous chapters.

For the remaining nine Class I Areas (represented by five IMPROVE sites), Montana concludes that a revision of the plan is not needed at this time, despite the fact that these areas are not yet meeting their reasonable progress goals on the 20% worst days.

This final conclusion is based on the data and analysis presented in this report demonstrating that the continued visibility impairment at these areas is not the result of deficiencies in control strategies for

anthropogenic emissions. Indeed, efforts to reduce anthropogenic impacts on visibility have generally been successful – emissions from controlled BART sources are below 2018 projections, anthropogenic emissions have decreased on the whole across the state, and monitored impacts from these emissions have been reduced. The timely implementation of remaining BART emission limits will only result in further emission reductions.

Wildfire smoke presents a huge issue for visibility in Montana, as in much of the west. Impacts from wildfires are considered natural and cannot be addressed through regulatory control measures. Despite revisions to the way the 20% worst days will be selected in future implementation periods, wildfire impacts will not simply go away for visitors of Montana's Class I Areas. As discussed at length in this report, no matter how sufficient/adequate/successful the control measures for anthropogenic sources of emissions are, a person who visits a Class I Area in western Montana during wildfire season may experience poor visibility.

This is not to suggest that reductions in anthropogenic emissions have no impact on visibility at Class I Areas. Instead, because of the reality of natural smoke impacts, it is important to focus on maintaining or improving visibility on the clearest, most pristine days, the days without wildfire impacts. As demonstrated in this report, the plan was successful in this regard. In Montana, these clearest days are the days when anthropogenic emissions of visibility-impairing pollutants are most likely to cause a perceptible difference in how far and how well we can see.

As the state of Montana prepares to develop a SIP for the second Regional Haze planning period, covering the ten-year period of 2018-2028, the 2017 revisions to the RHR will be helpful. The revisions, in part, attempt to better account for uncontrollable impacts to visibility in Class I Areas, several of which were discussed in this report. These include impacts from natural emissions like wildfire smoke and impacts from international emissions. The fact is that such impacts will remain despite any regulatory measures that are included in a SIP. A better understanding of these impacts will enable the state to target the controllable sources of anthropogenic haze more accurately in the next SIP, and more appropriately measure progress toward visibility goals in the future.

Appendix A. Montana Smoke Management Plan

Subchapter 6

Open Burning

17.8.601 DEFINITIONS (1) "Best available control technology" (BACT) means those techniques and methods of controlling emission of pollutants from an existing or proposed open burning source which limit those emissions to the maximum degree which the department determines, on a case-by-case basis, is achievable for that source, taking into account impacts on energy use, the environment, and the economy, and any other costs, including cost to the source.

(a) Such techniques and methods may include the following:

(i) scheduling of burning during periods and seasons of good ventilation;

(ii) applying dispersion forecasts;

(iii) utilizing predictive modeling results performed by and available from the department to minimize smoke impacts;

(iv) limiting the amount of burning to be performed during any one time;

(v) using ignition and burning techniques which minimize smoke production;

(vi) selecting fuel preparation methods that will minimize dirt and moisture content;

(vii) promoting fuel configurations which create an adequate air to fuel ratio;

(viii) prioritizing burns as to air quality impact and assigning control techniques accordingly;

(ix) promoting alternative treatments and uses of materials to be burned; and

(x) selecting sites that will minimize smoke impacts.

(b) For essential agricultural open burning, prescribed wildland open burning, conditional air quality open burning, commercial film production open burning, Christmas tree waste open burning, or any other minor open burning during September, October, or November, BACT includes burning only during the time periods specified by the department, which may be determined by calling the department at (800) 225-6779.

(c) For essential agricultural open burning, prescribed wildland open burning, conditional air quality open burning, commercial film production open burning, Christmas tree waste open burning, or any other minor open burning during December, January, or February, BACT includes burning only during the time periods specified by the department, which may be determined by calling the department at (800) 225-6779.

(2) "Christmas tree waste" means wood waste from commercially grown Christmas trees left in the field where the trees were grown, after harvesting and on-site processing.

(3) "Eastern Montana open burning zone" means the following counties or portions of counties: Big Horn, Blaine, Carbon, Carter, Cascade, Chouteau, Custer, Daniels, Dawson, Fallon, Fergus, Garfield, Glacier, Golden Valley, Hill, Judith Basin, Liberty, McCone, Meagher, Musselshell, Park (that portion north of Interstate 90), Petroleum, Phillips, Pondera, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux and Yellowstone.

(4) "Essential agricultural open burning" means any open burning conducted on a farm or ranch to:

(a) eliminate excess vegetative matter from an irrigation ditch when no reasonable alternative method of disposal is available;

(b) eliminate excess vegetative matter from cultivated fields after harvest has been completed when no reasonable alternative method of disposal is available;

(c) improve range conditions when no reasonable alternative method is available; or

(d) improve wildlife habitat when no reasonable alternative method is available.

(5) "Major open burning source" means any person, agency, institution, business, or industry conducting any open burning that, on a statewide basis, will emit more than 500 tons per calendar year of carbon monoxide or 50 tons per calendar year of any other pollutant regulated under this chapter, except hydrocarbons.

(6) "Minor open burning source" means any person, agency, institution, business, or industry conducting any open burning that is not a major open burning source.

(7) "Open burning" means combustion of any material directly in the open air without a receptacle, or in a receptacle other than a furnace, multiple chambered incinerator, or wood waste burner, with the exception of detonation of unexploded ordnance, small recreational fires, construction site heating devices used to warm workers, or safety flares used to combust or dispose of hazardous or toxic gases at industrial facilities, such as refineries, gas sweetening plants, oil and gas wells, sulfur recovery plants, or elemental phosphorus plants.

(8) "Prescribed wildland open burning" means any planned open burning, either deliberately or naturally ignited, that is conducted on forest land or relatively undeveloped rangeland to:

(a) improve wildlife habitat;

(b) improve range conditions;

(c) promote forest regeneration;

(d) reduce fire hazards resulting from forestry practices, including reduction of log deck debris when the log deck is close to a timber harvest site;

(e) control forest pests and diseases; or

(f) promote any other accepted silvicultural practices.

(9) "Salvage operation" means any operation conducted in whole or in part to salvage or reclaim any product or material, except the silvicultural practice commonly referred to as a salvage cut.

(10) "Trade wastes" means solid, liquid, or gaseous material resulting from construction or operation of any business, trade, industry, or demolition project. Wood product industry wastes such as sawdust, bark, peelings, chips, shavings, and cull wood are considered trade wastes. Trade wastes do not include wastes generally disposed of by essential agricultural open burning, prescribed wildland open burning, or Christmas tree waste, as defined in this rule.

(11) "Wood waste burner" means a device commonly called a tepee burner, silo, truncated cone, wigwam burner, or other similar burner commonly used by the wood products industry to dispose of wood. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, MCA; NEW, 1982 MAR p. 688, Eff. 4/16/82; AMD, 1994 MAR p. 2528, Eff. 9/9/94; AMD, 1995 MAR p. 2412, Eff. 11/10/95; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1999 MAR p. 1660, Eff. 7/23/99; AMD, 2002 MAR p. 3586, Eff. 12/27/02.)

17.8.602 INCORPORATION BY REFERENCE (1) For the purposes of this subchapter, the board adopts and incorporates by reference ARM Title 17, chapter 53, subchapter 5, identifying and defining hazardous wastes.

(2) A copy of ARM Title 17, chapter 53, subchapter 5, is available for public inspection and copying at the Department of Environmental Quality, 1520 E. 6th Ave., P.O. Box 200901, Helena, MT 59620-0901.

(3) Copies of federal materials also may be obtained from:

(a) National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; phone: (800) 553-6847 or (703) 605-6000; fax: (703) 605-6900; e-mail: orders@ntis.gov; web: http://www.ntis.gov;

(b) National Service Center for Environmental Publications (NSCEP), P.O. Box 42419, Cincinnati, OH 45242-0419; phone: (800) 490-9198 or (513) 489-8190; fax: (513) 489-8695; e-mail: ncepimal@one.net; web: http://www.epa.gov/ncepihom;

(c) U.S. Government Printing Office, Information Dissemination (Superintendent of Documents), P.O. Box 371954, Pittsburg, PA 15250-7954; phone: (866) 512-1800 or (202) 512-1800; fax: (202) 512-2104; e-mail: orders@gpo.gov; web: http://www.gpoaccess.gov; and

(d) the EPA regional office libraries listed at http://www.epa.gov/natlibra/libraries.htm.

(4) Copies of the CFR may be obtained from the U.S. Government Printing Office, as described in (3)(c). (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, MCA; NEW, 1996 MAR p. 1844, Eff. 7/4/96; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1997 MAR p. 1581, Eff. 9/9/97; AMD, 2001 MAR p. 1468, Eff. 8/10/01; AMD, 2005 MAR p. 959, Eff. 6/17/05; AMD, 2007 MAR p. 1663, Eff. 10/26/07.)

Rule 17.8.603 reserved

NEXT PAGE IS 17-395

17.8.604 MATERIALS PROHIBITED FROM OPEN BURNING (1) The following material may not be disposed of by open burning:

(a) any waste which is moved from the premises where it was generated, except as provided in ARM 17.8.604(2), 17.8.611, or 17.8.612(4)(a) or (4)(b);

(b) food wastes;

(c) Styrofoam and other plastics;

(d) wastes generating noxious odors;

(e) wood and wood byproducts that have been coated, painted, stained, treated, or contaminated by a foreign material, unless open burning is allowed under ARM 17.8.614 or 17.8.615;

(f) poultry litter;

(g) animal droppings;

(h) dead animals or dead animal parts;

(i) tires, except as provided in ARM 17.8.615;

(j) rubber materials;

(k) asphalt shingles, except as provided in ARM 17.8.614 or 17.8.615;

(l) tar paper, except as provided in ARM 17.8.614 or 17.8.615;

(m) automobile or aircraft bodies and interiors, except as provided in ARM 17.8.614 or 17.8.615;

(n) insulated wire, except as provided in ARM 17.8.614 or 17.8.615;

(o) oil or petroleum products, except as provided in ARM 17.8.614 or 17.8.615;

(p) treated lumber and timbers;

(q) pathogenic wastes;

(r) hazardous wastes, as defined by 40 CFR Part 261, incorporated by reference in ARM 17.8.602;

(s) trade wastes, except as provided in ARM 17.8.611 or 17.8.612;

(t) any materials resulting from a salvage operation;

(u) chemicals, except as provided in ARM 17.8.614 or 17.8.615;

(v) Christmas tree waste as defined in ARM 17.8.601, except as provided in ARM 17.8.613;

(w) asbestos or asbestos-containing materials;

(x) standing or demolished structures containing prohibited material, except as provided in ARM 17.8.612, 17.8.614, or 17.8.615; and

(y) paint, except as provided in ARM 17.8.614 or 17.8.615.

(2) A person may not conduct open burning of any wood waste that is moved from the premises where it was generated, except as provided in ARM 17.8.611 or 17.8.612(4)(a) or (4)(b), or unless the department determines:

(a) the material is wood or wood byproducts that have not been coated, painted, stained, treated, or contaminated by a foreign material; and

(b) alternative methods of disposal are unavailable or infeasible.

(3) A person conducting open burning of wood waste which is moved from the premises where it was generated shall comply with BACT.

(4) A person intending to conduct open burning of wood waste which is moved from the premises where it was generated shall contact the department by calling the number listed in ARM 17.8.601(1) prior to conducting open burning.

(5) Except as provided in ARM 17.8.606, a person may not open burn any nonprohibited material without first obtaining an air quality open burning permit from the department. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1982 MAR p. 689, Eff. 4/16/82; AMD, 1991 MAR p. 126, Eff. 2/1/91; AMD, 1994 MAR p. 2528, Eff. 9/9/94; AMD, 1995 MAR p. 535, Eff. 4/14/95; AMD, 1996 MAR p. 1844, Eff. 7/4/96; TRANS, from DHES, 1996 MAR p. 2285; AMD, 2002 MAR p. 3586, Eff. 12/27/02; AMD, 2011 MAR p. 569, Eff. 4/15/11.)

17.8.605 SPECIAL BURNING PERIODS (1) The following categories of open burning may be conducted during the entire year:

(a) prescribed wildland open burning;

(b) open burning to train firefighters under ARM 17.8.615;

(c) open burning authorized under the emergency open burning permit provisions in ARM 17.8.611;

(d) essential agricultural open burning;

(e) conditional air quality open burning;

(f) commercial film production open burning;

(g) Christmas tree waste open burning; and

(h) any minor open burning that is not prohibited by ARM 17.8.604 or that is allowed by ARM 17.8.606.

(2) Open burning other than those categories listed in (1) may be conducted only during the months of March through November. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, MCA; NEW, 1982 MAR p. 691, Eff. 4/16/82; AMD, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 2002 MAR p. 3586, Eff. 12/27/02.)

17.8.606 MINOR OPEN BURNING SOURCE REQUIREMENTS

(1) Unless required to obtain an open burning permit under another provision of this subchapter, a minor open burning source need not obtain an air quality open burning permit.

(2) A minor open burning source must:

(a) conform with BACT;

(b) comply with all rules in this subchapter, except ARM 17.8.610; and

(c) comply with any requirements or regulations relating to open burning established by any agency of local government, including local air pollution agencies established under 75-2-301, MCA, of the Montana Clean Air Act, or any other municipal or county agency responsible for protecting public health and welfare.

(3) During September, October, or November, to conduct any minor open burning not prohibited by ARM 17.8.604, a minor open burning source must adhere to the burning restrictions established by the department that are available by calling the department at (800) 225-6779.

(4) During December, January, or February, to conduct any minor open burning that is not prohibited by ARM 17.8.604, a minor open burning source must comply with the following conditions:

(a) Outside the eastern Montana open burning zone, a minor open burning source must:

(i) submit a written request to the department, demonstrating that the essential agricultural open burning or prescribed wildland open burning, or any minor open burning that is not prohibited by ARM 17.8.604 must be conducted prior to reopening of open burning in March;

(ii) receive permission for each specific burn from the department; and

(iii) adhere to the time periods set for burning by the department that are available by calling the department at (800) 225-6779.

(b) Inside the eastern Montana open burning zone, a minor open burning source need only notify the department by telephone of any essential agricultural open burning, prescribed wildland open burning, or any other minor open burning that is not prohibited by ARM 17.8.604 prior to ignition. Burning is allowed when ventilation conditions are good or excellent. Ventilation conditions are determined by the department using a ventilation index, which is defined as the product of the mixing depth in feet at the time of the daily maximum temperature, times the average transport wind in knots through the mixed layer divided by 100. Good or excellent ventilation conditions exist when the ventilation index is 400 or higher. Forecasts of ventilation conditions may be obtained by calling the department at (800) 225-6779.

(5) During March through August, subject to (2), a minor open burning source may conduct open burning not prohibited under ARM 17.8.604.

(6) The requirements of this rule are in addition to any other applicable state, federal or local open burning requirements. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, MCA; NEW, 1982 MAR p. 690, Eff. 4/16/82; AMD, 1994 MAR p. 2528, Eff. 9/9/94; AMD, 1995 MAR p. 2412, Eff. 11/10/95; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1999 MAR p. 1660, Eff. 7/23/99; AMD, 2002 MAR p. 3586, Eff. 12/27/02.)

Rules 17.8.607 through 17.8.609 reserved

NEXT PAGE IS 17-399

17.8.610 MAJOR OPEN BURNING SOURCE RESTRICTIONS (1) Prior to open burning, a major open burning source must submit an application to the department for an air quality major open burning permit. The application must be accompanied by the appropriate air quality permit application fee required under ARM 17.8.514 and must contain the following information:

(a) a legal description of each planned site of open burning or a detailed map showing the location of each planned site of open burning;

(b) the elevation of each planned site of open burning;

(c) the method of burning to be used at each planned site of open burning; and

(d) the average fuel loading or total fuel loading at each site to be burned.

(2) Proof of publication of public notice, consistent with this rule, must be submitted to the department before an application will be considered complete. An applicant for an air quality major open burning permit shall notify the public of the application for permit by legal publication, at least once, in a newspaper of general circulation in each airshed (as defined by the department) affected by the application. The notice must be published no sooner than ten days prior to submittal of an application and no later than ten days after submittal of an application. The form of the notice must be provided by the department and must include a statement that public comments concerning the application may be submitted to the department within 20 days after publication of notice or filing of the application, whichever is later. A single public notice may be published for multiple applicants.

(3) When the department approves or denies the application for a permit under this rule, a person who is directly and adversely affected by the department's decision may request a hearing before the board in the manner provided in 75-2-211, MCA.

(4) A major open burning source must:

(a) conform with BACT; and

(b) comply with the conditions in any air quality open burning permit issued to it by the department, which will be in effect for one year from its date of issuance or another time frame as specified in the permit by the department.

(5) To open burn in a manner other than that described in the application for an air quality open burning permit, the source must submit to the department, in writing or by telephone, a request for a change in the permit, including the information required by (1), and must receive approval from the department.

(History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1982 MAR p. 690, Eff. 4/16/82; AMD, 1992 MAR p. 2061, Eff. 9/11/92; AMD, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1999 MAR p. 1660, Eff. 7/23/99; AMD, 2002 MAR p. 3586, Eff. 12/27/02; AMD, 2011 MAR p. 569, Eff. 4/15/11; AMD, 2016 MAR p. 1164, Eff. 7/9/16.)

17.8.611 EMERGENCY OPEN BURNING PERMITS (1) The department may issue an emergency air quality open burning permit to allow burning of a substance not otherwise approved for burning under this subchapter if the applicant demonstrates that the substance to be burned poses an immediate threat to public health and safety, or plant or animal life, and that no alternative method of disposal is reasonably available.

(2) Oral authorization to conduct emergency open burning may be granted by the department upon receiving the following information:

(a) facts establishing that alternative methods of disposing of the substance are not reasonably available;

(b) facts establishing that the substance to be burned poses an immediate threat to human health and safety or plant or animal life;

(c) the legal description or address of the site where the burn will occur;

(d) the amount of material to be burned;

(e) the date and time of the proposed burn;

(f) the date and time that the spill or incident giving rise to the emergency was first noticed; and

(g) a commitment to pay the appropriate air quality permit application fee required under ARM 17.8.515 within ten working days of permit issuance.

(3) Within ten days of receiving oral authorization to conduct emergency open burning under (2), the applicant must submit to the department a written application for an emergency open burning permit containing the information required above under (2)(a) through (f). The applicant shall also submit the appropriate air quality permit application fee required under ARM 17.8.515. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1982 MAR p. 692, Eff. 4/16/82; AMD, 1992 MAR p. 2285, Eff. 10/16/92; AMD, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1999 MAR p. 1660, Eff. 7/23/99.)

17.8.612 CONDITIONAL AIR QUALITY OPEN BURNING PERMITS

(1) The department may issue a conditional air quality open burning permit if the department determines that:

(a) alternative methods of disposal would result in extreme economic hardship to the applicant; and

(b) emissions from open burning will not endanger public health or welfare or cause or contribute to a violation of any Montana or federal ambient air quality standard.

(2) The department must be reasonable when determining whether alternative methods of disposal would result in extreme economic hardship to the applicant.

(3) Conditional open burning must conform with BACT.

(4) The department may issue a conditional air quality open burning permit to dispose of:

(a) solid wood and wood byproduct trade wastes by any business, trade, industry, or demolition project; or

(b) untreated wood waste at a licensed landfill site, if the department determines that:

(i) the proposed open burning will occur at an approved burn site, as designated in the solid waste management system license issued by the department pursuant to ARM Title 17, chapter 50, subchapter 5;

(ii) the material to be burned complies with ARM Title 17, chapter 50, subchapter 5; and

(iii) prior to each burn, the burn pile was inspected by the department or its designated representative and no prohibited materials listed in ARM 17.8.604 were present.

(5) A permit issued under this rule is valid for the following periods:

(a) solid wood and wood byproduct trade wastes--one year; and

(b) untreated wood waste at licensed landfill sites--one year.

(6) The department may place any reasonable requirements in a conditional air quality open burning permit that the department determines will reduce emissions of air pollutants or minimize the impact of emissions, and the recipient of a permit must adhere to those conditions. For a permit granted under (4)(a), BACT for the year covered by the permit will be specified in the permit; however, the source may be required, prior to each burn, to receive approval from the department of the date of the proposed burn to ensure that good ventilation exists and to assign burn priorities if other sources in the area request permission to burn on the same day. Approval may be requested by calling the department at (800) 225-6779.

(7) An application for a conditional air quality open burning permit must be made on a form provided by the department, and must be accompanied by the appropriate air quality permit application fee required under ARM 17.8.515. The applicant shall provide adequate information to enable the department to determine whether the application satisfies the requirements for a conditional air quality open burning permit contained in this rule. Proof of publication of public notice, as required in (8), must be submitted to the department before an application will be considered complete.

(8) An applicant for a conditional air quality open burning permit shall notify the public of the application by legal publication, at least once, in a newspaper of general circulation in the area affected by the application. The notice must be published no sooner than ten days prior to submittal of an application and no later than ten days after submittal of an application. Form of the notice must be provided by the department and must include a statement that public comments may be submitted to the department concerning the application within 20 days after publication of notice or filing of the application, whichever is later. A single public notice may be published for multiple applicants.

(9) A conditional air quality open burning permit granted under (4)(a) of this rule is a temporary measure to allow time for the entity generating the trade wastes to develop alternative means of disposal.

(10) When the department approves or denies the application for a permit under this rule, a person who is directly and adversely affected by the department's decision may request a hearing before the board in the manner provided in 75-2-211, MCA. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1982 MAR p. 691, Eff. 4/16/82; AMD, 1991 MAR p. 126, Eff. 2/1/91; AMD, 1992 MAR p. 2285, Eff. 10/16/92; AMD, 1994 MAR p. 2528, Eff. 9/9/94; AMD, 1995 MAR p. 535, Eff. 4/14/95; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1999 MAR p. 1660, Eff. 7/23/99; AMD, 2002 MAR p. 3586, Eff. 12/27/02; AMD, 2011 MAR p. 569, Eff. 4/15/11; AMD, 2016 MAR p. 1164, Eff. 7/9/16.)

17.8.613 CHRISTMAS TREE WASTE OPEN BURNING PERMITS

(1) The department may issue an air quality open burning permit for disposal of Christmas tree waste, as defined in ARM 17.8.601(2).

(2) The department may issue an air quality Christmas tree waste open burning permit if the department determines that emissions from open burning will not endanger public health or welfare or cause or contribute to a violation of any Montana or federal ambient air quality standard.

(3) Christmas tree waste open burning must conform with BACT.

(4) A permit issued under this rule is valid for one year, and applicants may reapply for a permit annually.

(5) The department may place any reasonable requirements in an air quality Christmas tree waste open burning permit that the department determines will reduce emissions of air pollutants or minimize the impact of emissions, and the recipient of a permit must adhere to those conditions. The following conditions, at a minimum, must be included in any air quality Christmas tree waste open burning permit:

(a) BACT for the year covered by the permit; and

(b) a provision that the source may be required, prior to each burn, to receive approval from the department of the date and time of the proposed burn to ensure that good ventilation exists and to assign burn priorities, if necessary. Approval may be requested by calling the department at (800) 225-6779.

(6) An application for an air quality Christmas tree waste open burning permit must be made on a form provided by the department. The applicant shall provide adequate information to enable the department to determine whether the application satisfies the requirements of this rule for a permit.

(7) An applicant for an air quality Christmas tree waste open burning permit shall notify the public of its application either by publishing a notice in a newspaper of general circulation or by posting at least two public notices, one on the property as described in (a)(i), and one in a conspicuous location at the county courthouse as described in (a)(ii).

(a) Posted public notices must comply with the following conditions:

(i) at least one public notice must be posted on the property where the open burning is to occur, near the closest public right-of-way to the property, in a location clearly visible from the right-of-way;

(ii) at least one public notice must be posted in a conspicuous location at the county courthouse in the county where the burning is to take place;

(iii) the two public notices must be posted no sooner than ten days prior to submittal of the application and no later than ten days after submittal of the application and must remain posted in a visible condition for a minimum of 15 days; and

(iv) the two public notices must state the information in the application, the procedure for providing public comment to the department on the application, the date by which public comments must be submitted to the department, and the procedure for requesting a copy of the department's decision.

(b) Publication of public notices in a newspaper must:

(i) be by legal publication, at least once, in a newspaper of general circulation in the area affected by the application;

(ii) be published no sooner than ten days prior to submittal of the application and no later than ten days after submittal of the application; and

(iii) follow a form provided by the department, including a statement that public comments may be submitted to the department concerning the application within 20 days after publication of notice or filing of the application, whichever is later. A single public notice may be published for multiple applicants.

(8) When the department approves or denies the application for a permit under this rule, a person who is directly and adversely affected by the department's decision may request a hearing before the board in the manner provided in 75-2-211, MCA. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 1999 MAR p. 1660, Eff. 7/23/99; AMD, 2011 MAR p. 569, Eff. 4/15/11; AMD, 2016 MAR p. 1164, Eff. 7/9/16.)

17.8.614 COMMERCIAL FILM PRODUCTION OPEN BURNING PERMITS

(1) The department may issue an air quality commercial film production open burning permit for open burning of otherwise prohibited material as part of a commercial, educational film, or video production for motion pictures or television. Use of pyrotechnic special effects materials, including bulk powder compositions and devices, smoke powder compositions and devices, matches and fuses, squibs and detonators, and fireworks specifically created for use by special effects pyrotechnicians for use in motion picture or video productions is not considered open burning.

(2) The department may issue an air quality commercial film production open burning permit under this rule if the department determines that emissions from open burning will not endanger public health or welfare or cause or contribute to a violation of any Montana or federal ambient air quality standard.

(3) A permit issued under this rule is valid for a single production.

(4) Open burning under this rule must conform with BACT.

(5) The department may place any reasonable requirements in an air quality commercial film production open burning permit issued under this rule that the department determines will reduce emissions of air pollutants or minimize the impact of emissions, and the recipient of a permit must adhere to those conditions.

(6) An application for an air quality commercial film production open burning permit must be made on a form provided by the department. The applicant shall provide adequate information to enable the department to determine whether the application satisfies the requirements of this rule for a permit. Proof of publication of public notice, as required by (7), must be submitted to the department before an application will be considered complete.

(7) An applicant for an air quality commercial film production open burning permit shall notify the public of its application by legal publication, at least once, in a newspaper of general circulation in the area affected by the application. The notice must be published no sooner than ten days prior to submittal of the application and no later than ten days after submittal of the application. Form of the notice must be provided by the department and must include a statement that public comments may be submitted to the department concerning the application within 20 days after publication of notice or filing of the application, whichever is later. A single public notice may be published for multiple applicants.

(8) When the department approves or denies the application for a permit under this rule, a person who is directly and adversely affected by the department's decision may request a hearing before the board in the manner provided in 75-2-211, MCA. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 2002 MAR p. 3586, Eff. 12/27/02; AMD, 2011 MAR p. 569, Eff. 4/15/11; AMD, 2016 MAR p. 1164, Eff. 7/9/16.)

17.8.615 FIREFIGHTER TRAINING (1) The department may issue an air quality open burning permit for open burning of asphalt shingles, tar paper, or insulated wire which is part of a building or standing structure, oil or petroleum products, and automobile or aircraft bodies and interiors, for training firefighters, if:

(a) the fire will be restricted to a building or structure, a permanent training facility, or other appropriate training site, in a site other than a solid waste disposal site;

(b) the material to be burned will not be allowed to smolder after the training session has terminated, and no public nuisance will be created;

(c) all asbestos-containing material has been removed;

(d) asphalt shingles, flooring material, siding, and insulation which might contain asbestos have been removed, unless samples have been analyzed by a certified laboratory and shown to be asbestos-free;

(e) all prohibited material that can be removed safely and reasonably has been removed;

(f) the open burning accomplishes a legitimate training need;

(g) clear educational objectives have been identified for the training;

(h) burning is limited to that necessary to accomplish the educational objectives;

(i) the training operations and procedures are consistent with nationally accepted standards of good practice; and

(j) emissions from open burning will not endanger public health or welfare or cause or contribute to a violation of any Montana or federal ambient air quality standard.

(2) The department may place any reasonable requirements in an air quality firefighter training open burning permit that the department determines will reduce emissions of air pollutants or will minimize the impact of emissions, and the recipient of a permit must adhere to those conditions.

(3) The applicant may be required, prior to each burn, to notify the department of the anticipated date and location of the proposed training exercise and the type and amount of material to be burned. The department may be notified by phone, fax, or in writing.

(4) An application for an air quality firefighter training open burning permit must be made on a form provided by the department. The applicant must provide adequate information to enable the department to determine whether the application satisfies the requirements of this rule for a permit.

(5) Proof of publication of public notice, consistent with this rule, must be submitted to the department before an application will be considered complete. An applicant for an air quality firefighter training open burning permit shall notify the public of the application for a permit by legal publication, at least once, in a newspaper of general circulation in the area affected by the application. The notice must be published no sooner than ten days prior to submittal of an application and no later than ten days after submittal of an application. The form of the notice must be provided by the department and must include a statement that public comments may be submitted to the department concerning the application within 20 days after publication of notice or filing of the application, whichever is later. A single public notice may be published for multiple applicants.

(6) When the department approves or denies the application for a permit under this rule, a person who is directly and adversely affected by the department's decision may request a hearing before the board in the manner provided in 75-2-211, MCA. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1982 MAR p. 691, Eff. 4/1/82; AMD, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 2011 MAR p. 569, Eff. 4/15/11; AMD, 2016 MAR p. 1164, Eff. 7/9/16.)

NEXT PAGE IS 17-421

(5) Proof of publication of public notice, consistent with this rule, must be submitted to the department before an application will be considered complete. An applicant for an air quality firefighter training open burning permit shall notify the public of the application for a permit by legal publication, at least once, in a newspaper of general circulation in the area affected by the application. The notice must be published no sooner than ten days prior to submittal of an application and no later than ten days after submittal of an application. The form of the notice must be provided by the department and must include a statement that public comments may be submitted to the department concerning the application within 20 days after publication of notice or filing of the application, whichever is later. A single public notice may be published for multiple applicants.

(6) When the department approves or denies the application for a permit under this rule, a person who is jointly or severally adversely affected by the department's decision may request a hearing before the board. The request for hearing must be filed within 15 days after the department renders its decision. An affidavit setting forth the grounds for the request must be filed within 30 days after the department renders its decision. The contested case provisions of the Montana Administrative Procedure Act, Title 2, chapter 4, part 6, MCA, apply to a hearing before the board under this rule. The department's decision on the application is not final until 15 days have elapsed from the date of the decision. The filing of a request for a hearing does not stay the effective date of the department's decision. However, the board may order a stay upon receipt of a petition and a finding, after notice and opportunity for hearing, that:

(a) the person requesting the stay is entitled to the relief demanded in the request for a hearing; or

(b) continuation of the permit during the appeal would produce great or irreparable injury to the person requesting the stay.

(7) Upon granting a stay, the board may require a written undertaking to be given by the party requesting the stay for the payment of costs and damages incurred by the permit applicant and its employees if the board determines that the permit was properly issued. When requiring an undertaking, the board shall use the same procedures and limitations as are provided in 27-19-306(2) through (4), MCA, for undertakings on injunctions. (History: 75-2-111, 75-2-203, MCA; IMP, 75-2-203, 75-2-211, MCA; NEW, 1982 MAR p. 691, Eff. 4/1/82; AMD, 1994 MAR p. 2528, Eff. 9/9/94; TRANS, from DHES, 1996 MAR p. 2285; AMD, 2011 MAR p. 569, Eff. 4/15/11.)

NEXT PAGE IS 17-421

Appendix B. Emission Inventory Detail

BASELINE, PROJECTED, AND PROGRESS PERIODS

As discussed in the body of this report, sources of emissions are grouped into several source categories to create a snapshot that can be used to analyze and track changes in emissions over time. EPA requires that Regional Haze progress reports look at changes in emissions over a period of time, which means comparing emission inventories from several different years to look for changes in both the amount of pollutants being emitted and also the types of sources that are emitting the pollutants.

For the purpose of this report, we will be using the baseline emission year of 2002, which was used to project a picture of what emissions might look like in Montana in 2018 at the end of the implementation period.

The baseline period emissions ("Base02") were compiled by the Western Regional Air Partnership (WRAP) for the initial Regional Haze implementation period.[1] The Base02 represented actual conditions and used annual actual emissions reported from states to the EPA National Emission Inventory (NEI). The Base02 was used to create the 2000-04 baseline period planning emissions scenario, referred to as "Plan02." A series of Plan02 inventories (Plan02a, Plan02b, Plan02c and Plan02d) were subsequently released that refined the data to better represent baseline emission patterns based on average, or "typical," conditions rather than a single year snapshot. EPA selected Plan02d as the baseline case in the Montana FIP.

The WRAP used the Plan02 inventory to create a future year 2018 projected emissions scenario, the WRAP 2018 base case projection inventory ("Base18"). This projection was first compiled in 2006 and provided the data and information for developing future regional haze control strategies. The Base18 was developed using the revised WRAP 2002 Point and Area Source Inventory with adjustments made for emissions from new facilities that had come on-line since 2002 and corrections for facilities that retired in 2003 or 2004. Additionally, the inventory considered:

- Control factors (new and retired facilities, enforceable agreements, consent decrees, new rules and regulations that were on-the-books),
- Growth factors (standard classification code (SCC)-specific growth factors developed from projection factor models, special analysis of electric generating units (EGU) growth relative to unit capacity thresholds), and
- Retirement and replacement rates

The Base18 was revised in 2007 to update specific source categories whose 2018 emissions were known to be incorrect or required revision. The revised version is referred to as "PRP18a." The PRP18a effort updated projections for EGUs and incorporated the effects of known and presumed

[1] Western Regional Air Partnership (WRAP), Technical Support System (TSS), http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx. Detailed inventory descriptions for development of the WRAP Base02, Plan02 (and Plan02a-d) inventories are available on the WRAP TSS website and archived on the original WRAP website at http://www.wrapair.org/forums/ssjf/pivot.html.

BART emission levels. In 2009, the projection was revised again to create "PRP18b," which incorporated new control factors and corrected more errors.

The WRAP has continued to support emissions data tracking and related technical analyses. Methods for estimating emissions of many of the source categories that affect regional haze have continued to evolve and be refined over time. To that end, the WRAP helped to compile an updated progress period emissions scenario taken from work conducted as part of the West-wide Jumpstart Air Quality Modeling Study (WestJumpAQMS) project and the Deterministic and Empirical Assessment of Smoke's Contribution to Ozone ($DEASCO_3$) study, called WestJump2008. Many states were able to use the WestJump2008 emissions scenario to update control strategies and determine progress toward the 2018 milestone.[2,3] One of the objectives of developing the WestJump2008 inventory was to provide states with a tool to evaluate progress toward Regional Haze milestones. However, the Montana FIP was not finalized until several years after the WestJump2008 emissions scenario; therefore, Montana will not use these projections to report progress.

2002 Baseline Period

As mentioned above, for the Montana FIP, EPA used the Plan02d baseline inventory to document the emission reduction obligations in order to achieve Reasonable Progress in each mandatory Class I Area in Montana. EPA used the PRP18b projection to compare 2002 baseline to the first milestone in 2018.

A summary of the emission inventory descriptions for the Plan02d source categories are as follows:

Point source inventory – This inventory was generated using hourly EPA Clean Air Markets Division (CAMD) Continuous Emissions Monitoring (CEM) data for EGUs. Other point source emissions were developed in consultation with states.

Area Sources - These inventories were developed by a contractor in consultation with states.

Area Oil and Gas - These inventories were developed for specific oil and gas basins using WRAP Phase II emissions methodologies.

Onroad Mobile – This inventory used the EPA MOBILE6 emissions model as applied by the contractor using inputs from states.

Offroad Mobile - This inventory used the draft NONROAD2004 model as applied by the contractor using inputs from states.

Fugitive Dust and Road Dust – This inventory was compiled by the contractor with inputs from states.

---

[2] WRAP, WRAP Regional Technical Center and WestJumpAQMS, http://wrapair2.org/WestJumpAQMS.aspx.
[3] WRAP, Fire Emissions Tracking System (FETS), Deterministic and Empirical Assessment of Smoke's Contribution to Ozone Project, http://www.wrapfets.org/deasco3.cfm.

Windblown Dust - Generated using WRAP Windblown Dust Model and 2002 Mesoscale Model 5 (MM5) meteorology, at 36 km grid cell resolution.

Biogenic - The 2002 biogenic inventory used the BEIS3.12 model with BELD3 land use and 2002 MM5 meteorology data, at 36 km grid cell resolution.

Fires (Natural and Anthropogenic) - Baseline estimates used the WRAP Phase III fire inventory, which represented a 5-year average (2000-2004) of fire activity. Inventories included both anthropogenic and natural emissions.[4]

2014 National Emissions Inventory (NEI)

As discussed in Section 0 above, due to timing of finalization of the FIP, Montana wasn't able to leverage the WestJump2008 progress inventory to ascertain progress toward the 2018 milestone. In its place, the NEI proved to be the best option available to show emission trends.

The NEI is used for a variety of air quality analyses beyond what is needed in regional haze planning. While the WRAP data sets specifically address regional haze emissions concerning to the West, the NEI has a much broader scope. Despite these concerns, this progress report the 2014 NEI is used to mark progress between the 2002 baseline and 2018 projection. The source categories in the NEI are summarized below:

Point source inventory – This inventory was built off state/local/tribal (S/L/T)-submitted emissions; missing emission values are gap-filled with EPA data where needed (i.e., used annual sum of CAMD hourly CEM data for SO_2 and NO_x where necessary).

Area Sources - This inventory was built off S/L/T-submitted emissions; missing emission values are gap-filled with EPA data where needed.

Area Oil and Gas – This inventory was developed for specific oil and gas basins using WRAP Phase III emissions methodologies. For this document, WRAP Area O&G emissions were taken from 2015 Projections Emissions Data (https://www.wrapair2.org/PhaseIII.aspx).

Onroad Mobile – This inventory used the MOVES2014a model and used EPA inputs vs state-submitted inputs.

Offroad Mobile - This inventory used the NONROAD2008 model and used EPA inputs vs state-submitted inputs.

Fugitive Dust and Road Dust –This inventory includes the paved and unpaved road dust sector, which includes data from the S/L/T agency-submitted data, and the default EPA generated

[4] WRAP, Regional Haze Rule Reasonable Progress Summary Report (28 Jun. 2013), https://www.wrapair2.org/documents/SECTIONS%201.0%20-%203.0/WRAP_RHRPR_Sec_1-3_Background_Info.pdf.

emissions. Montana did not submit emissions for this sector so EPA estimates were used for the entire sector.

Windblown Dust – Not estimated in the NEI

Biogenic - This inventory was computed based on 2014 meteorology data from the Weather Research and Forecasting (WRF) model version 3.8 (WRFv3.8) and using the Biogenic Emission Inventory System, version 3.61 (BEIS3.61) model within the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system.

Fires (Natural and Anthropogenic) – This inventory was compiled based on the data provided from the Fire Emissions Tracking System (FETS) and supplemented with national data sets, where appropriate.[5]

Emissions Changes between the Baseline and Progress

[5] EPA, 2014 National Emissions Inventory, version 1, Technical Support Document Draft (22 Dec. 2016), https://www.epa.gov/sites/production/files/2016-12/documents/nei2014v1_tsd.pdf.

Appendix C. Detailed Visibility Analysis

Detailed Assessment of Visibility Conditions at each IMPROVE Monitoring Site

As discussed in the body of this report, 40 CFR 51.308(g)(3) requires that progress reports "assess the following visibility conditions and changes, with values for the most impaired and least impaired days expressed in terms of 5-year averages of these annual values.

i. The current visibility conditions for the most impaired and least impaired days;

ii. The difference between current visibility conditions for the most impaired and least impaired days and baseline conditions;

iii. The change in visibility impairment for the most impaired and least impaired days over the past 5 years."

As discussed in the main report, the original Regional Haze Rule (RHR) defined "most impaired days" as "the average visibility impairment (measured in deciviews) for the twenty percent of monitored days in a calendar year with the highest amount of visibility impairment."[1] In other words, for the purposes of the RHR and this progress report, the most impaired days in a given year are the 20% of days with the worst visibility or the haziest days. On the other end of the spectrum, the "least impaired days" were defined in the original RHR as "the twenty percent of monitored days in a calendar year with the lowest amount of visibility impairment," or the 20% of days with the best, clearest visibility.[2] To avoid confusion with terminology used in the recent revisions to the RHR, this progress report uses the phrases "worst days" or "20% worst days" in lieu of "most impaired days" and "best days" or "20% best days" in lieu of "least impaired days."

As previously discussed in the main report, Montana's twelve Class I areas are represented by eight IMPROVE sites. Although technically the Yellowstone National Park IMPROVE site is located in Wyoming, for this report, it will be considered part of the Montana IMPROVE monitoring network, since a portion of the park lies within Montana borders. Therefore, this appendix provides information by IMPROVE site, not by Class I area. All sites are identified by an IMPROVE code which is also included for completeness purposes.

In addition to the eight IMPROVE sites representing Montana's Class I areas, three Class I areas were identified in the Montana FIP as being affected by Montana sources. These Class I areas were North Absaroka and Washakie Wilderness Areas (WA) in Wyoming, and Theodore Roosevelt National Park in North Dakota. North Absaroka WA and Washakie WA are both represented by the North Absaroka IMPROVE site (NOAB1), while the Theodore Roosevelt NP has its own IMPROVE site (THRO1). These two sites are also included in this appendix. The Montana sites are discussed alphabetically, followed by Wyoming (WY) and North Dakota (ND) sites, respectively.

---

[1] 40 CFR 51.301, Definitions. See also: EPA, "Guidance for Tracking Progress under the Regional Haze Rule," EPA-454/B-03-004, Research Triangle Park: September 2003. "Most impaired days - Data representing a subset of the annual measurements that correspond to the dirtiest, or haziest, days of the year."

[2] Ibid.

For each site, average deciviews (dv) on the Best and Worst days in provided by year and averaging period. Light extinction contributions from the individual species that make up regional haze are also included. These species are sulfates (SO4), nitrates(NO3), organic carbon (OMC), elemental carbon (EC), coarse matter (CM), fine soil, and sea salt. Light extinction is defined as the "measure of how much light is absorbed or scattered as it passes through a medium." Light extinction is measured in million inverse meters (Mm^{-1}).

The baseline period is the 5-year 2000 – 2004 whereas the current period is 2011 through 2015. The RHR also states the visibility in the past 5 years (2006 – 2010) must be addressed in addition to 2018, the year set for the reasonable progress goal for all sites.

There is missing data at some of the Montana IMPROVE sites. The Table 1 below shows what years have complete data. For a year to be complete, the following criteria must be met:

- At least 75% of a year has complete measurements.
- At least 50% of each quarter has complete measurements.
- A single year is not missing more than 10 consecutive measurements.

If a year is considered incomplete, that year is not included in any averaging periods. A 5-year averaging period is only considered complete if 3 or more years of complete data are available. Average visibility will not be estimated for 5-year periods with less than 3 years of complete data. Due to the remote, high elevation locations of many of the IMPROVE sites, accessibility is a main contributor to missing data. Winter weather can inhibit the monitor technicians from reaching the site in a timely manner. Other reasons for missing data include equipment failure and power fluctuations.

TABLE 1. DATA COMPLETENESS BY IMPROVE SITE.

	Site				
Year	**CABI1**	**GAMO1**	**GLAC1**	**MELA1**	**MONT1**
2000	Missing	Missing	Complete	Complete	Missing
2001	Complete	Complete	Complete	Complete	Complete
2002	Complete	Complete	Missing	Complete	Complete
2003	Complete	Complete	Missing	Complete	Complete
2004	Complete	Complete	Complete	Complete	Complete
2005	Complete	Complete	Complete	Complete	Complete
2006	Complete	Complete	Complete	Complete	Complete
2007	Complete	Missing	Complete	Complete	Complete
2008	Complete	Complete	Complete	Complete	Complete
2009	Complete	Complete	Missing	Complete	Complete
2010	Complete	Missing	Complete	Complete	Complete
2011	Complete	Missing	Complete	Complete	Complete
2012	Complete	Missing	Complete	Complete	Complete
2013	Complete	Complete	Complete	Complete	Complete
2014	Complete	Complete	Complete	Complete	Complete
2015	Complete	Complete	Complete	Complete	Complete

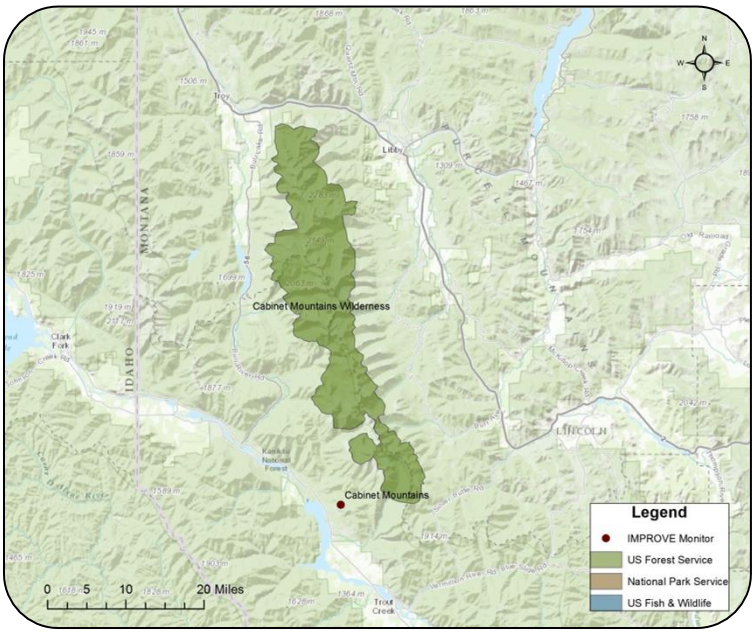
TABLE 1 (CON'T). DATA COMPLETENESS BY IMPROVE SITE.

Year	Site				
	SULA1	ULBE1	YELL2	NOAB1	THRO1
2000	Missing	Missing	Complete	Missing	Missing
2001	Complete	Complete	Complete	Missing	Complete
2002	Complete	Complete	Complete	Complete	Complete
2003	Complete	Complete	Complete	Complete	Complete
2004	Complete	Complete	Complete	Complete	Complete
2005	Complete	Complete	Complete	Complete	Complete
2006	Missing	Complete	Complete	Complete	Complete
2007	Complete	Complete	Complete	Missing	Missing
2008	Missing	Complete	Complete	Complete	Complete
2009	Complete	Complete	Complete	Missing	Complete
2010	Complete	Complete	Complete	Missing	Complete
2011	Complete	Complete	Complete	Missing	Complete
2012	Complete	Complete	Complete	Complete	Complete
2013	Complete	Complete	Complete	Complete	Complete
2014	Complete	Complete	Complete	Complete	Complete
2015	Missing	Complete	Complete	Complete	Complete

Cabinet Mountains (CABI1)

The Cabinet Mountains IMPROVE monitoring site is located in the Cabinet Mountains Wilderness Area and is the representative station for the Cabinet Mountains Wilderness Class I Area. The wilderness area is located in the northwest corner of the state, and runs from north of Trout Creek, Montana (MT) to west of Libby, MT, near the Idaho border. Figure 1 shows the Class I Area with the IMPROVE monitoring site.

FIGURE 1. CABINET MOUNTAINS WILDERNESS AREA



Current Visibility Conditions

The average visibility impairment at the Cabinet Mountains IMPROVE site was 14.5 dv on the worst days and 2.6 dv on the best days for 2011-2015. On the worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, elemental carbon, coarse mass, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the best days, sulfates had the largest contribution followed by organic carbon, nitrates and coarse mass. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 2 displays the current annual average light extinction and visibility impairment contributions on the 20% worst and 20% best visibility days. Figures 2 and 3 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 2. CURRENT VISIBILITY CONDITIONS – CABI1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Cabinet Mountains (CABI1)									
Worst Days	2011	12.4	6.18	2.30	12.17	2.05	0.55	2.32	0.12
	2012	14.4	4.59	1.25	24.60	2.98	0.98	3.47	0.08
	2013	12.8	4.83	1.81	13.42	1.99	2.17	3.02	0.33
	2014	13.9	4.33	1.54	21.30	3.29	0.92	3.13	0.17
	2015	19.1	4.31	2.08	69.05	5.96	0.75	3.26	0.09
	Average	**14.5**	**4.85**	**1.79**	**28.11**	**3.25**	**1.07**	**3.04**	**0.16**
Best Days	2011	2.9	1.53	0.54	0.56	0.16	0.10	0.28	0.23
	2012	2.1	1.16	0.27	0.50	0.13	0.10	0.18	0.05
	2013	2.7	1.44	0.42	0.74	0.17	0.18	0.12	0.09
	2014	2.6	1.03	0.43	0.63	0.17	0.16	0.41	0.14
	2015	2.9	1.16	0.48	0.97	0.13	0.08	0.35	0.25
	Average	**2.6**	**1.27**	**0.43**	**0.68**	**0.15**	**0.13**	**0.27**	**0.15**

FIGURE 2. CONTRIBUTION BY SPECIES FOR CABI1 2011-2015 ON WORST DAYS

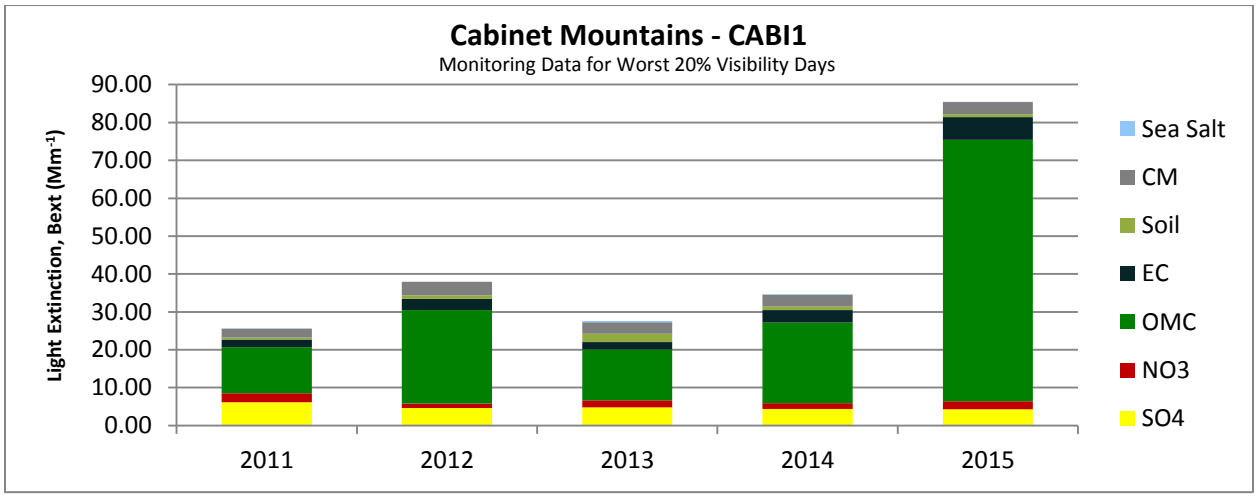
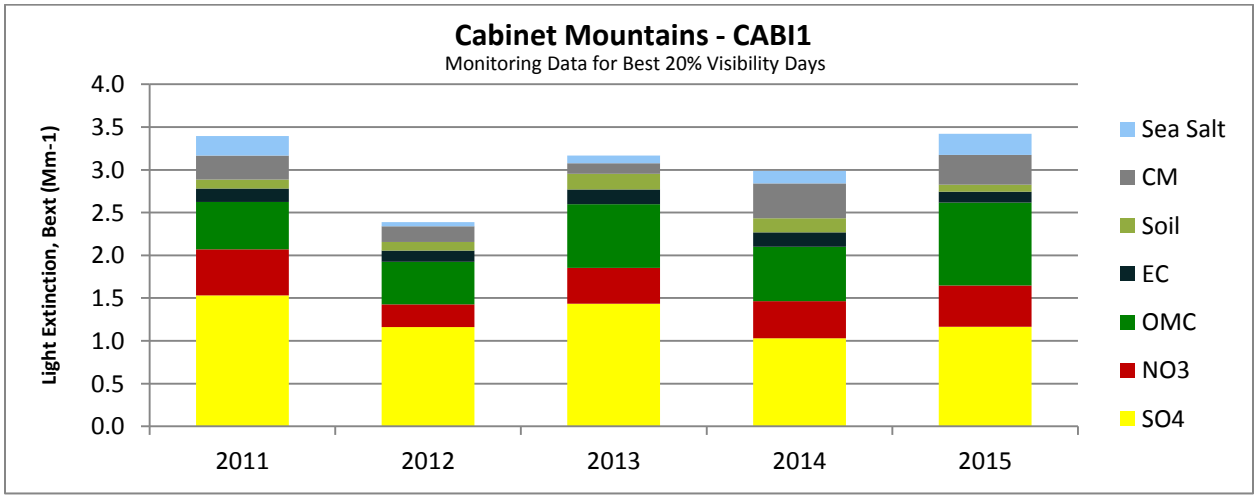


FIGURE 3. CONTRIBUTION BY SPECIES FOR CABI1 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has increased on the Worst days in the Cabinet Mountains Wilderness Area since the 2000-2004 baseline period. On the Worst days, average visibility impairment increased 0.4 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. On the Best days, visibility impairment decreased 1.0 deciview over the 11-year period. Table 3 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference tabulated represents the difference between the 2011-2015 planning period and baseline. Figures 4 and 5 display the species contribution in five-year rolling averages between the baseline period and 2011-2015 period for the Worst and Best days.

TABLE 3. COMPARISON OF CURRENT TO BASELINE - CABI1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Cabinet Mountains (CABI1)									
Worst Days	Baseline	14.1	6.48	2.02	16.95	2.79	1.03	2.81	0.10
	2007-2011	12.8	6.34	1.56	13.76	2.27	0.94	3.00	0.07
	2008-2012	12.7	5.96	1.53	13.85	2.13	0.96	3.10	0.06
	2009-2013	12.7	5.56	1.61	14.42	2.13	1.12	3.00	0.12
	2010-2014	13.1	5.07	1.60	16.71	2.45	1.11	3.06	0.14
	2011-2015	14.5	4.85	1.79	28.11	3.25	1.07	3.04	0.16
	Difference	**0.4**	**-1.63**	**-0.23**	**11.16**	**0.46**	**0.04**	**0.23**	**0.05**
Best Days	Baseline	3.6	1.79	0.77	1.03	0.32	0.11	0.32	0.13
	2007-2011	2.9	1.48	0.53	0.76	0.22	0.12	0.22	0.11
	2008-2012	2.6	1.36	0.47	0.62	0.18	0.12	0.20	0.09
	2009-2013	2.5	1.35	0.40	0.59	0.16	0.13	0.18	0.09
	2010-2014	2.5	1.23	0.38	0.61	0.16	0.14	0.22	0.10
	2011-2015	2.6	1.27	0.43	0.68	0.15	0.13	0.27	0.15
	Difference	**-1.0**	**-0.53**	**-0.34**	**-0.35**	**-0.17**	**0.02**	**-0.05**	**0.03**

FIGURE 4. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

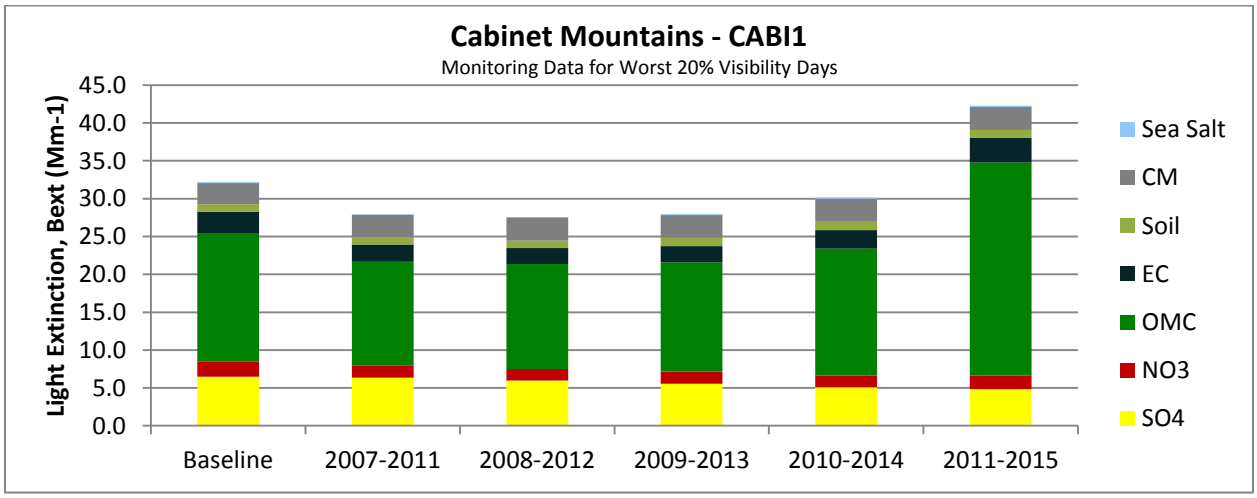
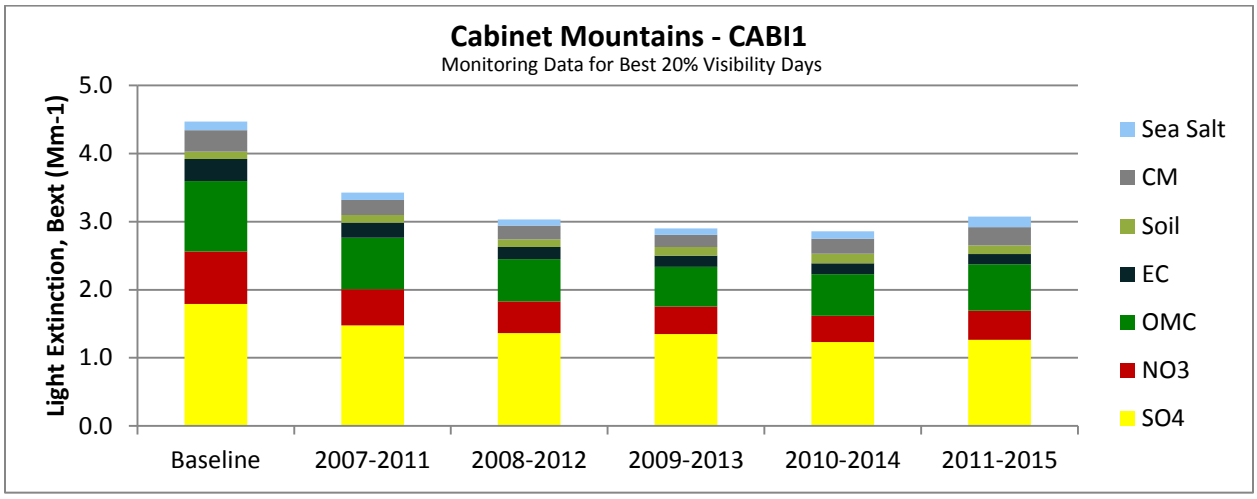
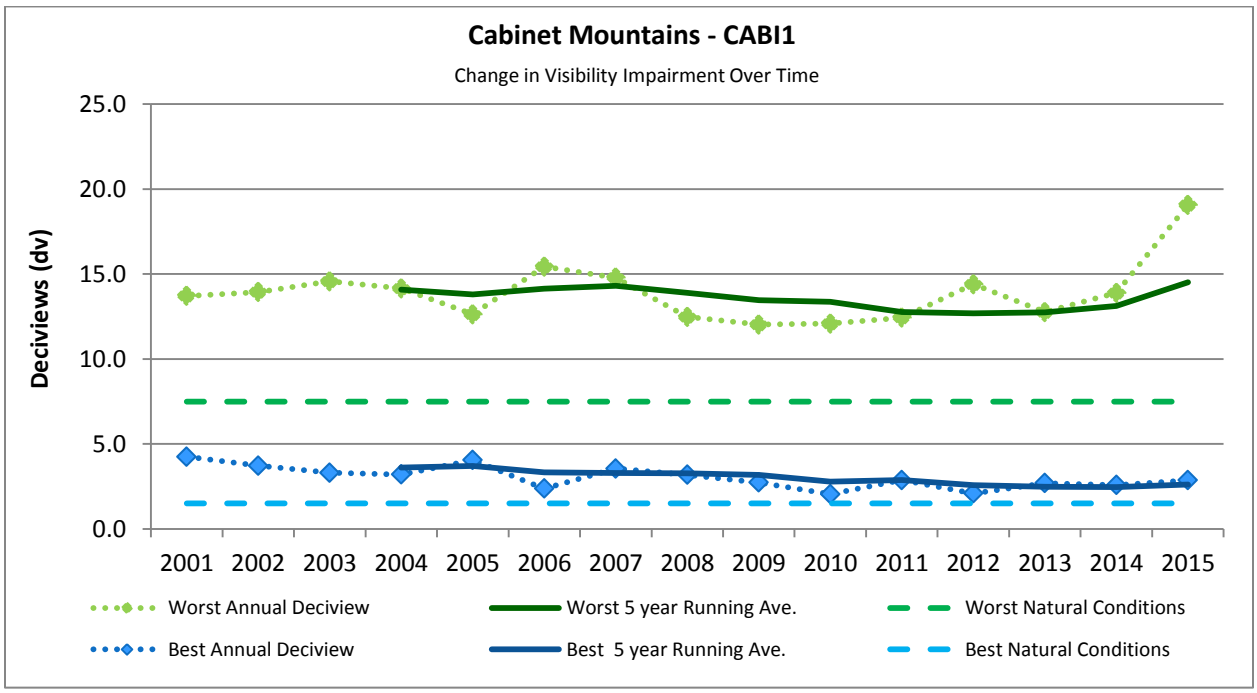


FIGURE 5. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 6 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the most and best days. The 2064 natural condition levels, as reported by WRAP, are also shown for reference.[3]

FIGURE 6. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME.



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile and significant contributor to overall visibility. The overall negative trend (visibility improvement) on the Best days indicates a steady reduction in sulfate and nitrate contributions.

[3] WRAP Technical Support System (TSS), http://vista.cira.colostate.edu/TSS/Results/Monitoring.aspx.

Figures 7 and 8 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 7. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

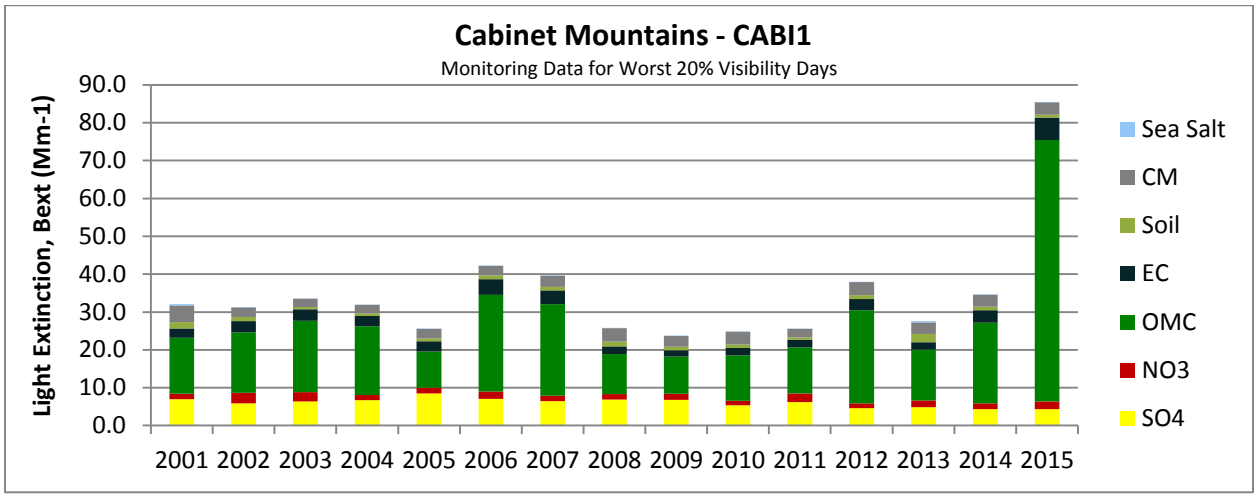


FIGURE 8. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

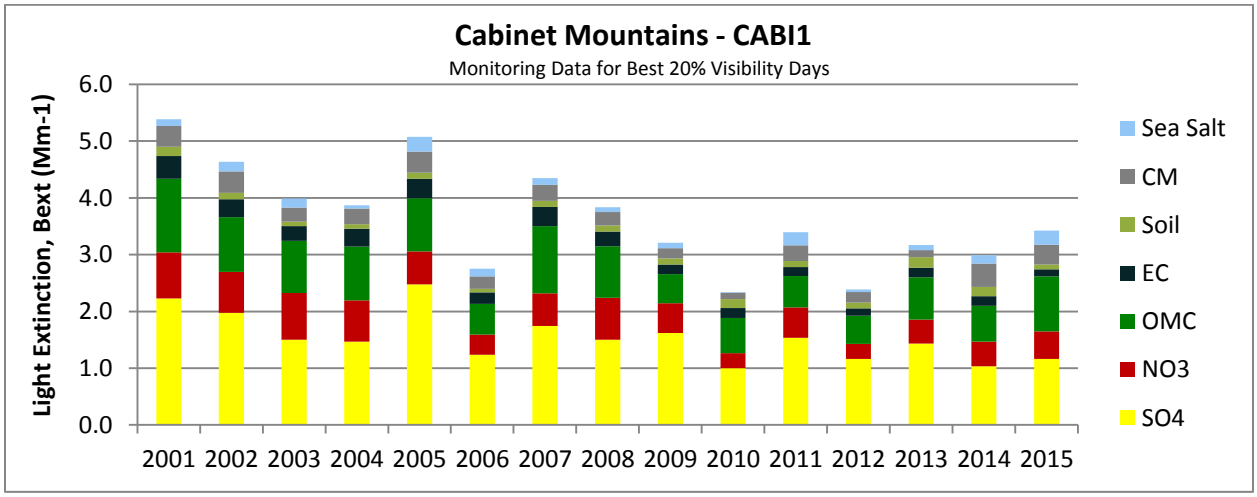
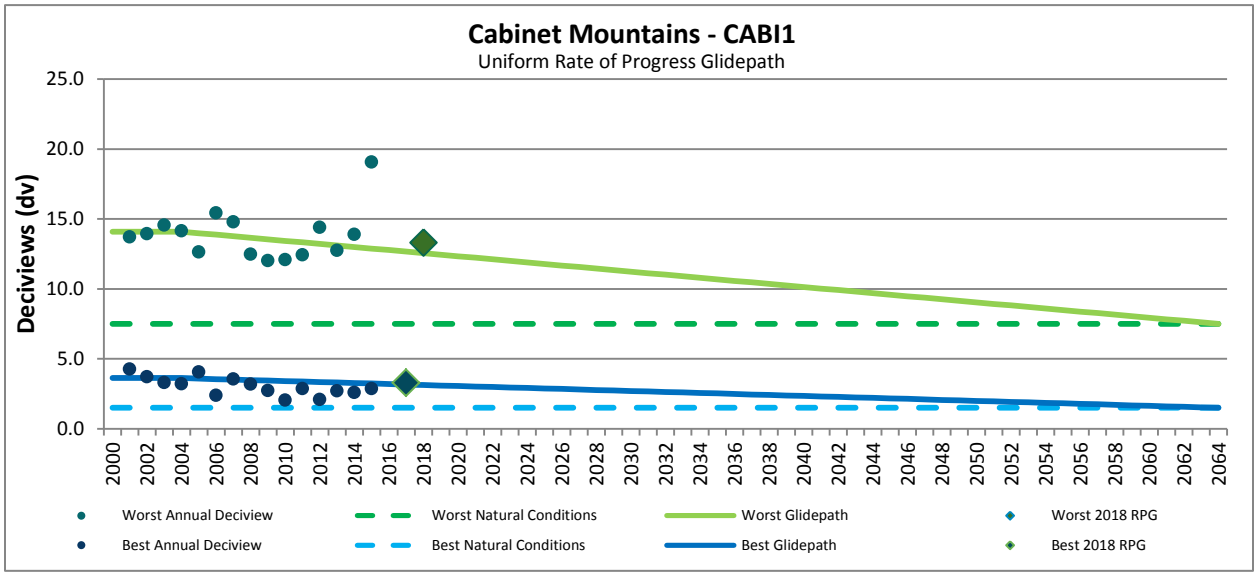


Figure 9 shows how visibility impairment over time matches up with the uniform rate of progress glidepath and the modeled 2018 reasonable progress goals set for the Cabinet Mountains Wilderness Area.

FIGURE 9. UNIFORM RATE OF PROGRESS - CABI1



Change in Visibility Over Past 5 Years

The average visibility impairment at the Cabinet Mountains IMPROVE site was 13.4 dv on the Worst days and 2.8 on the Best days for 2006-2010. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, coarse mass, elemental carbon, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon and nitrates. Elemental carbon, soil, coarse mass, and sea salt contributed little to the overall visibility impairment. Table 4 displays the past 5 years of annual average light extinction and visibility impairment contributions on the Worst and Best days; Figures 10 and 11 display the species contributions on the Worst and Best days, respectively.

TABLE 4. PAST 5 YEARS VISIBILITY CONDITIONS - CABI1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Cabinet Mountains (CABI1)									
Worst Days	2006	15.4	7.02	1.98	25.53	4.10	1.00	2.54	0.11
	2007	14.8	6.49	1.38	24.17	3.67	0.89	3.00	0.13
	2008	12.5	6.87	1.45	10.59	1.97	1.34	3.49	0.04
	2009	12.0	6.78	1.58	9.82	1.70	0.98	2.85	0.04
	2010	12.1	5.40	1.10	12.06	1.94	0.93	3.36	0.01
	Average	**13.4**	**6.51**	**1.50**	**16.44**	**2.68**	**1.03**	**3.05**	**0.07**
Best Days	2006	2.4	1.24	0.35	0.54	0.20	0.06	0.22	0.13
	2007	3.6	1.74	0.58	1.18	0.34	0.11	0.28	0.12
	2008	3.2	1.50	0.74	0.91	0.26	0.11	0.24	0.08
	2009	2.7	1.62	0.53	0.52	0.17	0.11	0.18	0.10
	2010	2.0	1.00	0.26	0.62	0.18	0.16	0.11	0.01
	Average	**2.8**	**1.42**	**0.49**	**0.75**	**0.23**	**0.11**	**0.21**	**0.09**

FIGURE 10. CONTRIBUTION BY SPECIES FOR CABI1 2006-2010 ON WORST DAYS

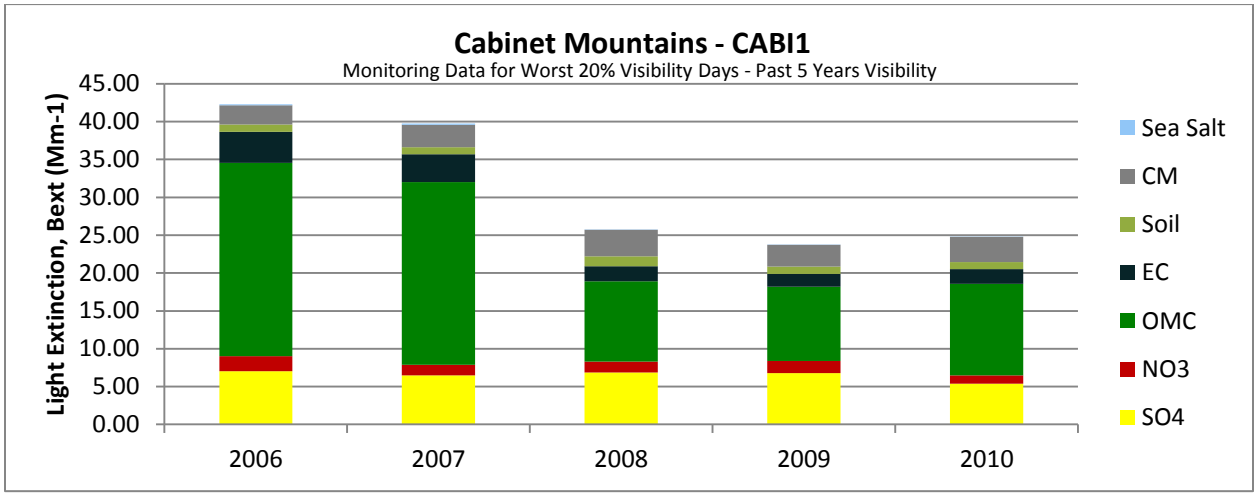


FIGURE 11. CONTRIBUTION BY SPECIES FOR CABI1 2006-2010 ON BEST DAYS

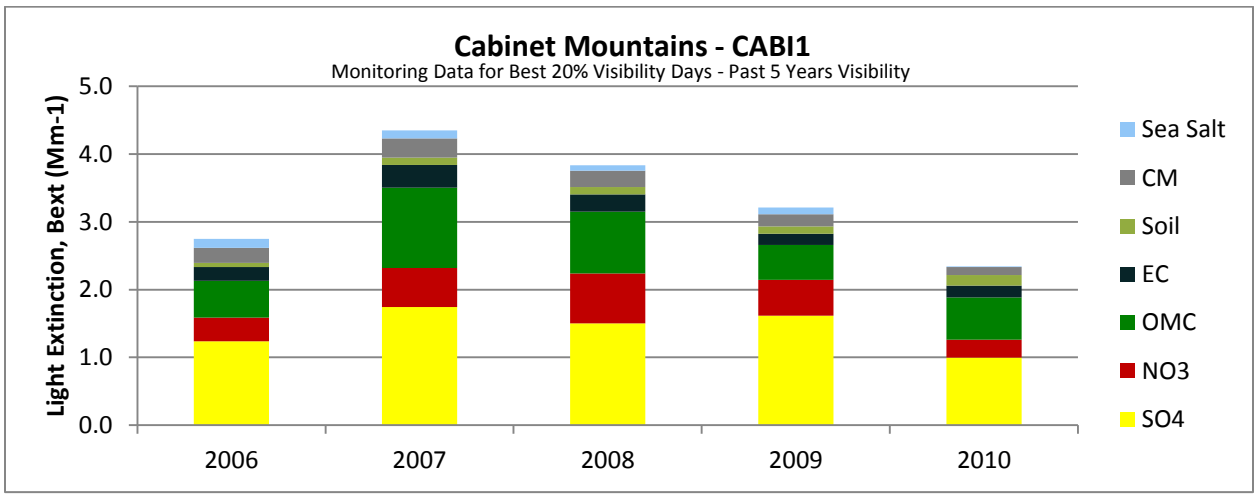


Table 5 shows the difference between the current visibility impairment and the past five years. Visibility impairment on the Worst days has increased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has improved during the same period.

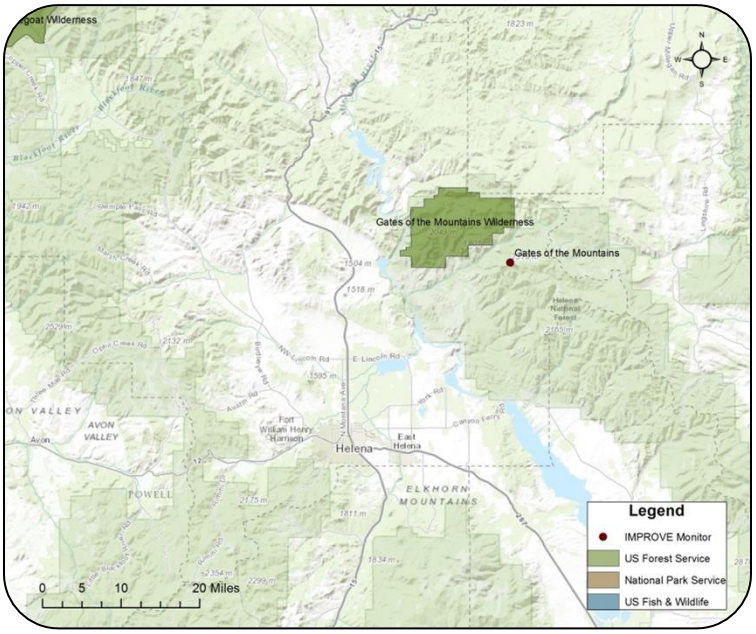
TABLE 5. COMPARISON OF CURRENT TO PAST 5 YEARS - CABI1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Cabinet Mountains (CABI1)									
Worst Days	2006-2010	13.4	6.51	1.50	16.44	2.68	1.03	3.05	0.07
	2011-2015	14.5	4.85	1.79	28.11	3.25	1.07	3.04	0.16
	Difference	**1.1**	**-1.66**	**0.30**	**11.67**	**0.58**	**0.04**	**-0.01**	**0.09**
Best Days	2006-2010	2.8	1.42	0.49	0.75	0.23	0.11	0.21	0.09
	2011-2015	2.6	1.27	0.43	0.68	0.15	0.13	0.27	0.15
	Difference	**-0.2**	**-0.15**	**-0.06**	**-0.07**	**-0.08**	**0.02**	**0.06**	**0.06**

Gates of the Mountains (GAMO1)

The Gates of the Mountains IMPROVE monitoring site is located in the Gates of the Mountains Wilderness Area and is the representative station for the Gates of the Mountain Wilderness Class I Area. The wilderness area is located north of Helena, MT. Figure 12 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 12. GATES OF THE MOUNTAIN WILDERNESS AREA



Current Visibility Conditions

The average visibility impairment at the Gates of the Mountains IMPROVE site was 11.7 dv on the Worst days and 0.6 on the Best days for 2013-2015. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, elemental carbon, coarse mass, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, nitrates and coarse mass. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 6 displays the current annual average light extinction and visibility impairment on the most and Best days. Figures 13 and 14 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 6. CURRENT VISIBILITY CONDITIONS – GAMO1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Gates of the Mountain (GAMO1)									
Worst Days	2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2013	10.6	3.36	0.81	11.26	1.89	0.64	2.76	0.02
	2014	11.2	3.80	1.02	18.07	2.53	0.57	1.85	0.02
	2015	13.3	3.91	1.59	40.26	3.84	0.56	2.15	0.03
	Average	**11.7**	**3.69**	**1.14**	**23.20**	**2.75**	**0.59**	**2.26**	**0.02**
Best Days	2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2013	0.53	0.62	0.27	0.33	0.06	0.05	0.22	0.01
	2014	0.65	0.63	0.22	0.43	0.07	0.05	0.23	0.04
	2015	0.64	0.64	0.26	0.46	0.07	0.05	0.15	0.05
	Average	**0.6**	**0.63**	**0.25**	**0.41**	**0.07**	**0.05**	**0.20**	**0.03**

FIGURE 13. CONTRIBUTION BY SPECIES FOR GAMO1 2011-2015 ON WORST DAYS

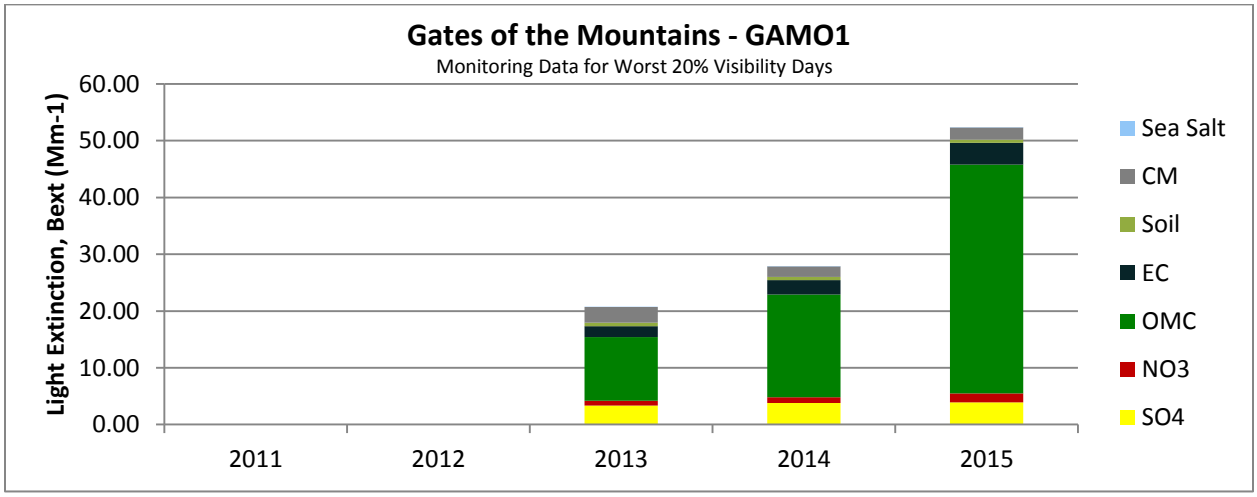
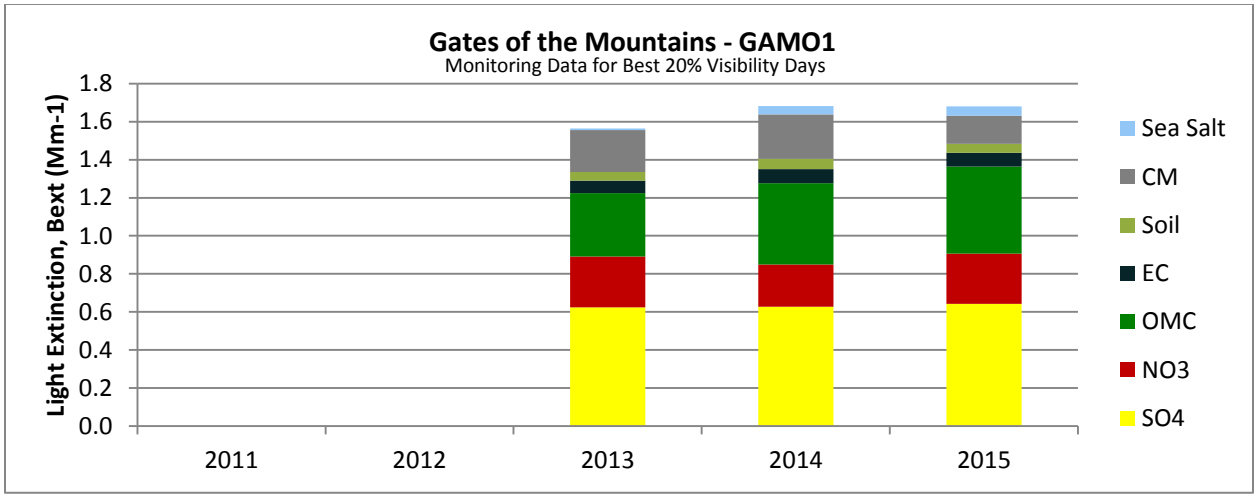


FIGURE 14. CONTRIBUTION BY SPECIES FOR GAMO1 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Significant data gaps exist for the Gates of Mountain IMPROVE site. The information displayed here represents the average of available data for each period. Visibility impairment has increased in the Gates of the Mountain Wilderness Area since the 2000-2004 baseline planning period. On the Worst days, visibility impairment increased 0.4 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 7 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 15 and16 display the species contribution between the baseline period and 2011-2015 planning period for the Worst and Best days.

TABLE 7. COMPARISON TO BASELINE - GAMO1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4 (Mm^{-1})**	**NO3 (Mm^{-1})**	**OMC (Mm^{-1})**	**EC (Mm^{-1})**	**Soil (Mm^{-1})**	**CM (Mm^{-1})**	**Sea Salt (Mm^{-1})**
Gates of the Mountain (GAMO1)									
Worst Days	Baseline	11.3	5.41	1.88	11.26	1.82	0.75	1.68	0.07
	2007-2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008-2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2009-2013	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010-2014	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2011-2015	11.7	3.69	1.14	23.20	2.75	0.59	2.26	0.02
	Difference	**0.4**	**-1.72**	**-0.73**	**11.94**	**0.93**	**-0.16**	**0.58**	**-0.04**
Best Days	Baseline	1.7	1.01	0.48	0.71	0.20	0.08	0.39	0.04
	2007-2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008-2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2009-2013	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010-2014	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2011-2015	0.6	0.63	0.25	0.41	0.07	0.05	0.20	0.03
	Difference	**-1.1**	**-0.38**	**-0.23**	**-0.31**	**-0.13**	**-0.03**	**-0.19**	**-0.01**

FIGURE 15. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

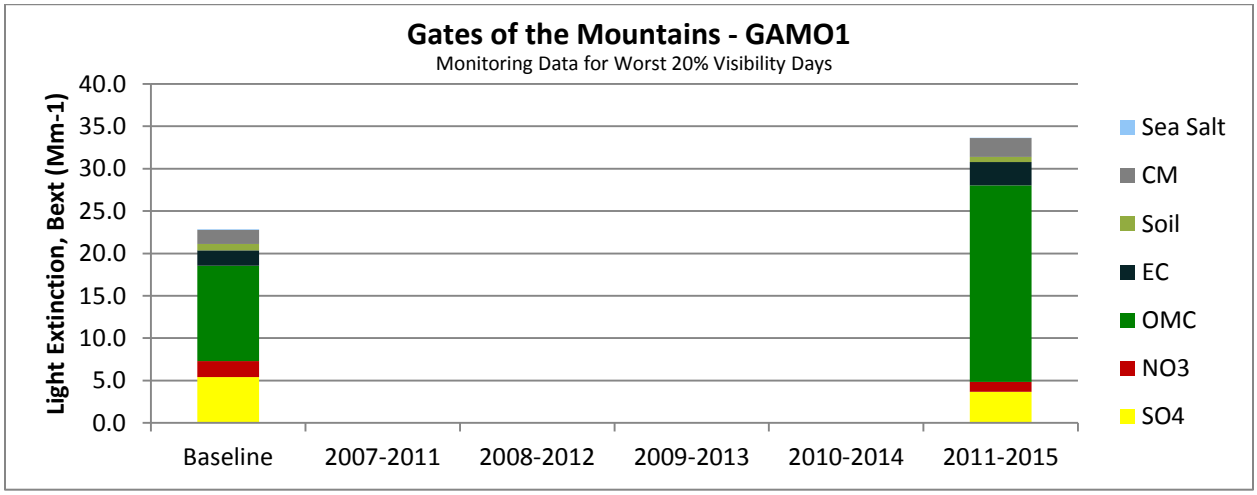
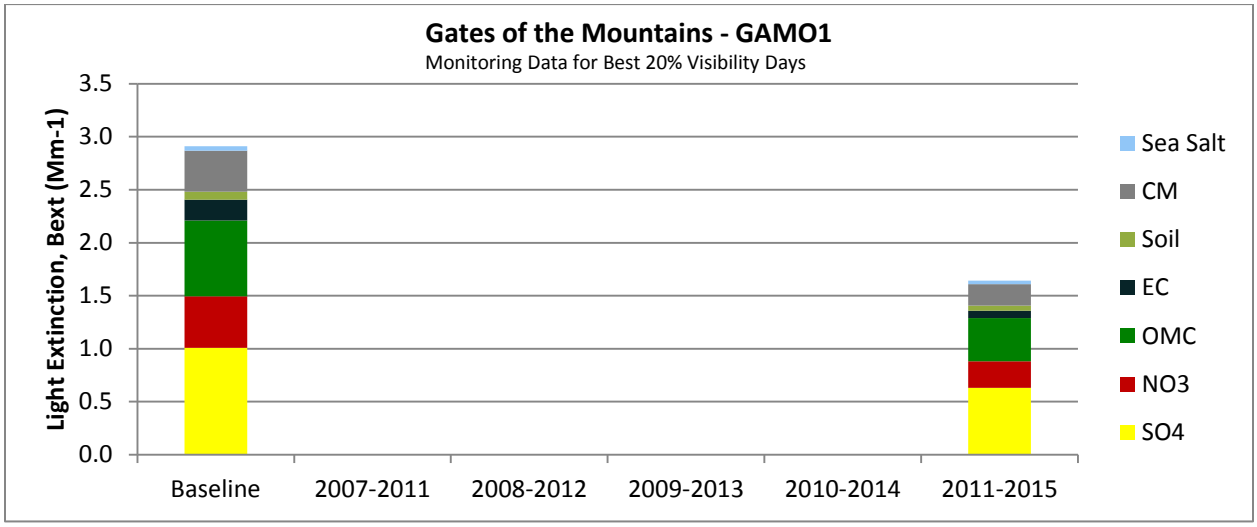
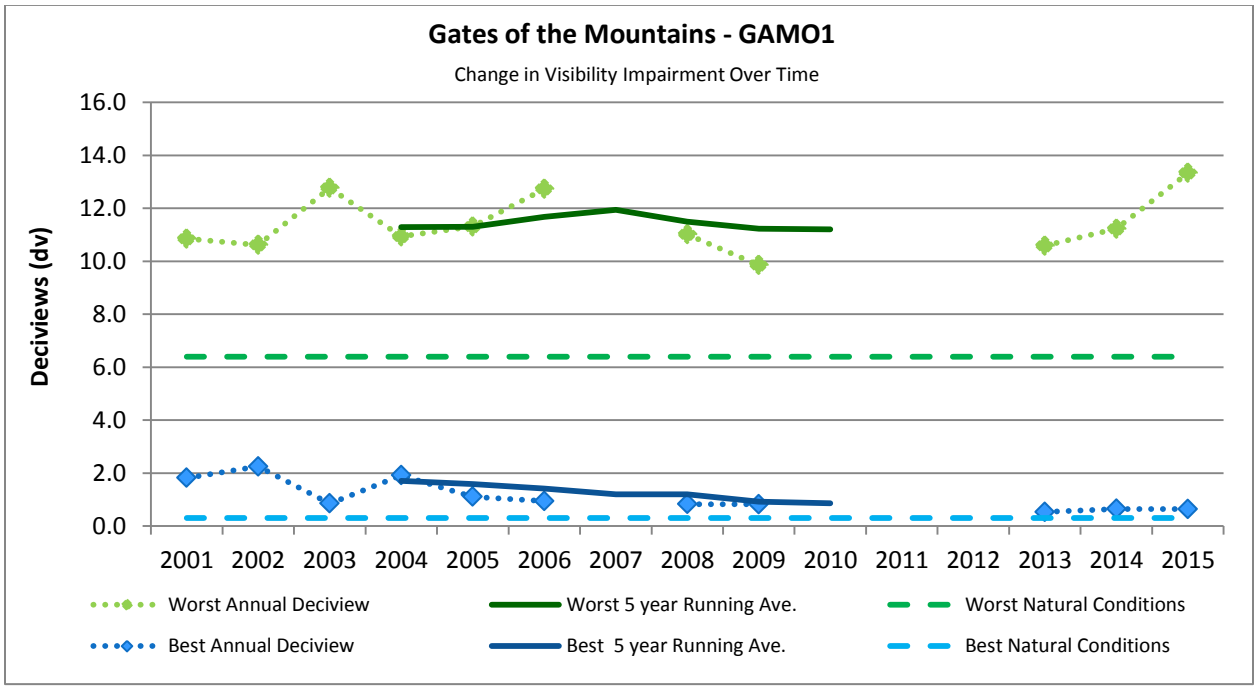


FIGURE 16. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 17 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 17. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 18 and 19 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 18. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

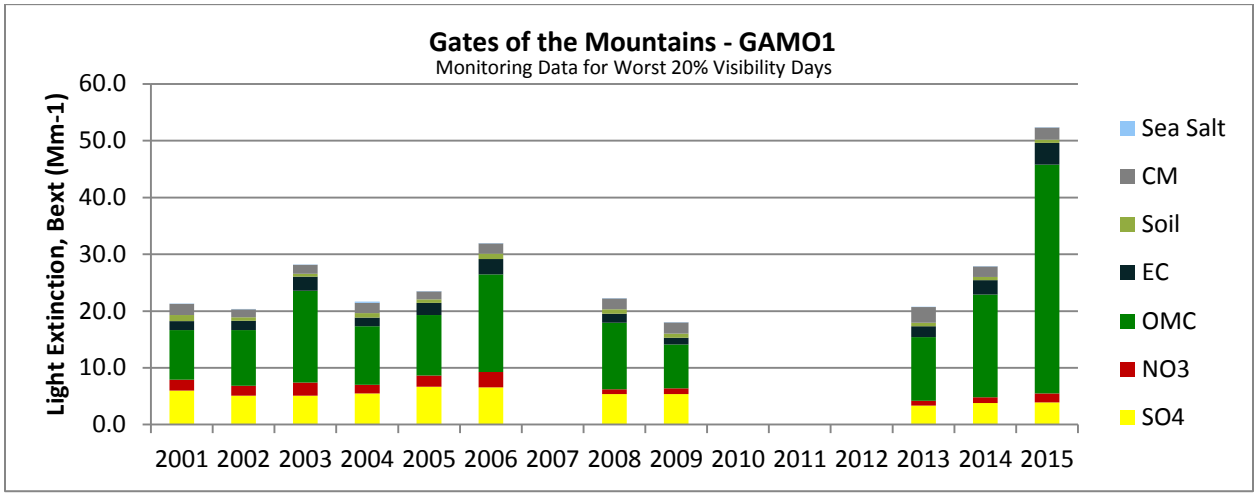


FIGURE 19. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

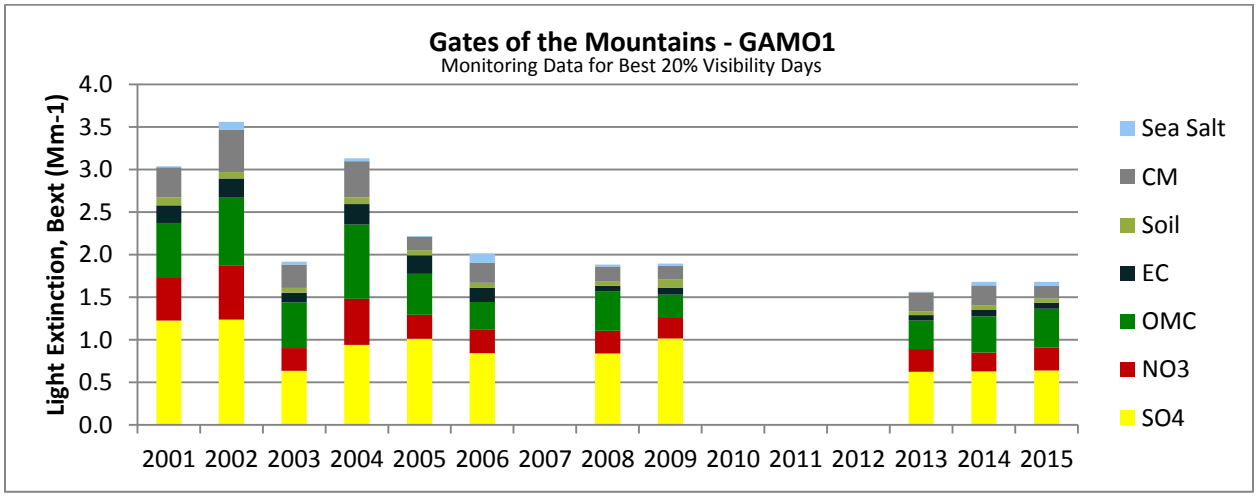
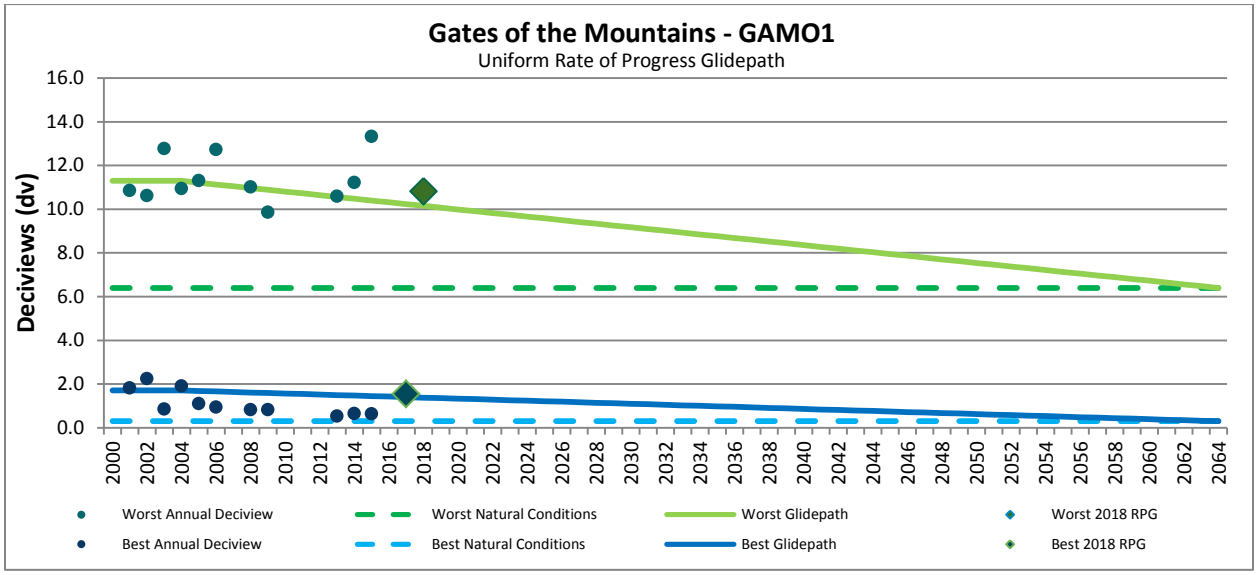


Figure 20 shows how visibility impairment over time matches up with the uniform rate of progress glidepath set for the Gates of the Mountain Wilderness Area.

FIGURE 20. UNIFORM RATE OF PROGRESS - GAMO1



Change in Visibility Over Past 5 Years

The average visibility impairment at the Gates of the Mountain IMPROVE site was 11.2 dv on the Worst days and 0.9 on the Best days for 2006-2010. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, coarse mass, elemental carbon, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon and nitrates. Elemental carbon, soil, coarse mass, and sea salt contributed little to the overall visibility impairment. Table 8 displays the past 5 years of annual average light extinction and visibility impairment contributions on the 20% worst and 20% best visibility days. Figures 21 and 22 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 8. PAST 5 YEARS VISIBILITY CONDITIONS - GAMO1

			Contribution to Light Extinction (Mm^{-1})						
	Year	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Gates of the Mountain (GAMO1)									
Worst Days	2006	12.7	6.57	2.67	17.18	2.74	0.97	1.78	0.01
	2007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008	11.0	5.38	0.84	11.72	1.56	0.83	1.88	0.01
	2009	9.9	5.37	1.00	7.73	1.19	0.71	2.01	0.02
	2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average	**11.2**	**5.78**	**1.51**	**12.21**	**1.83**	**0.84**	**1.89**	**0.01**
Best Days	2006	0.9	0.84	0.27	0.33	0.16	0.06	0.24	0.10
	2007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008	0.8	0.84	0.27	0.47	0.06	0.05	0.17	0.02
	2009	0.8	1.02	0.24	0.28	0.08	0.10	0.16	0.03
	2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average	**0.9**	**0.90**	**0.26**	**0.36**	**0.10**	**0.07**	**0.19**	**0.05**

FIGURE 21. CONTRIBUTION BY SPECIES FOR GAMO1 206-2010 ON WORST DAYS

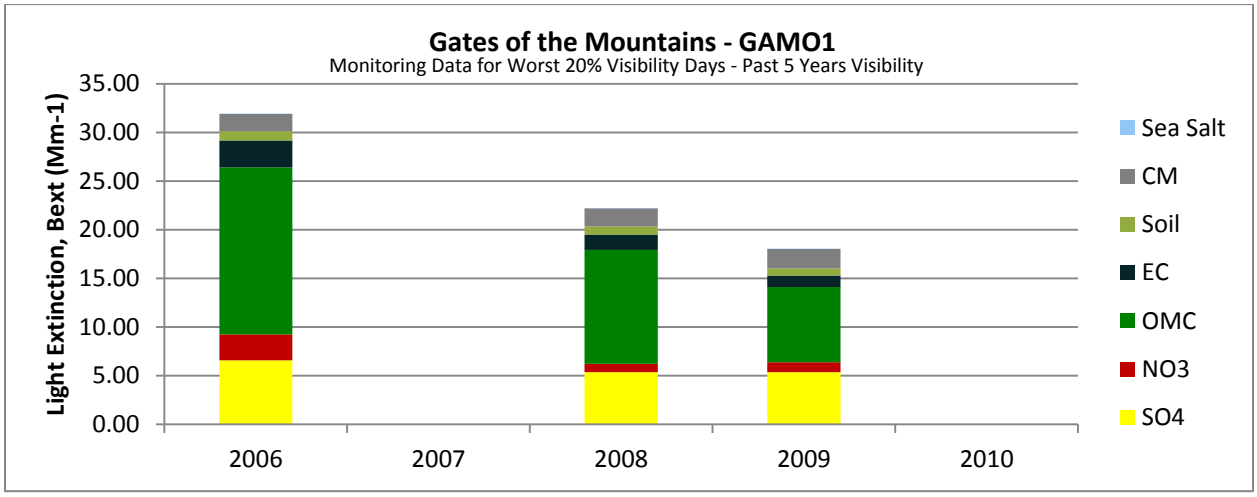


FIGURE 22. CONTRIBUTION BY SPECIES FOR GAMO1 2006-2010 ON BEST DAYS

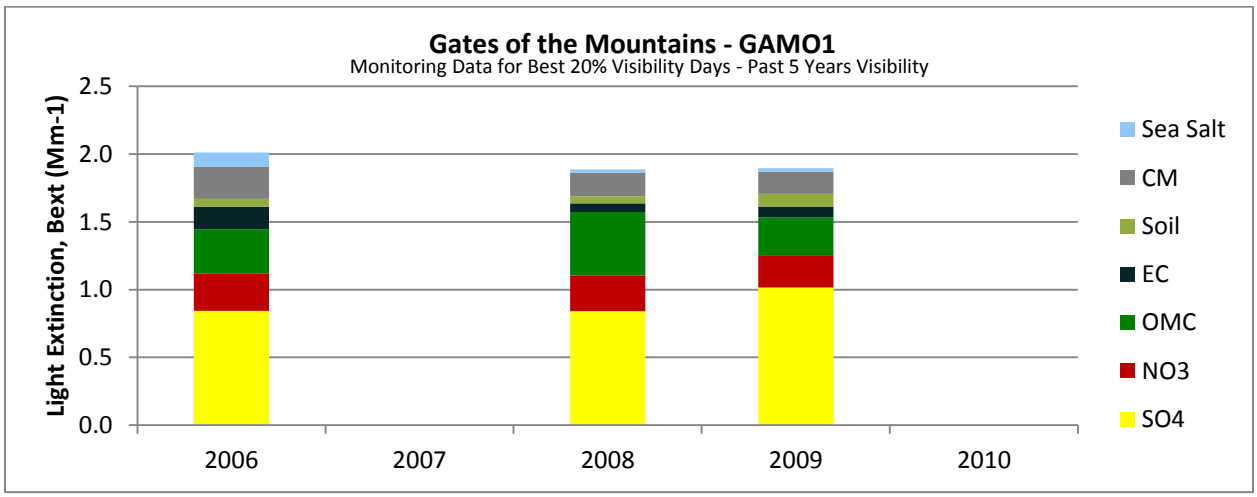


Table 9 shows the difference between the current visibility impairment to the past five years visibility. Visibility impairment on the Worst days has increased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has improved during the same period.

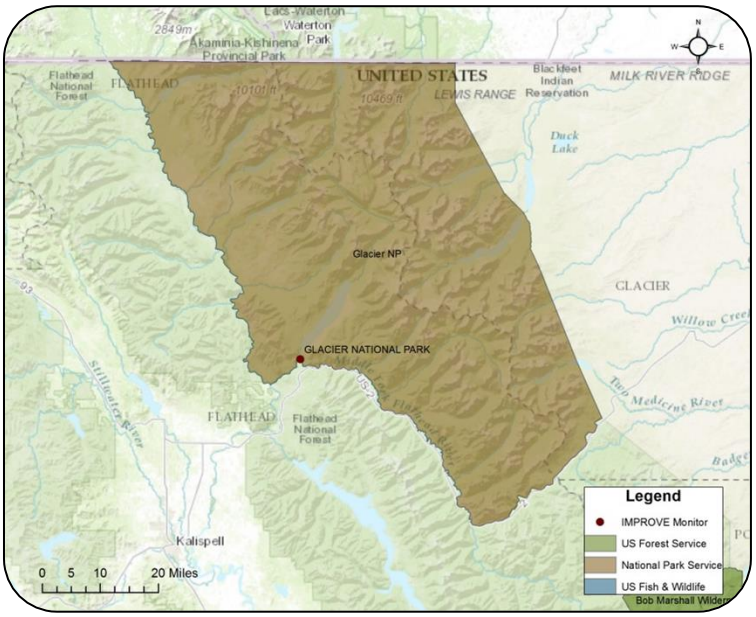
TABLE 9. COMPARISON OF CURRENT TO PAST 5 YEARS - GAMO1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Gates of the Mountain (GAMO1)									
Worst Days	2006-2010	11.2	5.78	1.51	12.21	1.83	0.84	1.89	0.01
	2011-2015	11.7	3.69	1.14	23.20	2.75	0.59	2.26	0.02
	Difference	**0.5**	**-2.09**	**-0.36**	**10.99**	**0.92**	**-0.25**	**0.37**	**0.01**
Best Days	2006-2010	0.9	0.90	0.26	0.36	0.10	0.07	0.19	0.05
	2011-2015	0.6	0.63	0.25	0.41	0.07	0.05	0.20	0.03
	Difference	**-0.3**	**-0.27**	**-0.01**	**0.05**	**-0.03**	**-0.02**	**0.01**	**-0.02**

Glacier (GLAC1)

The Glacier IMPROVE monitoring site is located in Glacier National Park and is the representative station for the Glacier National Park Class I Area. The national park is located in the northcentral part of the state, along the Continental Divide. Figure 23 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 23. GLACIER NATIONAL PARK



Current Visibility Conditions

The average visibility impairment at the Glacier IMPROVE site was 17.0 dv on the Worst days and 5.4 on the Best days for 2011-2015. On the Worst days the largest average light extinction contribution was from organic carbon, followed by sulfates, coarse mass, elemental carbon, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, elemental carbon, nitrates and coarse mass. Soil and sea salt contributed little to the overall visibility impairment. Table 10 displays the current annual average light extinction and visibility impairment contributions on the 20% worst and 20% best visibility days. Figures 24 and 25 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 10. CURRENT VISIBILITY CONDITIONS – GLAC1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Glacier (GLAC1)									
Worst Days	2011	15.6	9.46	3.08	16.44	3.74	0.77	4.07	0.12
	2012	17.3	6.00	2.93	27.30	4.75	1.13	5.69	0.06
	2013	15.6	6.05	3.97	17.36	4.14	0.88	4.67	0.11
	2014	16.8	6.51	5.96	26.51	4.71	0.85	4.20	0.16
	2015	19.8	6.41	5.30	66.07	5.86	1.20	5.88	0.12
	Average	**17.0**	**6.88**	**4.25**	**30.73**	**4.64**	**0.97**	**4.90**	**0.12**
Best Days	2011	5.61	2.51	0.64	1.90	0.84	0.08	0.57	0.12
	2012	5.12	2.09	0.58	1.63	0.76	0.08	0.40	0.18
	2013	5.73	2.39	0.69	2.02	0.89	0.11	0.66	0.08
	2014	5.13	1.63	0.60	1.92	0.90	0.10	0.53	0.16
	2015	5.64	1.69	0.73	2.62	1.05	0.11	0.49	0.07
	Average	**5.45**	**2.06**	**0.65**	**2.02**	**0.89**	**0.10**	**0.53**	**0.12**

FIGURE 24. CONTRIBUTION BY SPECIES FOR GLAC1 2011-2015 ON WORST DAYS

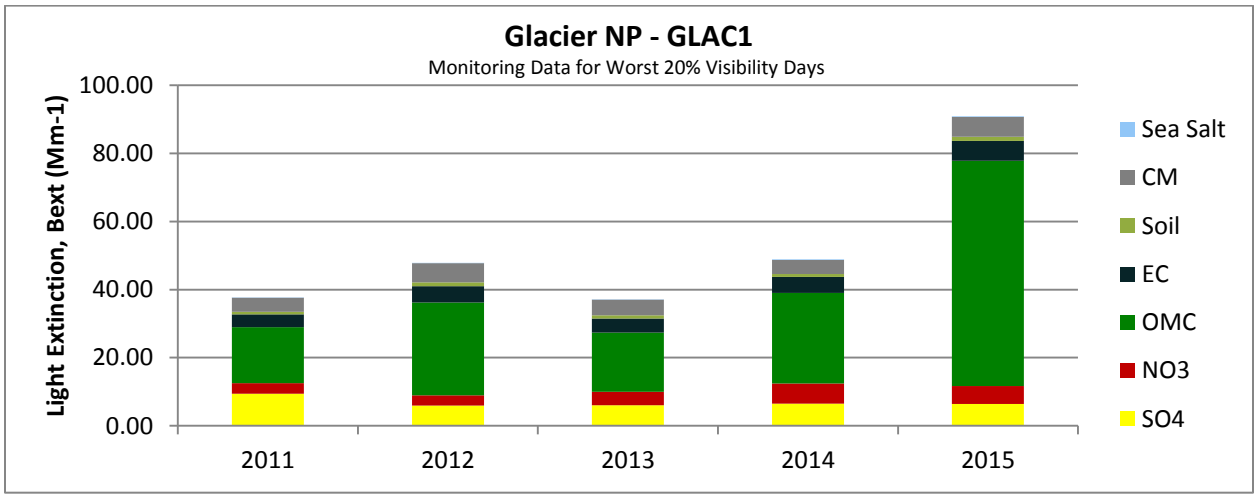
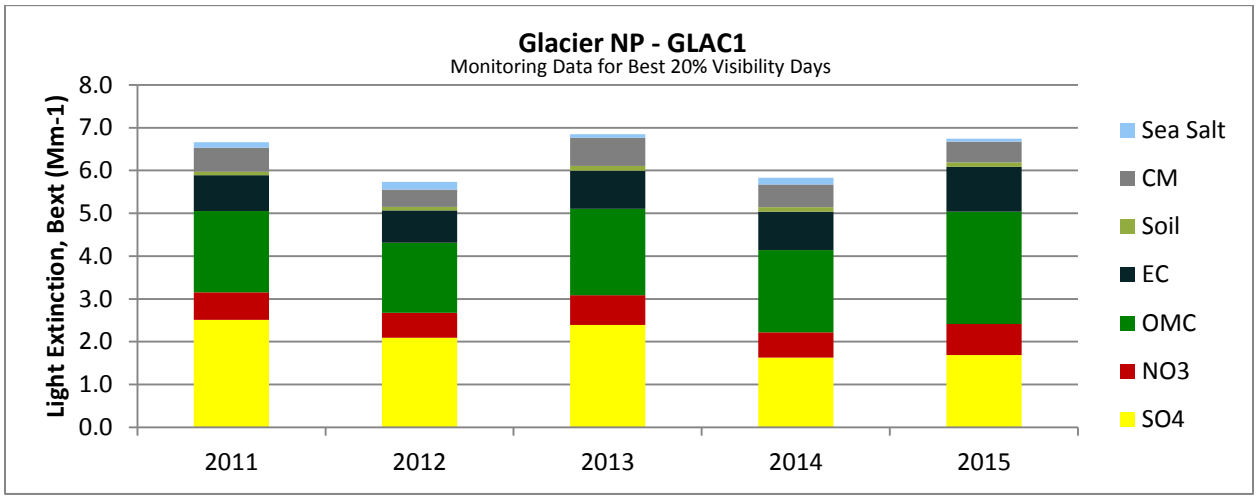


FIGURE 25. CONTRIBUTION BY SPECIES FOR GLAC1 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has decreased in Glacier National Park since the 2000-2004 baseline planning period. On the Worst days, visibility impairment decreased 3.4 deciviews over the 11 year period. All species decreased between the baseline and current period, for both the Worst and Best days. Table 11 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 26 and 27 display the species contribution between the baseline period and 2011-2015 planning period for the 20% worst and 20% best visibility days.

TABLE 11. COMPARISON TO BASELINE - GLAC1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Glacier (GLAC1)									
Worst Days	Baseline	20.5	11.23	10.23	37.84	6.71	1.44	5.72	0.42
	2007-2011	17.1	9.67	4.94	24.38	4.42	1.06	5.05	0.12
	2008-2012	16.1	8.62	4.12	18.08	3.94	0.97	4.75	0.09
	2009-2013	16.0	7.32	3.80	18.90	4.04	0.94	4.95	0.08
	2010-2014	16.2	7.16	4.24	20.42	4.17	0.92	4.80	0.09
	2011-2015	17.0	6.88	4.25	30.73	4.64	0.97	4.90	0.12
	Difference	**-3.4**	**-4.35**	**-5.98**	**-7.11**	**-2.07**	**-0.47**	**-0.81**	**-0.31**
Best Days	Baseline	7.2	3.10	0.83	3.33	1.31	0.18	0.91	0.03
	2007-2011	6.1	2.62	0.71	2.35	1.11	0.13	0.62	0.08
	2008-2012	5.7	2.44	0.63	2.02	0.93	0.11	0.55	0.10
	2009-2013	5.4	2.21	0.58	1.86	0.87	0.10	0.56	0.10
	2010-2014	5.3	2.09	0.58	1.87	0.88	0.10	0.55	0.11
	2011-2015	5.4	2.06	0.65	2.02	0.89	0.10	0.53	0.12
	Difference	**-1.8**	**-1.04**	**-0.18**	**-1.32**	**-0.42**	**-0.08**	**-0.38**	**0.09**

FIGURE 26. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

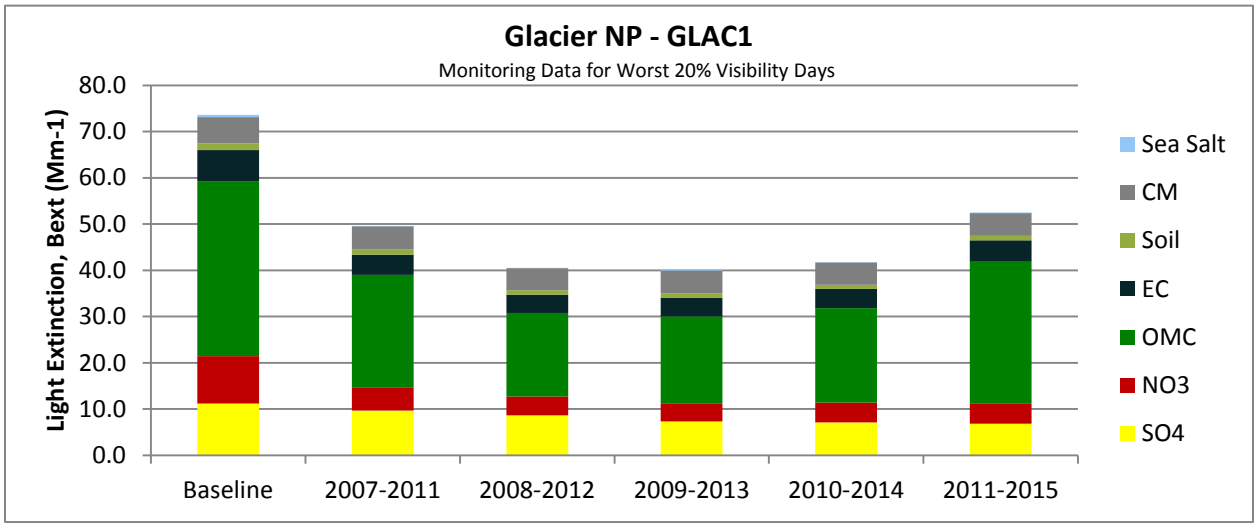
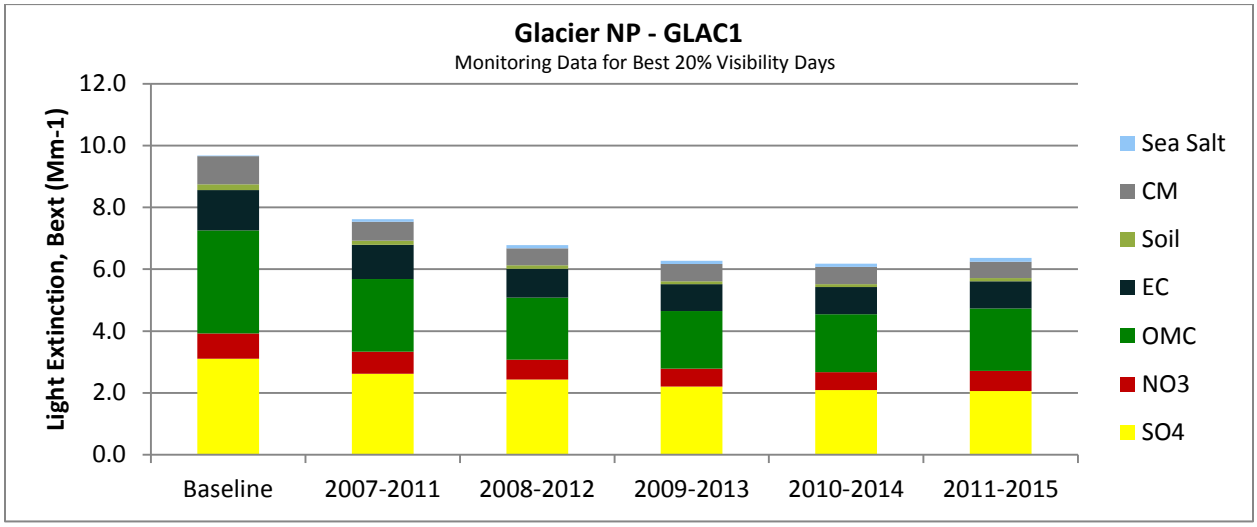
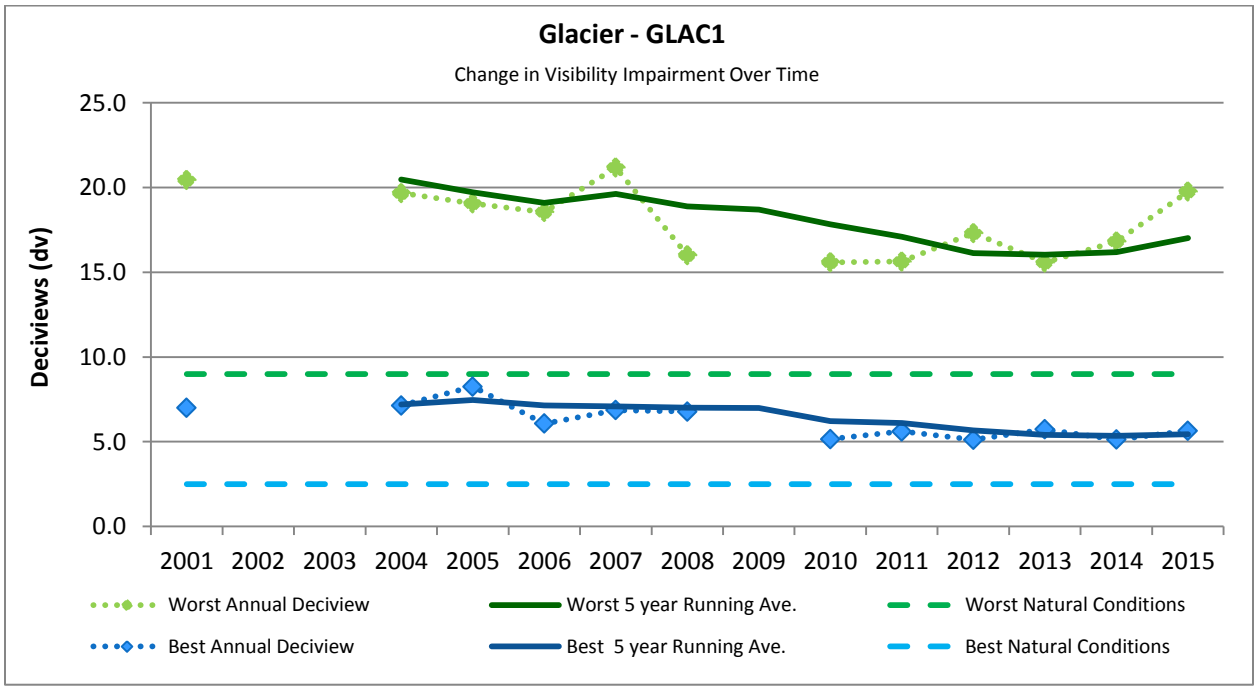


FIGURE 27. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 28 below displays the annual visibility impairment in deciviews since 2001, along with the 5 year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 28. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 29 and 30 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 29. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

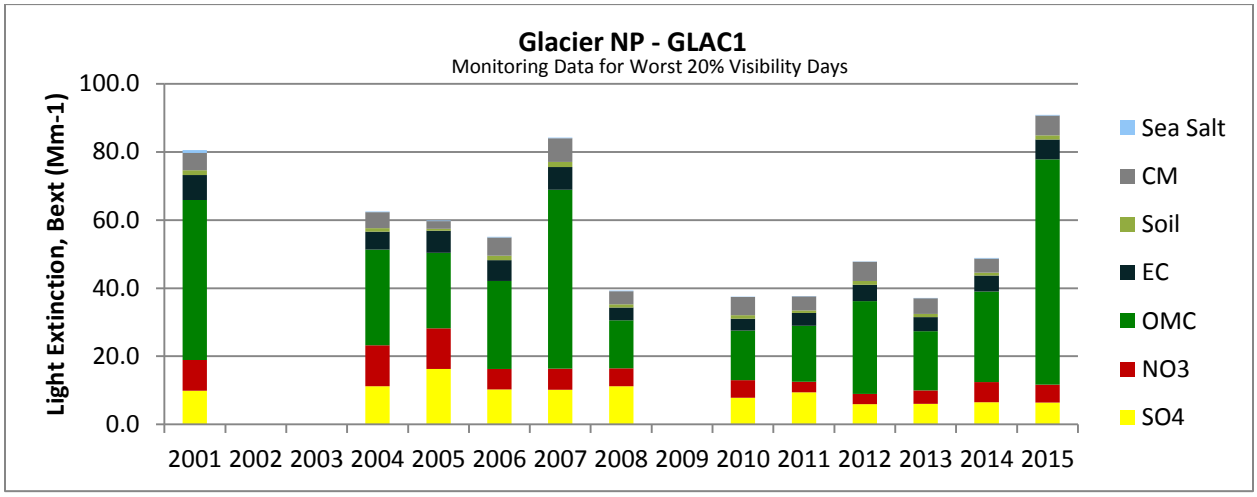


FIGURE 30. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

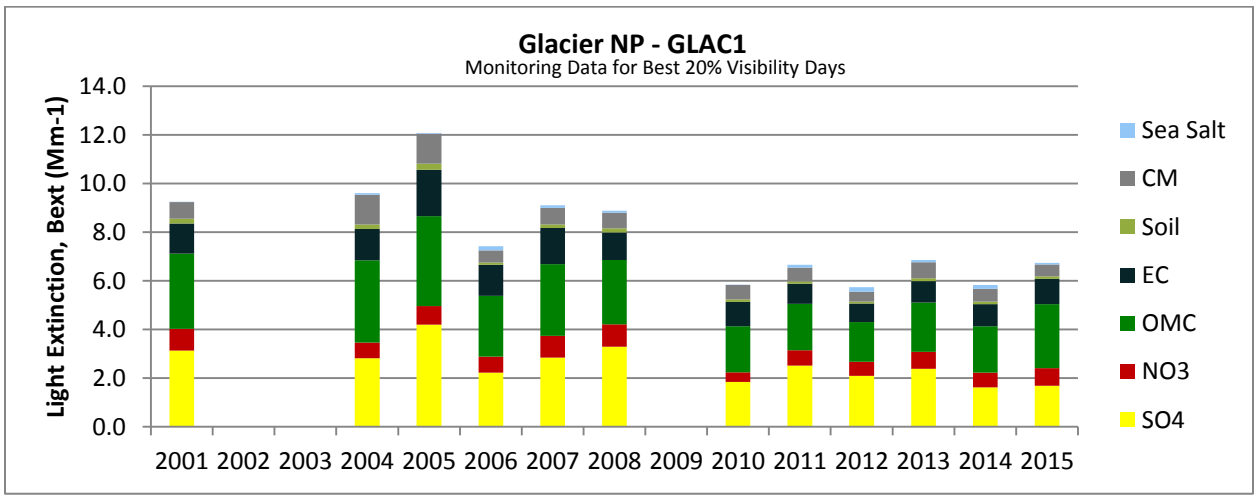
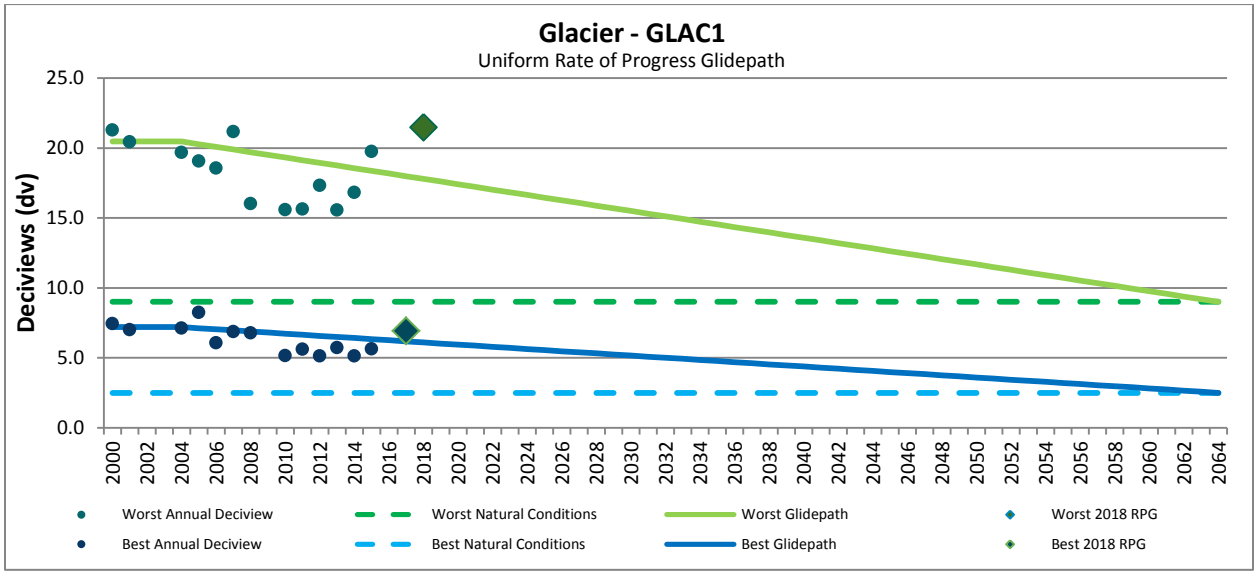


Figure 31 shows how visibility impairment over time matches up with the uniform rate of progress glidepath set for the Glacier National Park.

FIGURE 31. UNIFORM RATE OF PROGRESS – GLAC1



Change in Visibility Over 5 Years

The average visibility impairment at the Glacier IMPROVE site was 17.8 dv on the Worst days and 6.2 on the Best days for 2006-2010. On the Worst days the largest average light extinction contribution was from organic carbon, followed by sulfates, nitrate, coarse mass, elemental carbon, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, elemental carbon, nitrates, and coarse mass. Soil and sea salt contributed little to the overall visibility impairment. Table 12 displays the past 5 years of annual average light extinction and visibility impairment contributions on the 20% worst and 20% best visibility days. Figures 32 and 33 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 12. PAST 5 YEARS VISIBILITY CONDITIONS – GLAC1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Glacier (GLAC1)									
Worst Days	2006	18.6	10.28	6.03	25.82	6.10	1.33	5.35	0.17
	2007	21.2	10.22	6.19	52.49	6.68	1.49	6.90	0.19
	2008	16.0	11.22	5.24	14.09	3.74	0.99	3.86	0.16
	2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010	15.6	7.79	5.25	14.50	3.52	0.98	5.37	0.02
	Average	**17.8**	**9.88**	**5.68**	**26.73**	**5.01**	**1.20**	**5.37**	**0.14**
Best Days	2006	6.1	2.22	0.66	2.50	1.28	0.09	0.50	0.17
	2007	6.9	2.84	0.89	2.95	1.49	0.15	0.67	0.11
	2008	6.8	3.29	0.91	2.64	1.13	0.17	0.63	0.08
	2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010	5.2	1.84	0.40	1.89	1.00	0.11	0.60	0.01
	Average	**6.2**	**2.55**	**0.72**	**2.50**	**1.22**	**0.13**	**0.60**	**0.09**

FIGURE 32. CONTRIBUTION BY SPECIES FOR GLAC1 2006-2010 ON WORST DAYS

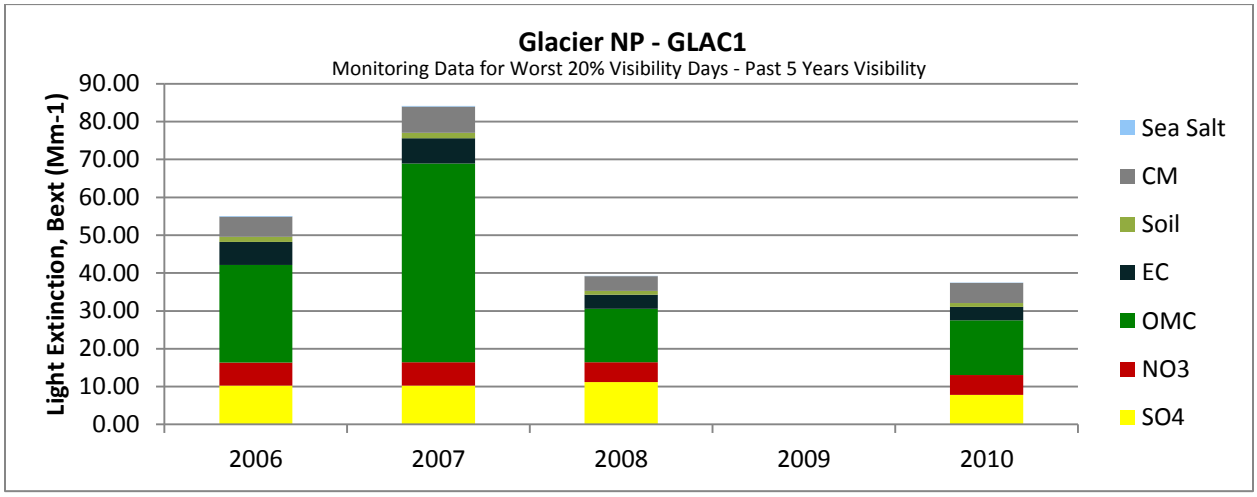


FIGURE 33. CONTRIBUTION BY SPECIES FOR GLAC1 2006-2010 ON BEST DAYS

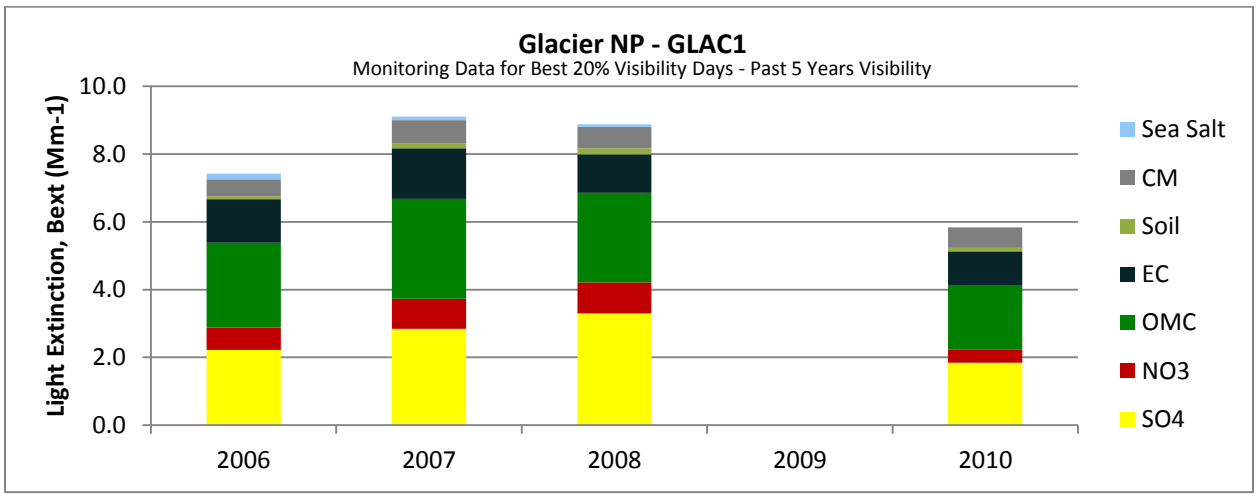


Table 13 shows the difference between the current visibility impairment to the past 5 years visibility. Visibility impairment on the Worst days and Best days has improved from the 2006-2010 planning period to the 2011-2015 planning period.

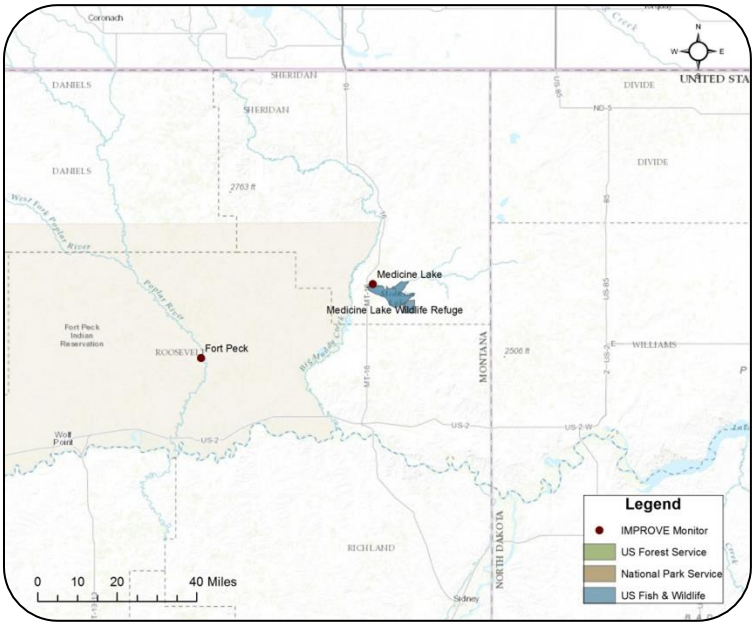
TABLE 13. COMPARISON OF CURRENT TO PAST 5 YEARS - GLAC1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Glacier (GLAC1)									
Worst Days	2006-2010	17.8	9.88	5.68	26.73	5.01	1.20	5.37	0.14
	2011-2015	17.0	6.88	4.25	30.73	4.64	0.97	4.90	0.12
	Difference	**-0.8**	**-2.99**	**-1.43**	**4.01**	**-0.37**	**-0.23**	**-0.47**	**-0.02**
Best Days	2006-2010	6.2	2.55	0.72	2.50	1.22	0.13	0.60	0.09
	2011-2015	5.4	2.06	0.65	2.02	0.89	0.10	0.53	0.12
	Difference	**-0.8**	**-0.49**	**-0.07**	**-0.48**	**-0.34**	**-0.03**	**-0.07**	**0.03**

Medicine Lake (MELA1)

The Medicine Lake IMPROVE monitoring site is located in the Medicine Lake National Wildlife Refuge and is the representative station for the Medicine Lake National Wildlife Refuge Class I Area. The wildlife refuge is located in the northeast corner of the state, close to the North Dakota border. Figure 34 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 34. MEDICINE LAKE WILDLIFE REFUGE



Current Visibility Conditions

The average visibility impairment at the Medicine Lake IMPROVE site was 17.9 dv on the Worst days and 6.5 on the Best days for 2011-2015. On the Worst days, the largest average light extinction contribution was from organic carbon, followed closely by nitrates and sulfates, then by coarse mass, elemental carbon, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by coarse mass, organic carbon, and nitrates. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 14 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 35 and36 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 14. CURRENT VISIBILITY CONDITIONS - MELA1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Medicine Lake (MELA1)									
Worst Days	2011	17.0	16.75	13.40	6.16	2.21	1.03	6.01	0.63
	2012	18.8	15.79	18.37	13.45	2.90	1.38	6.30	0.16
	2013	17.7	14.26	19.02	9.14	2.59	0.87	4.86	0.11
	2014	17.6	15.75	13.09	10.60	2.96	0.91	5.45	0.12
	2015	18.6	11.78	11.20	41.77	3.68	0.93	5.22	0.05
	Average	**17.9**	**14.87**	**15.02**	**16.22**	**2.87**	**1.03**	**5.57**	**0.22**
Best Days	2011	6.9	3.59	1.54	1.57	0.56	0.25	1.36	0.14
	2012	5.9	2.55	0.88	1.49	0.47	0.30	1.36	0.08
	2013	7.6	3.63	2.13	1.75	0.58	0.36	1.92	0.09
	2014	6.3	2.71	1.44	1.33	0.39	0.28	1.64	0.15
	2015	5.9	2.49	1.18	1.39	0.35	0.29	1.44	0.06
	Average	**6.5**	**2.99**	**1.44**	**1.51**	**0.47**	**0.30**	**1.54**	**0.11**

FIGURE 35. CONTRIBUTION BY SPECIES FOR MELA1 2011-2015 ON WORST DAYS

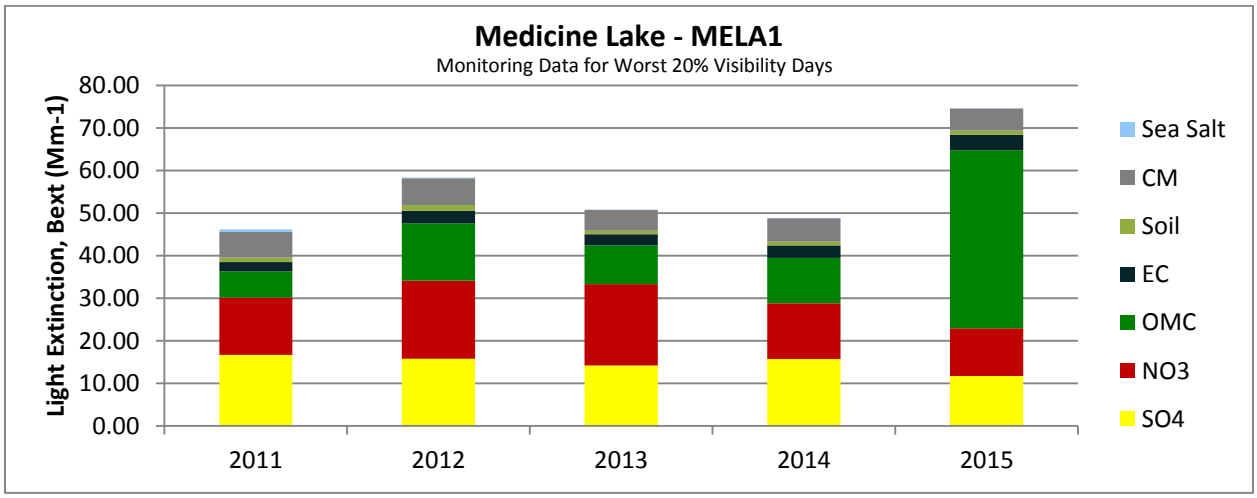
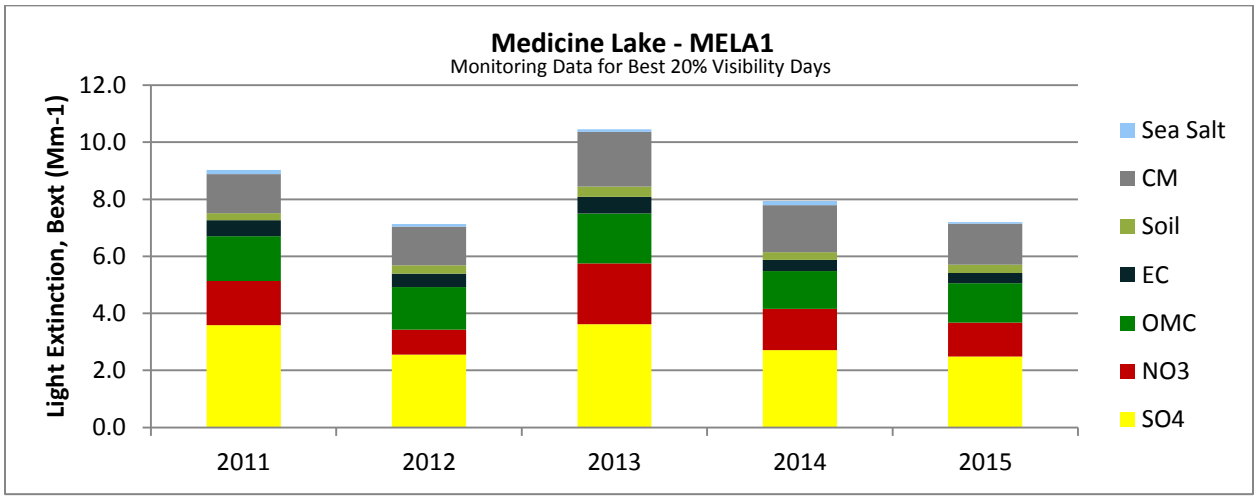


FIGURE 36. CONTRIBUTION BY SPECIES FOR MELA1 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has increased in the Medicine Lake National Wildlife Refuge since the 2000-2004 baseline planning period. On the Worst days, visibility impairment increased 0.2 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 15 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 37 and 38 display the species contribution between the baseline period and 2011-2015 planning period for the 20% worst and 20% best visibility days.

TABLE 15. COMPARISON TO BASELINE - MELA1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Medicine Lake (MELA1)									
Worst Days	Baseline	17.7	16.96	16.27	9.48	2.34	0.75	4.46	0.04
	2007-2011	18.1	20.03	15.79	8.92	2.05	0.83	4.82	0.71
	2008-2012	18.1	18.75	16.93	9.19	2.14	0.93	4.65	0.72
	2009-2013	18.0	18.13	17.50	8.67	2.28	0.94	4.82	0.35
	2010-2014	18.1	17.94	16.94	9.83	2.57	0.99	5.32	0.21
	2011-2015	17.9	14.87	15.02	16.22	2.87	1.03	5.57	0.22
	Difference	**0.2**	**-2.09**	**-1.25**	**6.74**	**0.52**	**0.27**	**1.11**	**0.18**
Best Days	Baseline	7.3	3.49	1.17	1.95	0.61	0.35	2.16	0.05
	2007-2011	6.5	3.45	1.09	1.33	0.48	0.33	1.66	0.06
	2008-2012	6.4	3.32	1.07	1.36	0.46	0.32	1.57	0.07
	2009-2013	6.6	3.33	1.26	1.40	0.48	0.30	1.60	0.08
	2010-2014	6.5	3.14	1.36	1.44	0.48	0.30	1.57	0.11
	2011-2015	6.5	2.99	1.44	1.51	0.47	0.30	1.54	0.11
	Difference	**-0.7**	**-0.50**	**0.26**	**-0.44**	**-0.14**	**-0.05**	**-0.62**	**0.06**

FIGURE 37. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

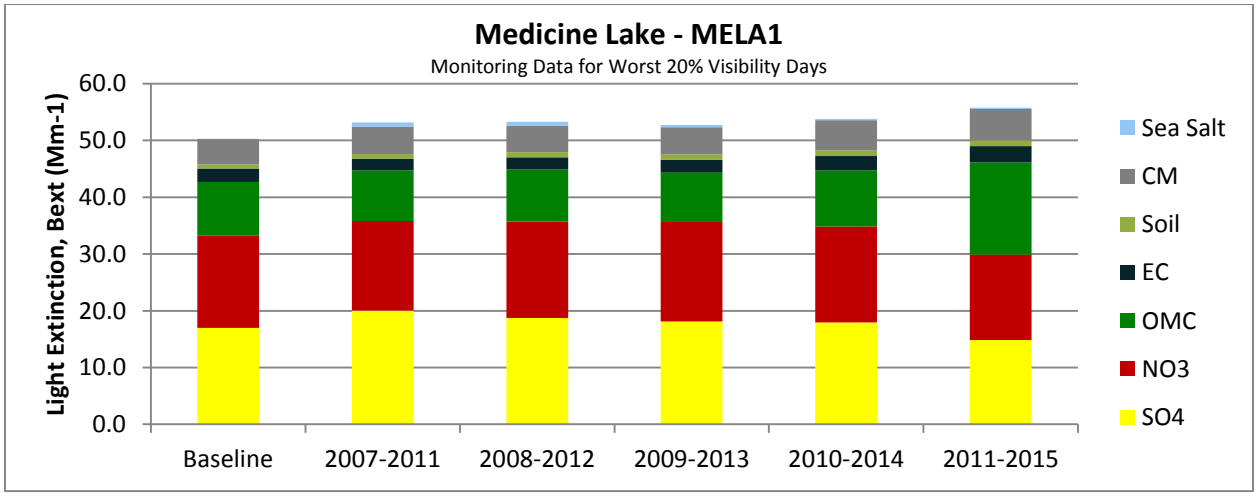
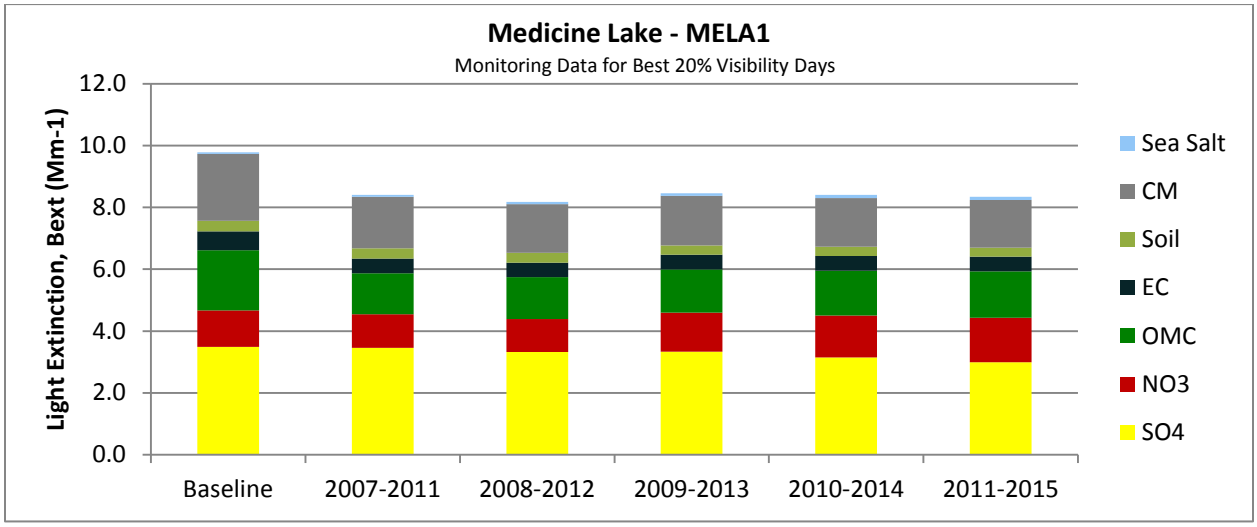
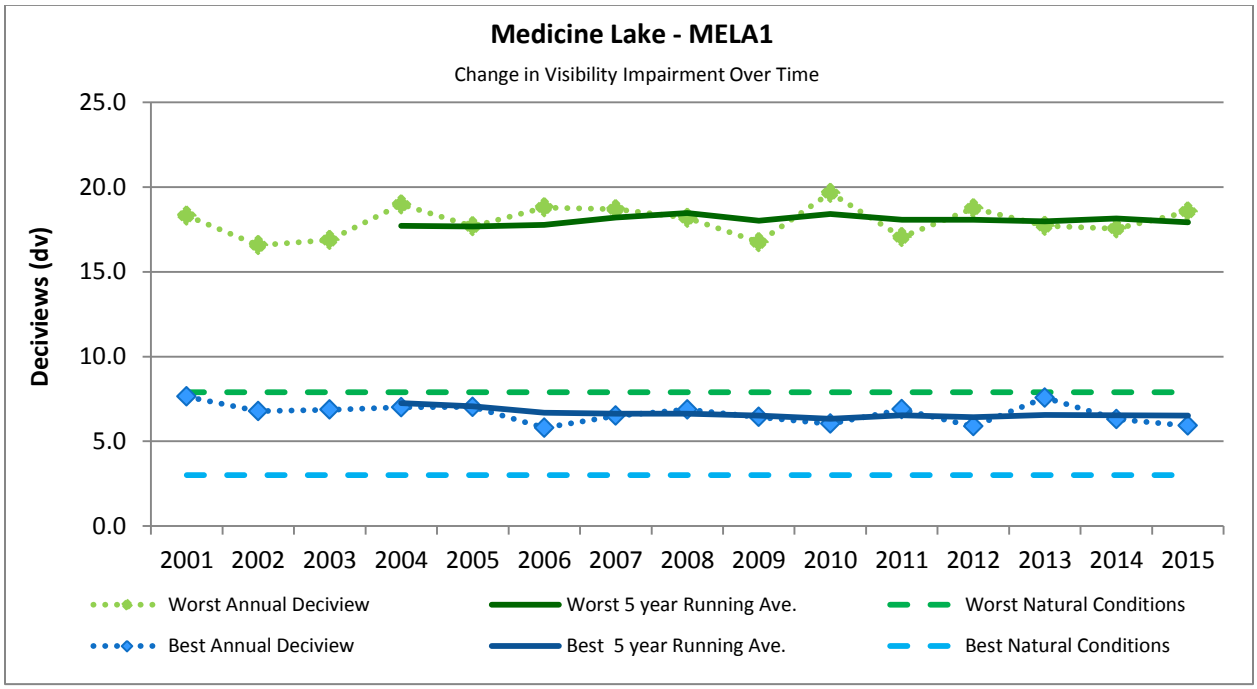


FIGURE 38. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 39 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 39. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in anthropogenic contributions. Figure 40 and 41 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 40. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

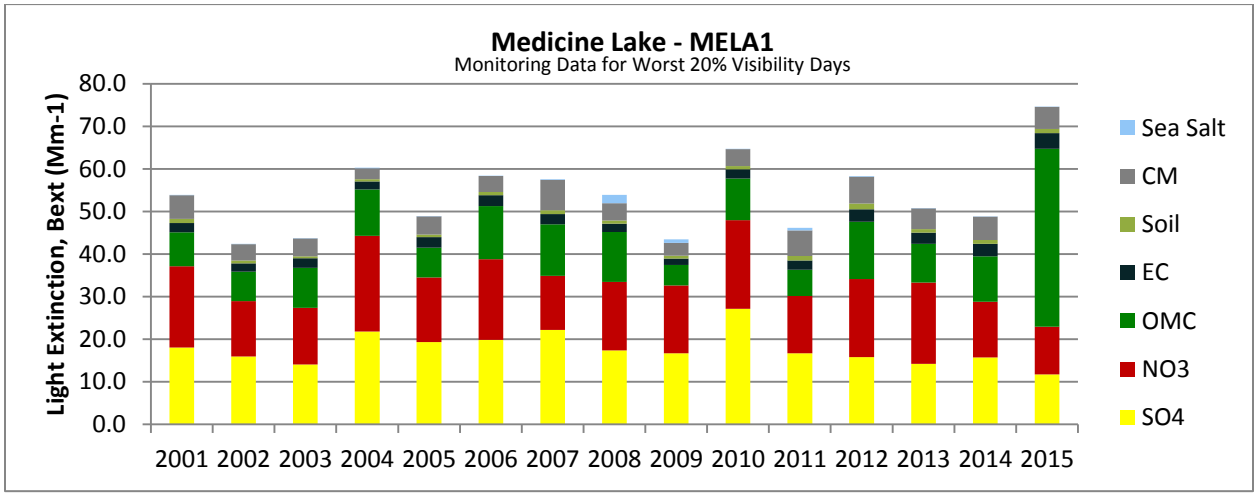


FIGURE 41. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

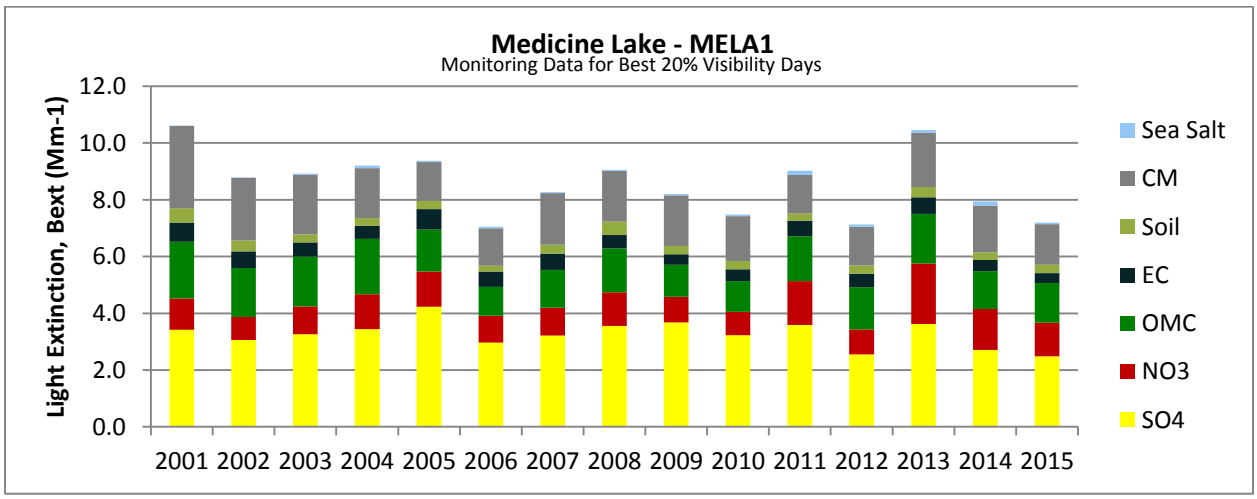
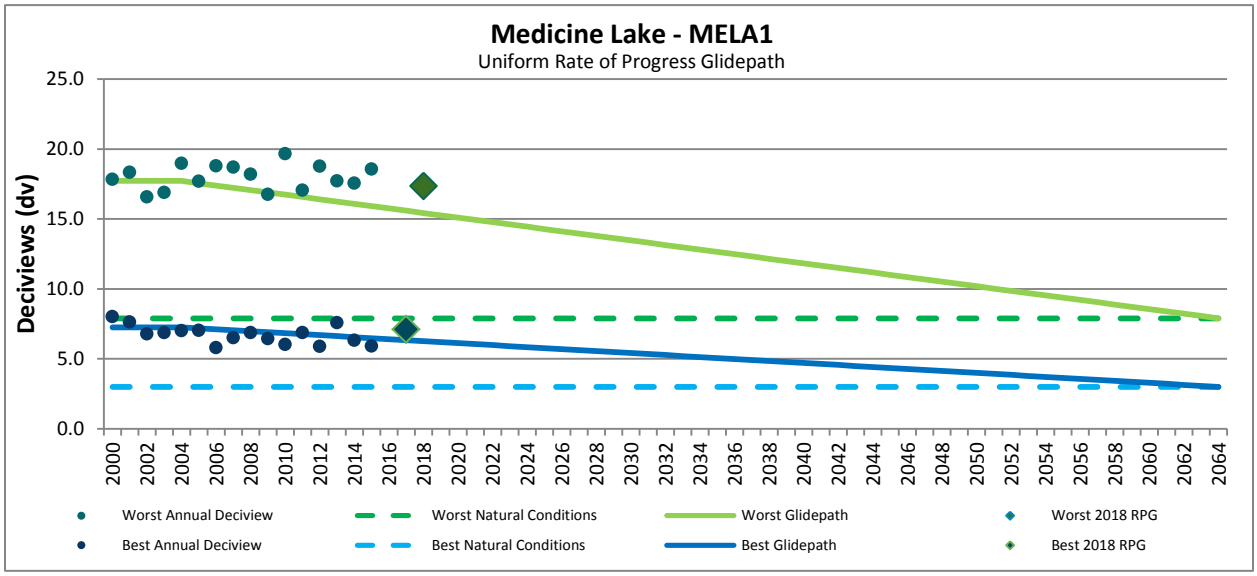


Figure 42 shows how visibility impairment over time matches up with the uniform rate of progress glidepath set for the Medicine Lake National Wildlife Refuge.

FIGURE 42. UNIFORM RATE OF PROGRESS - MELA1



Change in Visibility Over 5 Years

The average visibility impairment at the Medicine Lake IMPROVE site was 18.4 dv on the Worst days and 6.3 on the Best days for 2006-2010. On the Worst days, the largest average light extinction contribution was from sulfates, followed by nitrates, organic carbon, coarse mass, and elemental carbon. Soil and sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by coarse mass, organic matter, and nitrates. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 16 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 43 and 44 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 16. PAST 5 YEARS VISIBILITY CONDITIONS - MELA1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Medicine Lake (MELA1)									
Worst Days	2006	18.8	19.86	18.91	12.54	2.53	0.74	3.73	0.07
	2007	18.7	22.22	12.70	12.06	2.42	0.91	7.13	0.13
	2008	18.2	17.36	16.12	11.74	1.91	0.80	4.03	1.95
	2009	16.7	16.69	15.94	4.83	1.49	0.69	2.97	0.84
	2010	19.7	27.16	20.79	9.79	2.21	0.74	3.97	0.00
	Average	**18.4**	**20.66**	**16.89**	**10.19**	**2.11**	**0.78**	**4.37**	**0.60**
Best Days	2006	5.8	2.97	0.95	1.01	0.53	0.21	1.32	0.06
	2007	6.5	3.22	0.99	1.32	0.58	0.32	1.81	0.03
	2008	6.9	3.56	1.18	1.55	0.48	0.47	1.79	0.04
	2009	6.4	3.68	0.91	1.12	0.37	0.30	1.78	0.04
	2010	6.0	3.23	0.82	1.08	0.42	0.29	1.58	0.06
	Average	**6.3**	**3.33**	**0.97**	**1.22**	**0.48**	**0.32**	**1.66**	**0.05**

FIGURE 43. CONTRIBUTION BY SPECIES FOR MELA1 2006-2010 ON WORST DAYS

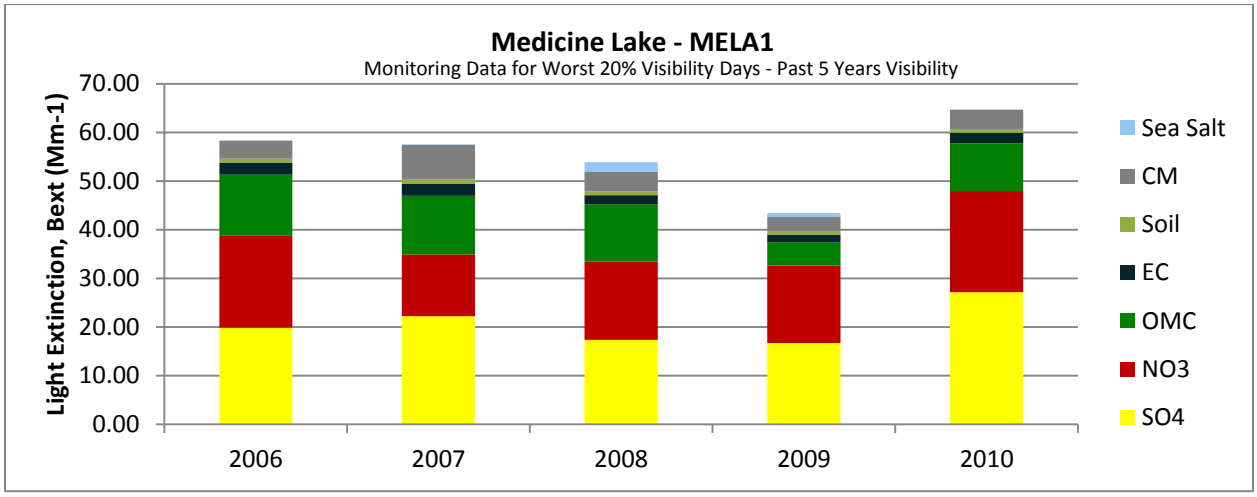


FIGURE 44. CONTRIBUTION BY SPECIES FOR MELA1 2006-2010 ON BEST DAYS

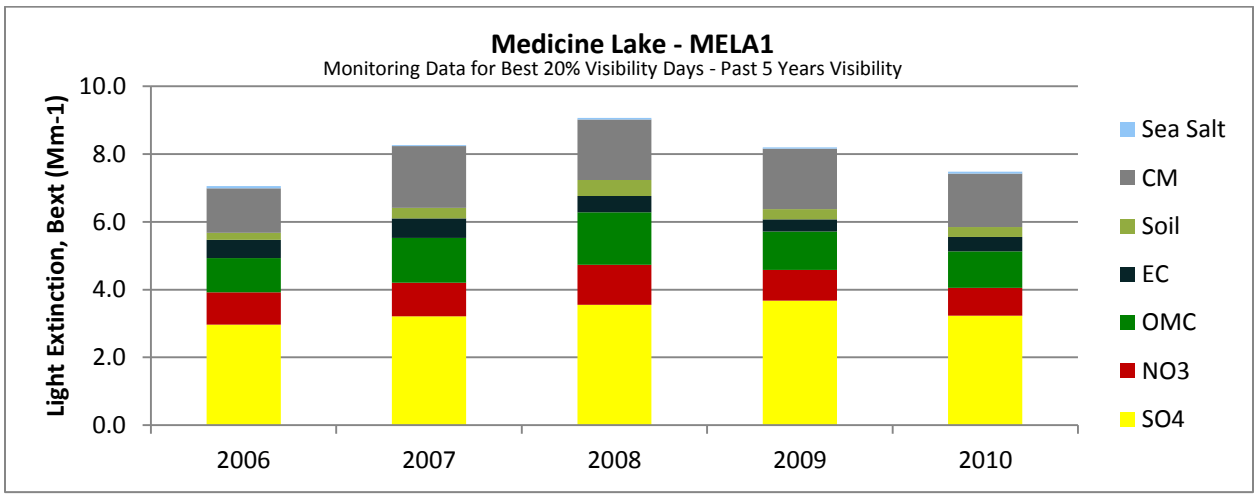


Table 17 shows the difference between the current visibility impairment and the past 5 years' average visibility conditions. Visibility impairment on the Worst days has decreased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has increased during the same period.

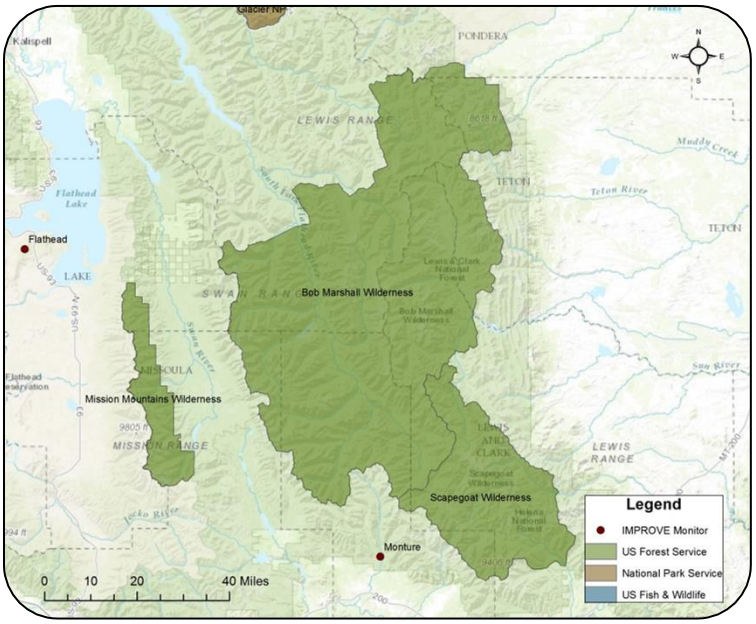
TABLE 17. COMPARISON OF CURRENT TO PAST 5 YEARS - MELA1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Medicine Lake (MELA1)									
Worst Days	2006-2010	18.4	20.66	16.89	10.19	2.11	0.78	4.37	0.60
	2011-2015	17.9	14.87	15.02	16.22	2.87	1.03	5.57	0.22
	Difference	**-0.5**	**-5.79**	**-1.88**	**6.03**	**0.76**	**0.25**	**1.20**	**-0.38**
Best Days	2006-2010	6.3	3.33	0.97	1.22	0.48	0.32	1.66	0.05
	2011-2015	6.5	2.99	1.44	1.51	0.47	0.30	1.54	0.11
	Difference	**0.2**	**-0.33**	**0.47**	**0.29**	**-0.01**	**-0.02**	**-0.11**	**0.06**

Monture, MT (MONT1)

The Monture IMPROVE monitoring site is located in Powell County Montana and is the representative station for the Bob Marshall Wilderness Class I Area, the Mission Mountains Wilderness Class I Area, and The Scapegoat Wilderness Class I Area. The wilderness areas are located south of Glacier National Park and stretch from the eastern side of the Flathead Valley in the west to the Rocky Mountain Front in the east. Figure 45 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 45. MONTURE IMPROVE SITE



Current Visibility Conditions

The average visibility impairment at the Monture IMPROVE site was 15.7 dv on the Worst days and 2.6 on the Best days for 2011-2015. On the Worst days the largest average light extinction contribution was from organic carbon, followed by coarse mass, sulfates, elemental carbon, soil, and nitrates. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, elemental carbon, nitrates and coarse mass. Soil and sea salt contributed little to the overall visibility impairment. Table 18 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 46 and 47 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 18. CURRENT VISIBILITY CONDITIONS - MONT1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Monture (MONT1)									
Worst Days	2011	13.9	5.72	1.06	19.24	2.81	0.97	3.69	0.11
	2012	20.2	3.87	0.96	59.14	5.07	4.02	9.28	0.07
	2013	13.2	3.71	0.59	18.25	2.52	1.42	3.96	0.03
	2014	14.1	3.22	0.42	25.60	3.16	2.29	6.35	0.03
	2015	17.2	3.61	1.53	61.70	5.95	0.59	1.93	0.05
	Average	**15.7**	**4.03**	**0.91**	**36.79**	**3.90**	**1.86**	**5.04**	**0.06**
Best Days	2011	2.7	1.13	0.16	1.17	0.28	0.05	0.21	0.11
	2012	2.6	1.25	0.20	0.92	0.28	0.05	0.15	0.09
	2013	2.5	1.25	0.18	1.01	0.20	0.06	0.19	0.02
	2014	2.4	1.07	0.28	0.80	0.18	0.06	0.23	0.08
	2015	2.8	1.01	0.34	1.36	0.23	0.07	0.21	0.04
	Average	**2.6**	**1.14**	**0.23**	**1.05**	**0.24**	**0.06**	**0.20**	**0.07**

FIGURE 46. CONTRIBUTION BY SPECIES FOR MONT12011-2015 ON WORST DAYS

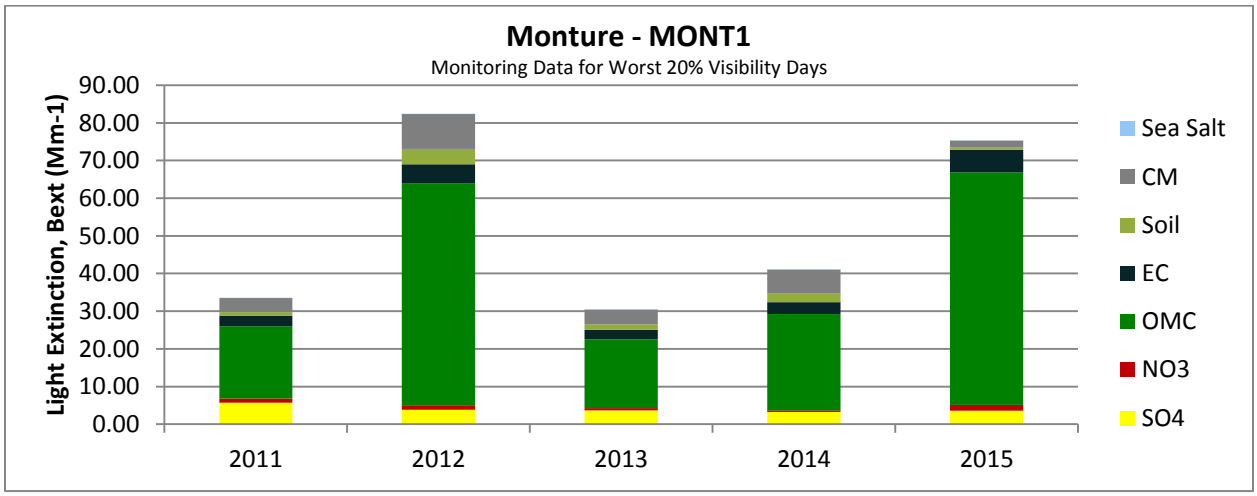
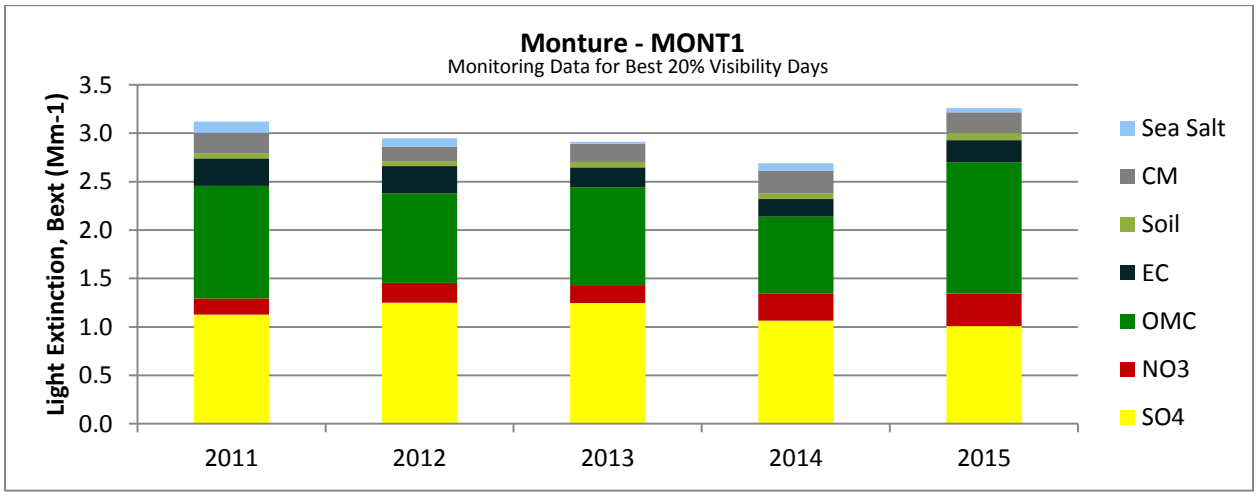


FIGURE 47. CONTRIBUTION BY SPECIES FOR MONT12011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has increased at the Monture IMPROVE site since the 2000-2004 baseline planning period. On the Worst days, visibility impairment increased 1.2 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 19 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 48 and 49 display the species contribution between the baseline period and 2011-2015 period for the 20% worst and 20% best visibility days.

TABLE 19. COMPARISON TO BASELINE - MONT1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Monture (MONT1)									
Worst Days	Baseline	14.5	5.12	1.43	22.29	2.80	1.29	3.60	0.03
	2007-2011	14.6	5.64	1.30	28.42	3.28	1.47	3.38	0.17
	2008-2012	14.3	5.26	1.23	23.93	2.65	1.79	4.48	0.17
	2009-2013	14.4	4.85	1.04	24.95	2.82	1.85	4.93	0.04
	2010-2014	14.8	4.28	0.98	27.88	3.13	2.02	5.59	0.05
	2011-2015	15.7	4.03	0.91	36.79	3.90	1.86	5.04	0.06
	Difference	**1.2**	**-1.10**	**-0.52**	**14.49**	**1.10**	**0.56**	**1.44**	**0.03**
Best Days	Baseline	3.9	1.50	0.51	1.82	0.51	0.11	0.30	0.04
	2007-2011	2.8	1.28	0.23	1.10	0.32	0.12	0.20	0.06
	2008-2012	2.8	1.24	0.20	1.11	0.32	0.12	0.19	0.06
	2009-2013	2.7	1.24	0.19	1.09	0.30	0.11	0.20	0.05
	2010-2014	2.6	1.11	0.20	1.03	0.27	0.11	0.20	0.06
	2011-2015	2.6	1.14	0.23	1.05	0.24	0.06	0.20	0.07
	Difference	**-1.3**	**-0.36**	**-0.28**	**-0.77**	**-0.28**	**-0.05**	**-0.10**	**0.02**

FIGURE 48. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

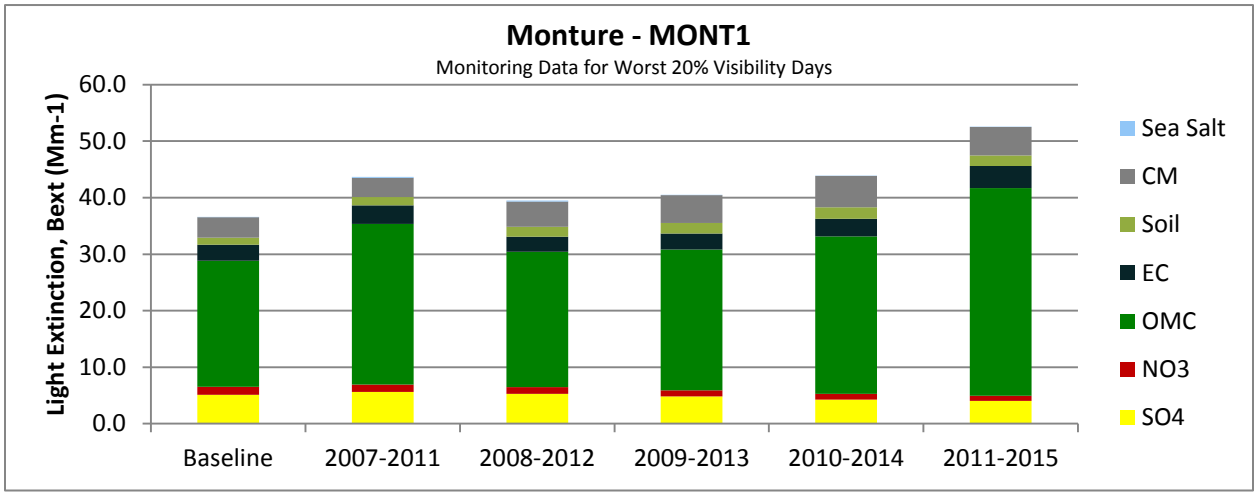
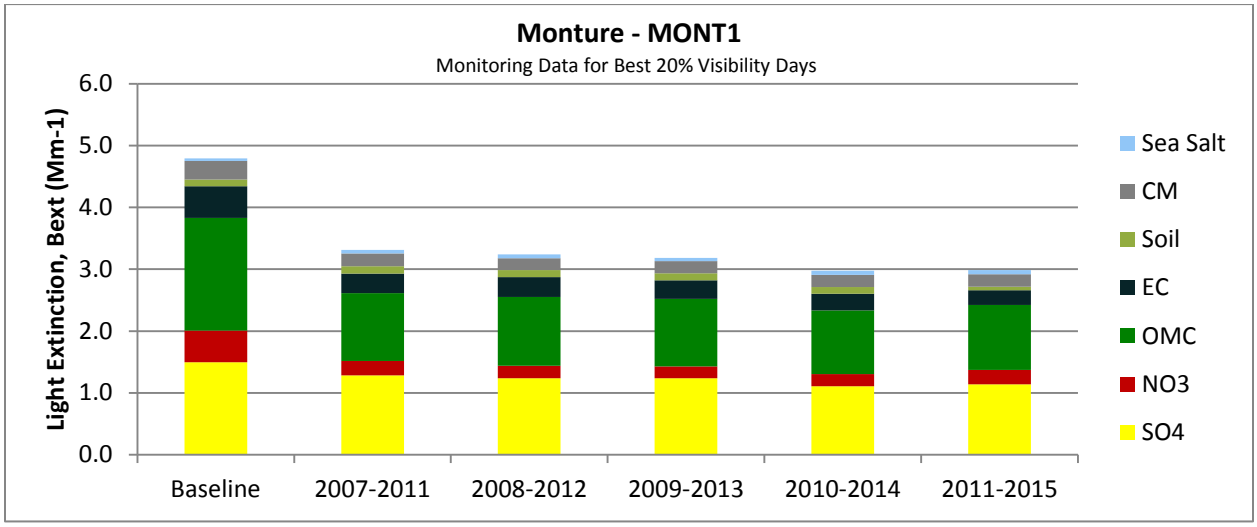
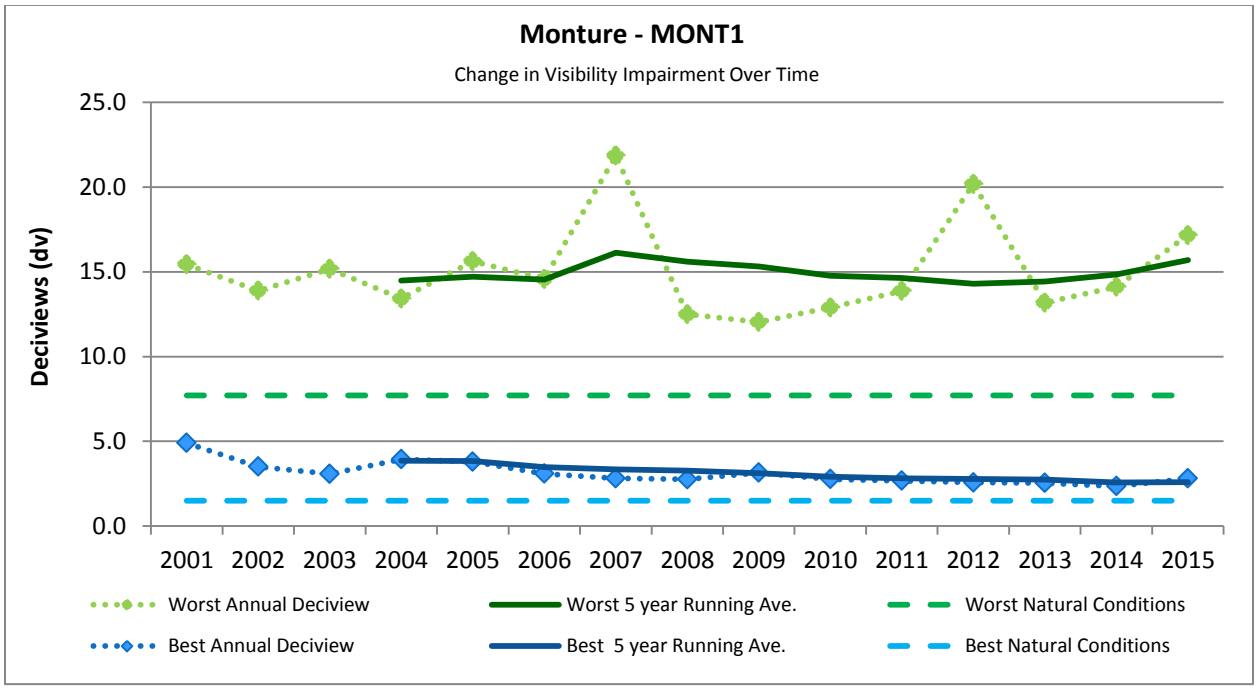


FIGURE 49. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 50 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 50. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figures 51 and 52 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 51. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

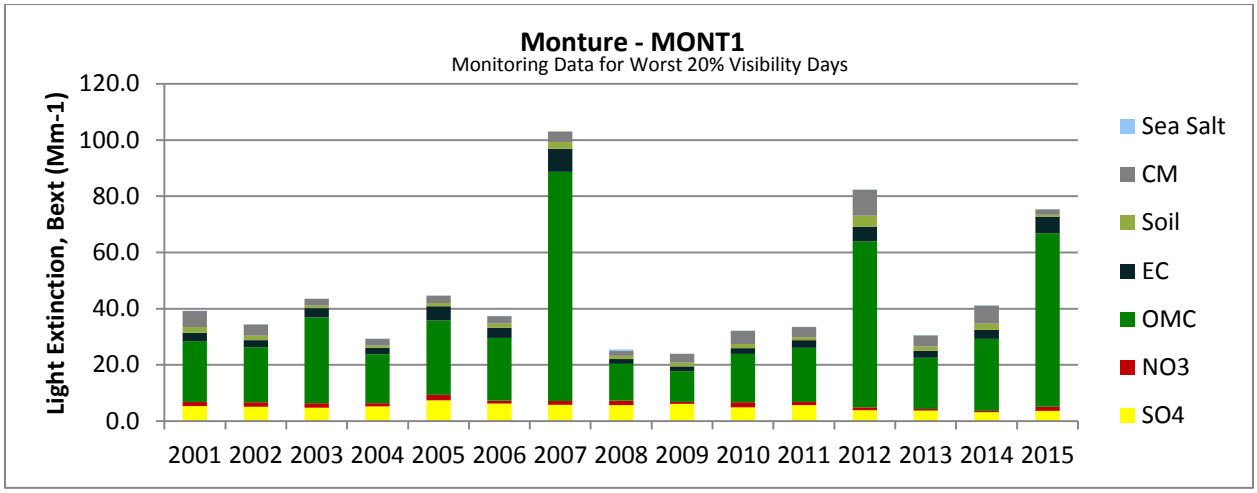


FIGURE 52. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

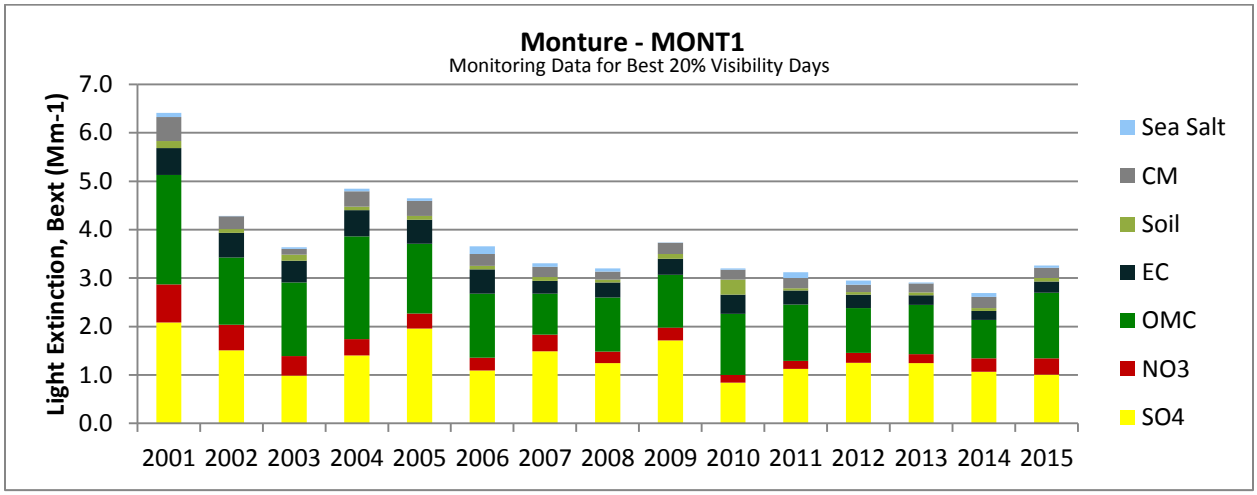
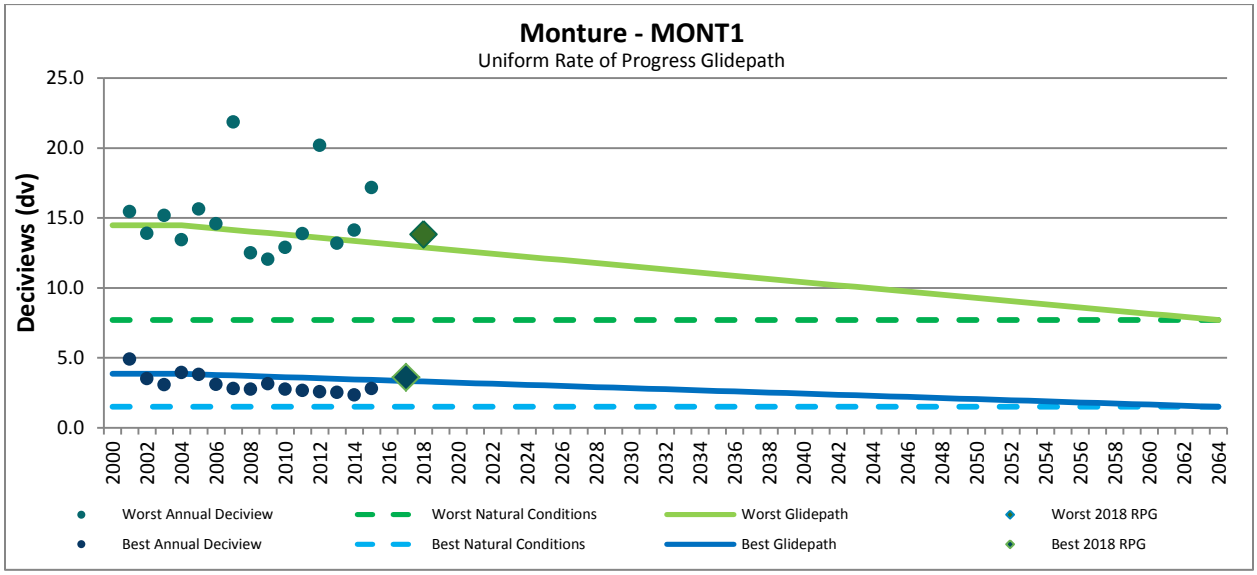


Figure 53 shows how visibility impairment over time matches up with the uniform rate of progress glidepath and reasonable progress goals set for the Monture IMPROVE site.

FIGURE 53. UNIFORM RATE OF PROGRESS - MONT1



Change in Visibility Over 5 Years

The average visibility impairment at the Monture IMPROVE site was 14.8 dv on the Worst days and 2.9 on the Best days for 2006-2010. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, elemental carbon, coarse mass, soil, and nitrates. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, elemental carbon, nitrates, and coarse mass. Soil and sea salt contributed little to the overall visibility impairment. Table 20 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 54 and 55 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 20. PAST 5 YEARS VISIBILITY CONDITIONS - MONT1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Monture (MONT1)									
Worst Days	2006	14.6	6.22	1.04	22.35	3.65	1.43	2.67	0.02
	2007	21.9	5.79	1.32	81.57	8.23	2.39	3.77	0.10
	2008	12.5	5.73	1.51	13.14	1.67	1.11	1.71	0.65
	2009	12.0	6.10	0.74	10.94	1.63	1.45	3.08	0.00
	2010	12.9	4.87	1.86	17.19	2.08	1.42	4.64	0.00
	Average	**14.8**	**5.74**	**1.30**	**29.04**	**3.45**	**1.56**	**3.17**	**0.15**
Best Days	2006	3.1	1.09	0.26	1.32	0.50	0.07	0.25	0.16
	2007	2.8	1.49	0.34	0.84	0.27	0.08	0.21	0.08
	2008	2.8	1.25	0.24	1.12	0.31	0.06	0.17	0.07
	2009	3.1	1.71	0.26	1.09	0.33	0.10	0.23	0.01
	2010	2.8	0.84	0.15	1.27	0.40	0.31	0.20	0.03
	Average	**2.9**	**1.28**	**0.25**	**1.13**	**0.36**	**0.12**	**0.21**	**0.07**

FIGURE 54. CONTRIBUTION BY SPECIES FOR MONT1 2006-2010 ON WORST DAYS

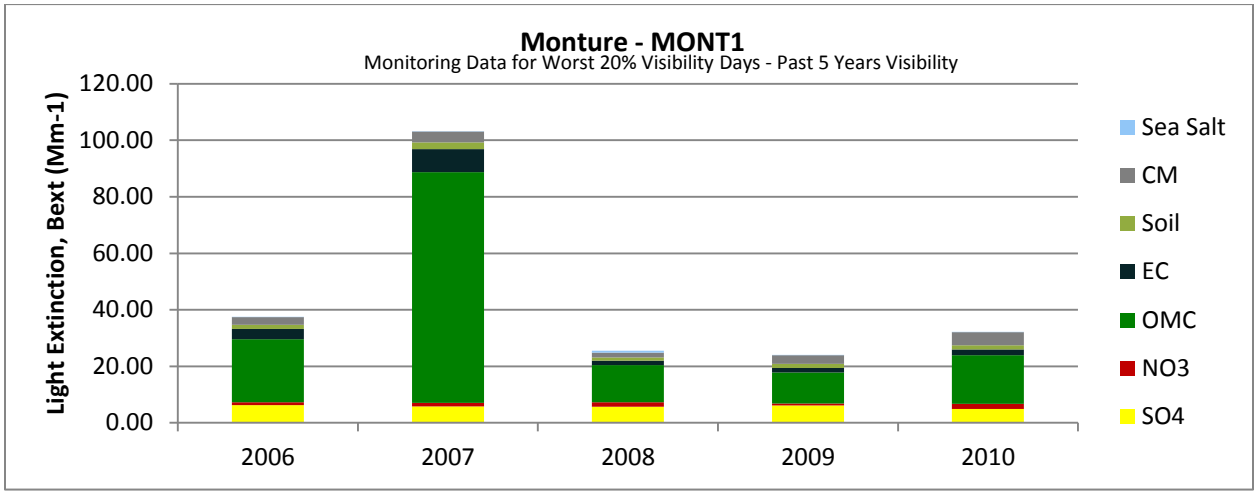


FIGURE 55. CONTRIBUTION BY SPECIES FOR MONT1 2006-2010 ON BEST DAYS

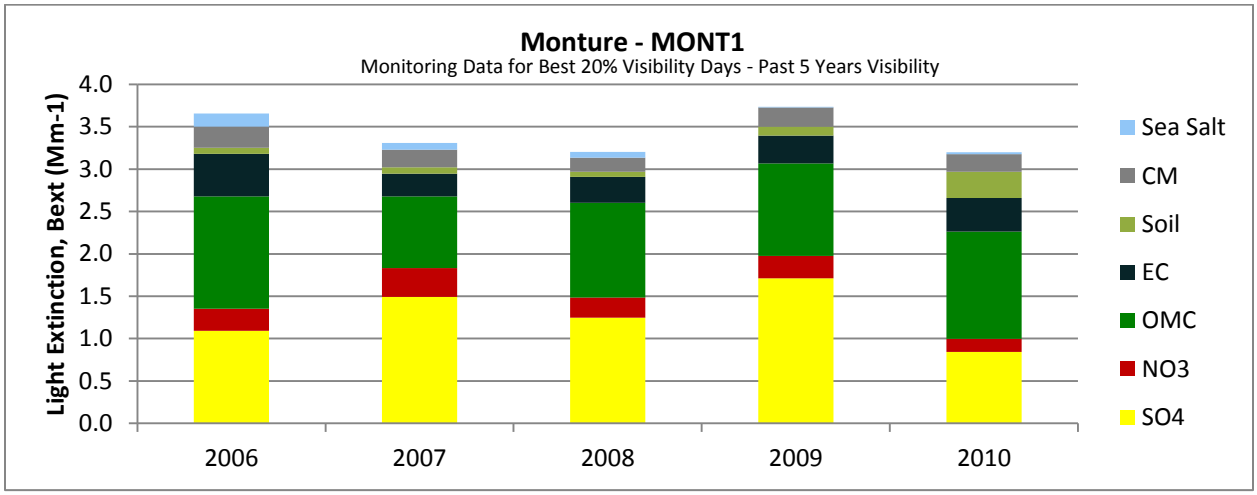


Table 21 shows the difference between the current visibility impairment and the past 5 years' average visibility conditions. Visibility impairment on the Worst days has increased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has improved during the same period.

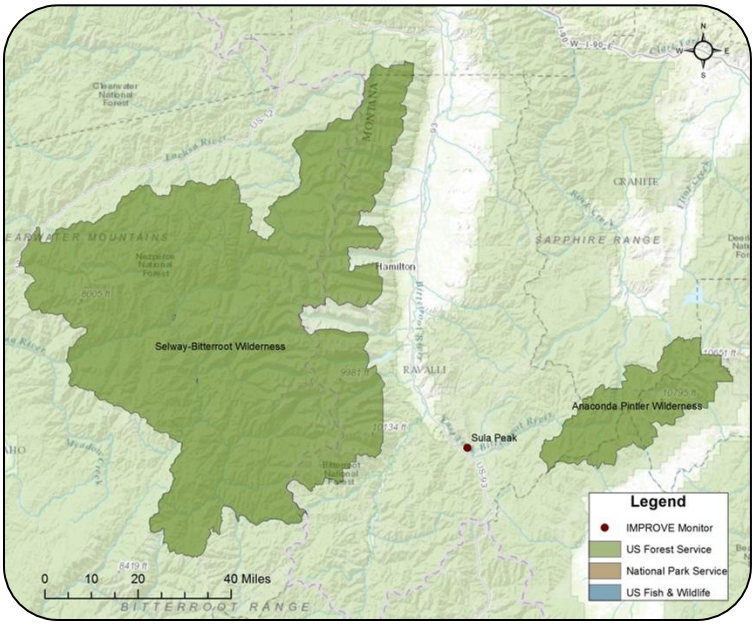
TABLE 21. COMPARISON OF CURRENT TO PAST 5 YEARS - MONT1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Monture (MONT1)									
Worst Days	2006-2010	14.8	5.74	1.30	29.04	3.45	1.56	3.17	0.15
	2011-2015	15.7	4.03	0.91	36.79	3.90	1.86	5.04	0.06
	Difference	**0.9**	**-1.71**	**-0.38**	**7.75**	**0.45**	**0.30**	**1.87**	**-0.09**
Best Days	2006-2010	2.9	1.28	0.25	1.13	0.36	0.12	0.21	0.07
	2011-2015	2.6	1.14	0.23	1.05	0.24	0.06	0.20	0.07
	Difference	**-0.3**	**-0.14**	**-0.02**	**-0.08**	**-0.12**	**-0.07**	**-0.01**	**0.00**

Sula Peak (SULA1)

The Sula Peak IMPROVE monitoring site is located at the southern end of the Bitterroot Valley and is the representative station for the Anaconda-Pintler Wilderness Class I Area and the Selway-Bitterrrot Wilderness Class I Area. The Selway- Bitterroot Wilderness Area spans but Idaho and Montana, bordering the western edge of the Bitterroot Valley in Ravalli County. The Anaconda-Pintler Wilderness Area is located to the east of the Selway-Bitterroot Wilderness Area, at the southern end of the Sapphire Mountain Range. Figure 56 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 56. SULA PEAK IMPROVE SITE



Current Visibility Conditions

The average visibility impairment at the Sula Peak IMPROVE site was 16.3 dv on the Worst days and 1.6 on the Best days for 2011-2015. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by elemental carbon, sulfates, coarse mass, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, coarse mass and nitrates. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 22 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 57 and 58 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 22. CURRENT VISIBILITY CONDITIONS - SULA1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Sula Peak (SULA1)									
Worst Days	2011	13.6	5.38	0.90	27.41	2.69	0.64	2.08	0.05
	2012	26.4	4.26	3.95	181.43	17.88	0.73	3.70	0.17
	2013	13.2	3.06	0.74	21.79	2.88	0.55	2.66	0.03
	2014	11.8	4.00	0.86	15.70	2.39	0.54	2.20	0.04
	2015	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average	**16.3**	**4.17**	**1.61**	**61.58**	**6.46**	**0.61**	**2.66**	**0.07**
Best Days	2011	1.69	0.84	0.13	0.50	0.13	0.06	0.20	0.01
	2012	1.89	0.83	0.24	0.43	0.08	0.03	0.43	0.06
	2013	1.53	0.86	0.17	0.34	0.06	0.04	0.16	0.03
	2014	1.44	0.77	0.16	0.26	0.06	0.05	0.19	0.05
	2015	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average	**1.64**	**0.83**	**0.18**	**0.38**	**0.08**	**0.05**	**0.24**	**0.04**

FIGURE 57. CONTRIBUTION BY SPECIES FOR SULA12011-2015 ON WORST DAYS

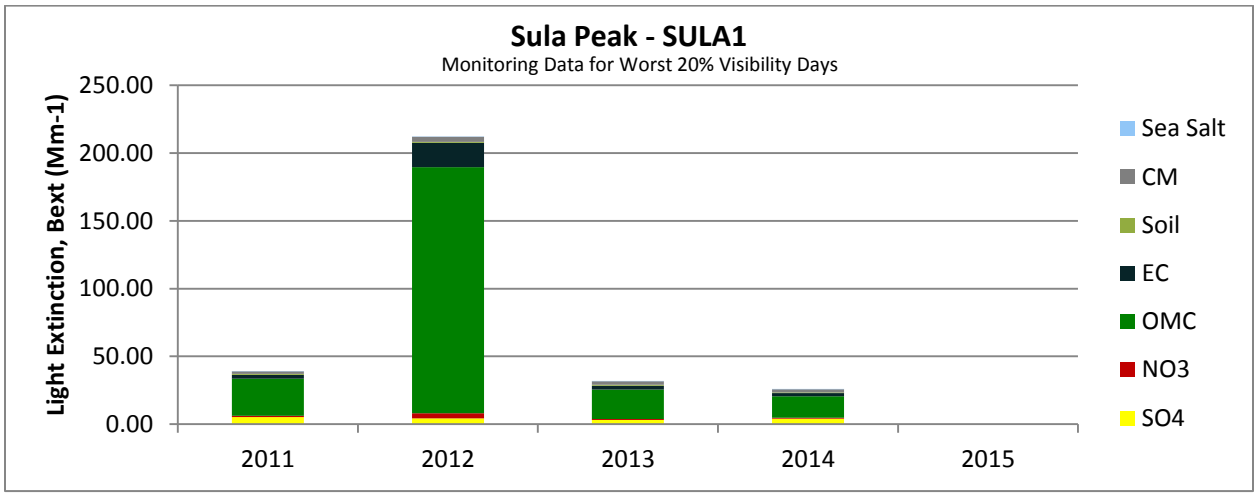
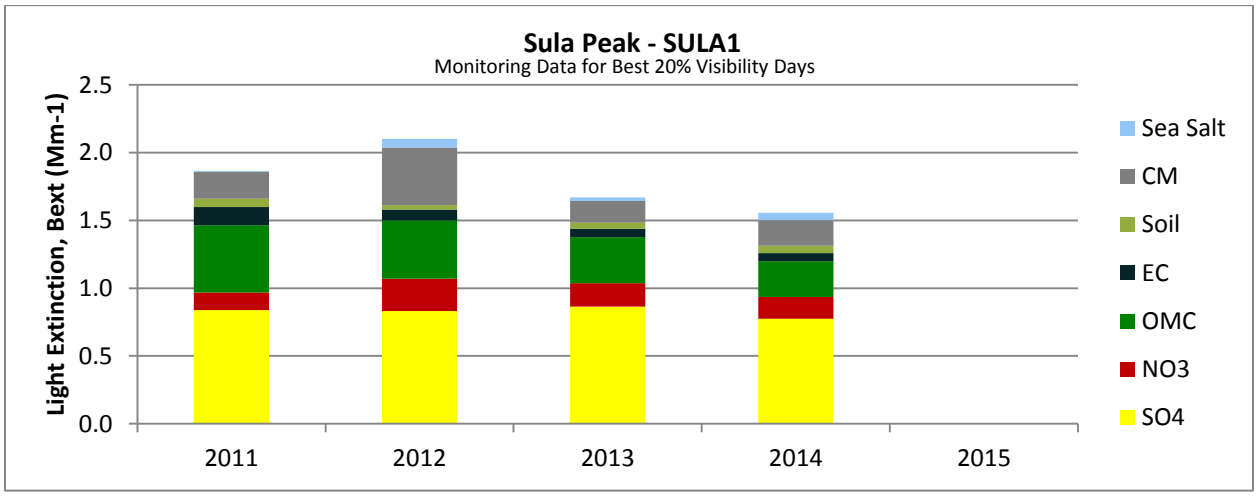


FIGURE 58. CONTRIBUTION BY SPECIES FOR SULA12011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has increased at the Sula Peak IMPROVE site since the 2000-2004 baseline planning period. On the Worst days, visibility impairment increased 2.8 deciviews over the 11 year period. The most substantial increase was in organic carbon, while sulfates decreased during the time period. Table 23 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 59 and 60 display the species contribution between the baseline period and 2011-2015 period for the 20% worst and 20% best visibility days.

TABLE 23. COMPARISON TO BASELINE - SULA1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Sula Peak (SULA1)									
Worst Days	Baseline	13.4	4.83	1.46	20.01	2.52	0.94	2.49	0.26
	2007-2011	15.0	4.61	1.36	45.89	6.39	0.76	3.08	0.04
	2008-2012	15.3	4.72	1.67	57.11	5.91	0.76	2.70	0.06
	2009-2013	14.9	4.39	1.48	50.05	5.30	0.72	2.69	0.06
	2010-2014	15.0	4.17	1.45	50.92	5.44	0.71	2.57	0.06
	2011-2015	16.3	4.17	1.61	61.58	6.46	0.61	2.66	0.07
	Difference	**2.8**	**-0.66**	**0.15**	**41.57**	**3.94**	**-0.32**	**0.17**	**-0.19**
Best Days	Baseline	2.6	1.09	0.34	0.94	0.28	0.10	0.21	0.03
	2007-2011	2.1	1.04	0.20	0.59	0.15	0.07	0.28	0.04
	2008-2012	1.9	0.94	0.18	0.53	0.12	0.06	0.30	0.04
	2009-2013	1.9	0.92	0.17	0.49	0.11	0.06	0.27	0.04
	2010-2014	1.7	0.84	0.17	0.43	0.09	0.05	0.23	0.04
	2011-2015	1.6	0.83	0.18	0.38	0.08	0.05	0.24	0.04
	Difference	**-0.9**	**-0.27**	**-0.16**	**-0.55**	**-0.19**	**-0.05**	**0.03**	**0.00**

FIGURE 59. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

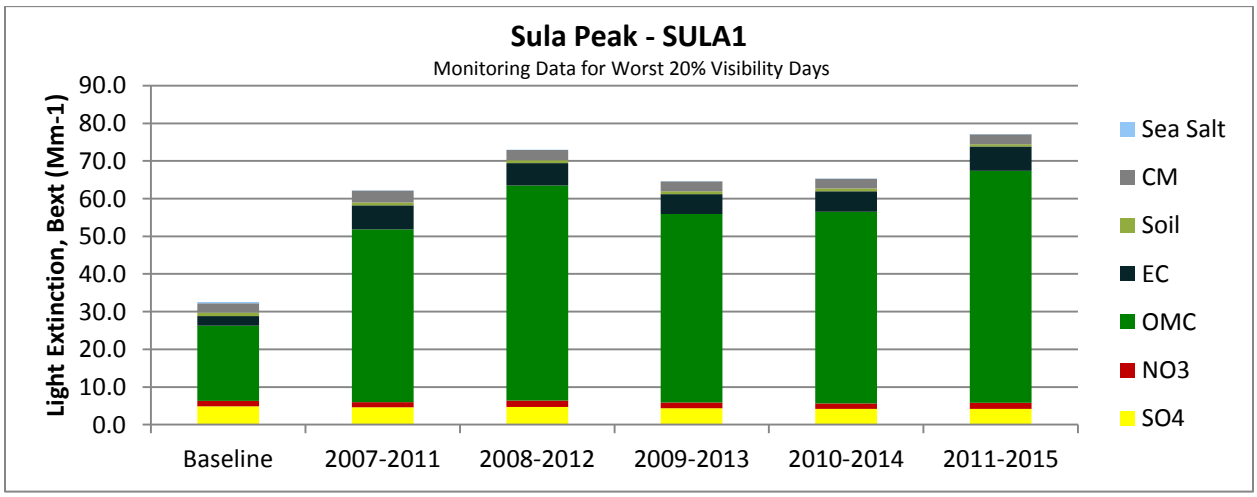
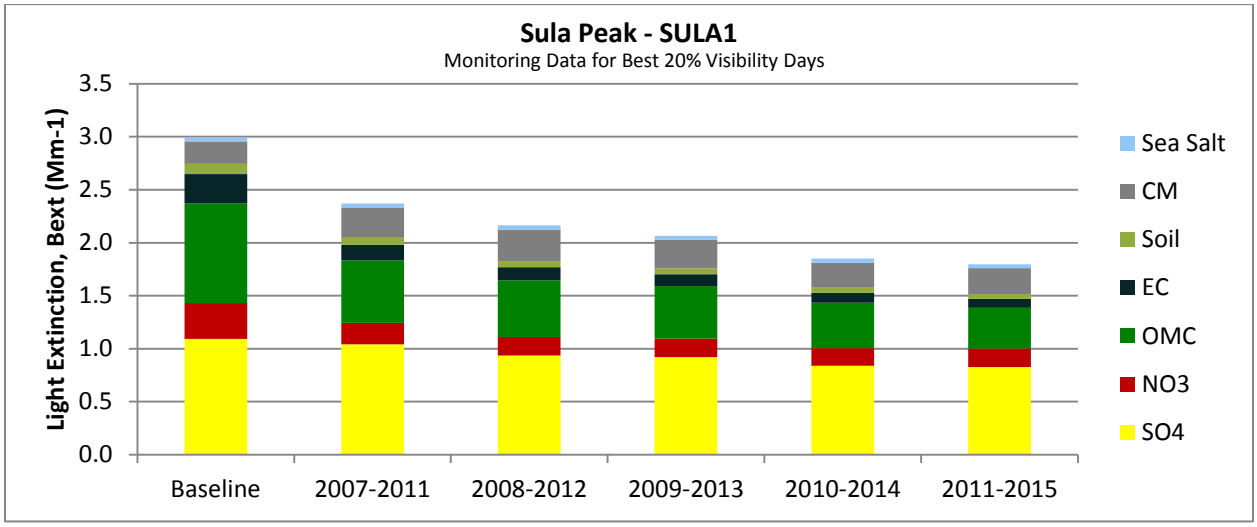
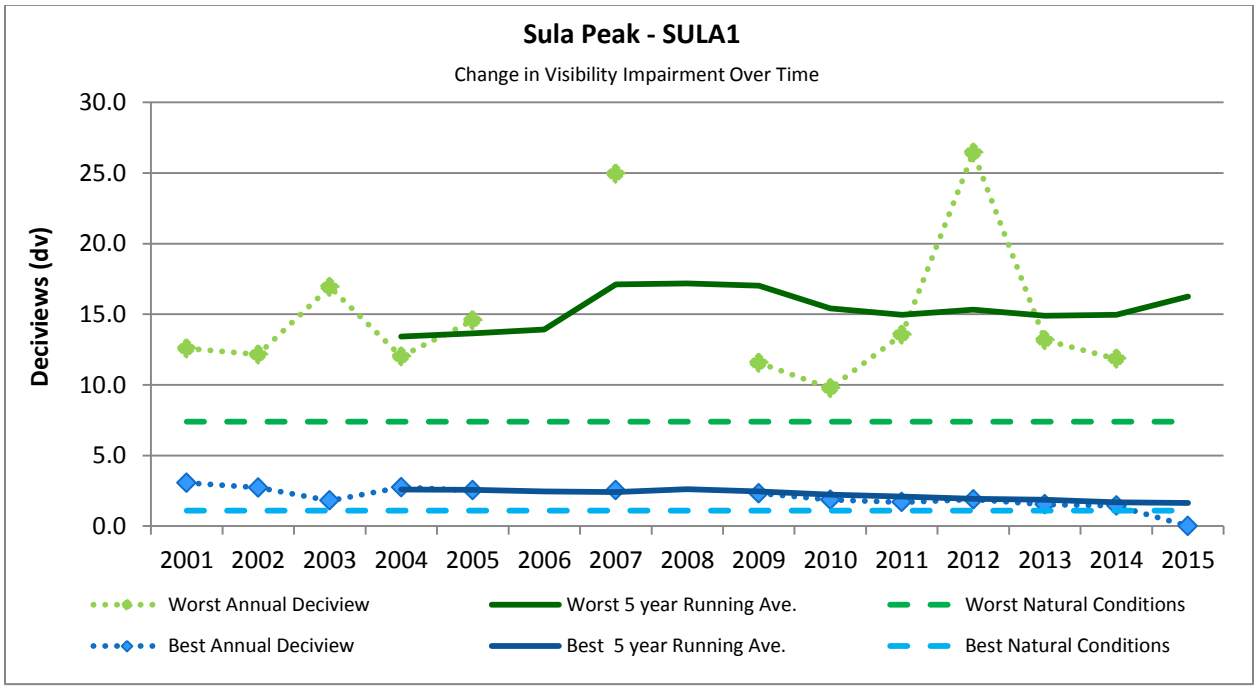


FIGURE 60. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 61 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 61. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 62 and 63 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 62. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

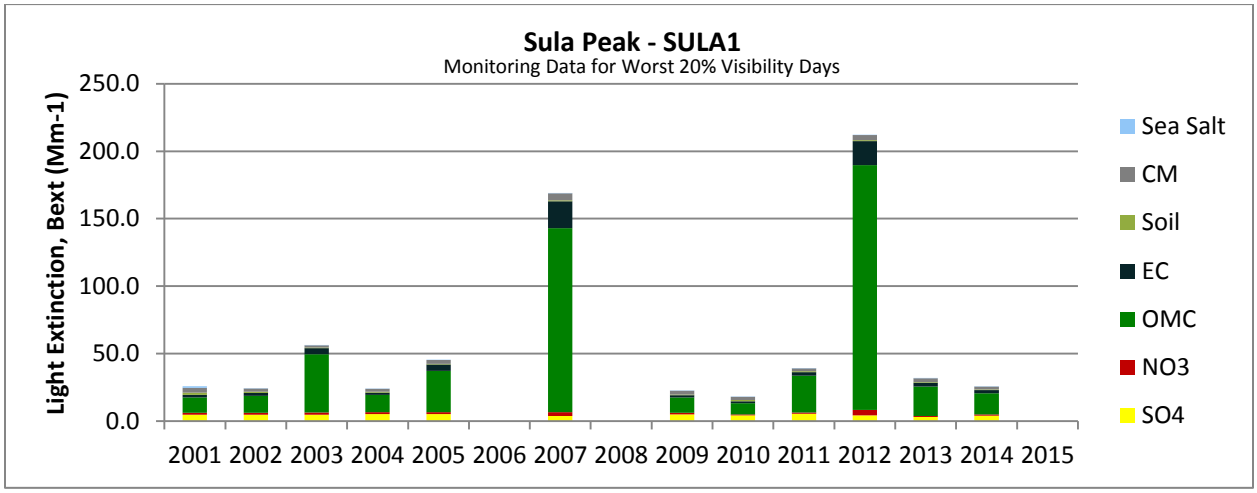


FIGURE 63. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

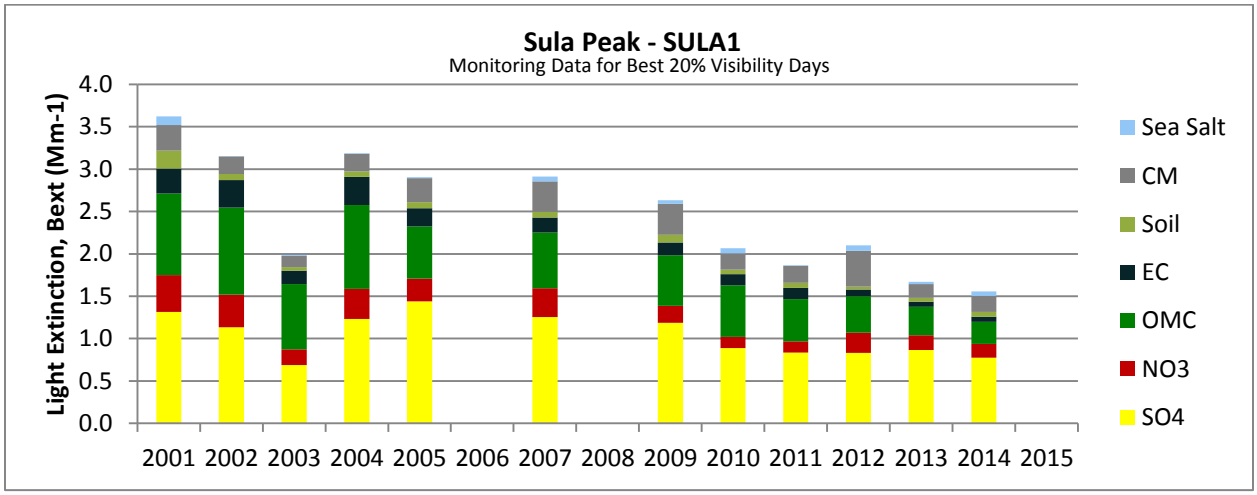
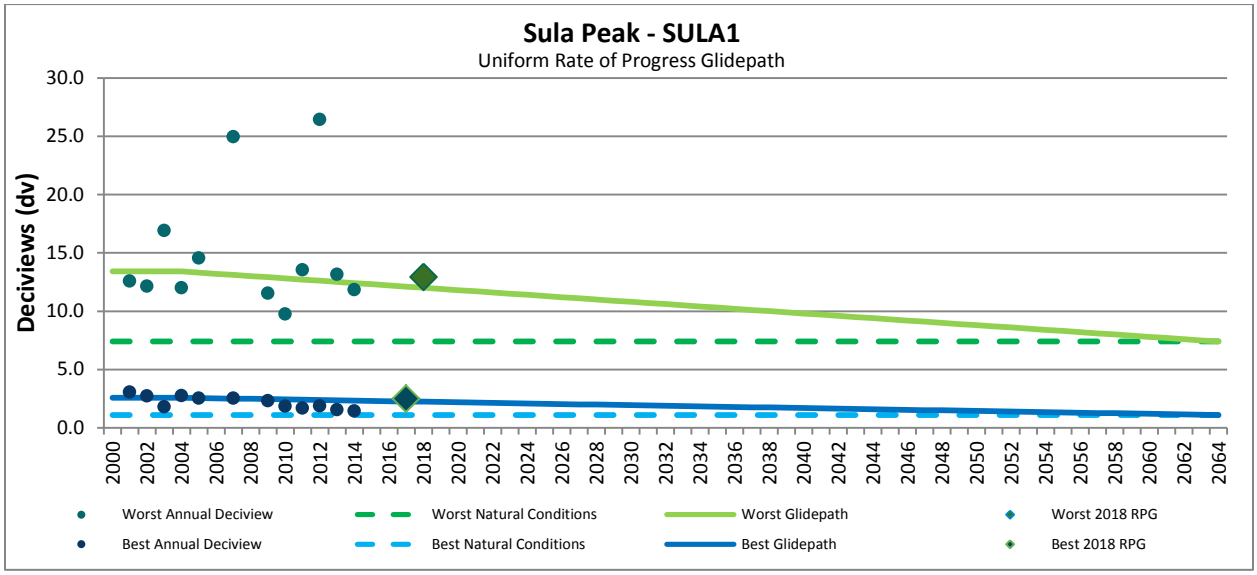


Figure 64 shows how visibility impairment over time matches up with the uniform rate of progress glidepath set for the Sula Peak IMPROVE site.

FIGURE 64. UNIFORM RATE OF PROGRESS - SULA1



Change in Visibility Over 5 Years

The average visibility impairment at the Sula Peak IMPROVE site was 15.4 dv on the Worst days and 2.2 on the Best days for 2006-2010. On the Worst days the largest average light extinction contribution was from organic carbon, followed by elemental carbon, sulfates, coarse mass, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, coarse mass, and nitrates. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 24 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 65 and 66 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 24. PAST 5 YEARS VISIBILITY CONDITIONS - SULA1

			Contribution to Light Extinction (Mm^{-1})						
	Year	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Sula Peak (SULA1)									
Worst Days	2006	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2007	24.9	3.82	2.71	136.55	19.80	0.70	5.22	0.09
	2008	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2009	11.6	5.07	1.03	11.34	1.72	0.61	2.80	0.02
	2010	9.8	4.17	0.80	8.27	1.36	1.07	2.21	0.01
	Average	**15.4**	**4.35**	**1.51**	**52.05**	**7.63**	**0.79**	**3.41**	**0.04**
Best Days	2006	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2007	2.5	1.26	0.34	0.65	0.18	0.07	0.36	0.06
	2008	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2009	2.3	1.19	0.20	0.60	0.15	0.09	0.37	0.04
	2010	1.9	0.89	0.13	0.61	0.13	0.05	0.20	0.06
	Average	**2.2**	**1.11**	**0.23**	**0.62**	**0.15**	**0.07**	**0.31**	**0.05**

FIGURE 65. CONTRIBUTION BY SPECIES FOR SULA12006-2010 ON WORST DAYS

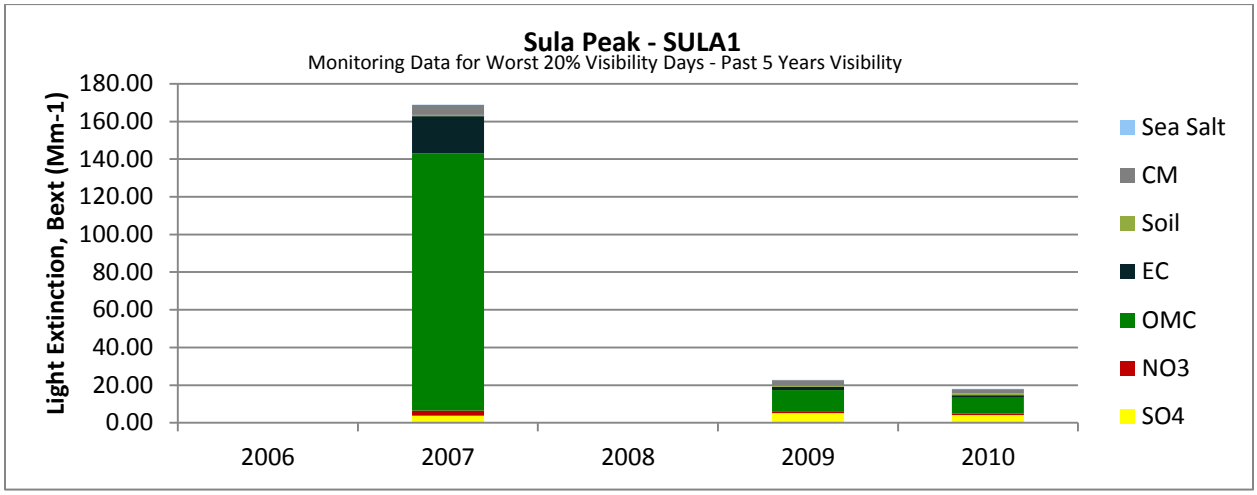


FIGURE 66. CONTRIBUTION BY SPECIES FOR SULA12006-2010 ON BEST DAYS

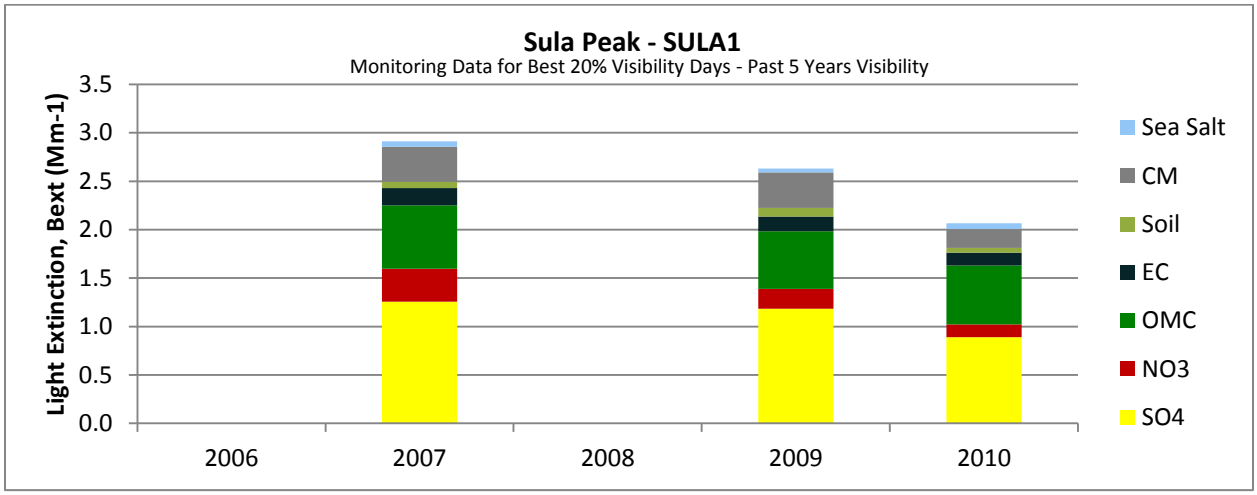


Table 25 shows the difference between the current visibility impairment to the past 5 years visibility. Visibility impairment on the Worst days has increased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has improved during the same period.

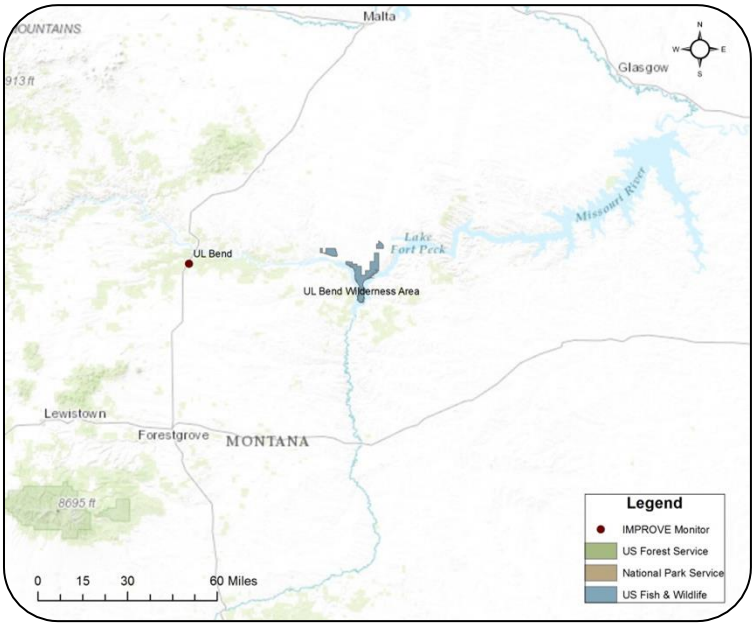
TABLE 25. COMPARISON TO PAST 5 YEARS - SULA1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Sula Peak (SULA1)									
Worst Days	2006-2010	15.4	4.35	1.51	52.05	7.63	0.79	3.41	0.04
	2011-2015	13.0	3.34	1.29	49.27	5.17	0.49	2.13	0.06
	Difference	**-2.4**	**-1.02**	**-0.22**	**-2.79**	**-2.46**	**-0.30**	**-1.28**	**0.02**
Best Days	2006-2010	2.2	1.11	0.23	0.62	0.15	0.07	0.31	0.05
	2011-2015	1.6	0.83	0.18	0.38	0.08	0.05	0.24	0.04
	Difference	**-0.6**	**-0.28**	**-0.05**	**-0.24**	**-0.07**	**-0.02**	**-0.06**	**-0.02**

U.L. Bend (ULBE1)

The UL Bend IMPROVE monitoring site is located in the UL Bend Wilderness Area and is the representative station for the UL Bend Wilderness Class I Area. The wilderness area is located in central Montana at the start of Fort Peck Lake. Figure 67 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 67. UL BEND WILDERNESS AREA



Current Visibility Conditions

The average visibility impairment at the UL Bend IMPROVE site was 14.5 dv on the Worst days and 3.7 on the Best days for 2011-2015. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, coarse mass, nitrates, elemental carbon, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, coarse mass, and nitrates. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 26 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 68 and 69 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 26. CURRENT VISIBILITY CONDITIONS - ULBE1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
UL Bend (ULBE1)									
Worst Days	2011	13.5	10.45	5.21	6.46	1.56	0.76	4.19	0.05
	2012	15.5	6.20	2.62	18.01	2.65	1.68	7.47	0.05
	2013	13.0	7.91	3.10	8.83	1.66	0.86	3.83	0.02
	2014	14.7	9.00	4.54	18.34	2.42	0.48	3.36	0.04
	2015	15.7	7.80	3.16	38.97	3.23	0.60	3.09	0.04
	Average	**14.5**	**8.27**	**3.73**	**18.12**	**2.30**	**0.87**	**4.39**	**0.04**
Best Days	2011	3.7	1.41	0.23	0.80	0.22	0.14	0.67	0.05
	2012	3.7	1.35	0.31	0.77	0.23	0.17	0.62	0.03
	2013	3.8	1.53	0.35	0.82	0.18	0.12	0.62	0.01
	2014	3.6	1.16	0.32	0.90	0.19	0.10	0.71	0.02
	2015	3.6	1.06	0.30	1.14	0.14	0.10	0.68	0.04
	Average	**3.7**	**1.30**	**0.30**	**0.89**	**0.19**	**0.12**	**0.66**	**0.03**

FIGURE 68. CONTRIBUTION BY SPECIES FOR ULBE12011-2015 ON WORST DAYS

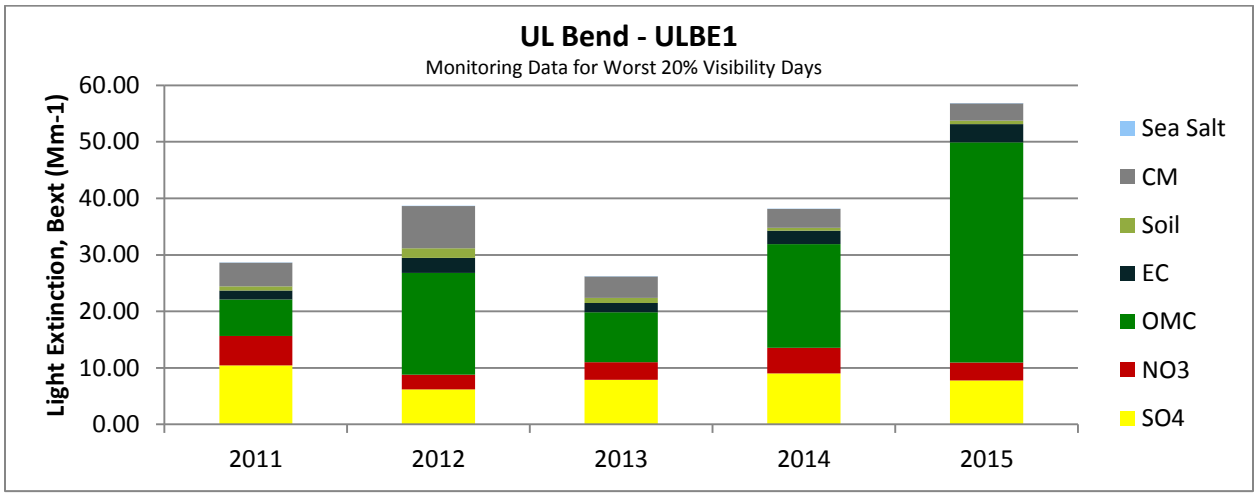
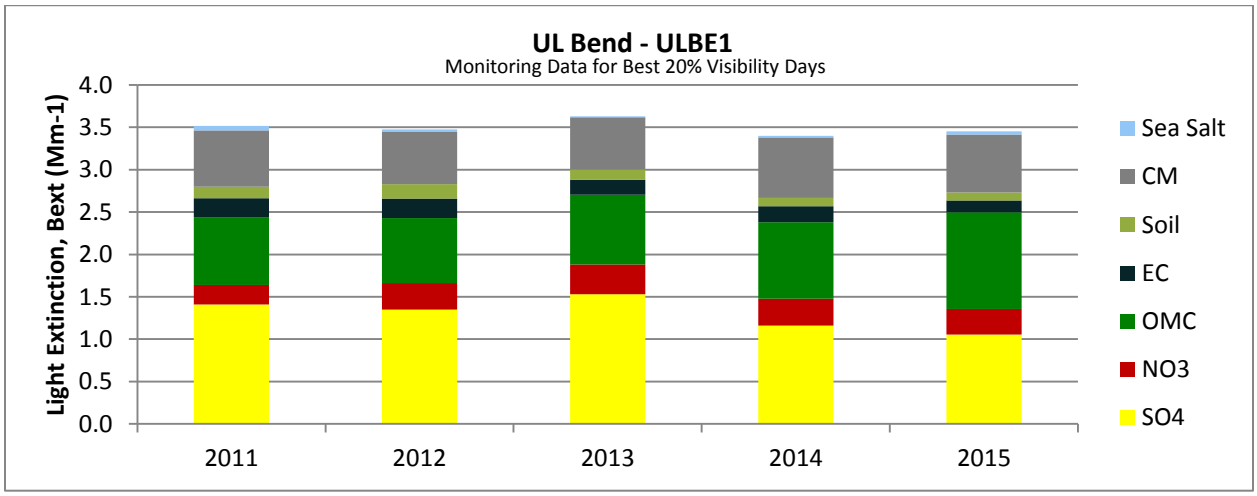


FIGURE 69. CONTRIBUTION BY SPECIES FOR ULBE12011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has decreased in the UL Bend Wilderness Area since the 2000-2004 baseline planning period. On the Worst days, visibility impairment decreased 0.7 deciviews over the 11 year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 27 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 70 and 71 display the species contribution between the baseline period and 2011-2015 planning period for the most and Best days.

TABLE 27. COMPARISON TO BASELINE - ULBE1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
UL Bend (ULBE1)									
Worst Days	Baseline	15.1	9.78	8.01	12.76	2.08	0.77	4.01	0.01
	2007-2011	14.6	10.36	6.59	11.23	1.87	0.84	4.10	0.47
	2008-2012	14.4	9.65	6.06	9.59	1.65	1.00	4.70	0.47
	2009-2013	14.1	9.46	5.52	9.21	1.68	0.99	4.72	0.04
	2010-2014	14.3	9.10	5.16	11.44	1.91	0.94	4.66	0.03
	2011-2015	14.5	8.27	3.73	18.12	2.30	0.87	4.39	0.04
	Difference	**-0.7**	**-1.51**	**-4.28**	**5.36**	**0.22**	**0.10**	**0.38**	**0.03**
Best Days	Baseline	4.8	1.77	0.51	1.24	0.47	0.18	0.92	0.05
	2007-2011	4.3	1.79	0.34	0.94	0.29	0.17	0.84	0.04
	2008-2012	4.1	1.70	0.33	0.93	0.29	0.17	0.74	0.04
	2009-2013	4.0	1.62	0.31	0.91	0.27	0.15	0.72	0.04
	2010-2014	3.8	1.45	0.31	0.91	0.24	0.13	0.66	0.04
	2011-2015	3.7	1.30	0.30	0.89	0.19	0.12	0.66	0.03
	Difference	**-1.1**	**-0.47**	**-0.21**	**-0.35**	**-0.28**	**-0.06**	**-0.26**	**-0.02**

FIGURE 70. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS.

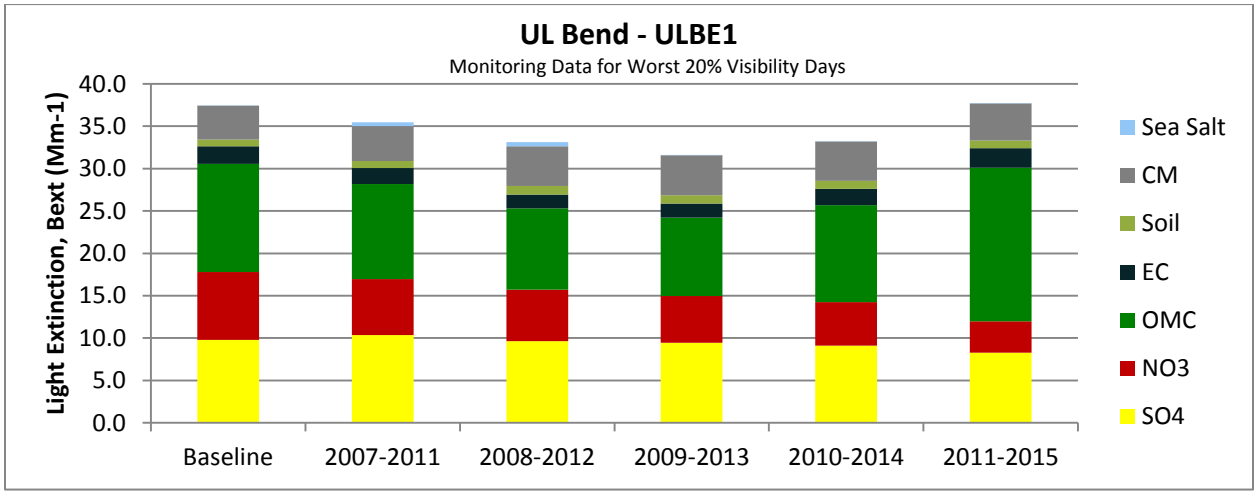
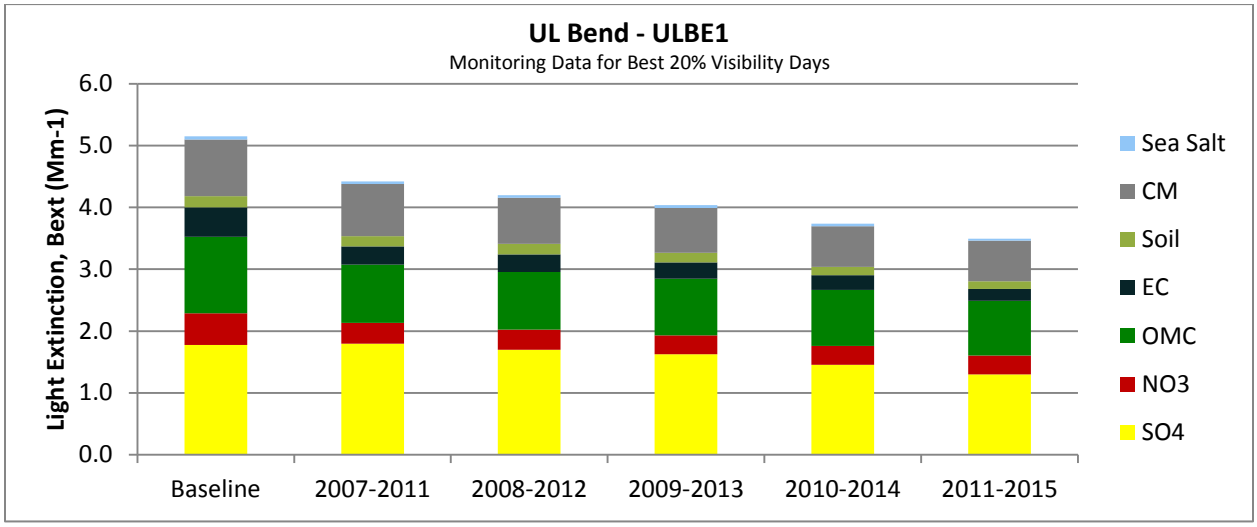
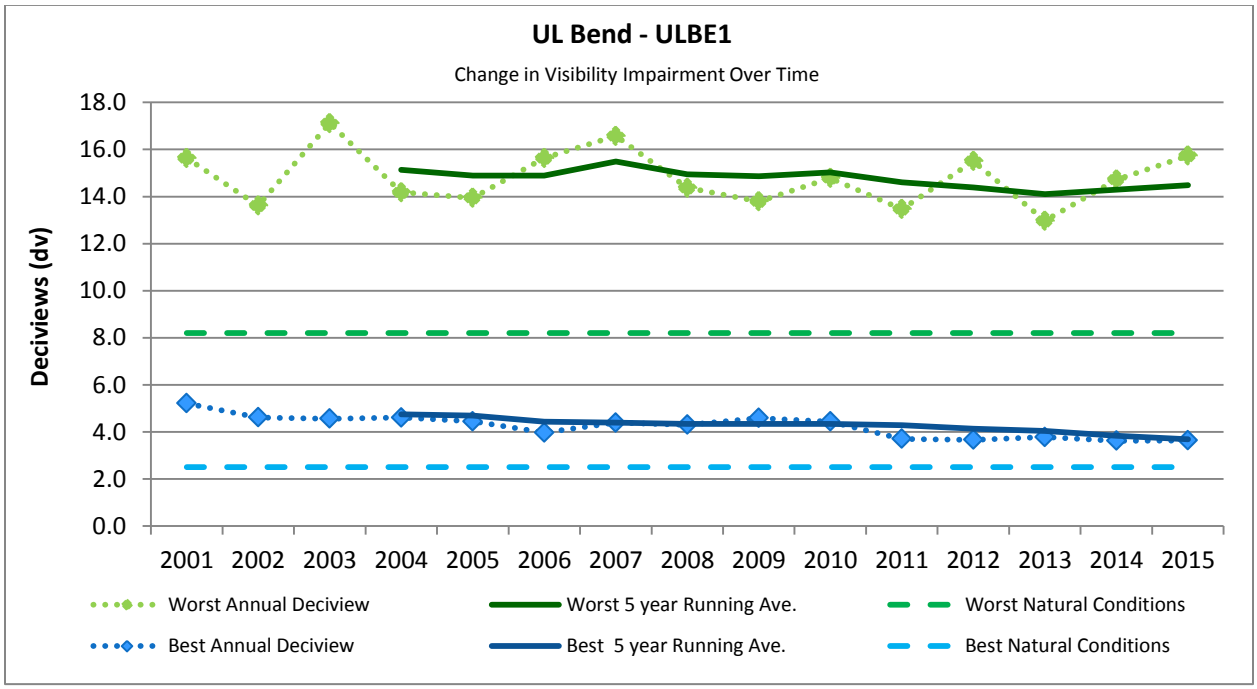


FIGURE 71. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS.



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 72 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 72. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME.



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 73 and 74 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 73. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS.

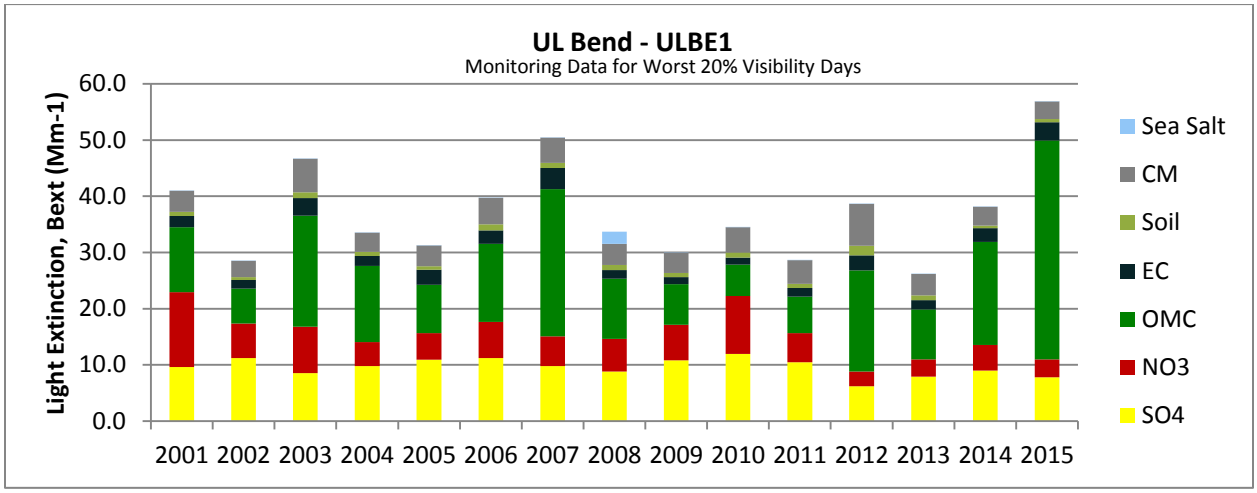


FIGURE 74. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS.

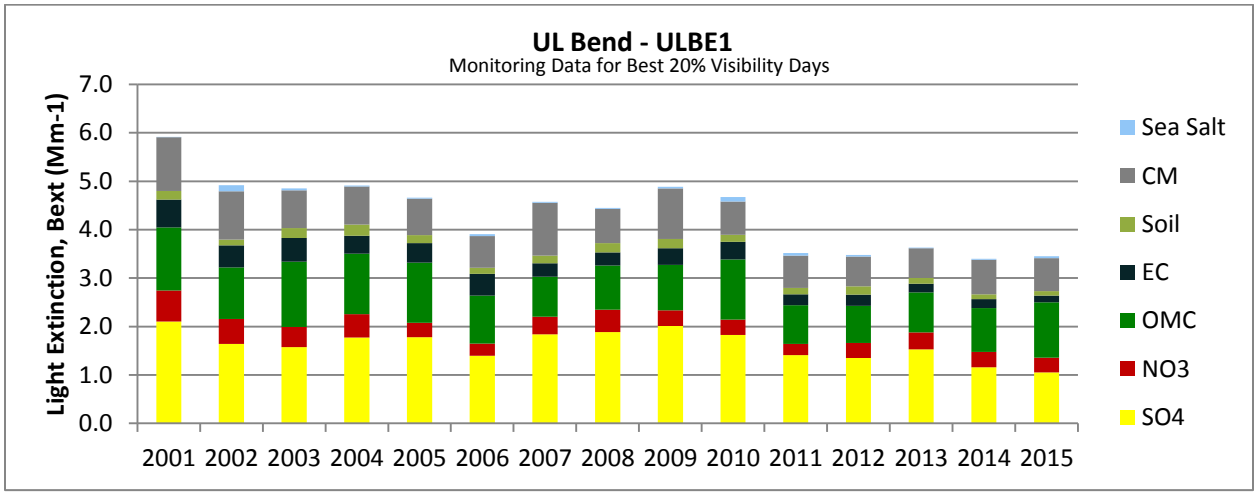
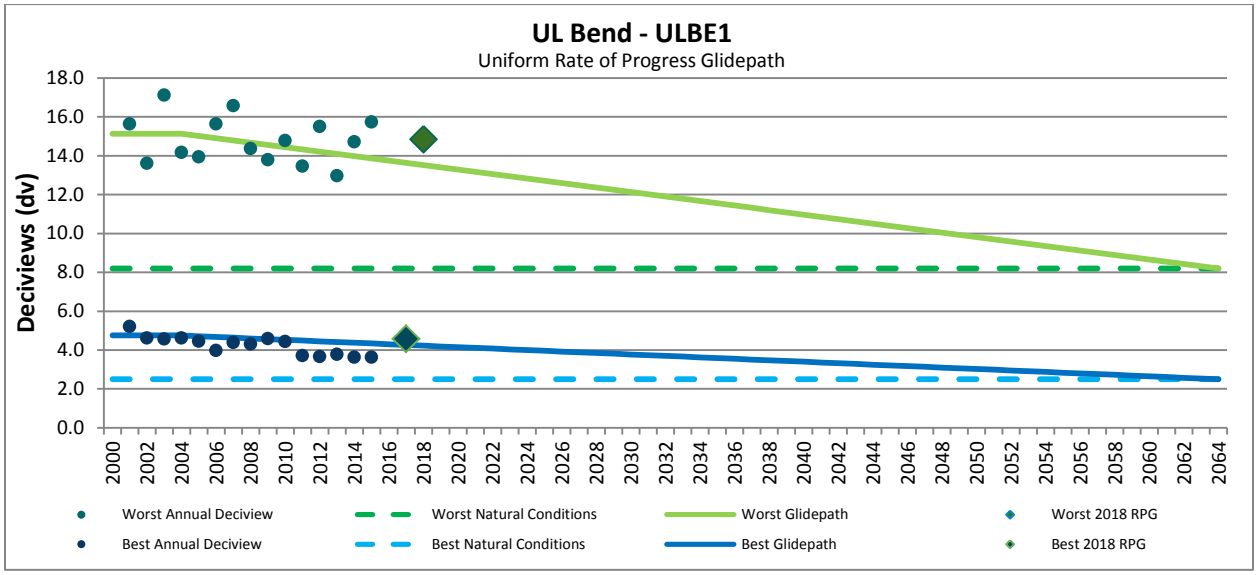


Figure 75 shows how visibility impairment over time matches up with the uniform rate of progress glidepath set for the UL Bend Wilderness Area.

FIGURE 75. UNIFORM RATE OF PROGRESS - ULBE1



Change in Visibility Over 5 Years

The average visibility impairment at the UL Bend IMPROVE site was 15.0 dv on the Worst days and 4.3 on the Best days for 2006-2010. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, nitrates, coarse mass, elemental carbon, soil, and sea salt. On the Best days, sulfates had the largest contribution followed by organic carbon, coarse mass, nitrates, and elemental carbon. Soil and sea salt contributed little to the overall visibility impairment. Table 28 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 76 and 77 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 28. PAST 5 YEARS VISIBILITY CONDITIONS - ULBE1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
UL Bend (ULBE1)									
Worst Days	2006	15.6	11.22	6.43	13.87	2.41	1.08	4.71	0.03
	2007	16.6	9.79	5.27	26.21	3.75	0.89	4.48	0.04
	2008	14.4	8.84	5.77	10.73	1.53	0.91	3.73	2.17
	2009	13.8	10.80	6.34	7.21	1.24	0.75	3.64	0.09
	2010	14.8	11.94	10.34	5.56	1.28	0.90	4.47	0.00
	Average	**15.0**	**10.52**	**6.83**	**12.71**	**2.04**	**0.91**	**4.21**	**0.47**
Best Days	2006	4.0	1.40	0.25	0.99	0.45	0.13	0.65	0.04
	2007	4.4	1.84	0.36	0.83	0.28	0.16	1.09	0.02
	2008	4.3	1.89	0.46	0.91	0.27	0.19	0.71	0.02
	2009	4.6	2.01	0.33	0.94	0.34	0.20	1.04	0.03
	2010	4.4	1.83	0.32	1.24	0.36	0.15	0.69	0.09
	Average	**4.3**	**1.79**	**0.34**	**0.98**	**0.34**	**0.16**	**0.84**	**0.04**

FIGURE 76. CONTRIBUTION BY SPECIES FOR ULBE12006-2010 ON WORST DAYS

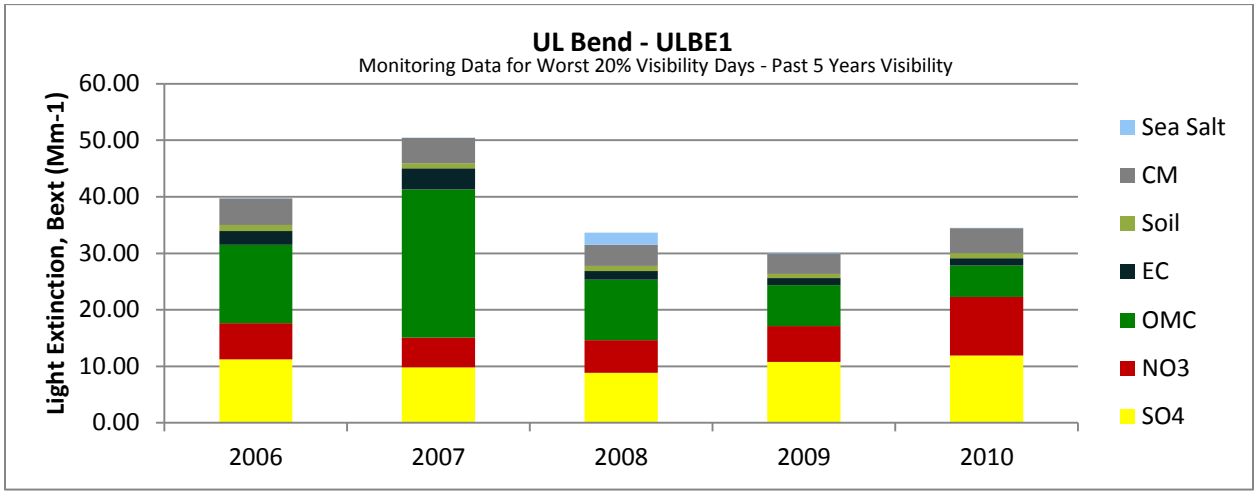


FIGURE 77. CONTRIBUTION BY SPECIES FOR ULBE12006-2010 ON BEST DAYS

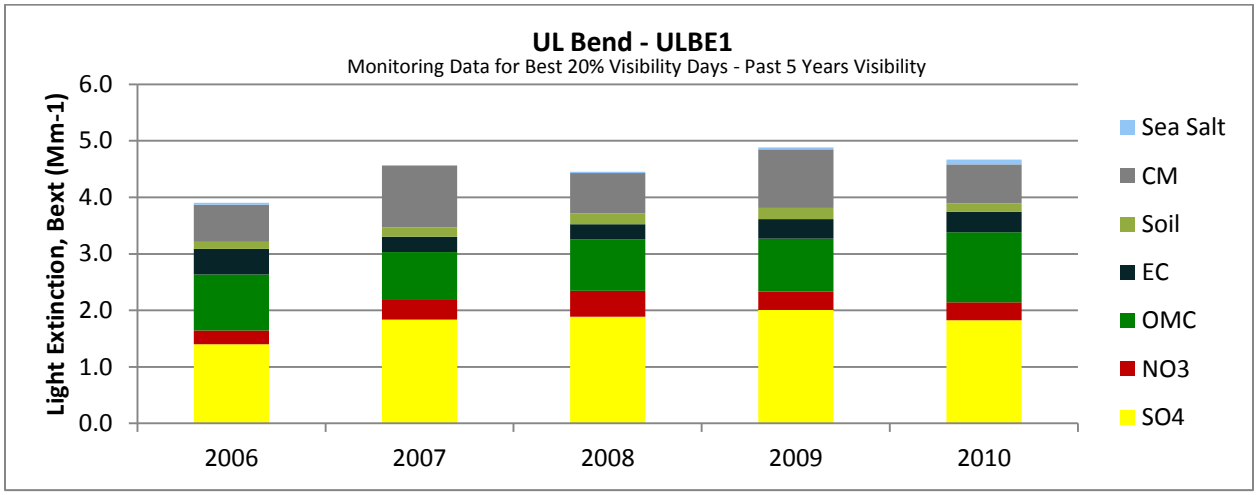


Table 29 shows the difference between the current visibility impairment to the past 5 years visibility. Visibility impairment on the Worst days has decreased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has also improved during the same period.

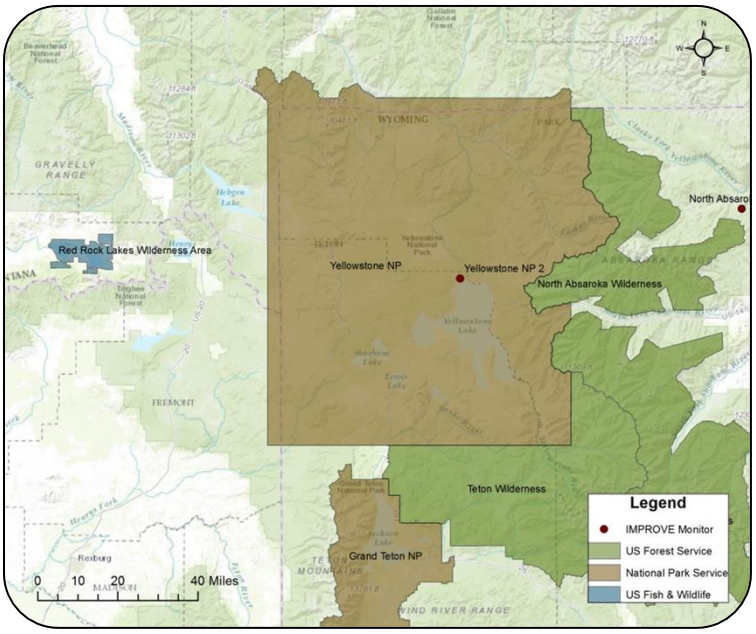
TABLE 29. COMPARISON TO PAST 5 YEARS - ULBE1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
UL Bend (ULBE1)									
Worst Days	2006-2010	15.0	10.52	6.83	12.71	2.04	0.91	4.21	0.47
	2011-2015	14.5	8.27	3.73	18.12	2.30	0.87	4.39	0.04
	Difference	**-0.6**	**-2.25**	**-3.10**	**5.41**	**0.26**	**-0.03**	**0.18**	**-0.43**
Best Days	2006-2010	4.3	1.79	0.34	0.98	0.34	0.16	0.84	0.04
	2011-2015	3.7	1.30	0.30	0.89	0.19	0.12	0.66	0.03
	Difference	**-0.7**	**-0.49**	**-0.04**	**-0.09**	**-0.15**	**-0.04**	**-0.18**	**-0.01**

Yellowstone (YELL2)

The Yellowstone NP 2 IMPROVE monitoring site is located in Yellowstone National Park and is the representative station for the Yellowstone National Park Class I Area and the Red Rock Lakes Wilderness Area. The national park is located in the northwest corner of Wyoming with the northwest and north borders crossing into Montana. The wilderness area is located to the west of the national park, near the Montana/Idaho border. Figure 78 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 78. YELLOWSTONE NATIONAL PARK IMPROVE MONITOR



Current Visibility Conditions

The average visibility impairment at the Yellowstone IMPROVE site was 12.4 dv on the Worst days and 1.5 on the Best days for 2011-2015. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, elemental carbon, coarse mass, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, nitrates and coarse mass. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 30 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 79 and 80 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 30. CURRENT VISIBILITY CONDITIONS - YELL2

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Yellowstone (YELL2)									
Worst Days	2011	12.2	4.52	2.82	14.94	2.45	0.60	1.77	0.63
	2012	16.5	3.59	1.00	41.55	4.46	0.88	2.58	0.11
	2013	11.6	4.20	1.97	11.43	2.73	0.81	4.05	0.09
	2014	9.6	3.63	1.03	8.69	1.49	0.65	2.39	0.04
	2015	12.2	3.09	1.12	24.03	2.59	0.67	2.49	0.04
	Average	**12.4**	**3.81**	**1.59**	**20.13**	**2.74**	**0.72**	**2.66**	**0.18**
Best Days	2011	1.4	1.18	0.44	0.49	0.17	0.05	0.23	0.02
	2012	1.4	1.00	0.47	0.51	0.14	0.08	0.28	0.03
	2013	1.7	1.21	0.45	0.66	0.16	0.09	0.32	0.03
	2014	1.4	0.98	0.38	0.58	0.14	0.07	0.30	0.05
	2015	1.4	1.03	0.41	0.75	0.09	0.05	0.13	0.02
	Average	**1.5**	**1.08**	**0.43**	**0.60**	**0.14**	**0.07**	**0.25**	**0.03**

FIGURE 79. CONTRIBUTION BY SPECIES FOR YELL22011-2015 ON WORST DAYS

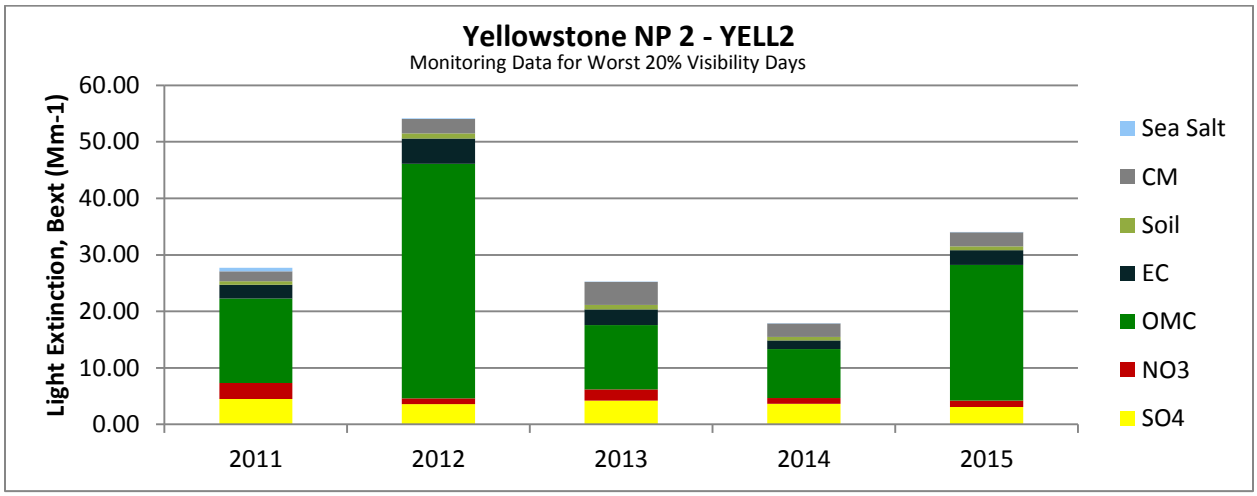
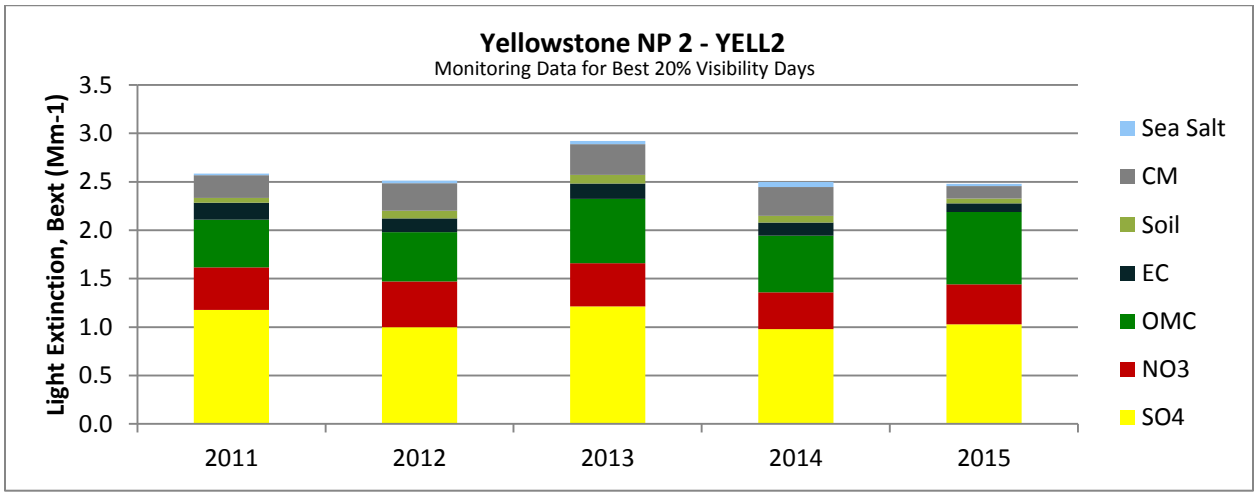


FIGURE 80. CONTRIBUTION BY SPECIES FOR YELL2 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has increased at the Yellowstone IMPROVE site since the 2000-2004 baseline planning period. On the Worst days, visibility impairment increased 0.6 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 31 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 81 and 82 display the species contribution between the baseline period and 2011-2015 planning period for the 20% worst and 20% best visibility days.

TABLE 31. COMPARISON TO BASELINE - YELL2

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4 (Mm^{-1})**	**NO3 (Mm^{-1})**	**OMC (Mm^{-1})**	**EC (Mm^{-1})**	**Soil (Mm^{-1})**	**CM (Mm^{-1})**	**Sea Salt (Mm^{-1})**
Yellowstone (YELL2)									
Worst Days	Baseline	11.8	4.26	1.77	13.48	2.48	0.95	2.58	0.02
	2007-2011	11.7	4.15	1.94	15.52	2.15	0.88	2.71	0.17
	2008-2012	12.5	4.01	1.67	20.89	2.57	0.90	2.69	0.18
	2009-2013	12.0	3.84	1.71	18.07	2.60	0.85	2.99	0.18
	2010-2014	12.0	3.86	1.60	16.76	2.55	0.86	3.00	0.18
	2011-2015	12.4	3.81	1.59	20.13	2.74	0.72	2.66	0.18
	Difference	**0.6**	**-0.45**	**-0.18**	**6.65**	**0.26**	**-0.23**	**0.08**	**0.16**
Best Days	Baseline	2.6	1.47	0.72	1.13	0.31	0.10	0.24	0.02
	2007-2011	1.7	1.21	0.51	0.65	0.18	0.07	0.23	0.03
	2008-2012	1.5	1.16	0.47	0.56	0.16	0.07	0.25	0.02
	2009-2013	1.5	1.17	0.44	0.54	0.16	0.07	0.26	0.02
	2010-2014	1.4	1.08	0.39	0.55	0.14	0.07	0.26	0.03
	2011-2015	1.5	1.08	0.43	0.60	0.14	0.07	0.25	0.03
	Difference	**-1.1**	**-0.39**	**-0.29**	**-0.53**	**-0.17**	**-0.03**	**0.01**	**0.01**

FIGURE 81. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS.

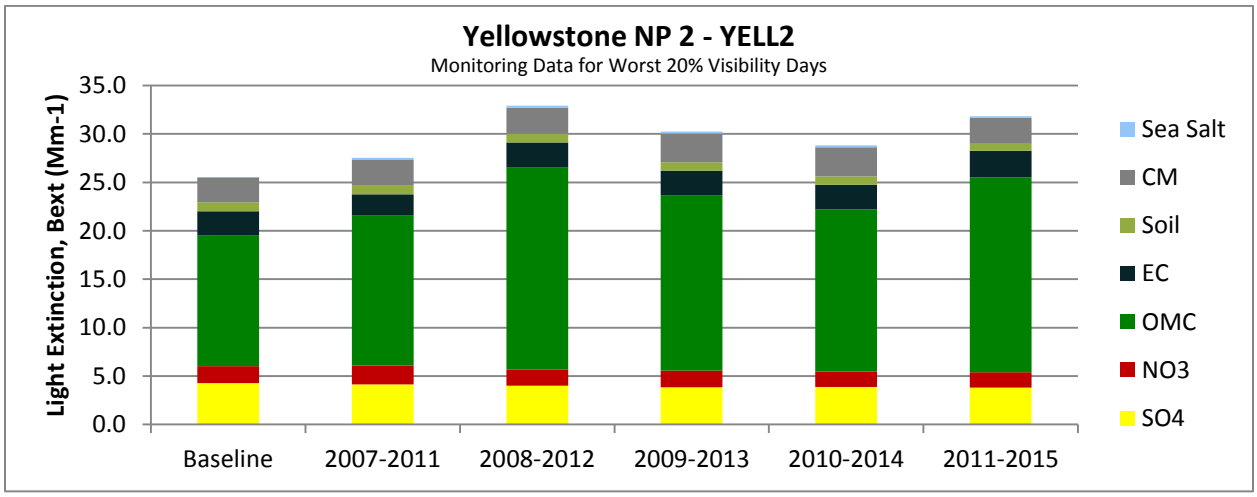
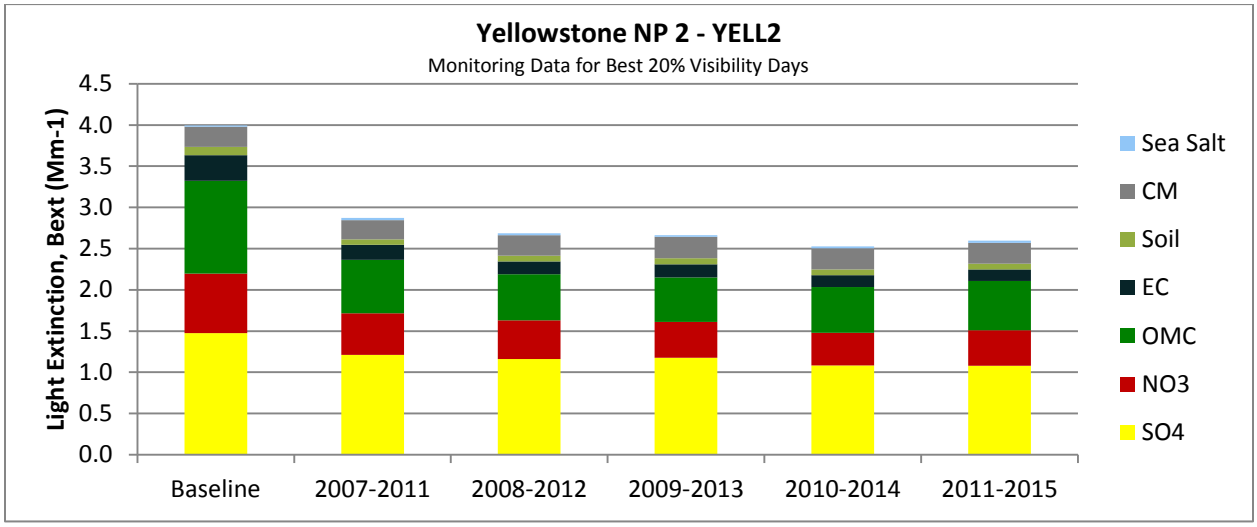
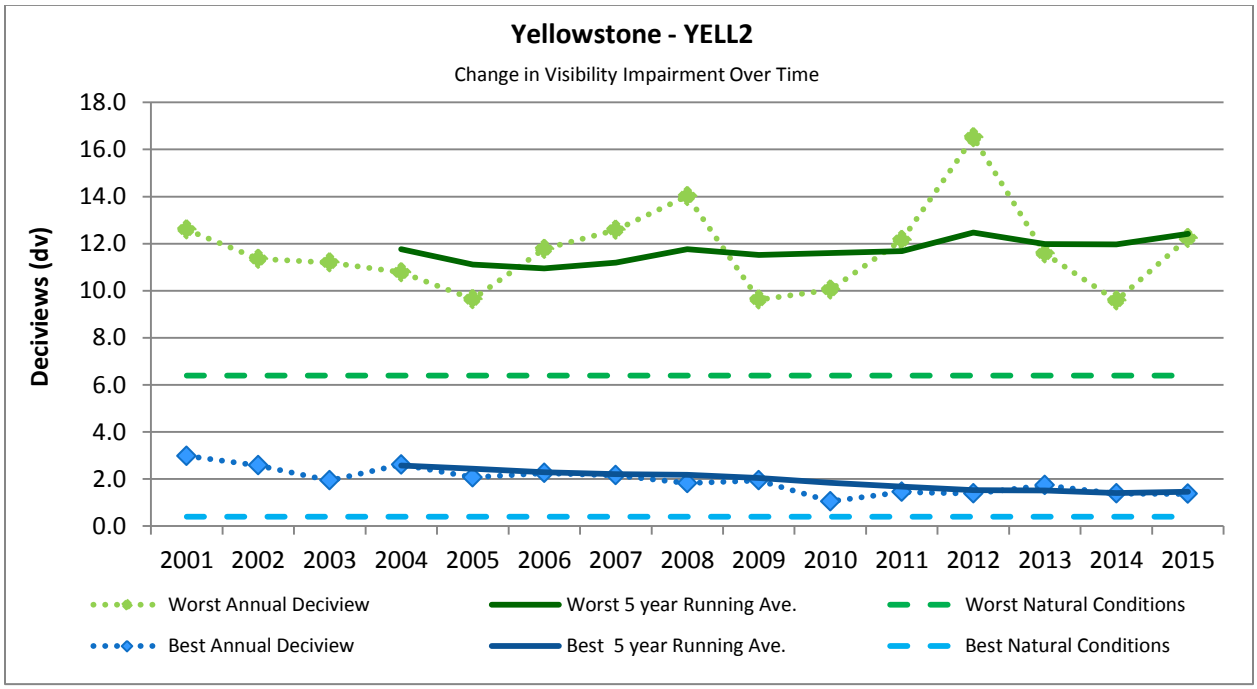


FIGURE 82. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS.



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 83 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 83. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME.



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 84 and 85 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 84. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS.

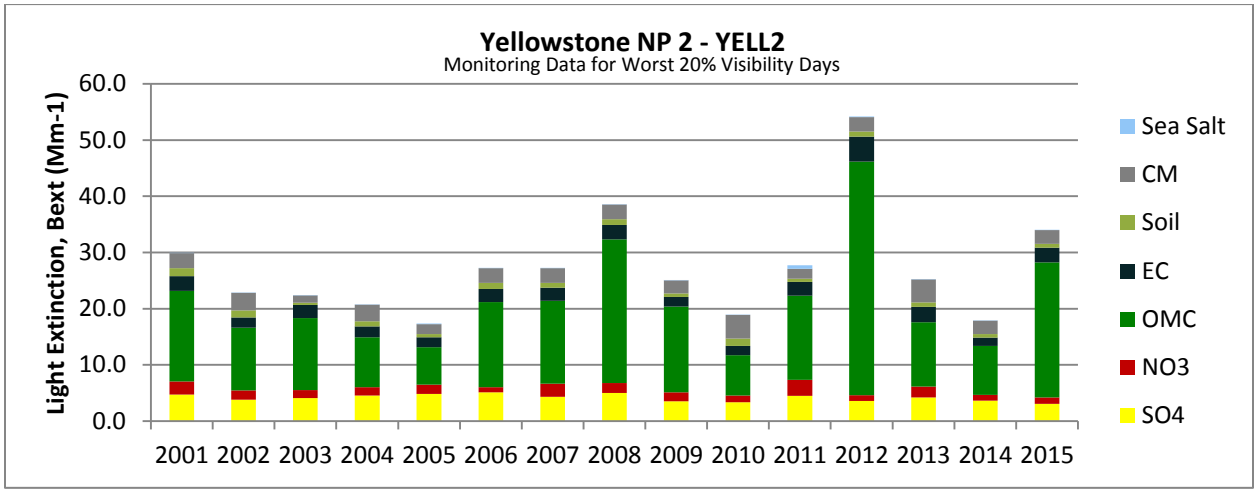


FIGURE 85. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS.

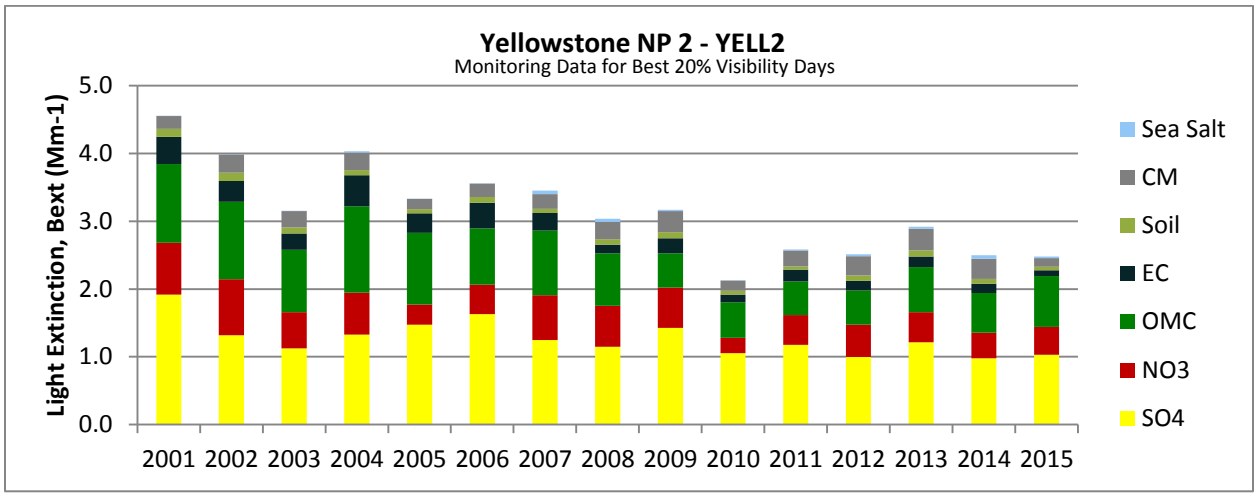
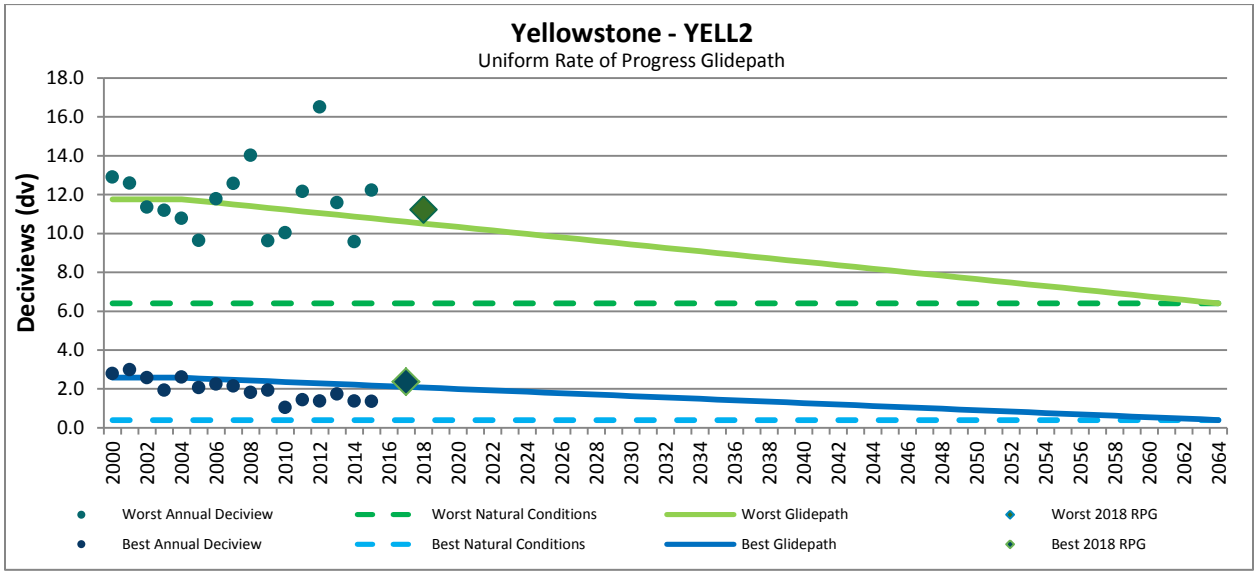


Figure 86 shows how visibility impairment over time matches up with the uniform rate of progress glidepath set for the Cabinet Mountains Wilderness Area.

FIGURE 86. UNIFORM RATE OF PROGRESS - YELL2



Change in Visibility Over 5 Years

The average visibility impairment at the Yellowstone IMPROVE site was 11.6 dv on the Worst days and 1.8 on the Best days for 2006-2010. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, coarse mass, elemental carbon, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by organic carbon, nitrates, coarse mass, and elemental carbon. Soil and sea salt contributed little to the overall visibility impairment. Table 32 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 87 and 88 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 32. PAST 5 YEARS VISIBILITY CONDITIONS - YELL2

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Yellowstone (YELL2)									
Worst Days	2006	11.8	5.13	0.89	15.12	2.35	1.09	2.61	0.04
	2007	12.6	4.30	2.37	14.72	2.37	0.81	2.65	0.04
	2008	14.0	5.02	1.74	25.55	2.57	1.05	2.58	0.09
	2009	9.6	3.52	1.59	15.23	1.73	0.62	2.34	0.06
	2010	10.0	3.38	1.18	7.18	1.61	1.35	4.20	0.03
	Average	**11.6**	**4.27**	**1.56**	**15.56**	**2.13**	**0.98**	**2.88**	**0.05**
Best Days	2006	2.3	1.63	0.43	0.83	0.38	0.08	0.20	0.01
	2007	2.2	1.25	0.66	0.95	0.26	0.06	0.22	0.05
	2008	1.8	1.15	0.61	0.77	0.13	0.08	0.25	0.05
	2009	1.9	1.43	0.59	0.50	0.22	0.09	0.32	0.02
	2010	1.0	1.05	0.23	0.52	0.11	0.06	0.15	0.00
	Average	**1.8**	**1.30**	**0.50**	**0.72**	**0.22**	**0.07**	**0.23**	**0.02**

FIGURE 87. CONTRIBUTION BY SPECIES FOR YELL22006-2010 ON WORST DAYS

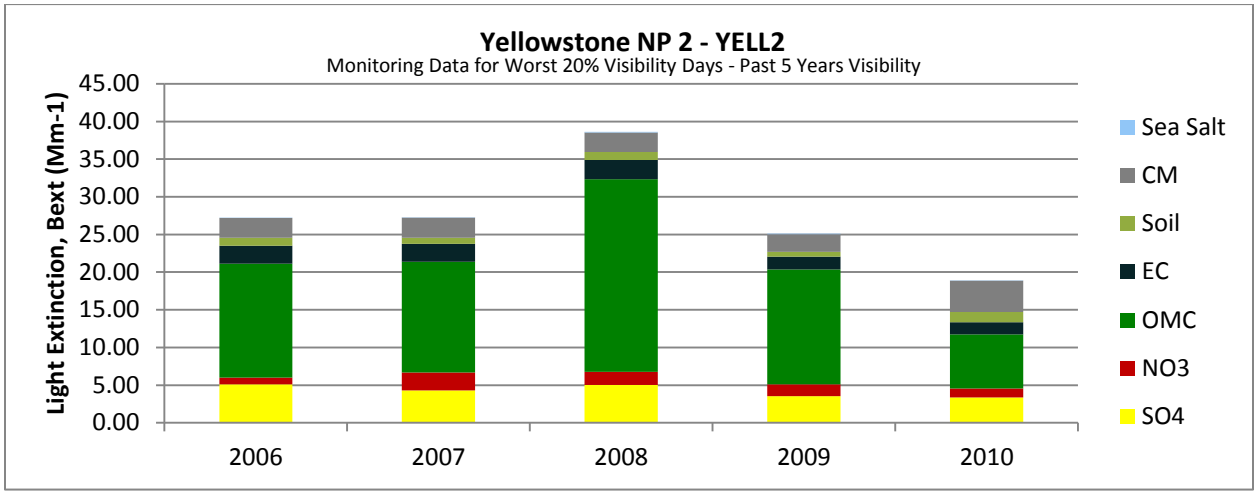


FIGURE 88. CONTRIBUTION BY SPECIES FOR YELL22006-2010 ON BEST DAYS

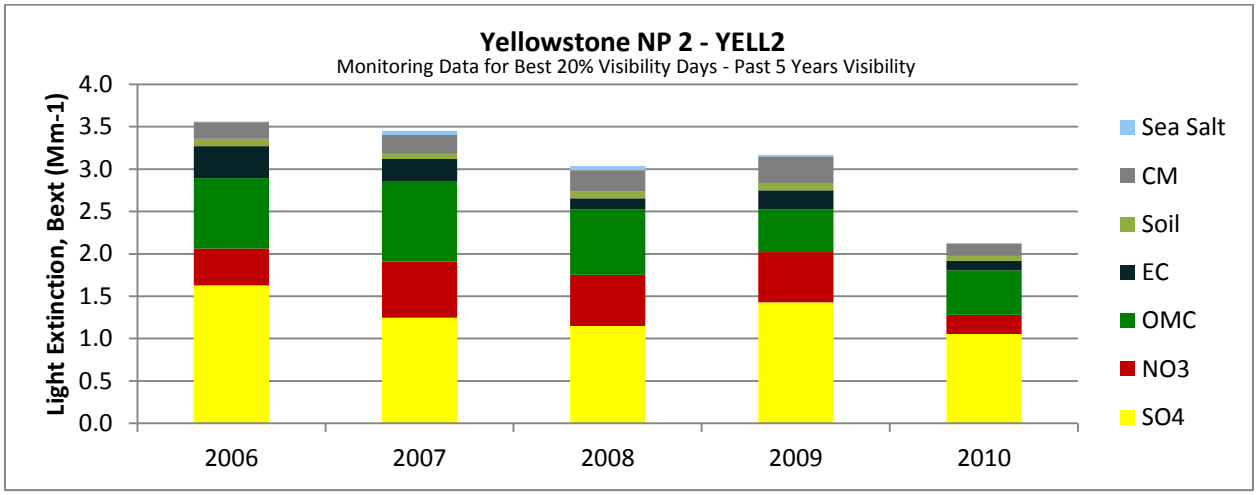


Table 33 shows the difference between the current visibility impairment to the past 5 years visibility. Visibility impairment on the worst days has increased from the 2006-2010 planning period to the 2011-2015 planning period, while visibility impairment on the Best days has improved during the same period.

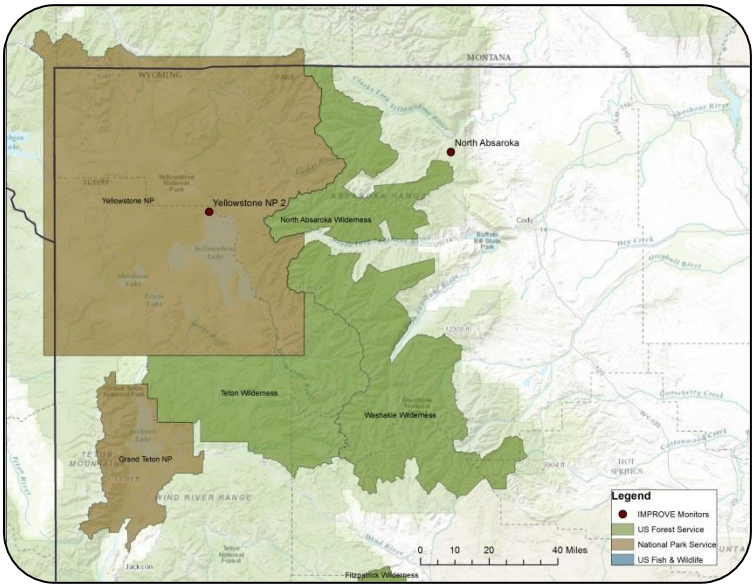
TABLE 33. COMPARISON TO PAST 5 YEARS - YELL2

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO_4**	**NO_3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Yellowstone (YELL2)									
Worst Days	2006-2010	11.6	4.27	1.56	15.56	2.13	0.98	2.88	0.05
	2011-2015	12.4	3.81	1.59	20.13	2.74	0.72	2.66	0.18
	Difference	**0.8**	**-0.46**	**0.03**	**4.57**	**0.62**	**-0.26**	**-0.22**	**0.13**
Best Days	2006-2010	1.8	1.30	0.50	0.72	0.22	0.07	0.23	0.02
	2011-2015	1.5	1.08	0.43	0.60	0.14	0.07	0.25	0.03
	Difference	**-0.4**	**-0.22**	**-0.07**	**-0.12**	**-0.08**	**-0.01**	**0.03**	**0.01**

North Absaroka (NOAB1)

The North Absaroka IMPROVE monitoring site is located to the east of the North Absaroka Wilderness Area and is the representative station for the North Absaroka WA and the Washakie WA. Both wilderness areas are located along the eastern edge of Yellowstone National Park. Figure 89 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 89. NORTH ABSAROKA AND WASHAKIE WILDERNESS AREAS



Current Visibility Conditions

The average visibility impairment at North Absaroka IMPROVE site was 11.8 dv on the Worst days and 1.2 on the Best days for 2011-2015. On the Worst days, the largest average light extinction contribution was from organic carbon, followed by sulfates, coarse mass, elemental carbon, nitrates, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by coarse mass, organic carbon, and nitrates. Elemental carbon, soil, and sea salt contributed little to the overall visibility impairment. Table 34 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 90 and 91 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 34. CURRENT VISIBILITY CONDITIONS – NOAB1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
North Absaroka (NOAB1)									
Worst Days	2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2012	15.4	4.03	1.05	33.82	3.92	1.40	2.20	0.04
	2013	10.0	4.54	1.55	9.02	1.42	0.98	2.20	0.06
	2014	9.2	3.81	1.02	7.62	1.30	0.87	2.03	0.05
	2015	12.4	3.02	0.96	21.12	2.20	0.59	2.97	0.01
	Average	**11.8**	**3.85**	**1.14**	**17.89**	**2.21**	**0.96**	**2.35**	**0.04**
Best Days	2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2012	1.4	0.88	0.28	0.54	0.07	0.10	0.70	0.01
	2013	1.3	0.89	0.23	0.56	0.10	0.11	0.54	0.01
	2014	0.9	0.92	0.25	0.14	0.07	0.09	0.49	0.01
	2015	1.0	0.94	0.16	0.45	0.06	0.05	0.38	0.02
	Average	**1.2**	**0.91**	**0.23**	**0.42**	**0.08**	**0.09**	**0.53**	**0.01**

FIGURE 90. CONTRIBUTION BY SPECIES FOR NOAB1 2011-2015 ON WORST DAYS

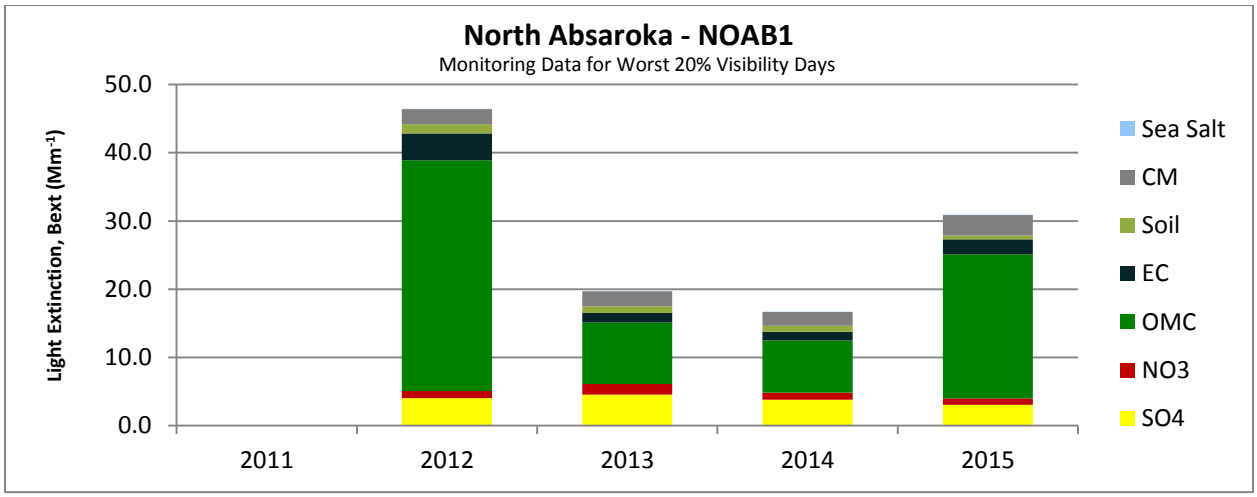
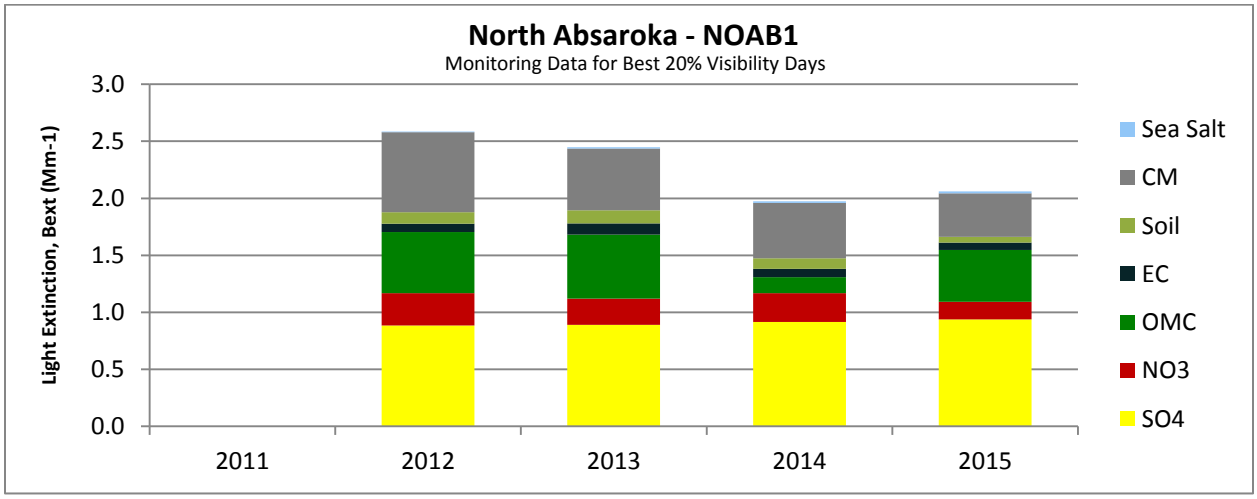


FIGURE 91. CONTRIBUTION BY SPECIES FOR NOAB1 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has increased on the Worst days in the North Absaroka WA since the 2000-2004 baseline period. On the Worst days, average visibility impairment increased 0.3 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 35 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 92 and 93 display the species contribution in five-year rolling averages between the baseline period and 2011-2015 period for the 20% worst and 20% best visibility days.

TABLE 35. COMPARISON OF CURRENT TO BASELINE - NOAB1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
North Absaroka (NOAB1)									
Worst Days	Baseline	11.5	4.87	1.61	11.64	1.86	0.85	2.91	0.01
	2007-2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008-2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2009-2013	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010-2014	11.6	4.13	1.20	16.82	2.22	1.09	2.14	0.05
	2011-2015	11.8	3.85	1.14	17.89	2.21	0.96	2.35	0.04
	Difference	**0.3**	**-1.02**	**-0.46**	**6.25**	**0.35**	**0.11**	**-0.56**	**0.03**
Best Days	Baseline	2.0	1.11	0.37	0.80	0.16	0.12	0.71	0.02
	2007-2011	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008-2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2009-2013	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010-2014	1.2	0.90	0.25	0.41	0.08	0.10	0.58	0.01
	2011-2015	1.2	0.91	0.23	0.42	0.08	0.09	0.53	0.01
	Difference	**-0.9**	**-0.20**	**-0.14**	**-0.37**	**-0.09**	**-0.03**	**-0.18**	**-0.01**

FIGURE 92. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

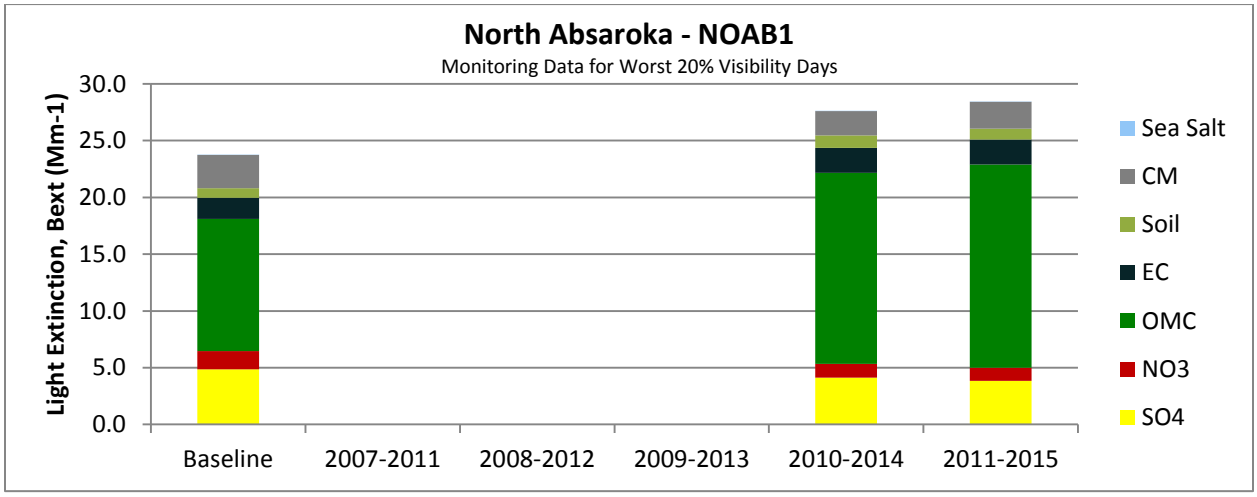
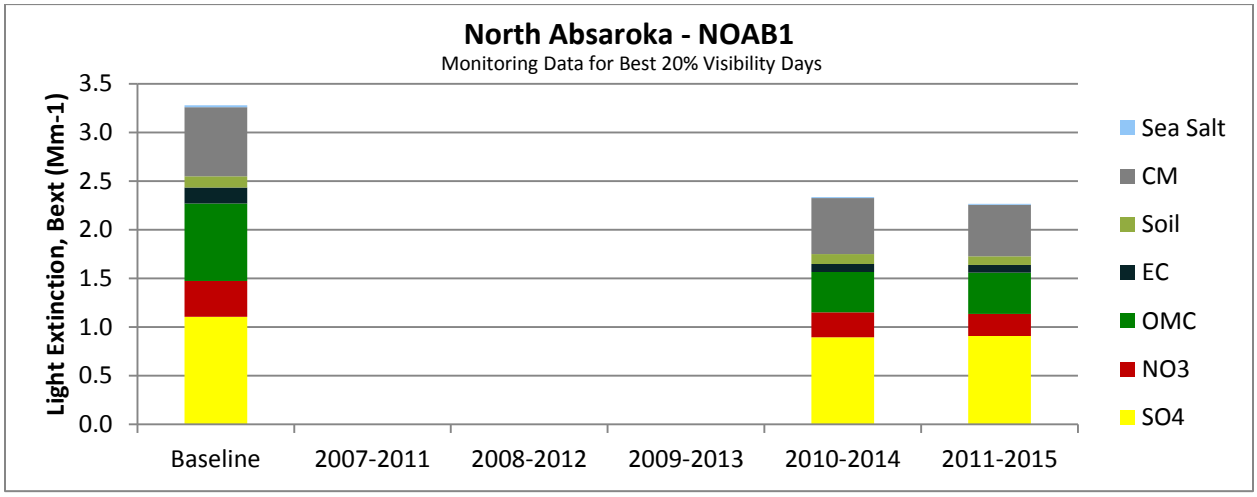
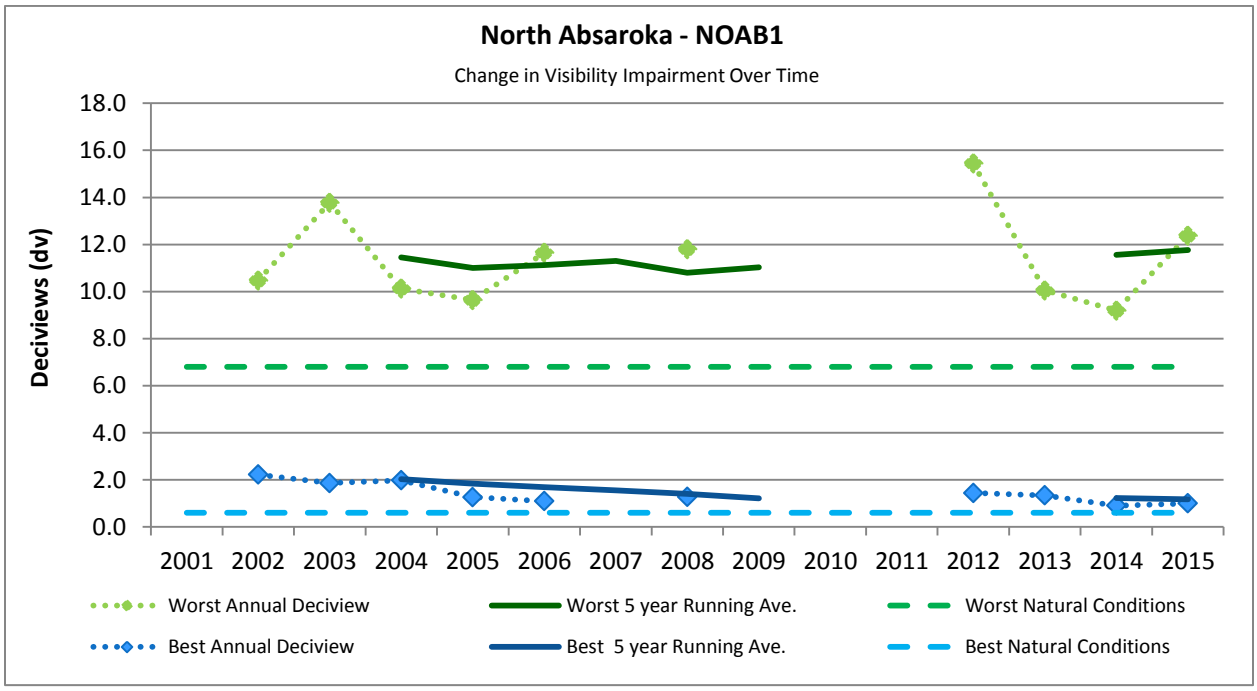


FIGURE 93. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 94 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 94. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility. The overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 95 and 96 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 95. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

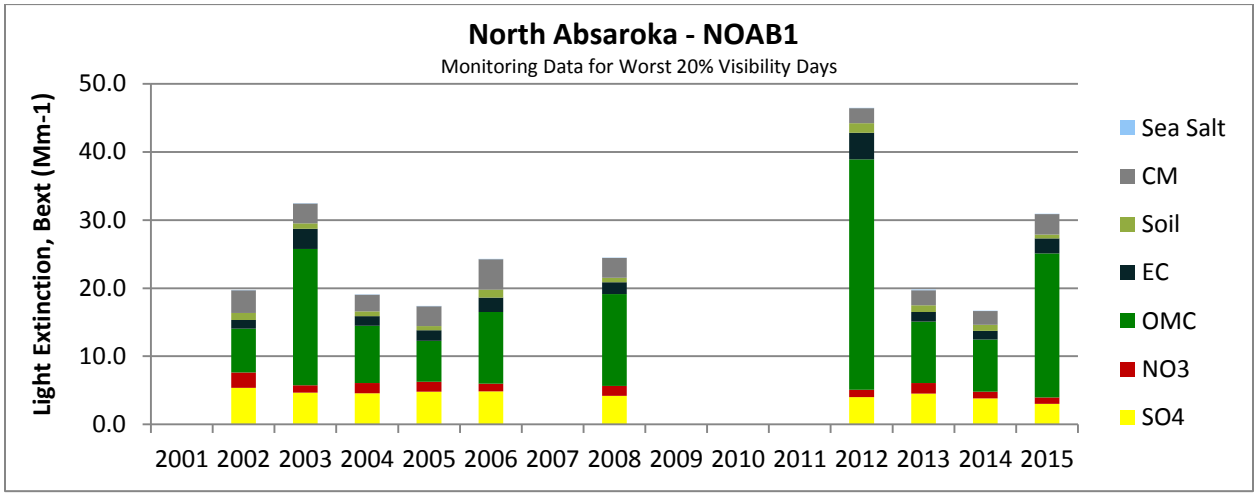


FIGURE 96. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

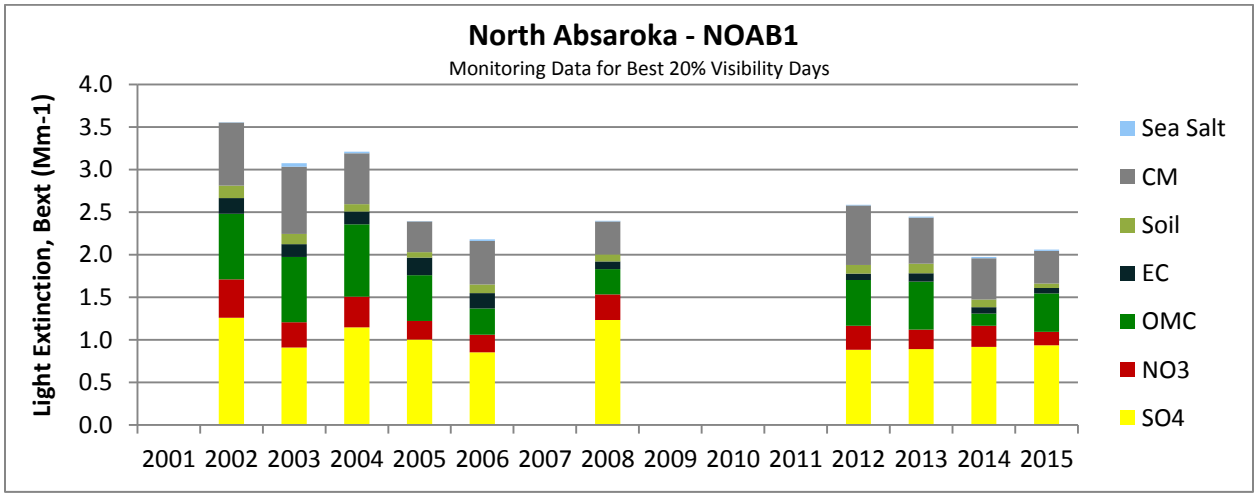
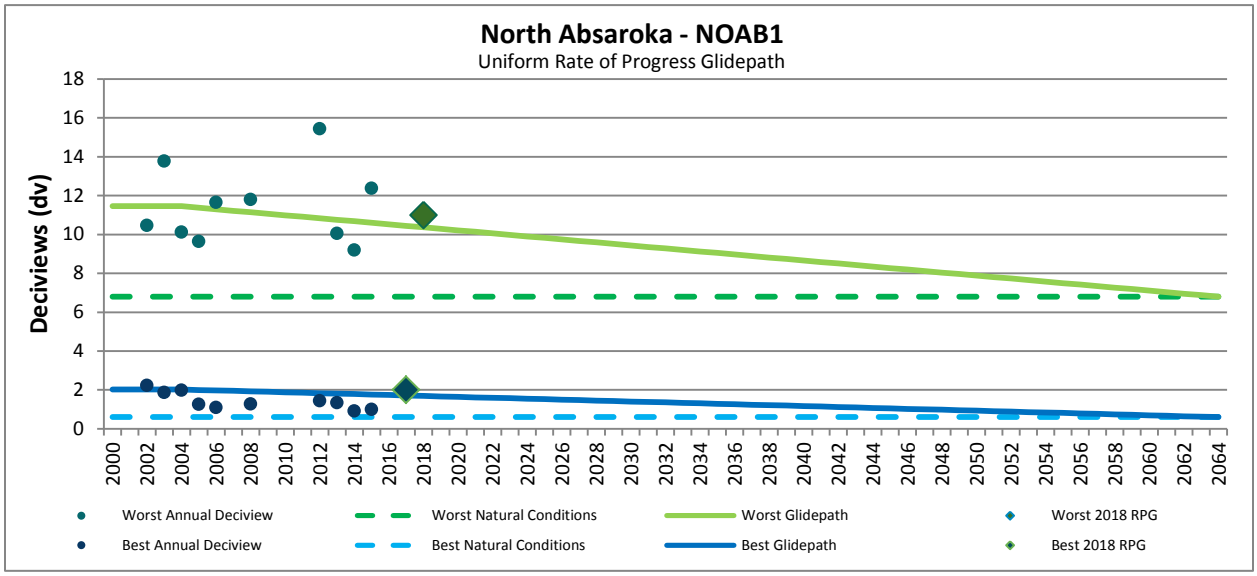


Figure 97 shows how visibility impairment over time matches up with the uniform rate of progress glidepath and the modeled 2018 reasonable progress goals set for the North Absaroka Wilderness Area.

FIGURE 97. UNIFORM RATE OF PROGRESS - NOAB1



Change in Visibility Over Past 5 Years

The average visibility impairment at the North Absaroka IMPROVE site is not available for the 2006-2010 period due to three years of missing data (2007, 2009, 2010). Table 36 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 98 and 99 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 36. PAST 5 YEARS VISIBILITY CONDITIONS – NOAB1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
North Absaroka (NOAB1)									
Worst Days	2006	11.6	4.83	1.14	10.52	2.14	1.17	4.44	0.02
	2007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008	11.8	4.19	1.48	13.46	1.75	0.67	2.88	0.03
	2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Best Days	2006	1.1	0.85	0.21	0.31	0.18	0.10	0.51	0.02
	2007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008	1.3	1.23	0.30	0.30	0.09	0.08	0.39	0.01
	2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

FIGURE 98. CONTRIBUTION BY SPECIES FOR NOAB1 2006-2010 ON WORST DAYS

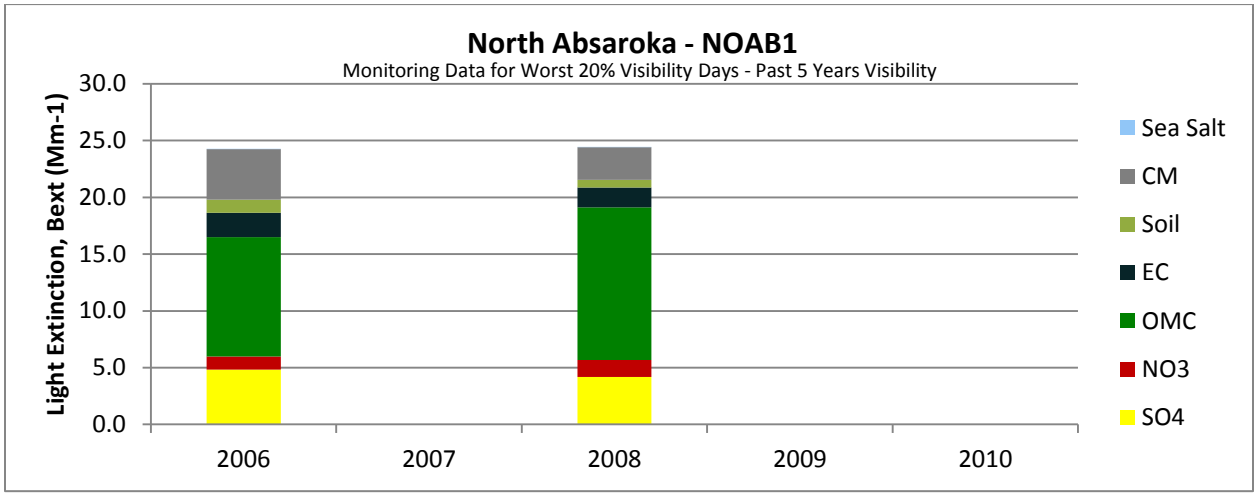


FIGURE 99. CONTRIBUTION BY SPECIES FOR NOAB1 2006-2010 ON BEST DAYS

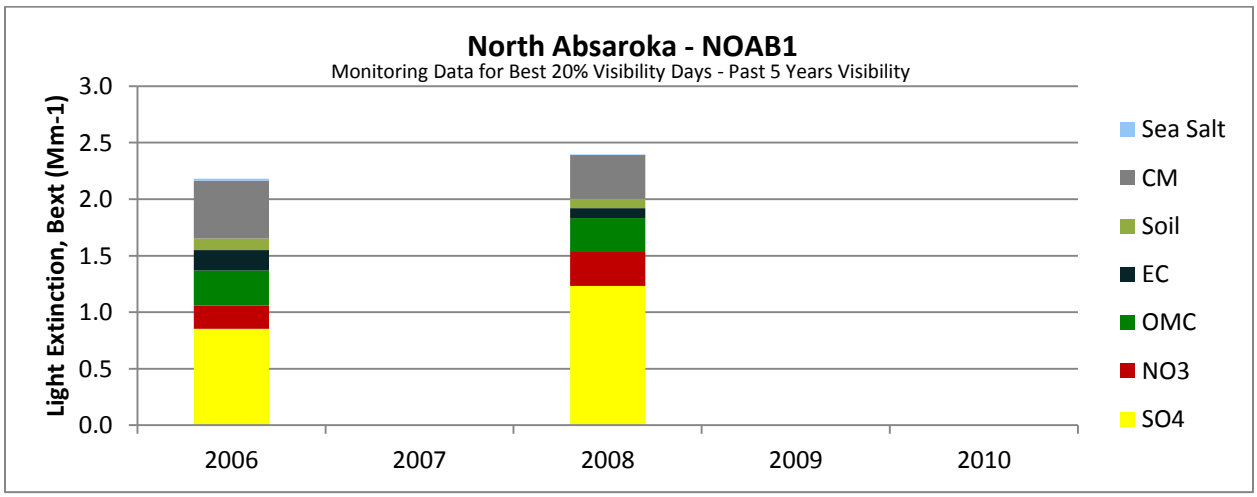


Table 37 shows the difference between the current visibility impairment and the past five years. Due to missing data, this comparison cannot be made to the past five years.

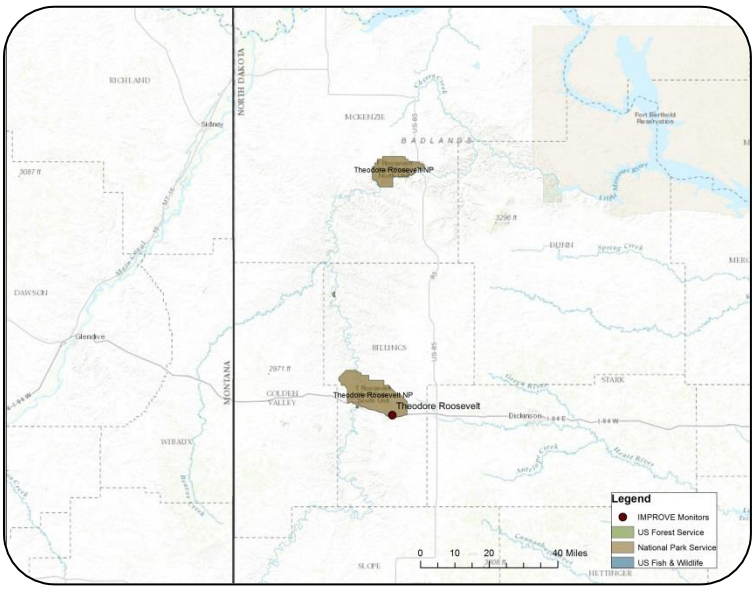
TABLE 37. COMPARISON OF CURRENT TO PAST 5 YEARS - NOAB1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
North Absaroka (NOAB1)									
Worst Days	2006-2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2011-2015	11.8	3.85	1.14	17.89	2.21	0.96	2.35	0.04
	Difference	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Best Days	2006-2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2011-2015	1.2	0.91	0.23	0.42	0.08	0.09	0.53	0.01
	Difference	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Theodore Roosevelt (THRO1)

The Theodore Roosevelt IMPROVE monitoring site is located on western North Dakota and is the representative IMPROVE monitor for the Theodore Roosevelt National Park. Figure 100 shows this Class I Area with the IMPROVE monitoring site.

FIGURE 100. THEODORE ROOSEVELT NATIONAL PARK



Current Visibility Conditions

The average visibility impairment at Theodore Roosevelt IMPROVE site was 16.4 dv on the Worst days and 6.2 on the Best days for 2011-2015. On the Worst days, the largest average light extinction contribution was from sulfates, followed by organic carbon, nitrates, coarse mass, elemental carbon, and soil. Sea salt contributed very little to the overall visibility impairment. On the Best days, sulfates had the largest contribution followed by coarse mass, organic carbon, nitrates, elemental carbon, and soil. Sea salt contributed little to the overall visibility impairment. Table 38 displays the current annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 101 and 102 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 38. CURRENT VISIBILITY CONDITIONS – THRO1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Theodore Roosevelt (THRO1)									
Worst Days	2011	16.4	16.20	10.08	6.13	2.26	0.98	5.89	0.16
	2012	16.3	12.30	7.58	9.71	2.52	1.32	7.18	0.22
	2013	16.0	13.14	13.11	6.43	2.13	0.70	4.38	0.13
	2014	15.4	10.53	6.32	10.15	2.43	0.92	6.20	0.11
	2015	17.9	11.85	7.65	29.24	3.33	0.81	5.03	0.16
	Average	**16.4**	**12.80**	**8.95**	**12.33**	**2.53**	**0.95**	**5.74**	**0.16**
Best Days	2011	5.8	2.43	0.93	1.38	0.59	0.15	1.36	0.12
	2012	6.1	2.36	0.64	1.37	0.78	0.27	1.97	0.07
	2013	6.5	2.66	1.31	1.66	0.65	0.29	1.79	0.05
	2014	6.1	2.70	0.99	1.43	0.64	0.20	1.63	0.06
	2015	6.2	2.33	0.80	1.74	0.57	0.38	1.95	0.03
	Average	**6.2**	**2.49**	**0.93**	**1.52**	**0.65**	**0.26**	**1.74**	**0.07**

FIGURE 101. CONTRIBUTION BY SPECIES FOR THOR1 2011-2015 ON WORST DAYS

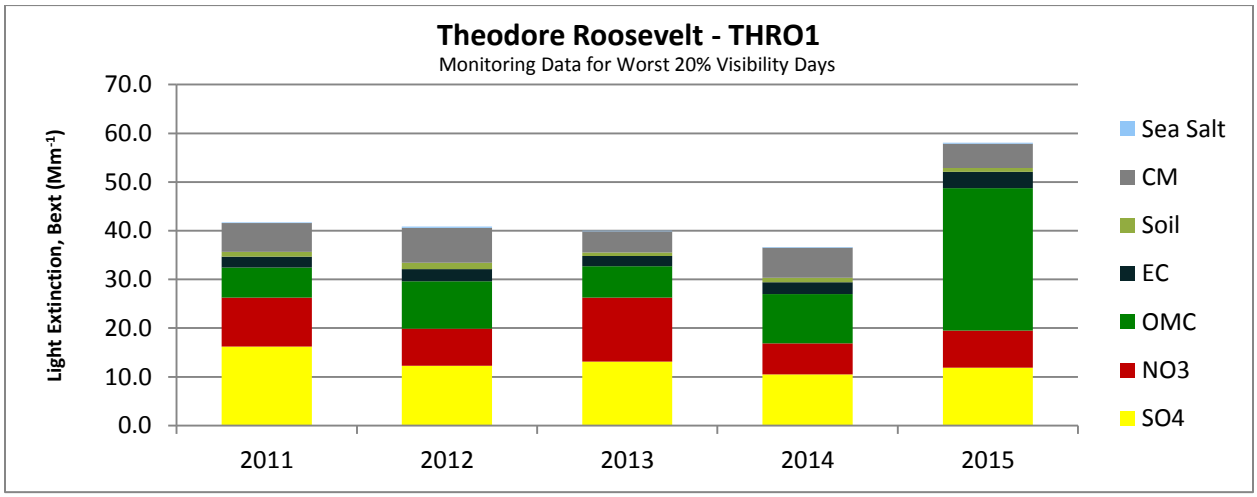
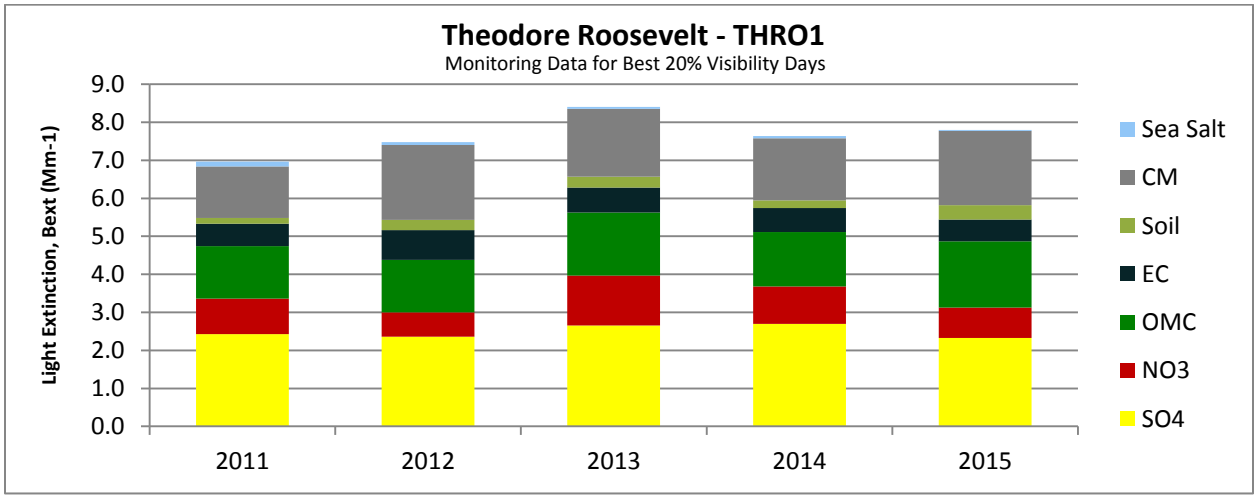


FIGURE 102. CONTRIBUTION BY SPECIES FOR THOR1 2011-2015 ON BEST DAYS



Differences between Current and Baseline Conditions

Visibility impairment has decreased on the Worst days in the Theodore Roosevelt NP since the 2000-2004 baseline period. On the Worst days, average visibility impairment decreased 1.3 deciviews over the 11-year period. The most substantial increase was in organic carbon, while sulfates and nitrates both decreased during the time period. Table 39 shows the average visibility impairment and species contribution from the baseline through each planning period. The difference field represents the difference between the 2011-2015 planning period and baseline. Figures 103 and 104 display the species contribution in five-year rolling averages between the baseline period and 2011-2015 period for the 20% worst and 20% best visibility days.

TABLE 39. COMPARISON OF CURRENT TO BASELINE - THOR1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Theodore Roosevelt (THRO1)									
Worst Days	Baseline	17.7	17.81	13.77	10.58	2.62	0.93	4.62	0.09
	2007-2011	17.5	19.00	13.15	8.18	2.24	0.87	5.43	0.56
	2008-2012	17.3	17.66	12.03	8.49	2.30	0.96	5.78	0.49
	2009-2013	17.0	16.97	12.29	6.83	2.22	0.95	5.84	0.12
	2010-2014	16.6	14.67	11.18	7.77	2.33	1.01	6.20	0.14
	2011-2015	16.4	12.80	8.95	12.33	2.53	0.95	5.74	0.16
	Difference	**-1.3**	**-5.01**	**-4.83**	**1.75**	**-0.08**	**0.02**	**1.11**	**0.07**
Best Days	Baseline	7.6	3.54	1.51	1.99	0.88	0.42	2.22	0.04
	2007-2011	6.5	3.24	0.81	1.50	0.66	0.26	1.70	0.06
	2008-2012	6.4	3.06	0.78	1.47	0.68	0.26	1.75	0.06
	2009-2013	6.4	2.94	0.90	1.50	0.67	0.27	1.74	0.06
	2010-2014	6.2	2.66	0.89	1.49	0.67	0.25	1.71	0.06
	2011-2015	6.2	2.49	0.93	1.52	0.65	0.26	1.74	0.07
	Difference	**-1.5**	**-1.05**	**-0.57**	**-0.47**	**-0.23**	**-0.16**	**-0.48**	**0.02**

FIGURE 103. SPECIES CONTRIBUTION BY PLANNING PERIOD ON WORST DAYS

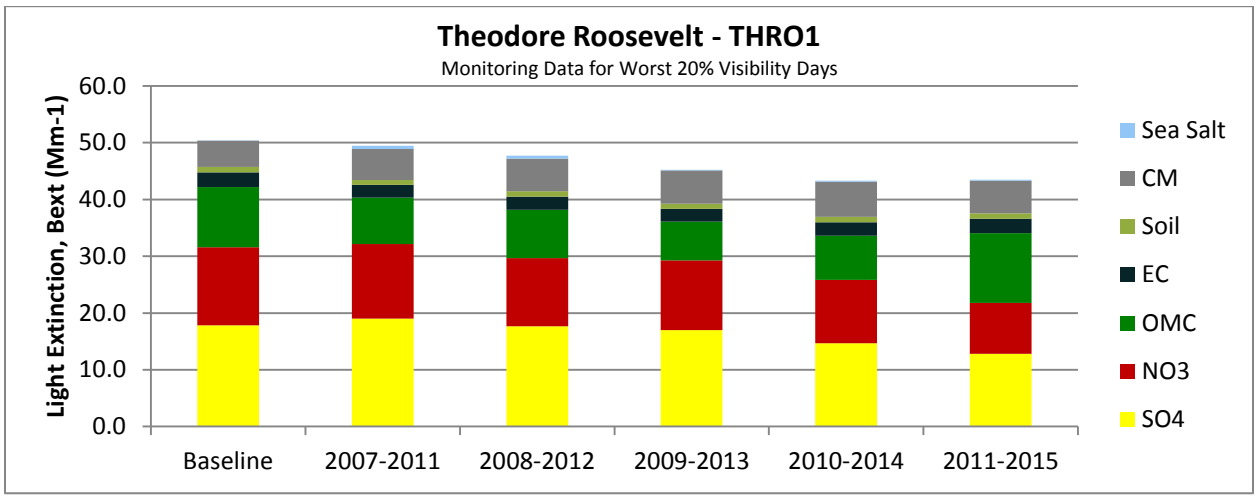
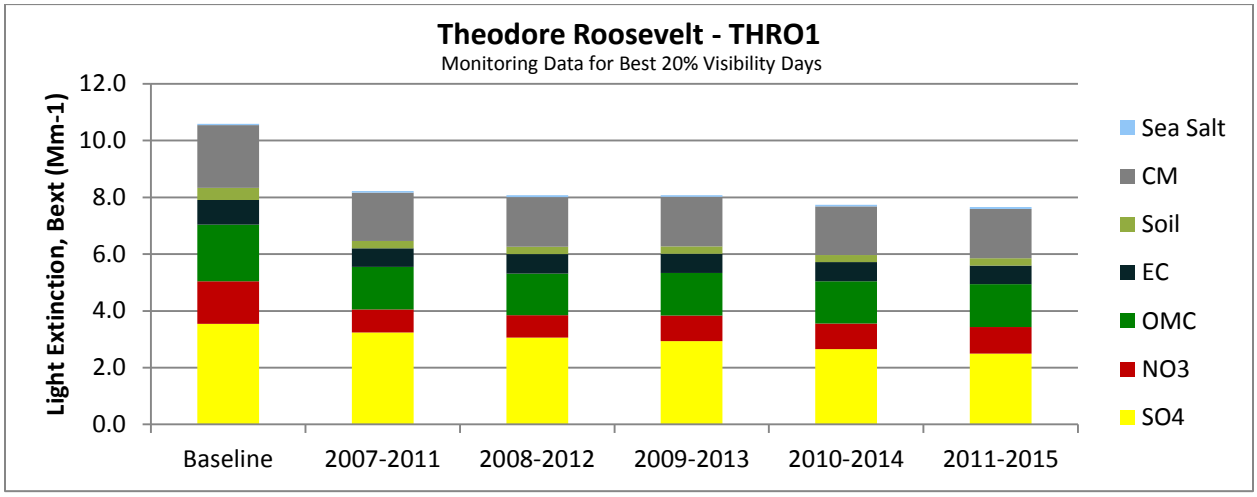
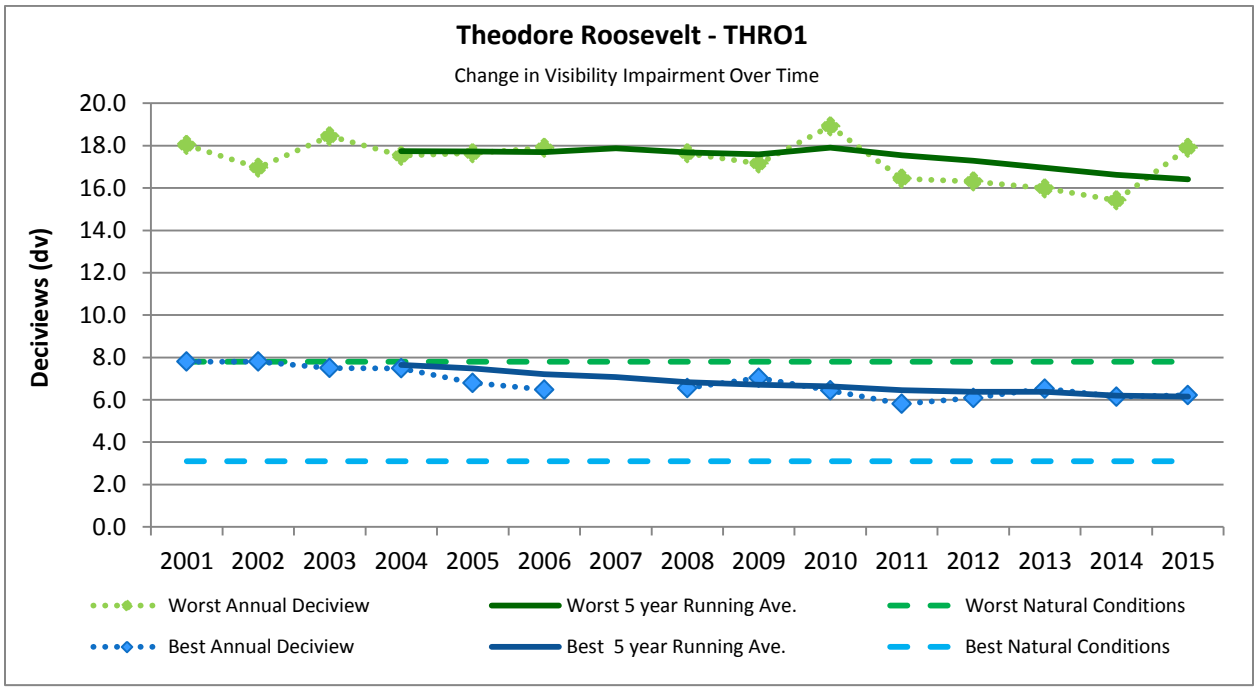


FIGURE 104. SPECIES CONTRIBUTION BY PLANNING PERIOD ON BEST DAYS



EPA guidance (2013) recommends showing how visibility has changed through time using both annual and 5-year averages. Figure 105 below displays the annual visibility impairment in deciviews since 2001, along with the 5-year rolling average for both the 20% worst and 20% best visibility days.

FIGURE 105. CHANGE IN VISIBILITY IMPAIRMENT OVER TIME



A review of the annual contribution since the baseline period indicates that organic carbon remains a volatile contributor to overall visibility, particularly in 2015. Sulfates and nitrates have also varied in recent years, likely due to the growth of the oil and gas industry in western North Dakota. There is an overall negative trend of visibility impairment on the Best days indicates a steady reduction in sulfate and nitrate contributions. Figure 106 and 107 show the annual average light extinction contributions by species on the Worst and Best days, respectively.

FIGURE 106. SPECIES CONTRIBUTION 2001-2015 ON THE WORST DAYS

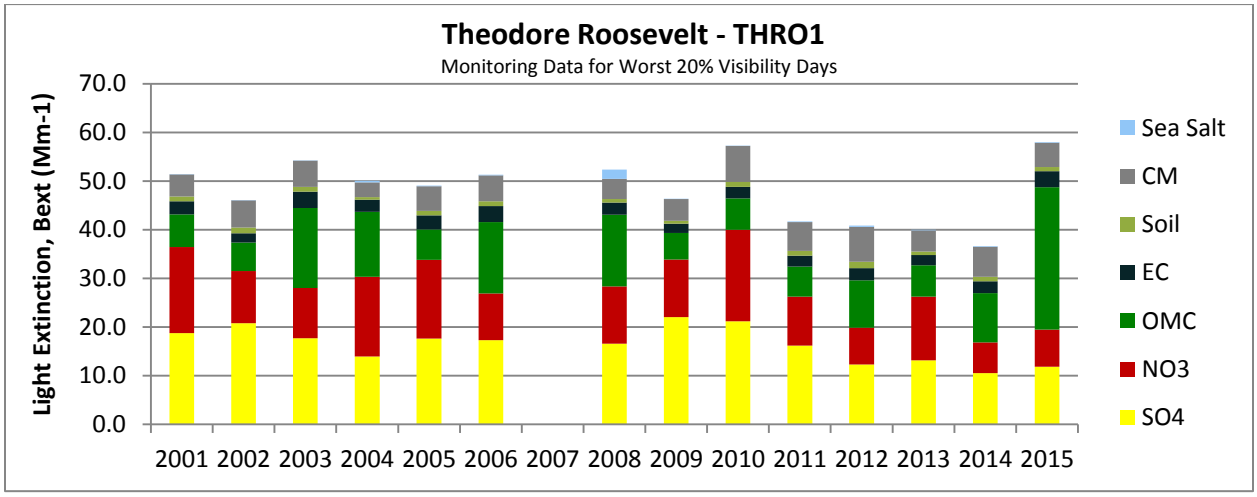


FIGURE 107. SPECIES CONTRIBUTION 2001-2015 ON THE BEST DAYS

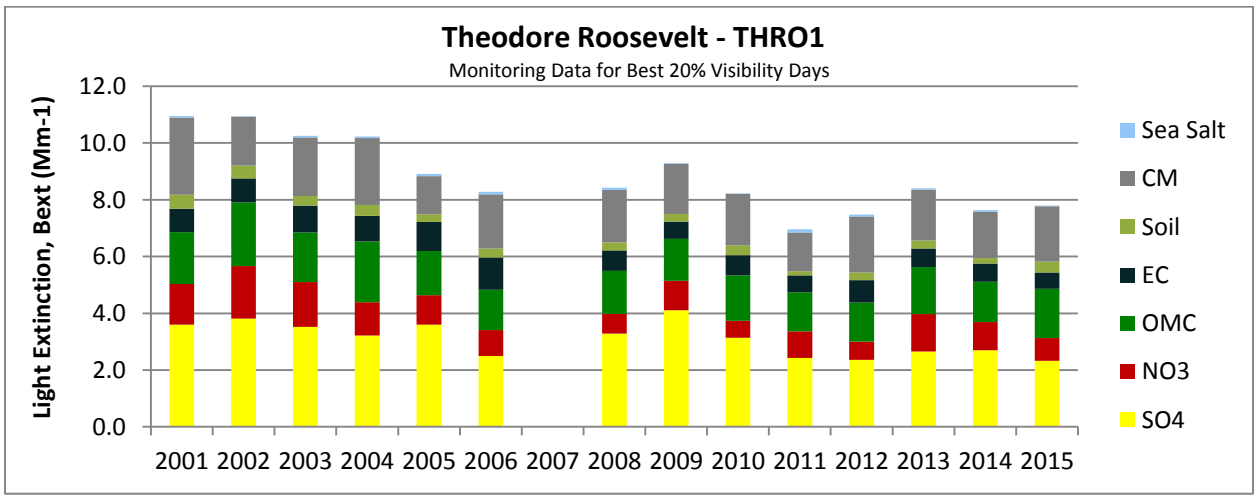
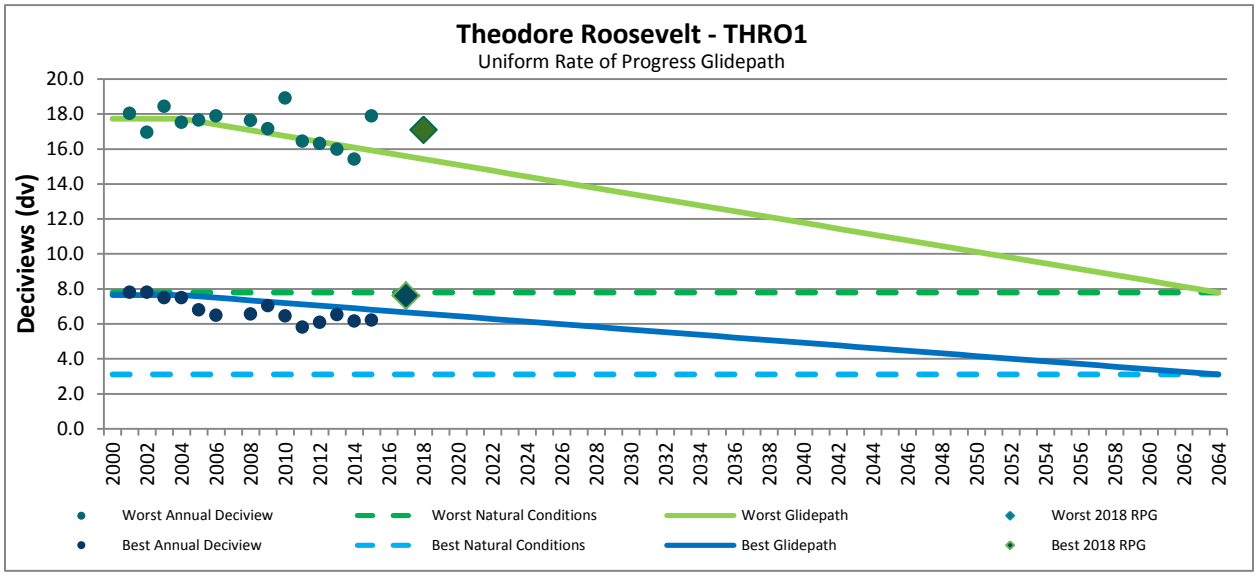


Figure 108 shows how visibility impairment over time matches up with the uniform rate of progress glidepath and the modeled 2018 reasonable progress goals set for the Theodore Roosevelt National Park.

FIGURE 108. UNIFORM RATE OF PROGRESS – THOR1



Change in Visibility Over Past 5 Years

The average visibility impairment at the Theodore Roosevelt IMPROVE site was 17.9 dv on the Worst days and 6.6 on the Best days for 2006-2010. On the Worst days the largest average light extinction contribution was from sulfates, followed by nitrates, organic carbon, coarse mass, elemental carbon, soil, and seas salt. On the Best days, sulfates had the largest contribution followed by coarse mass, organic carbon, elemental carbon, nitrates, and soil. Sea salt contributed little to the overall visibility impairment. Table 40 displays the past 5 years of annual average light extinction and visibility impairment on the 20% worst and 20% best visibility days. Figures 109 and 110 display the contribution by species on the 20% worst and 20% best visibility days, respectively.

TABLE 40. PAST 5 YEARS VISIBILITY CONDITIONS – THOR1

			Contribution to Light Extinction (Mm^{-1})						
	Year	Deciview	SO_4	NO_3	OMC	EC	Soil	CM	Sea Salt
Theodore Roosevelt (THRO1)									
Worst Days	2006	17.9	17.34	9.55	14.70	3.31	0.96	5.35	0.09
	2007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008	17.6	16.58	11.79	14.72	2.49	0.76	4.08	1.97
	2009	17.2	22.02	11.89	5.42	1.89	0.65	4.41	0.05
	2010	18.9	21.21	18.82	6.45	2.31	1.10	7.33	0.06
	Average	**17.9**	**19.29**	**13.01**	**10.33**	**2.50**	**0.87**	**5.29**	**0.54**
Best Days	2006	6.5	2.50	0.91	1.42	1.14	0.32	1.90	0.09
	2007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2008	6.6	3.28	0.70	1.51	0.72	0.28	1.85	0.08
	2009	7.0	4.10	1.04	1.48	0.60	0.27	1.77	0.03
	2010	6.4	3.14	0.59	1.60	0.71	0.36	1.81	0.00
	Average	**6.6**	**3.26**	**0.81**	**1.50**	**0.79**	**0.30**	**1.83**	**0.05**

FIGURE 109. CONTRIBUTION BY SPECIES FOR THRO1 2006-2010 ON WORST DAYS

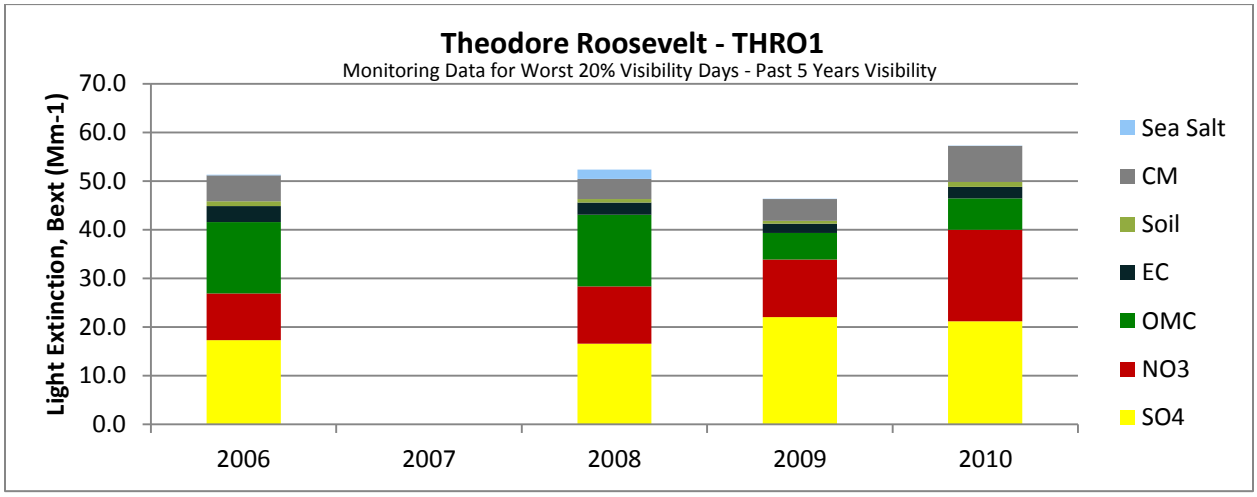


FIGURE 110. CONTRIBUTION BY SPECIES FOR THRO1 2006-2010 ON BEST DAYS

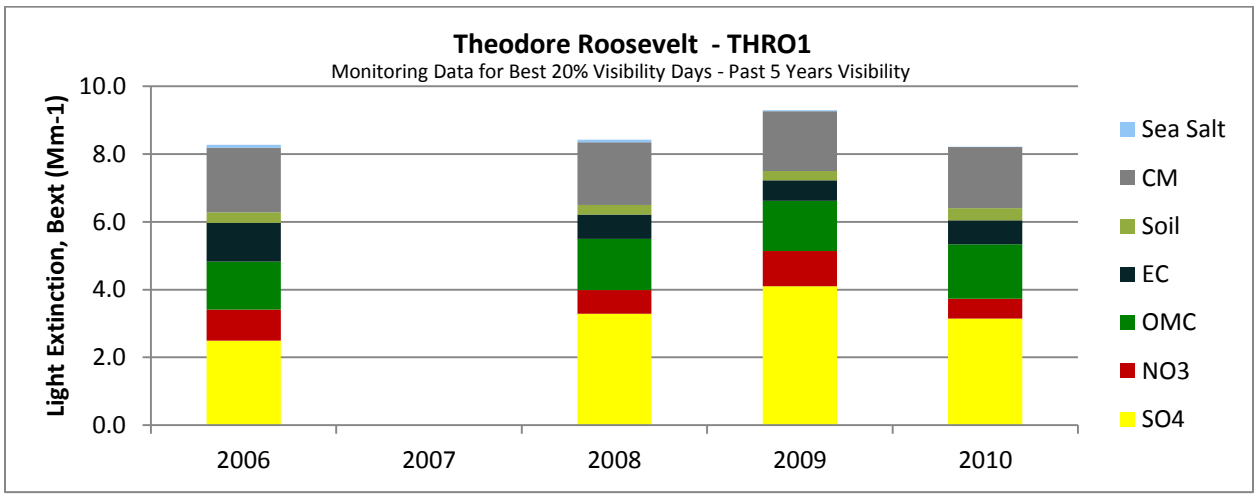


Table 41 shows the difference between the current visibility impairment and the past five years. Due to missing data, this comparison cannot be made to the past five years.

TABLE 41. COMPARISON OF CURRENT TO PAST 5 YEARS - THRO1

			Contribution to Light Extinction (Mm^{-1})						
	Planning Period	**Deciview**	**SO4**	**NO3**	**OMC**	**EC**	**Soil**	**CM**	**Sea Salt**
Theodore Roosevelt (THRO1)									
Worst Days	2006-2010	17.9	19.29	13.01	10.33	2.50	0.87	5.29	0.54
	2011-2015	16.4	12.80	8.95	12.33	2.53	0.95	5.74	0.16
	Difference	**-1.5**	**-6.48**	**-4.07**	**2.00**	**0.03**	**0.08**	**0.44**	**-0.38**
Best Days	2006-2010	6.6	3.26	0.81	1.50	0.79	0.30	1.83	0.05
	2011-2015	6.2	2.49	0.93	1.52	0.65	0.26	1.74	0.07
	Difference	**-0.5**	**-0.76**	**0.13**	**0.01**	**-0.15**	**-0.05**	**-0.09**	**0.02**

Appendix D. Documentation of Federal Land Manager Consultation & Public Notice Process

CONTENTS

(1) Letters to Federal Land Managers
(2) Response from Federal Land Managers
(3) SIP public notice statement
(4) Notice as published on DEQ website
(5) Proof of notice to interested parties
(6) Public hearing transcript
(7) Written public comments

July 12, 2017

Tim Allen
U.S. Fish and Wildlife Service
Branch of Air Quality
7333 W Jefferson Ave, Ste. 375
Lakewood, CO 80235-2017

Montana Regional Haze Five-Year Progress Report

Dear Mr. Allen:

In 1999, the U.S. Environmental Protection Agency (EPA) published the Regional Haze Rule (RHR) calling on states to adopt plans to improve visibility on the haziest days and protect the clearest days at each mandatory Class I Area affected by sources of emissions in the state. In 2006, Montana elected not to submit a Regional Haze State Implementation Plan (SIP) for the initial ten-year planning period (2008-2018), triggering the publication of a Federal Implementation Plan (FIP), effective October 18, 2012. Progress reports are due five years after publication of the initial plan.

The revised RHR requires that states submit SIP revisions in 2021 to address the second ten-year planning period (2018-2028). In preparation to submit a SIP for the second planning period, the Montana Department of Environmental Quality (Department), in coordination with EPA Region 8, took this opportunity to prepare a progress report on the initial plan.

In accordance with RHR requirements in 40 CFR 51.308(i), the Department is providing you with an opportunity to consult on the draft progress report. The draft document has been posted on the Department's website at http://deq.mt.gov/Public/publiccomment. Copies of the draft will also be made available upon request by contacting Rebecca Harbage, Montana Regional Haze Project Manager, at 406-444-1472 or rharbage@mt.gov. We ask that any comments be submitted by September 18, 2017.

The Department is also offering an opportunity to comment on the draft report in person at a public hearing scheduled for 1:00 p.m. on Monday, September 11, 2017, in room 45 of the Metcalf Building (1502 E. 6th Ave) in Helena, MT.

If you have any questions regarding Regional Haze or the progress report, please feel free to contact Rebecca Harbage at the phone number or email address listed above.

Sincerely,

David L. Klemp
Air Quality Bureau Chief

Cc: Jaslyn Dobrahner, U.S. EPA Region 8

July 12, 2017

Pat Brewer
National Park Service
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

Montana Regional Haze Five-Year Progress Report

Dear Ms. Brewer:

In 1999, the U.S. Environmental Protection Agency (EPA) published the Regional Haze Rule (RHR) calling on states to adopt plans to improve visibility on the haziest days and protect the clearest days at each mandatory Class I Area affected by sources of emissions in the state. In 2006, Montana elected not to submit a Regional Haze State Implementation Plan (SIP) for the initial ten-year planning period (2008-2018), triggering the publication of a Federal Implementation Plan (FIP), effective October 18, 2012. Progress reports are due five years after publication of the initial plan.

The revised RHR requires that states submit SIP revisions in 2021 to address the second ten-year planning period (2018-2028). In preparation to submit a SIP for the second planning period, the Montana Department of Environmental Quality (Department), in coordination with EPA Region 8, took this opportunity to prepare a progress report on the initial plan.

In accordance with RHR requirements in 40 CFR 51.308(i), the Department is providing you with an opportunity to consult on the draft progress report. The draft document has been posted on the Department's website at http://deq.mt.gov/Public/publiccomment. Copies of the draft will also be made available upon request by contacting Rebecca Harbage, Montana Regional Haze Project Manager, at 406-444-1472 or rharbage@mt.gov. We ask that any comments be submitted by September 18, 2017.

The Department is also offering an opportunity to comment on the draft report in person at a public hearing scheduled for 1:00 p.m. on Monday, September 11, 2017, in room 45 of the Metcalf Building (1502 E. 6th Ave) in Helena, MT.

If you have any questions regarding Regional Haze or the progress report, please feel free to contact Rebecca Harbage at the phone number or email address listed above.

Sincerely,

David L. Klemp
Air Quality Bureau Chief

Cc: Jaslyn Dobrahner, U.S. EPA Region 8

July 12, 2017

Bret Anderson
U.S. Forest Service
Air Program
2150 Centre Ave, Bldg. A
Fort Collins, CO 80526

Montana Regional Haze Five-Year Progress Report

Dear Mr. Anderson:

In 1999, the U.S. Environmental Protection Agency (EPA) published the Regional Haze Rule (RHR) calling on states to adopt plans to improve visibility on the haziest days and protect the clearest days at each mandatory Class I Area affected by sources of emissions in the state. In 2006, Montana elected not to submit a Regional Haze State Implementation Plan (SIP) for the initial ten-year planning period (2008-2018), triggering the publication of a Federal Implementation Plan (FIP), effective October 18, 2012. Progress reports are due five years after publication of the initial plan.

The revised RHR requires that states submit SIP revisions in 2021 to address the second ten-year planning period (2018-2028). In preparation to submit a SIP for the second planning period, the Montana Department of Environmental Quality (Department), in coordination with EPA Region 8, took this opportunity to prepare a progress report on the initial plan.

In accordance with RHR requirements in 40 CFR 51.308(i), the Department is providing you with an opportunity to consult on the draft progress report. The draft document has been posted on the Department's website at http://deq.mt.gov/Public/publiccomment. Copies of the draft will also be made available upon request by contacting Rebecca Harbage, Montana Regional Haze Project Manager, at 406-444-1472 or rharbage@mt.gov. We ask that any comments be submitted by September 18, 2017.

The Department is also offering an opportunity to comment on the draft report in person at a public hearing scheduled for 1:00 p.m. on Monday, September 11, 2017, in room 45 of the Metcalf Building (1502 E. 6th Ave) in Helena, MT.

If you have any questions regarding Regional Haze or the progress report, please feel free to contact Rebecca Harbage at the phone number or email address listed above.

Sincerely,

David L. Klemp
Air Quality Bureau Chief

Cc: Jaslyn Dobrahner, U.S. EPA Region 8
Ralph Rau, U.S. Forest Service Northern Region

From:	Allen, Tim
To:	Harbage, Rebecca
Cc:	Klemp, David; Dobrahner, Jaslyn; Collins, Catherine; Tamara McCandless
Subject:	Re: Montana Regional Haze Progress Report Consultation
Date:	Tuesday, July 25, 2017 3:12:25 PM
Attachments:	image004.png image005.png image006.png image003.png

---

Hi Rebecca,

We have reviewed the Regional Haze 5-year Progress Report Draft (July 2017) and have the following informal comment:

We agree with the general conclusion that international emissions contribute to the budget of visibility impairment at Class I areas within the State of Montana, however, we feel that attribution from the oil and gas sector is a growing concern and needs more attention. Our concern is highlighted at the Medicine Lake National Wildlife Refuge and we continue to show interest with progress at UL Bend National Wildlife Refuge.

A recent preliminary NEPA oil and gas air quality study conducted by the Bureau of Land Management indicated cumulative attribution from the Federal mineral estate alone as an approximate 12dv impact with an additional 2dv in future growth. If this analysis is confirmed, the State should consider further regional haze factor analysis in evaluating the reasonableness of applying control measures to this sector.

We agree with Montana that the plan may be inadequate at Medicine lake and look forward to working with the State to investigate ways to ensure progress in reaching the Clean Air Act's national visibility impairment goal.

Sincerely,
Tim Allen and Catherine Collins

On Wed, Jul 12, 2017 at 2:13 PM, Harbage, Rebecca <RHarbage@mt.gov> wrote:

> Good Afternoon,
>
> The Montana Department of Environmental Quality invites you to consult on the draft Montana 5-Year Regional Haze Progress Report. The attached letter provides additional detail on the draft document, which has been posted for your review on the Department's website at http://deq.mt.gov/Public/publiccomment. As indicated on the website, please submit your comments to me, either electronically or by mail, **by 5:00 p.m. on Monday, September 18, 2017**. The Department would also like to invite you to comment in person, should you wish to do so, at a public hearing scheduled for Monday, September 11, 2017, in Helena, MT.

Please feel free to contact me if you have any questions about the draft document.

At this time, the Department intends to work toward submitting a SIP by 2021 for the second planning period. My hope is that this brief consultation on the progress report is just the start of a dialogue between the state and FLMs that will continue through development of our next SIP. I look forward to working with you!

Rebecca

--

Rebecca Harbage | Air Quality Planner
406-444-1472 | rharbage@mt.gov

1520 E 6th Avenue, Helena, MT 59620

DEQ Montana Department of Environmental Quality

--

Tim Allen
U.S. Fish & Wildlife Service
(303) 914-3802

United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

TRANSMITTED VIA ELECTRONIC MAIL - NO HARDCOPY TO FOLLOW

N3615 (2350)

September 13, 2017

Rebecca Harbage
Air Quality Planner
Montana Department of Environmental Quality
1520 E 6th Avenue
Helena, MT 59620

Dear Ms. Harbage:

Thank you for the opportunity to review and comment on Montana's draft Regional Haze 5-Year Progress Report. The state has addressed all the requirements for the periodic progress report as outlined in 40 CFR§ 41.508 (g) and (h). The report is comprehensive, well written, and clearly lays out the changes in emissions in Montana since the 2000-2004 baseline period and the visibility trends for Montana's Class I areas.

The report summarizes Best Available Control Technology (BART) requirements in Montana, Idaho, Oregon, and Wyoming, and subsequent revisions to those requirements through court decisions. The report also summarizes additional emissions reductions that were not included Montana's 2018 reasonable progress goals and points out emissions increases from oil and gas development, particularly in the Bakken region of eastern Montana and North Dakota that partially offset emission reductions. We agree that visibility improvements on the clearest days at Montana Class I areas reflect the reductions in anthropogenic emissions and that wildfires and Canadian emissions are contributing to the haziest days. Thus we agree with MDEQ's conclusion that further regulatory actions are not needed in response to this progress report. The progress report is a good technical evaluation and starting point as MDEQ prepares for the second regional haze planning period. Early in MDEQ's planning, we would like to discuss the state's process for screening sources and evaluating emission sources as part of the reasonable progress evaluation for the next planning period.

We appreciate the opportunity to work with Montana DEQ to improve visibility in our Class I national park and wilderness areas. If you have questions, please contact me at patricia_f_brewer@nps.gov (303-969-2153).

Sincerely,

Patricia Brewer

Patricia Brewer
Acting Chief, Policy, Planning and Permit Review Branch

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PUBLIC NOTICE

August 11, 2017

1) In accordance with 40 CFR 51.102, the Department of Environmental Quality (Department) invites the public to submit written comments on the submittal of the Periodic Progress Report for the Regional Haze Program into the Montana State Implementation Plan (SIP).

2) The Periodic Progress Report for the Regional Haze Program addresses visibility in mandatory Federal Class I Areas in Montana and neighboring states. The document proposed for submittal into the SIP provides a summary of progress made to protect and improve visibility in these areas since a baseline period of 2000-2004. The document discusses the status of emission control measures at several large Montana facilities, as well as emission and visibility trends across the state.

3) On Monday, September 11, 2017, at 1:00 p.m., the Department will hold a public hearing in room 45 of the Metcalf Building (1520 E 6th Ave, Helena, MT) to consider the proposed submittal. Immediately preceding the hearing, at 12:00 p.m., at the same location, the Department will hold an informal question and answer session regarding the proposed submittal.

4) Interested persons may view the associated documents on the Department's website at: http://deq.mt.gov/Public/publiccomment or may call the Department at 406-444-1472 to have copies made available for their inspection.

5) The State of Montana makes reasonable accommodations for any known disability that may interfere with a person's ability to participate in state government proceedings. Persons requiring accommodation should contact Deb Sutliff concerning the nature of the accommodation. Please contact Deb at P.O. Box 200901, Helena, Montana 59620-0901; phone 406-444-7889; fax 406-444-1499; or email dsutliff@mt.gov.

6) Interested parties may submit their comments concerning the proposal described above in writing to the Department by

- addressing them to Rebecca Harbage, Air Quality Bureau, P.O. Box 200901, Helena, MT 59620-0901;
- faxing them to 406-444-1499; or
- sending them via email addressed to rharbage@mt.gov.

To be guaranteed consideration, written comments must be postmarked on or before 5:00 p.m. on Friday, September 22, 2017.

Public Comment Periods

By Subject or Program:

- Air Quality Permits
- Draft TMDL Reports
- Water Quality Discharge Permits
- Nutrient Management Plans
- Coal and Uranium Program
- Opencut Permits. Enter County, site name and/or contractor to navigate to page

The documents listed in the links above may not be included in the list below.

The **DEQ Public Comment Site** shows major programs open for comment with instructions on how to enter comments and attachments.

Electronic Comments Only to the Draft Environmental Assessment analyzing potential environmental impacts that may result from the proposed exploration activity by **Lucky Minerals, Inc. [Comment period ended midnight, December 12, 2016.]**

DEQ will not respond to comments that are threatening, defamatory, libelous, slanderous, or discriminatory in nature.

DEQswprogram@mt.gov

In accordance with 40 CFR §1.102, the Department is providing notice of a public hearing and the opportunity to submit written comments on the submittal of the Periodic Progress Report for the Regional Haze Program into the State Implementation Plan (SIP) **At this time, the Department is accepting public comments.** **SIP Public Notice**	September 22, 2017, by 5 p.m. Public Hearing: September 11, 2017 at 1:00 p.m., to be preceded by an informal question and answer session at 12:00 p.m. Metcalf Building, Rm 45 (1520 E. 6th Ave, Helena, MT)	Draft Progress Report	Montana Department of Environmental Quality Air Quality Bureau c/o Rebecca Harbage P.O. Box 200901 Helena, MT 59620 Or via email to RHarbage@mt.gov

From:	Debi Sutliff
To:	Harbage, Rebecca
Subject:	Notice of Public Hearing and Opportunity for Public Comment on the Submittal of the Regional Haze Periodic Progress Report
Date:	Friday, August 11, 2017 11:21:52 AM

Date: August 11, 2017
To: Air Interested Parties
From: MT DEQ Air Quality Bureau

RE: Notice of Public Hearing and Opportunity for Public Comment on the Submittal of the Regional Haze Periodic Progress Report

In accordance with 40 CFR 51.102, the Department of Environmental Quality invites the public to submit written comments on the submittal of the Periodic Progress Report for the Regional Haze Program into the State Implementation Plan. The Department has also scheduled a public hearing on Monday, September 11, 2017, at 1:00 p.m. at the Metcalf Building in Helena (1502 E 6th Ave). Immediately preceding the hearing, at 12:00 p.m., at the same location, the Department will hold an informal question and answer session regarding the proposed submittal.

Interested Parties may view the associated documents on the Department's website (http://deq.mt.gov/Public/publiccomment) or may call the Department at 406-444-1472 to have copies made available for their inspection.

To be guaranteed consideration, written comments on the proposed submittal must be postmarked by 5:00 p.m. on Friday, September 22, 2017.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

STATE OF MONTANA

SUBMITTAL OF THE

REGIONAL HAZE PROGRESS REPORT

FOR INCLUSION IN THE

STATE IMPLEMENTATION PLAN (SIP)

TRANSCRIPT OF PROCEEDINGS - PUBLIC HEARING

Heard at the Metcalf Building

1520 East Sixth Avenue Room 45

Helena, Montana

September 11, 2017

1:00 p.m.

BEFORE HEARING OFFICER NORMAN MULLAN

PREPARED BY: LAURIE CRUTCHER, RPR

COURT REPORTER, NOTARY PUBLIC

P.O. BOX 1192

HELENA, MT 59624

(406) 442-8262

WHEREUPON, the following proceedings were had and testimony taken, to-wit:

* * * * *

HEARING OFFICER MULLAN: Good afternoon. My name is Norman Mullan, and I'm the Hearing Officer for the Montana Department of Environmental Quality today. I will refer to that agency as "the Department" for brevity here.

The time is about 1:01 p.m. on September 11th, 2017. We're in Room 45 of the Metcalf Building at 1520 East Sixth Avenue in Helena, Montana. This is time and place set forth in the public notice for a public hearing to receive comment on the proposed submission by the Department to the Federal Environmental Protection Agency (EPA) of the Department's Regional Haze Periodic Progress Report.

The Regional Haze Periodic Progress Report is intended to meet the requirements of the Federal Regional Haze Rule, which is codified in Title 40 of the Code of Federal Regulations, Part 51, Subpart P. The Periodic Progress Report evaluates visibility in Montana since the baseline years of 2000 through 2004, and more specifically, progress made toward improving visibility as a

result of the Montana Federal Implementation Plan, or FIP, which was published in 2012.

The Regional Haze Periodic Progress Report provides a five year update on the current state of visibility at the mandatory Federal Class I areas affected by emissions from sources of air pollution in Montana. It describes statewide emissions reductions, and concludes with the determination that the Montana FIP is adequate, and does not require substantive revision at this time in order to achieve established visibility goals.

Copies of the Regional Haze Periodic Progress Report are available in this room on the table, and anyone needing a copy of the public notice can ask Rebecca, who is sitting to my right, to obtain another copy.

In addition to receiving written or oral comments at this hearing, the Department will also receive written comments through 5:00 p.m. on September 22nd, 2017. Anyone who wishes to comment at this hearing must register on the sign-up sheet. There is a sign-up sheet on the table at the entrance to the room.

To make it easier for the stenographer

to create an accurate transcription of the testimony, please identify yourself and spell your name at the beginning of your comment, and it might help the Department also if you identified if you're with any particular organization or company.

The Department will comment first and submit written comments. There is no requirement that the Department respond today to matters raised in the comments. However, the Department will respond in writing to comments if and when it submits the Periodic Progress Report to EPA. In addition, as described in the public notice, representatives of the Department were available before this hearing at twelve noon today to informally discuss the Periodic Progress Report with any person wishing to do so, and I believe there were at least two people who did engage in discussion with the Department.

Please be aware that you must submit comments either orally or in writing during the hearing, or in writing after the hearing, by September 22nd, 2017 to have them made part of the record, and for them to be considered and responded to.

After the Department presents its comments, I will ask anyone wishing to comment in support of the proposed submission to come to the microphone. And there are microphones up here, but the Stenographer has indicated that she doesn't necessarily need them if she can hear your testimony. So I think people can remain where they are unless indicated that the Stenographer can't hear.

Next after the Department presents its comments, and I've asked anyone wishing to comment in support to come to the microphone or speak, I will ask anyone wishing to testify in opposition to the proposed submission to speak. Finally, I will ask anyone else who wishes to testify to speak.

Will the representative of the Department please begin.

MS. HARBAGE: Good afternoon. My name is Rebecca Harbage. For the record that's R-E-B-E-C-C-A H-A-R-B-A-G-E. I'm representing the Department recording the proposed submittal to the US Environmental Protection Agency or EPA of the Regional Haze Periodic Progress Report. The Periodic Progress Report for the Regional Haze

Program addresses visibility in mandatory Federal Class I areas in Montana and neighboring states.

The document proposed for submittal into the State Implementation Plan or SIP provides a summary of progress made to protect and improve visibility in these areas since the baseline period of 2000 to 2004. The document discusses the status of emission control measures at several large Montana facilities, as well as emission and visibility trends across the state.

Because there are no people here who were not at the informal question and answer session before this hearing, I'm going to skip the bulk of my summary of the Progress Report, and indicate, though, that a copy of the proposed SIP submittal is available for viewing at this hearing, and the proposed SIP submittal is also available to the public on the Department's website, which is at deq.mt.gov/public/public comment.

The Department gave reasonable notice of the proposed SIP action on August 11th, 2017 by notifying interested parties of the Department's intent to submit the progress report for inclusion in the SIP, and of the availability of the

1 document for review online, at the Department's
2 Helena office, or by request.
3 On August 11th, 2017, the Department
4 also notified interested parties of the intent to
5 hold this hearing regarding the proposed SIP
6 submittal. I'm submitting copies of the public
7 notice into the hearing record today. Thank you.
8 HEARING OFFICER MULLAN: Ms. Harbage is
9 handing a copy of her written testimony for
10 inclusion in the record.
11 Does anyone wish to comment in support
12 of the action set forth in the notice?
13 MR. NEUMILLER: I would like to comment.
14 My name is William L. Neumiller,
15 N-E-U-M-I-L-L-E-R. I work for the Colstrip power
16 plant in Colstrip, Montana.
17 And I would like to publicly thank the
18 Montana DEQ for providing a question and answer
19 period prior to the public hearing. I have no
20 specific comments on the progress part at this
21 time, but may submit written comments prior to the
22 deadline. But I just wanted to say thank you for
23 the question and answer period, which was very
24 informative. I appreciate their efforts.
25 HEARING OFFICER MULLAN: Thank you. So

there is no one else in the room other than Department staff. There's one other person who said she does not wish to comment. So seeing no one else, I'm wondering if we should wait just a few more minutes, since it is only about 1:10, to just see if somebody else was going to come in, say, the next five minutes. So we can maybe adjourn for a few minutes and see if anybody is here in five more minutes.

We stand adjourned for five more minutes temporarily.

(Recess taken)

HEARING OFFICER MULLAN: This is Norman Mullan again, the Hearing Officer in the matter concerning the submission of the Periodic Progress Report for Regional Haze to EPA by the Department of Environmental Quality. And it's about 1:15 now, and no one else has come into the room, or indicated that they have an interest in testifying, so we're going to conclude the hearing permanently. And again, comments are due on September 22nd, 2017. Thank you.

(The proceedings were concluded at 1:16 p.m.)

* * * * *

C E R T I F I C A T E

STATE OF MONTANA)

: SS.

COUNTY OF LEWIS & CLARK)

I, LAURIE CRUTCHER, RPR, Court Reporter, Notary Public in and for the County of Lewis & Clark, State of Montana, do hereby certify:

That the proceedings were taken before me at the time and place herein named; that the proceedings were reported by me in shorthand and transcribed using computer-aided transcription, and that the foregoing - 8 - pages contain a true record of the proceedings to the best of my ability.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this _____ day of _____, 2017.

_____

LAURIE CRUTCHER, RPR
Court Reporter - Notary Public
My commission expires
March 9, 2020.

1

11 - 1:16
1192 - 1:23
11th [3] 2:10, 6:22, 7:3
1520 [2] 1:14, 2:11
1:00 - 1:17
1:01 - 2:9
1:10 - 8:5
1:15 - 8:17
1:16 - 8:24

2

2000 [2] 2:24, 6:7
2004 [2] 2:24, 6:7
2012 - 3:2
2017 [8] 1:16, 2:10, 3:21, 4:23, 6:22, 7:3, 8:22, 9:17
2020 - 9:22
22nd [3] 3:21, 4:23, 8:22

4

40 - 2:21
406 - 1:25
442-8262 - 1:25
45 [2] 1:14, 2:10

5

51 - 2:22
59624 - 1:24
5:00 - 3:20

8

8 - 9:12

9

9 - 9:22

A

ability - 9:14
accurate - 4:1
achieve - 3:11
across - 6:10
action [2] 6:22, 7:12
addition [2] 3:18, 4:13
addresses - 6:1
adequate - 3:9
adjourn - 8:8
adjourned - 8:10
affected - 3:6
affixed - 9:16
afternoon [2] 2:4, 5:19
agency [3] 2:8, 2:16, 5:23
appreciate - 7:24
areas [3] 3:6, 6:2, 6:6
August [2] 6:22, 7:3
availability - 6:25
available [4] 3:14, 4:14, 6:16, 6:18
Avenue [2] 1:14, 2:11

B

baseline [2] 2:23, 6:6
begin - 5:18
beginning - 4:3
best - 9:13
BOX - 1:23
brevity - 2:8
Building [2] 1:13, 2:11
bulk - 6:14

C

can't - 5:9
certify - 9:7
Clark [2] 9:4, 9:7
Class [2] 3:5, 6:2
Code - 2:21
codified - 2:20
Colstrip [2] 7:15, 7:16
comment [10] 2:14, 3:22, 4:3, 4:7, 5:2, 5:11, 6:20, 7:11, 7:13, 8:3
comments [11] 3:19, 3:20, 4:8, 4:10, 4:11, 4:21, 5:2, 5:11, 7:20, 7:21, 8:21
commission - 9:21
company - 4:6
computer-aided - 9:11
concerning - 8:15
conclude - 8:20
concluded - 8:23
concludes - 3:8
considered - 4:24
contain - 9:12
control - 6:8
copies [2] 3:13, 7:6
County [2] 9:4, 9:6
Court [3] 1:22, 9:5, 9:20
create - 4:1
CRUTCHER [3] 1:21, 9:5, 9:19
current - 3:4

D

deadline - 7:22
Department [19] 1:1, 2:6, 2:8, 2:15, 3:19, 4:4, 4:7, 4:9, 4:10, 4:14, 4:19, 5:1, 5:10, 5:18, 5:22, 6:21, 7:3, 8:2, 8:16
Department's [4] 2:16, 6:18, 6:23, 7:1
DEQ - 7:18
deq.mt.gov/public - 6:19
described - 4:13
describes - 3:7
determination - 3:9
discuss - 4:16
discusses - 6:7
discussion - 4:19
document [3] 6:3, 6:7, 7:1
due - 8:21

E

easier - 3:25
East [2] 1:14, 2:11
efforts - 7:24
either - 4:21
emission [2] 6:8, 6:9
emissions [2] 3:6, 3:8
engage - 4:18
entrance - 3:24
Environmental [5] 1:1, 2:7, 2:15, 5:23, 8:17
EPA [4] 2:16, 4:12, 5:23, 8:16
established - 3:11
evaluates - 2:23
expires - 9:21

F

facilities - 6:9
Federal [6] 2:15, 2:20, 2:21, 3:1, 3:5, 6:1
Finally - 5:14
FIP [2] 3:2, 3:9
five [4] 3:4, 8:7, 8:9, 8:10
foregoing - 9:12
forth [2] 2:12, 7:12

G

gave - 6:21
goals - 3:12

H

H-A-R-B-A-G-E - 5:21
handing - 7:9
Harbage [3] 5:19, 5:20, 7:8
Haze [9] 1:6, 2:16, 2:18, 2:20, 3:3, 3:13, 5:24, 5:25, 8:16
hear [2] 5:6, 5:9
Heard - 1:13
hearing [20] 1:11, 1:19, 2:4, 2:5, 2:13, 3:19, 3:22, 4:15, 4:22, 4:22, 6:13, 6:17, 7:5, 7:7, 7:8, 7:19, 7:25, 8:13, 8:14, 8:20
Helena [4] 1:15, 1:24, 2:11, 7:2
hereby - 9:7
herein - 9:9
hereunto - 9:15
hold - 7:5
However - 4:10

I

identified - 4:4
identify - 4:2
Implementation [3] 1:8, 3:1, 6:4
improve - 6:5
improving - 2:25
inclusion [3] 1:7, 6:24, 7:10
indicate - 6:15
indicated [3] 5:5, 5:8, 8:19
informal - 6:12
informally - 4:16
informative - 7:24
intended - 2:19
intent [2] 6:24, 7:4
interest - 8:19
interested [2] 6:23, 7:4

L

LAURIE [3] 1:21, 9:5, 9:19
least - 4:18
Lewis [2] 9:4, 9:6

M

mandatory [2] 3:5, 6:1
March - 9:22
matter - 8:14
matters - 4:9
maybe - 8:7
measures - 6:8
meet - 2:19
Metcalf [2] 1:13, 2:10
microphone [2] 5:4, 5:12
microphones - 5:4
minutes [5] 8:5, 8:7, 8:8, 8:9, 8:10
Montana [15] 1:1, 1:2, 1:15, 2:6, 2:12, 2:23, 3:1, 3:7, 3:9, 6:2, 6:9, 7:16, 7:18, 9:2, 9:7
MT - 1:24
Mullan [7] 1:19, 2:4, 2:5, 7:8, 7:25, 8:13, 8:14

N

N-E-U-M-I-L-L-E- - 7:15
named - 9:9
necessarily - 5:6
needing - 3:15
neighboring - 6:2
Neumiller [2] 7:13, 7:14
noon - 4:15
Norman [3] 1:19, 2:5, 8:13
notarial - 9:16
Notary [3]

1:22, 9:6, 9:20
notice [6] 2:13, 3:16, 4:13, 6:21, 7:7, 7:12
notified - 7:4
notifying - 6:23

O

obtain - 3:17
office - 7:2
Officer [7] 1:19, 2:4, 2:6, 7:8, 7:25, 8:13, 8:14
online - 7:1
opposition - 5:13
oral - 3:18
orally - 4:21
order - 3:11
organization - 4:5

P

p.m [4] 1:17, 2:9, 3:20, 8:24
P.O - 1:23
pages - 9:12
particular - 4:5
parties [2] 6:23, 7:4
period [3] 6:7, 7:19, 7:23
Periodic [10] 2:17, 2:18, 2:22, 3:3, 3:13, 4:12, 4:16, 5:24, 5:25, 8:15
permanently - 8:21
Plan [3] 1:8, 3:1, 6:4
plant - 7:16
please [3] 4:2, 4:20, 5:18
pollution - 3:7
power - 7:15
PREPARED - 1:21
presents [2] 5:1, 5:10
prior [2] 7:19, 7:21
proceedings [6] 1:11, 2:1, 8:23, 9:8, 9:10, 9:13
Program - 6:1
progress [16] 1:6, 2:17, 2:18, 2:22, 2:25, 3:3, 3:14, 4:12, 4:16, 5:24, 5:25, 6:5, 6:14, 6:24, 7:20, 8:15
proposed [9] 2:14, 5:3, 5:14, 5:22, 6:3, 6:15, 6:17, 6:22, 7:5
protect - 6:5
Protection [2] 2:15, 5:23
provides [2] 3:4, 6:4
providing - 7:18
public [11] 1:11, 1:22, 2:13, 2:13, 3:15, 4:13, 6:18, 7:6, 7:19, 9:6, 9:20
publicly - 7:17
published - 3:2

Q

Quality [3] 1:1, 2:7, 8:17

R

R-E-B-E-C-C-A - 5:21
raised - 4:10
reasonable - 6:21
Rebecca [2] 3:16, 5:20
receive [2] 2:13, 3:20
receiving - 3:18
Recess - 8:12
record [5] 4:24, 5:20, 7:7, 7:10, 9:13
recording - 5:22
reductions - 3:8
refer - 2:7
regarding - 7:5
Regional [9] 1:6, 2:16, 2:18, 2:20, 3:3, 3:13, 5:24, 5:25, 8:16
register - 3:22
Regulations - 2:21
remain - 5:7
report [13] 1:6, 2:17, 2:19, 2:22, 3:4, 3:14, 4:12, 4:16, 5:24, 5:25, 6:14, 6:24, 8:16
reported - 9:10
Reporter [3] 1:22, 9:5, 9:20
representative - 5:17
representatives - 4:14
representing - 5:21
request - 7:2
require - 3:10
requirement - 4:8
requirements - 2:19
respond [2] 4:9, 4:11
responded - 4:25
result - 3:1
review - 7:1
revision - 3:10
room [6] 1:14, 2:10, 3:14, 3:24, 8:1, 8:18
RPR [3] 1:21, 9:5, 9:19
Rule - 2:20

S

seal - 9:16
seeing - 8:3
September [5] 1:16, 2:9, 3:21, 4:23, 8:22
session - 6:13
several - 6:8
sheet [2] 3:23, 3:23
shorthand - 9:10
sign-up [2] 3:23, 3:23
SIP [7] 1:8, 6:4, 6:15, 6:17, 6:22, 6:25, 7:5
sitting - 3:16
Sixth [2] 1:14, 2:11
skip - 6:13
somebody - 8:6
sources - 3:6
speak [3] 5:12, 5:14, 5:16
specific - 7:20
specifically - 2:24
spell - 4:2
SS - 9:3
staff - 8:2
stand - 8:10
state [7] 1:2, 1:8, 3:5, 6:4, 6:10, 9:2, 9:7
states - 6:2
statewide - 3:7
status - 6:8
stenographer [3] 3:25, 5:5, 5:8
submission [4] 2:14, 5:3, 5:14, 8:15
submit [4] 4:8, 4:20, 6:24, 7:21
submits - 4:12
submittal [6] 1:5, 5:22, 6:3, 6:16, 6:17, 7:6
submitting - 7:6
Subpart - 2:22
substantive - 3:10
summary [2] 6:5, 6:14
support [3] 5:3, 5:12, 7:11

T

table [2] 3:15, 3:24
taken [3] 2:2, 8:12, 9:8
temporarily - 8:11
testify [2] 5:13, 5:15
testifying - 8:20
testimony [4] 2:2, 4:2, 5:7, 7:9
thank [5] 7:7, 7:17, 7:22, 7:25, 8:22
There's - 8:2
though - 6:15
Title - 2:21
to-wit - 2:2
today [4] 2:7, 4:9, 4:15, 7:7
toward - 2:25
transcribed - 9:11
TRANSCRIPT - 1:11
transcription [2] 4:1, 9:11
trends - 6:10
true - 9:12
twelve - 4:15

U

unless - 5:8
update - 3:4
using - 9:11

V

viewing - 6:16
visibility [7] 2:23, 2:25, 3:5, 3:11, 6:1, 6:6, 6:10

W

wait - 8:4
wanted - 7:22
we're [2] 2:10, 8:20
website - 6:19
WHEREOF - 9:15
WHEREUPON - 2:1
William - 7:14
wish [2] 7:11, 8:3
wishes [2] 3:21, 5:15
wishing [4] 4:17, 5:2, 5:11, 5:13
WITNESS - 9:15
wondering - 8:4
writing [3] 4:11, 4:21, 4:22
written [5] 3:18, 3:20, 4:8, 7:9, 7:21

Y

yourself - 4:2

Harbage, Rebecca

From: Peterson, Todd <Todd.Peterson@mdu.com>
Sent: Friday, September 22, 2017 7:23 AM
To: Harbage, Rebecca
Cc: Krebsbach, Abbie; Dihle, Mark
Subject: Comments on Draft Progress Report
Attachments: 20160810 Regional Haze Comment Letter to EPA.PDF

Ms. Harbage,

Montana Dakota Utilities Co. (Montana-Dakota) appreciates the opportunity to review and comment on the Montana Department of Environmental Quality (DEQ) Periodic Progress Report for the Regional Haze Program into the State Implementation Plan (SIP). Montana-Dakota agrees with and supports the DEQ taking on administrative authority of the Regional Haze Rule requirements from EPA Region 8. Montana-Dakota does not have any significant concerns with DEQs determinations and we recommend DEQ continue working to understand and quantify international and natural source emissions contributions to regional haze.

Montana-Dakota would like to reaffirm our comments (attached) on the U.S. Environmental Protection Agency (EPA) Proposed Rule Regarding Protection of Visibility: Amendments to Requirements for State Plans that Montana-Dakota provided to the EPA on August 10, 2016 submitted via www.regulations.gov e-docket: DOCKET ID NO. EPA-HQ-OAR-2015-0531. See 81 Fed. Reg. 26,942 (May 4, 2016).

Thank you for reviewing our comments.

Todd Peterson, CHMM
Environmental Scientist
Montana-Dakota Utilities
400 North 4th St
Bismarck, ND 58501
701-222-7835 office
701-222-7845 fax

****Confidentiality Statement****
Privileged/Confidential Information may be contained in this message. If you are not the addressee indicated in this message (or responsible for the delivery of the message to such person), you may not copy or deliver this message to anyone. In such case, you should destroy this message without copying it or further reading, and notify me by telephone.