AVISTA CORP.
RESPONSE TO REQUEST FOR INFORMATION

JURISDICTION:	WASHINGTON	DATE PREPARED:	10/16/2017
CASE NO.:	UE-170485 & UG-170486	WITNESS:	Scott Kinney
REQUESTER:	UTC Staff	RESPONDER:	Darrell Soyars
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REQUEST:

Referring to Scott Kinney's Exh. SJK-1T, page 25, lines 3-20, for Colstrip Thermal Capital, under "Environmental Must Do", please identify the Regional Haze Plan for Montana environmental requirements beyond 2022

RESPONSE:

The Regional Haze Program set a national goal of eliminating man-made visibility degradation in Class I areas by the year 2064. States are expected to take actions to make "reasonable progress" to maintain the proper glide-path of pollutant reductions to achieve the 2064 goal. On September 18, 2012, the EPA finalized the Regional Haze federal implementation plan (FIP) for Montana which included both emission limitations and pollution controls for Colstrip Units 1 & 2.

Anticipating that Colstrip Units 3 & 4 could be ordered to install Selective Catalytic Reduction (SCR) during the 2017 review period, the Colstrip Owners' proactively installed the Smart Burn technology to reduce the formation of Nitrous Oxides (NOx) in combustion zone for two major benefits:

Make proactive and verifiable NOx reductions and
Optimize the size, scope and ammonia use of any future SCR installation.

Colstrip Units 3 & 4 are currently being evaluated as part of the State of Montana Regional Haze 5-Year Progress Report (please see: https://deq.mt.gov/Portals/112/Public/Air/ProgressReport_DRAFT_7-2017.pdf) for more information.

STATE OF MONTANA

REGIONAL HAZE
5-YEAR PROGRESS REPORT

DRAFT

Montana Department of Environmental Quality

JULY 2017

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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

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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 (2^{nd} 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.

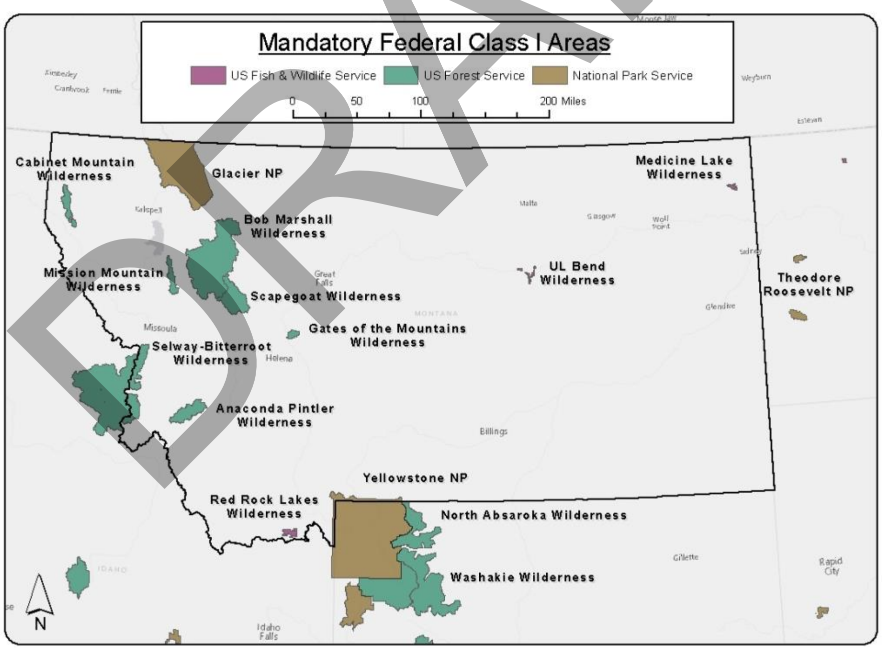
Ultimately, the findings in this progress report support the conclusion that the control strategies in the Montana FIP have been effective at decreasing visibility impacts from manmade emissions. Emission reductions resulting from the Montana FIP, *plus* additional emission reductions at Montana sources 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



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[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

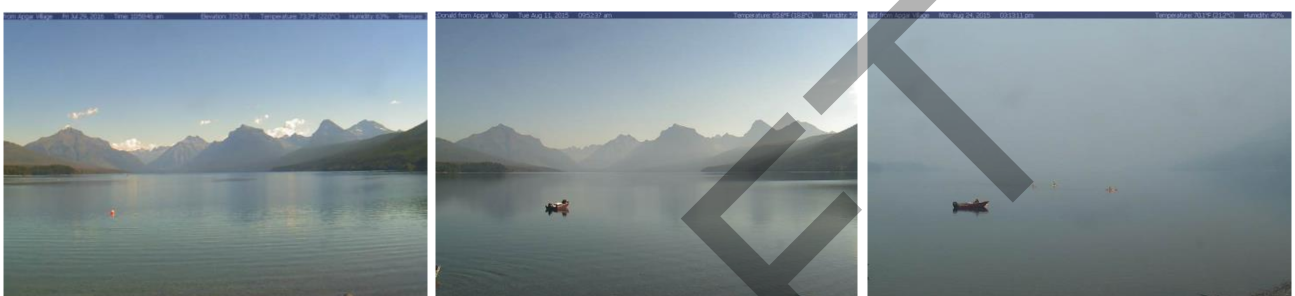
[5] Montana did submit limited SIP revisions regarding visibility, including a Smoke Management Plan (SMP), to satisfy that portion of the RHR and retain control of the SMP in our state.
[6] Environmental Protection Agency (EPA), Approval and Promulgation of Implementation Plans; State of Montana; State 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

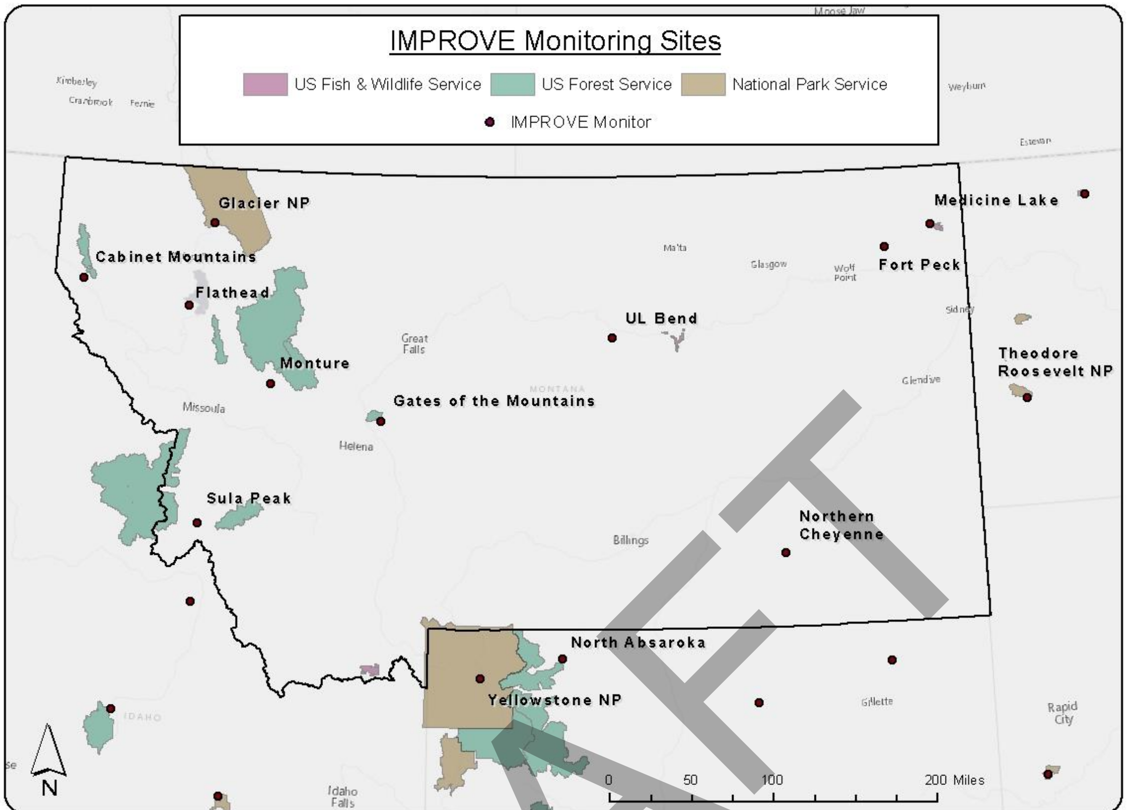


The picture on the left shows a day with relatively good visibility. Not much haze obscures the color and texture of the mountains in the distance. The picture in the middle is a bit hazier, with less texture visible on the mountains. On the right, the mountains are completely obscured by smoke from 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."

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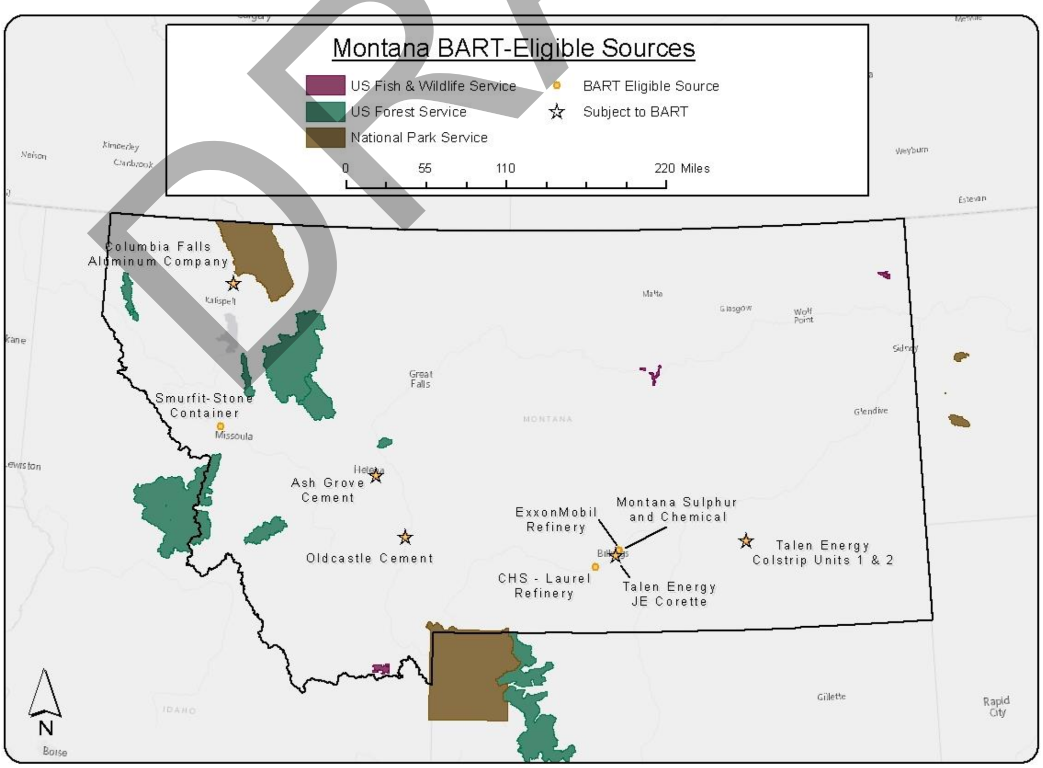
[9] EPA, Approval and Promulgation of Implementation Plans; State of Montana; Regional Haze Federal Implementation Plan, Final Rule, 77 Fed. Reg. 57863 (18 Sep. 2012), https://www.federalregister.gov/d/2012-20918. See also: Proposed Rule at 77 Fed. Reg. 23987 (20 Apr. 2012), https://www.federalregister.gov/d/2012-8367.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

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[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

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[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.

lb/ton of clinker. EPA reviewed the submitted information and, on April 14, 2017, published a proposed revision to the Montana FIP raising the Oldcastle NO_x limit from 6.5 to 7.6 lb/ton of clinker.[21]

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. Should the rule be finalized as proposed, the facility would no longer be 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
- Colstrip Steam Electric Station, Unit 4
- Columbia Falls Aluminum Company
- ExxonMobil, Billings Refinery
- Montana-Dakota Utilities Lewis & Clark Station
- Montana Sulfur & Chemical Company
- Plum Creek Manufacturing
- Roseburg Forest Products
- Smurfit-Stone Container
- Yellowstone Energy Limited Partnership

[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.

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%.[22]

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.[23]

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

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

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. 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.[25] 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.

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.[27] 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 Dave 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).

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

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[25] 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.
[26] State of North Dakota, "Regional Haze State Implementation Plan Periodic Progress Report" (Jan. 2015).
[27] 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.

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.[28]

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.[29]

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.[30] 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 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.

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28 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.
29 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.
30 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.

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.[31] 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.[32] 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.[33] 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 to be developed, additional emission decreases will be realized. Although in some source categories,

[31] 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
[32] 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.
[33] 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.

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.[34] 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.[35] 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."[36] 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 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.[37] 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 account in the projected 2018 emission inventory and will continue to provide for emissions reductions going forward.

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34 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.
35 Montana/Idaho Airshed Group, Airshed Management System: http://www.smokemu.org/.
36 ARM 17.8.601(5), www.mtrules.org/gateway/RuleNo.asp?RN=17%2E8%2E601.
37 EPA, Petroleum Refinery National Case Results, https://www.epa.gov/enforcement/petroleum-refinery-national-case-results.

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.[38] 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 referred to as the Mercury and Air Toxics Standards (MATS).[39] 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

[38] EPA, Diesel Fuels Standards and Rulemakings, https://www.epa.gov/diesel-fuel-standards/diesel-fuel-standards-rulemakings.
[39] 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.

reduced by 75, 19, 41, and 88%, respectively, from coal-fired EGUs greater than 25 megawatts (MW).[40] 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.[41] 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.[42] 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.

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.

[40] Ibid. p. 9424.
[41] EPA, Clean Air Mercury Rule, https://www3.epa.gov/airtoxics/utility/utiltoxpg.html.
[42] ARM 17.8.771 Mercury Emission Standards for Mercury-Emitting Generating Units, http://www.mtrules.org/gateway/RuleNo.asp?RN=17%2E8%2E771.

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."[43] 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.

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.

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

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.[44] 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.[45]

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.[46] 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.[47]

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 (μg/m^3) to 12.0 μg/m^3.[48] According to EPA, "Emission 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."[49] These rules include many of

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44 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.
45 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.
46 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.
47 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.
48 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.
49 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).

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.[50] 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.

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.

[50] 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.

TABLE 2-3. NEW AND PROPOSED RENEWABLE GENERATION IN MONTANA AS OF NOVEMBER 2016[51]

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

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

TABLE 2-4. EXISTING MONTANA NONATTAINMENT AREAS

Pollutant	Standard Violated	Community	Current Standard	2016 Design Value (With EE)ƚ	2016 Design Value (Without EE)ƚ	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[52]
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[53]
		Great Falls		NA	NA		7/8/2002[54]
		Missoula		NA	NA		9/17/2007[55]
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.
ƚ 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 the actual and projected emissions of visibility-impairing pollutants from Montana sources. The following chapter further assesses emissions reductions resulting from these measures.

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[52] 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.
[53] 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.
[54] 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.
[55] 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.

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).[56]

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.

[56] 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.[57]

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. 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, but is also currently awaiting a final revision of the original BART determination. As a result, NO_x emissions from the kiln have increased over the last several years. However, with the anticipated installation of controls, emissions should decrease prior to the end of the implementation period in 2018.

[57] 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

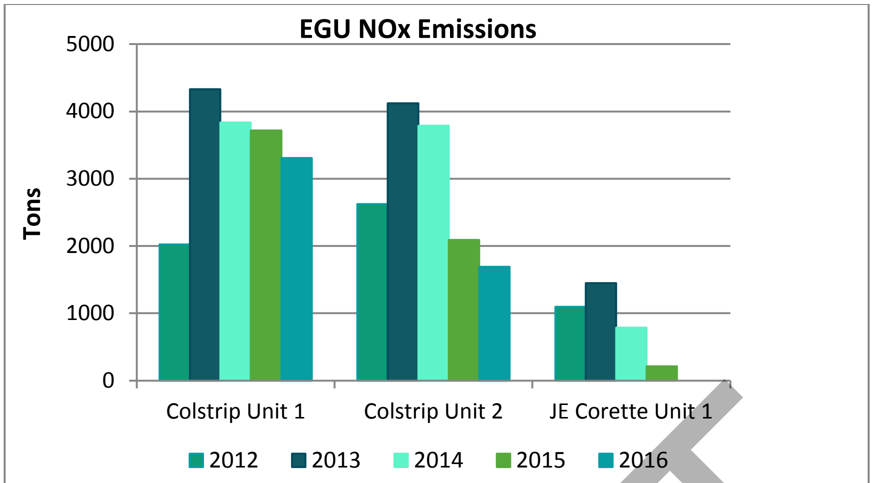


FIGURE 3-2. SO_2 EMISSIONS CHANGES AT BART SOURCES - EGUS

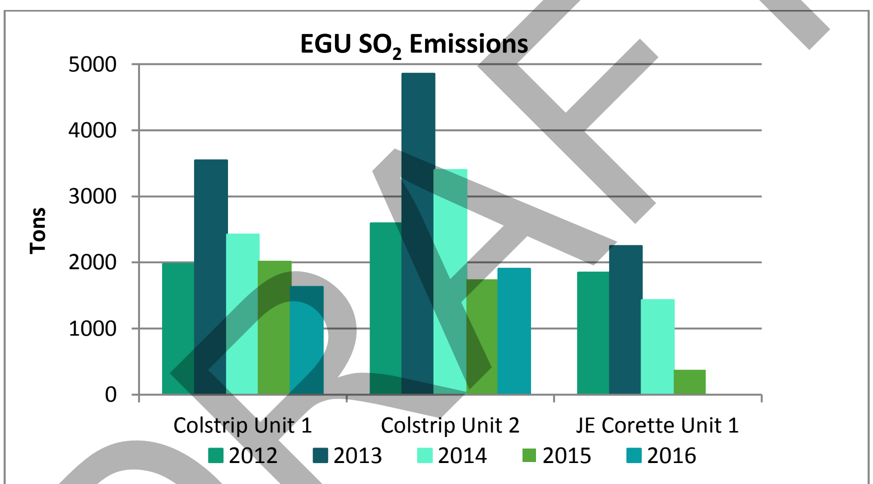


FIGURE 3-3. $PM_{2.5}$ EMISSIONS CHANGES AT BART SOURCES - EGUS

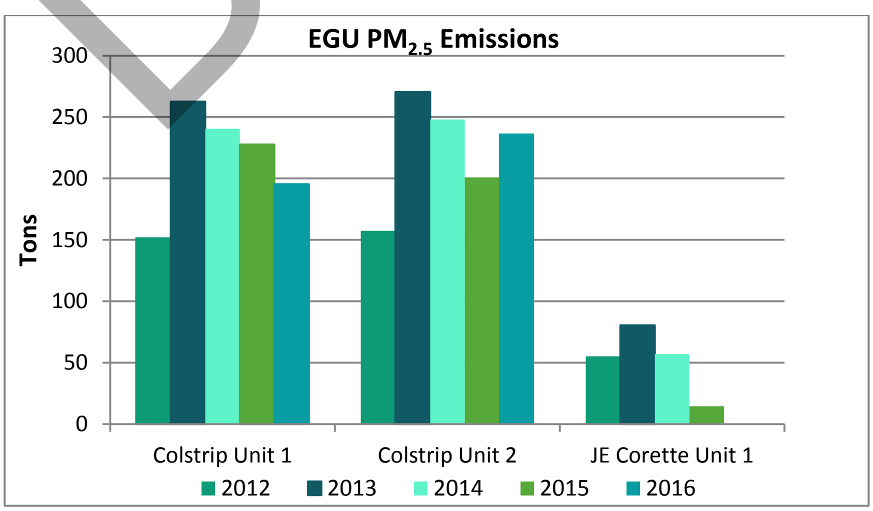


FIGURE 3-4. NO_x EMISSIONS CHANGES AT BART SOURCES – CEMENT KILNS

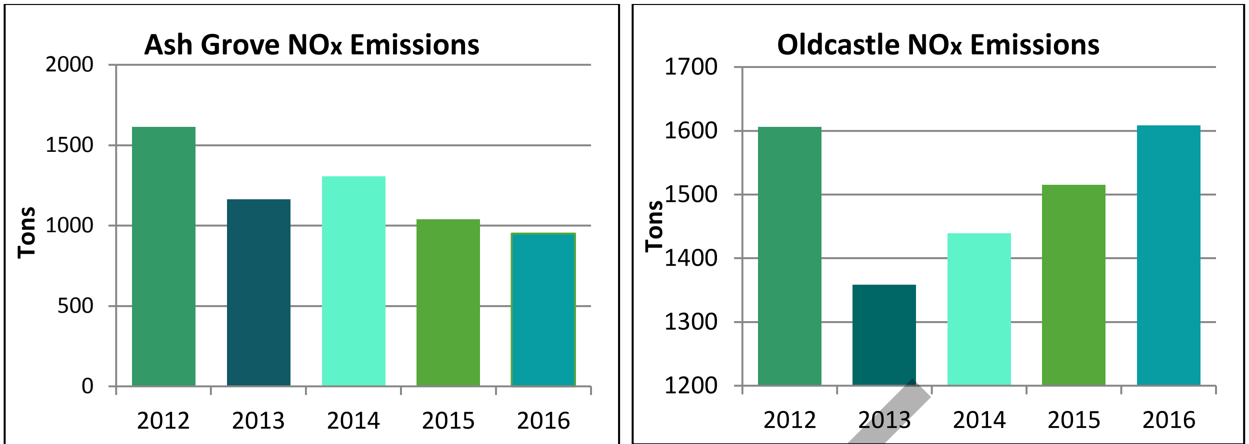


FIGURE 3-5. SO_2 EMISSIONS CHANGES AT BART SOURCES – CEMENT KILNS

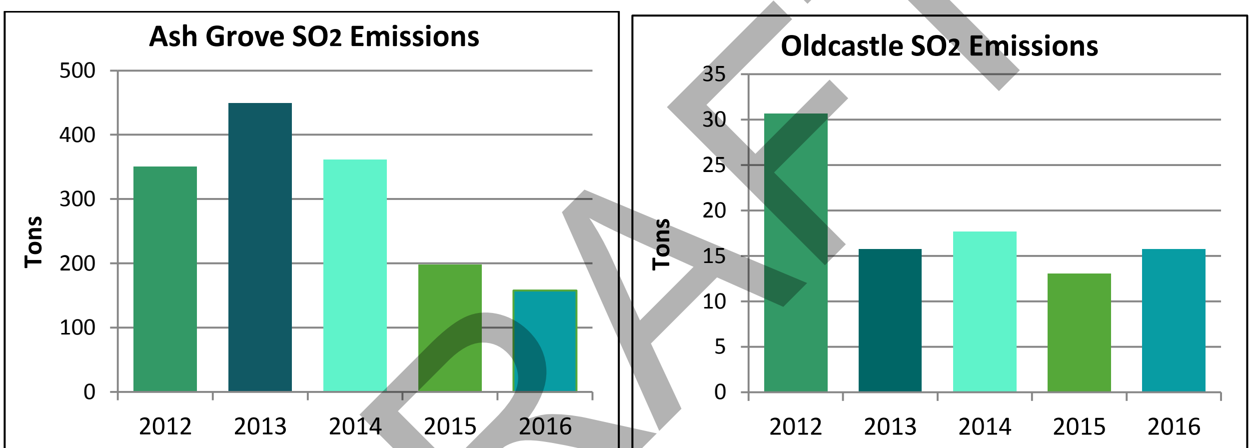
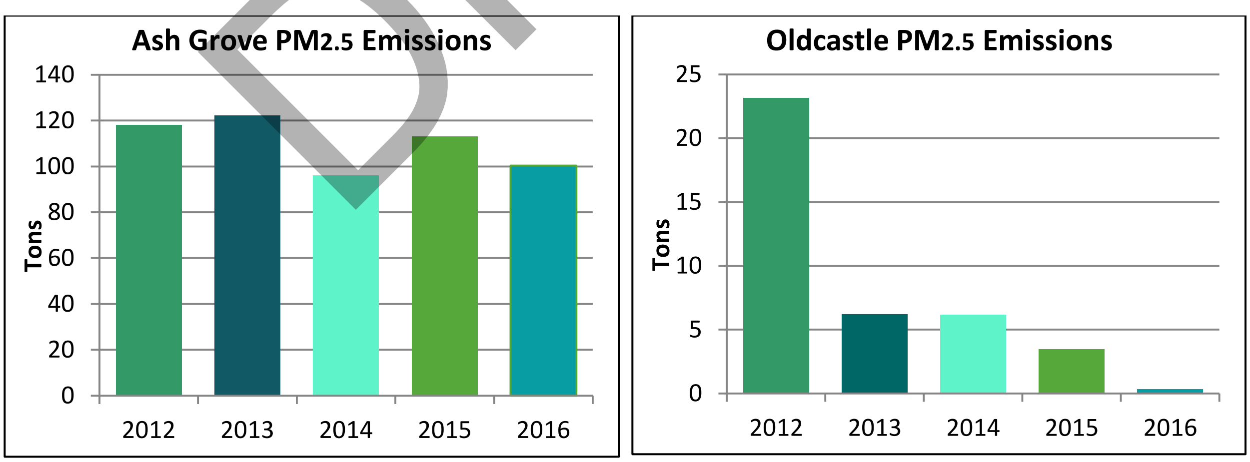


FIGURE 3-6. $PM_{2.5}$ EMISSIONS CHANGES AT BART SOURCES – CEMENT KILNS



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%.[58] 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. 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 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

[58] 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.

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.[59]

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)

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.

[59] 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.

The methodology for calculating fire emissions has been updated to better reflect actual emissions; therefore, the 2014 NEI data is likely reflective of actual annual emissions. However, it is very difficult to conduct trend analysis on fire (both prescribed and natural) because of 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 particulate matter emissions.

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.[60] 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.[61]

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 but could be explained by a large percentage of emissions coming from fire and wind-blown dust.

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%**

[60] 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.

[61] 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.[62] 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.

[62] 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

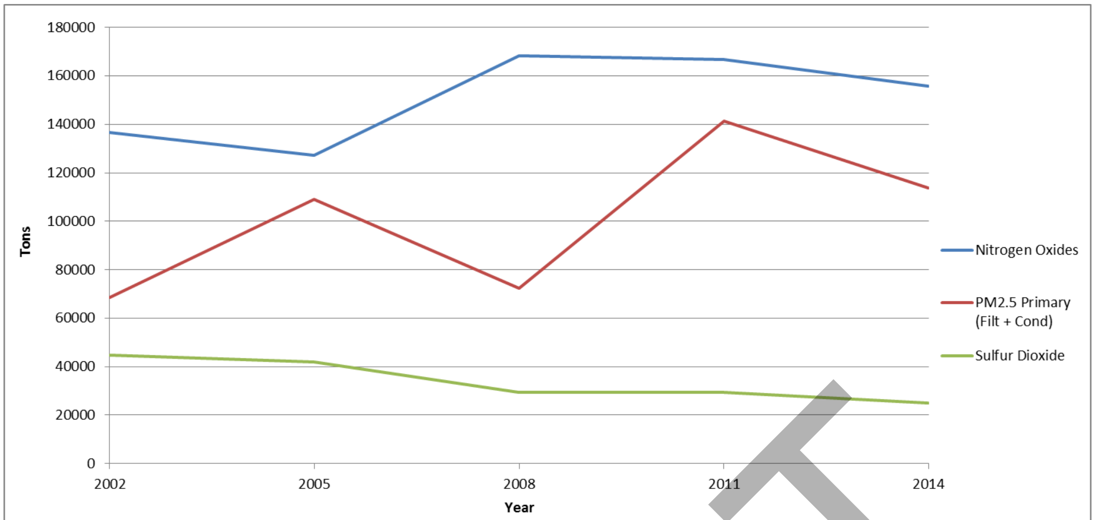


FIGURE 3-8. NO_X, SO_2 AND $PM_{2.5}$ PRI EMISSIONS IN MONTANA, REMOVING BIOGENICS AND MISC. TIERS

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**

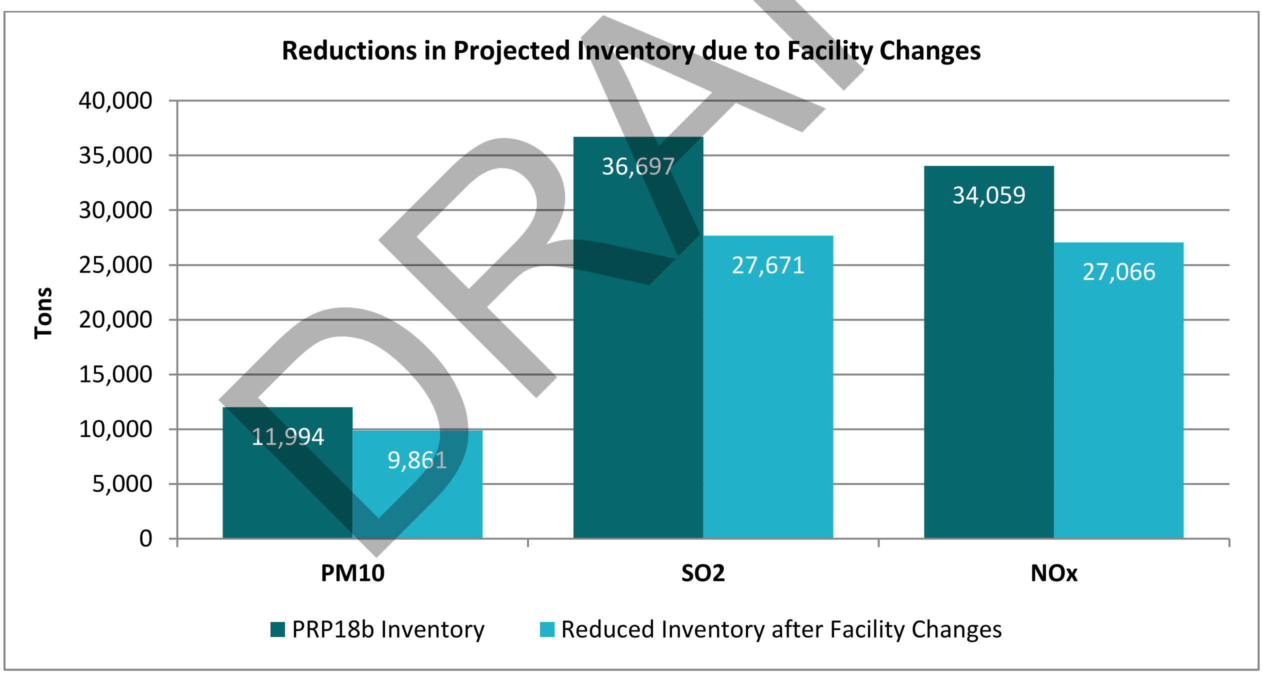
* Rocky Mountain Power, Dave Gates, and Basin Creek emissions are averaged emission inventories for 2012-2016.
Unless otherwise indicated, revised emissions are the emissions reported to the state for the year 2015.

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

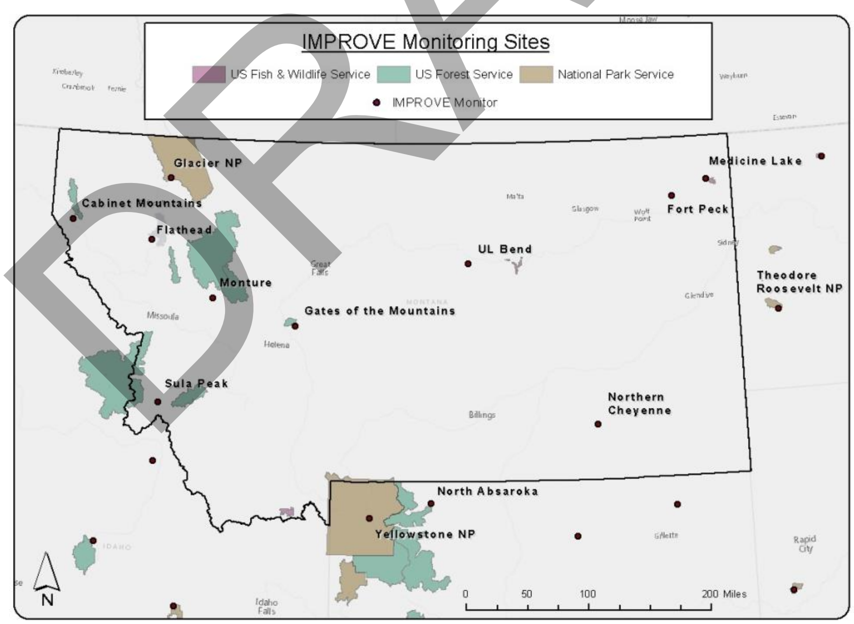
This chapter documents changes in visibility conditions between the baseline and current time periods for each of Montana's 12 mandatory Class I Areas plus two Class I Areas outside of Montana that the Montana FIP identified as being influenced by Montana sources. Title 40 of the Code of Federal Regulations, 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.[63] 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



[63] 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."

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. 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."[64] 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.[65] 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.

[64] 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."
[65] 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.

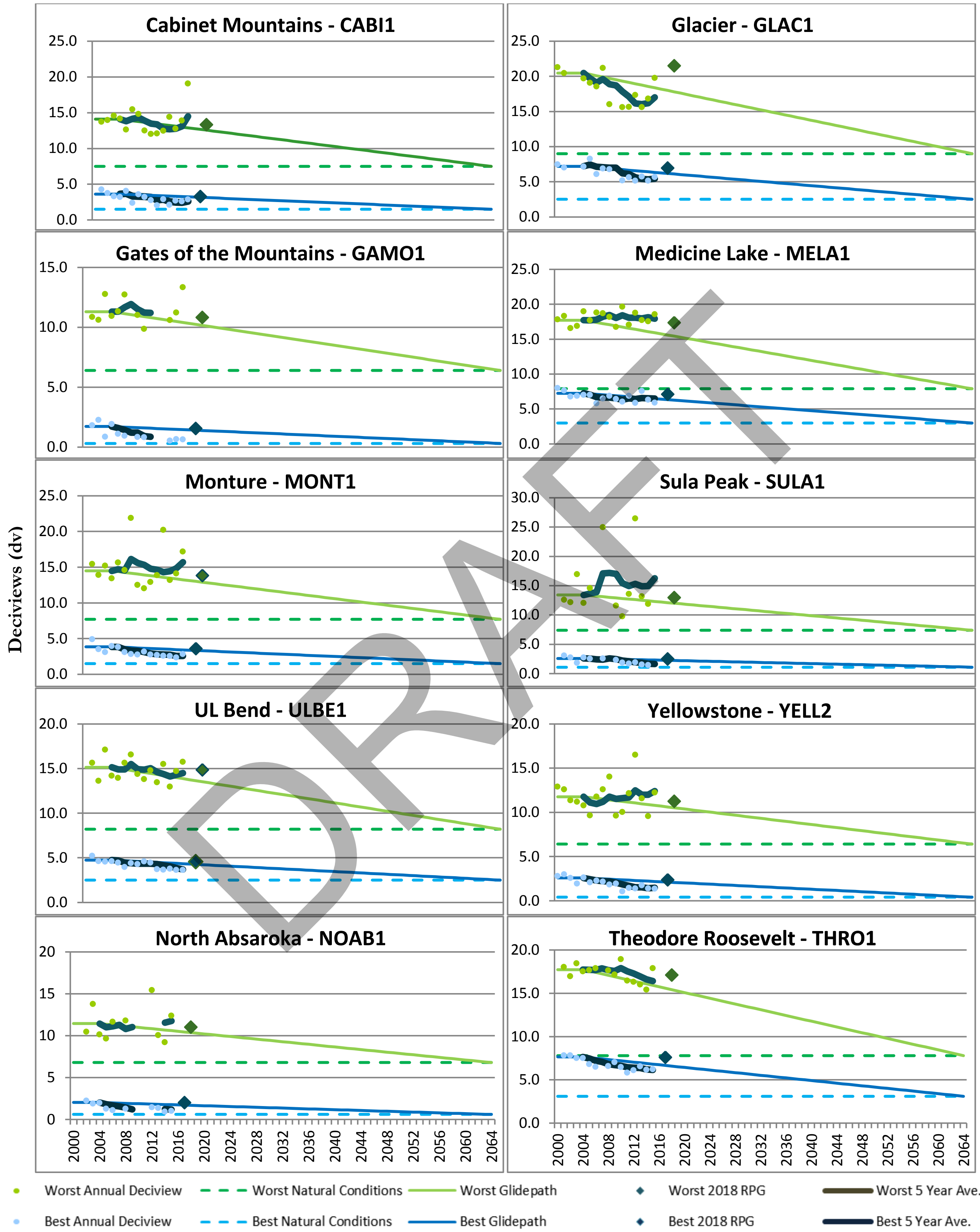
Only three of the ten sites have seen improvement in visibility impairment on the worst days for the 2011-2015 period compared to baseline. As seen in this table, on the worst days, organic carbon contributed the largest increases in light extinction at most sites. Organic carbon is associated with fire (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

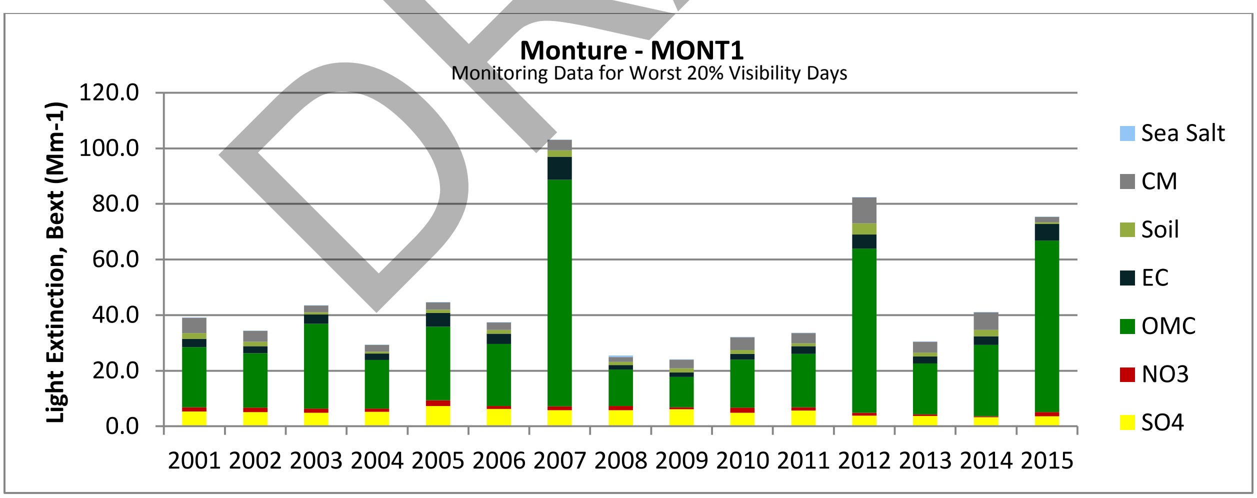
In the original Regional Haze Rule, which informs this progress report, visibility impairment on the worst days was represented by the haziest days within a year. In the western U.S., including Montana, wildfires contribute to the large majority of the haziest days in a year. Wildfire activity in Montana, 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.[66] 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

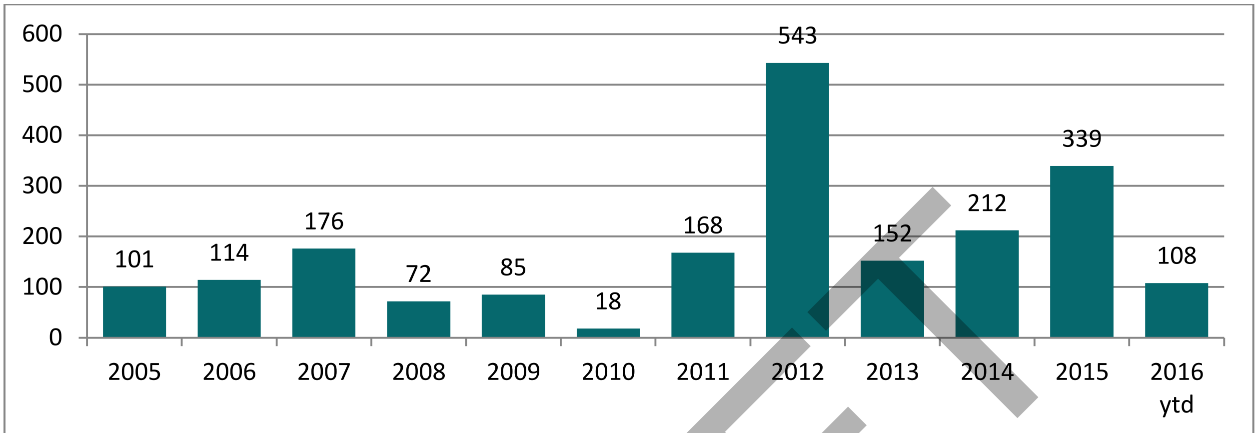


In the graph above, three years stand out as having noticeably higher organic carbon contributions, 2007, 2012, and 2015. These years also stand out in Figure 4-4, which shows the total number of

[66] 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.

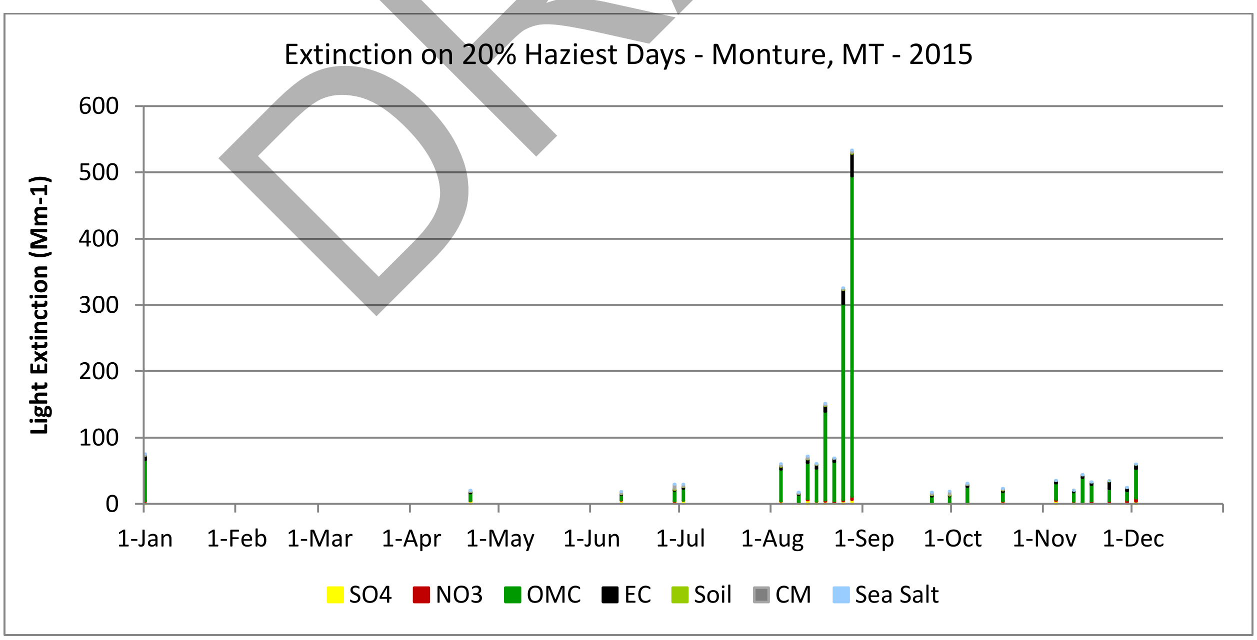
flagged events at the state of Montana's regulatory $PM_{2.5}$ monitors. A flagged monitoring day could include data from any/all regulatory monitors that have been documented as being impacted by smoke from wildfires on the given day. This only includes NAAQS compliance monitors and not special purpose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

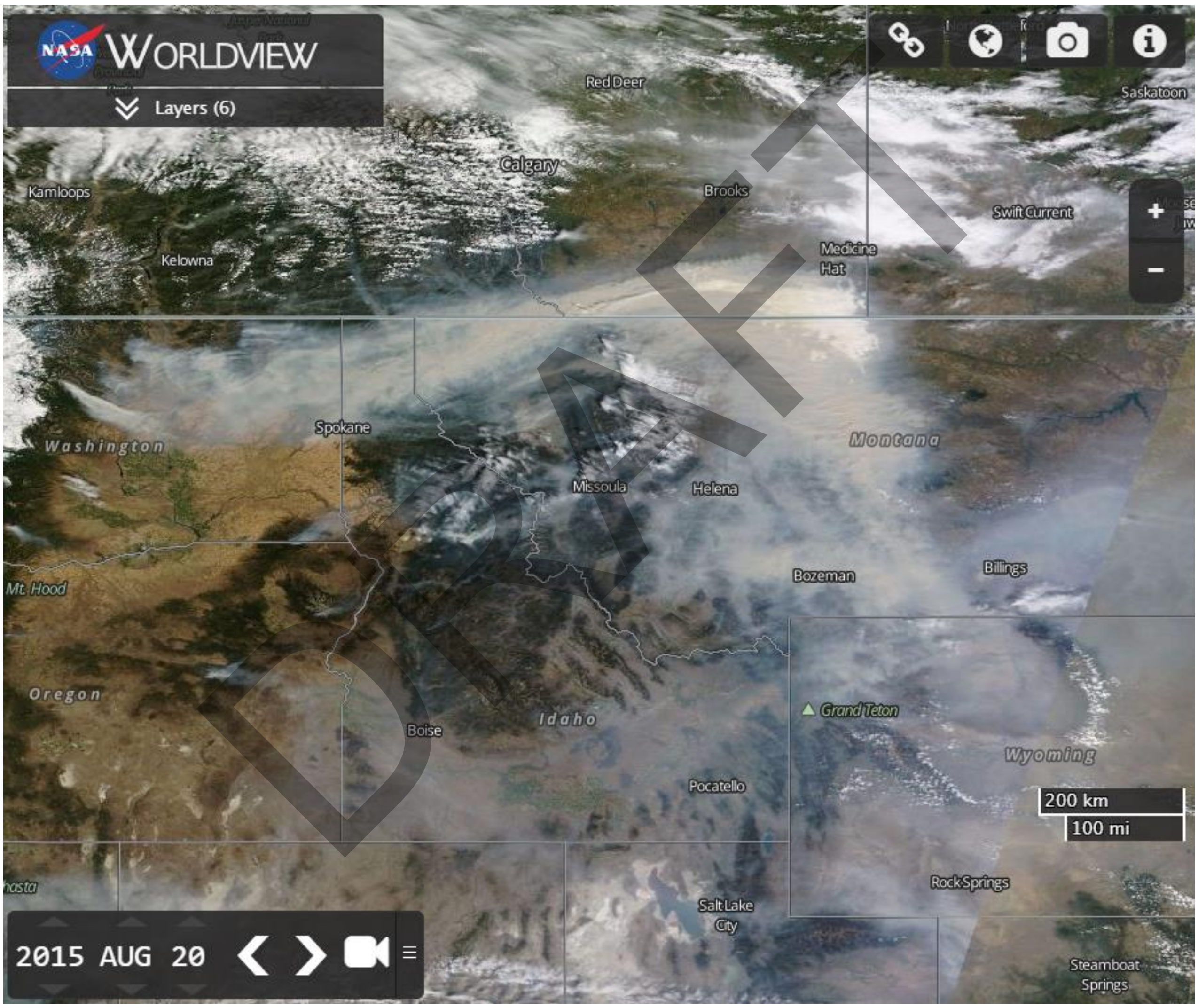
FIGURE 4-5. LIGHT EXTINCTION ON 20% HAZIEST DAYS – MONTURE, MT – 2015



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[67]



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.

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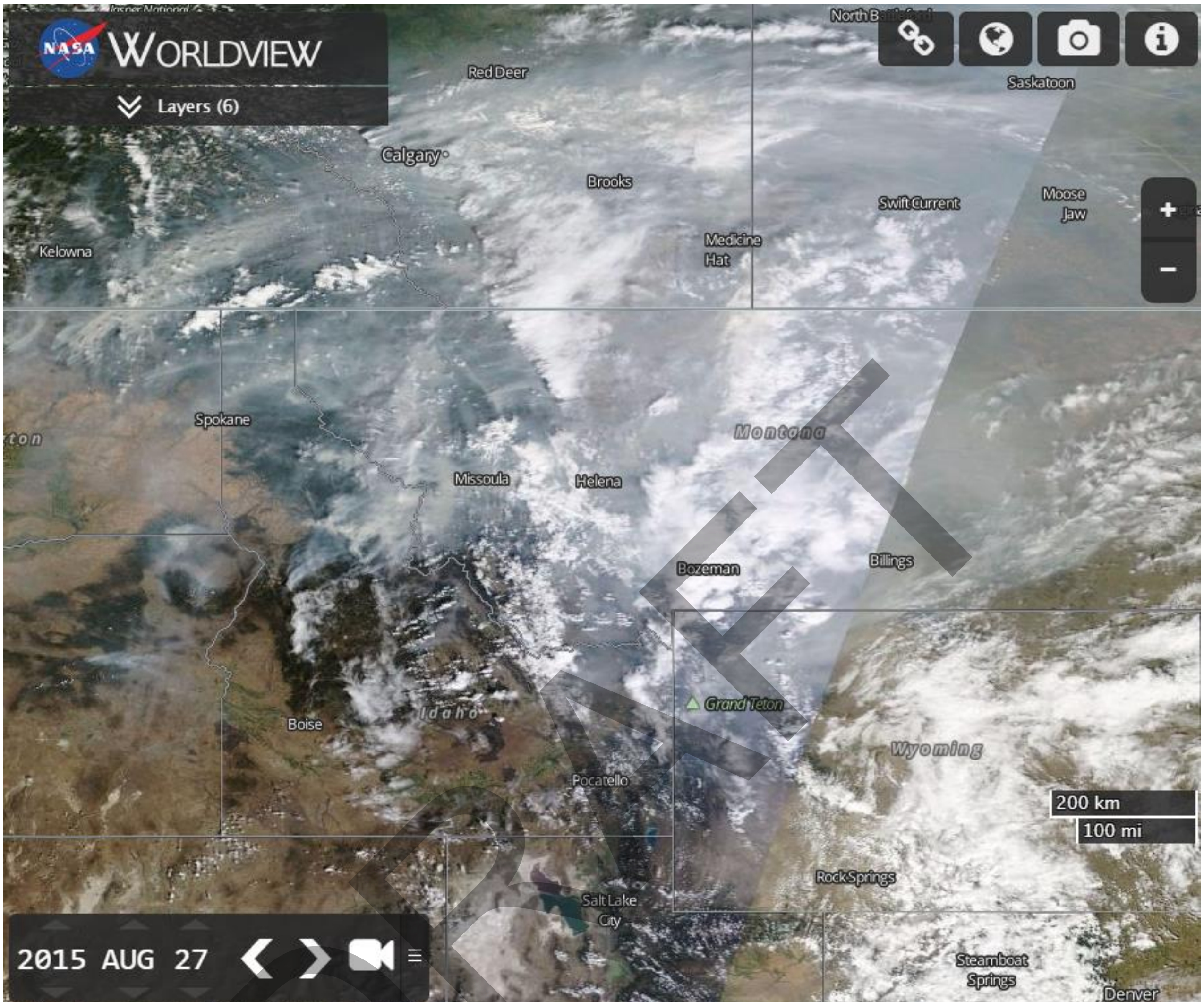
[67] National Aeronautics and Space Administration (NASA), EOSDIS Worldview, 20 Aug. 2015, http://go.nasa.gov/2ifG7G0.

FIGURE 4-7. WILDFIRE ACTIVITY AS SEEN ON SATELLITE IMAGERY ON AUGUST 27, 2015[68]

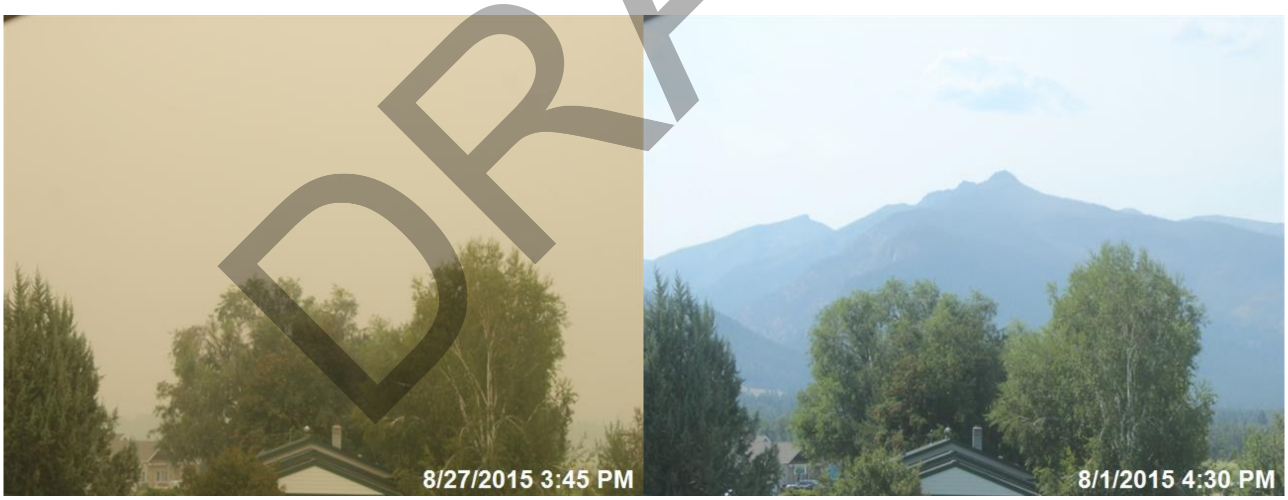


Satellite imagery is helpful to identify sources of wildfire smoke affecting Montana, but it doesn't show the impacts at the ground level and on visibility. For that, webcams can be more informative. For example, Figure 4-8 and Figure 4-9, on the following page, clearly show degraded visibility in two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

[68] 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[69]



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

[69] 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."[70] The following sections provide a discussion of (1) anticipated emissions decreases that may not have occurred and (2) possible unanticipated emissions increases. Taken together, both 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 proposed revisions to the Oldcastle NO_x emission limit. The facility installed controls in spring 2017 and expects lower emissions by the compliance date, but the exact limit Oldcastle must meet is not yet final.

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

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

to improve visibility at Gates of the Mountains by 0.424 deciviews. Despite the regional character of 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.[71] 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. [72]

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.

[71] NPCA v. EPA, No. 12-73710, U.S. 9th Cir. (2015), http://caselaw.findlaw.com/us-9th-circuit/1703871.html.
[72] 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

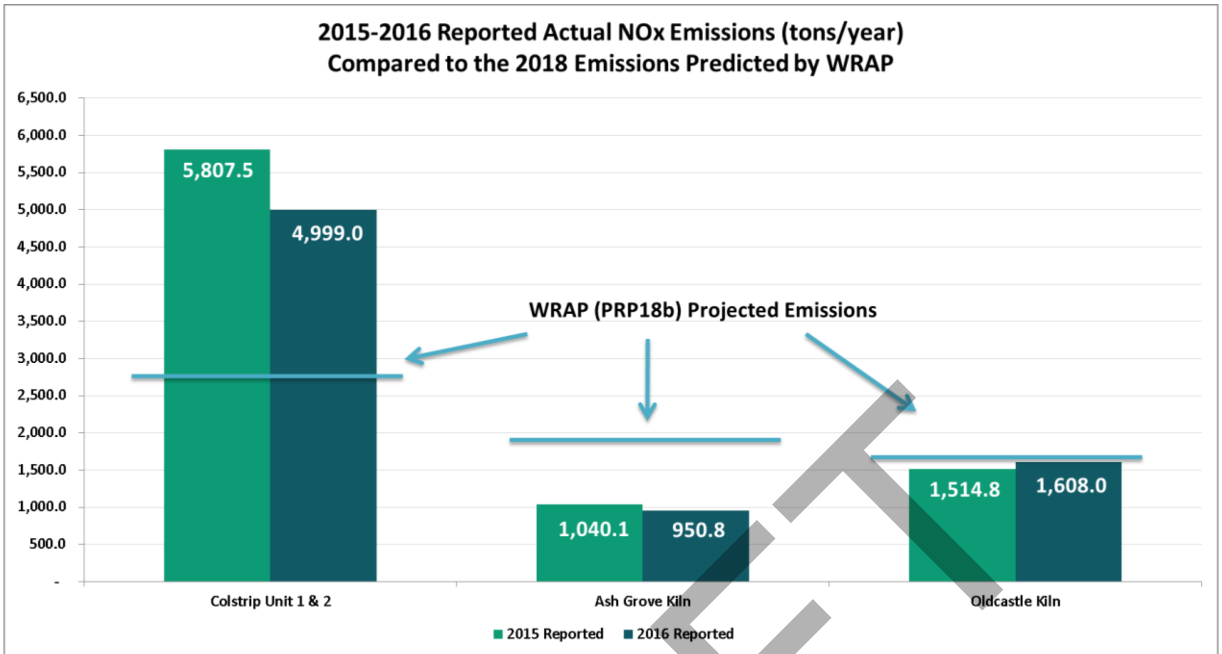


FIGURE 5-2. SO_2 REPORTED VS. PROJECTED EMISSIONS AT BART SOURCES

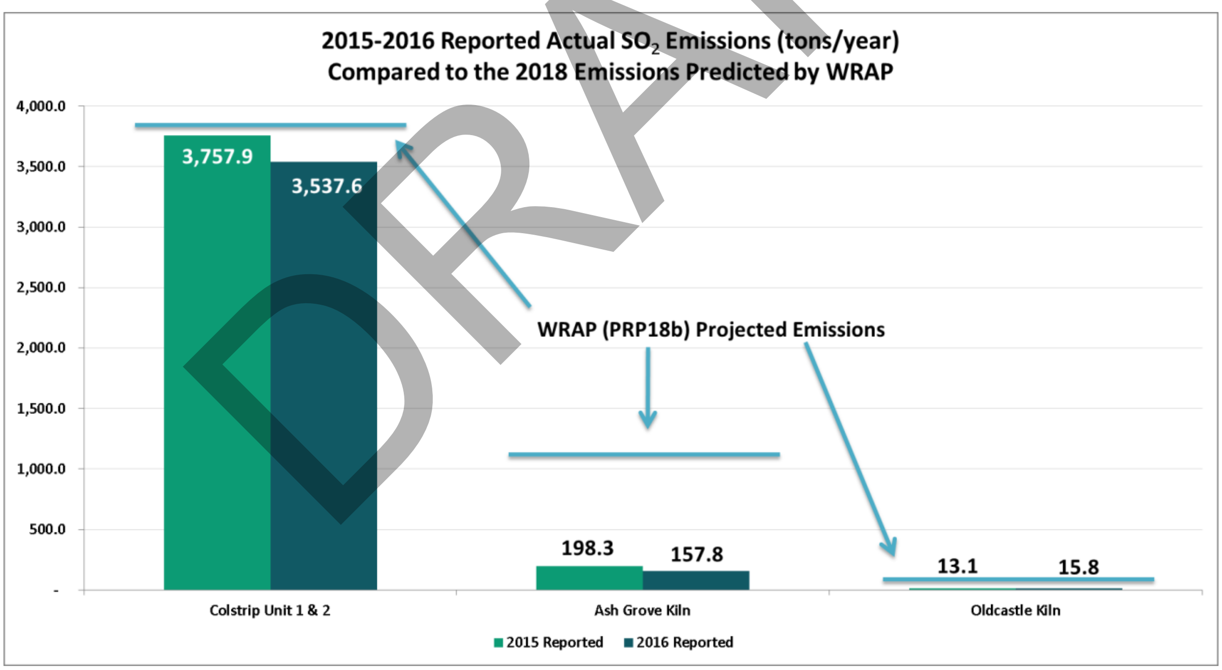
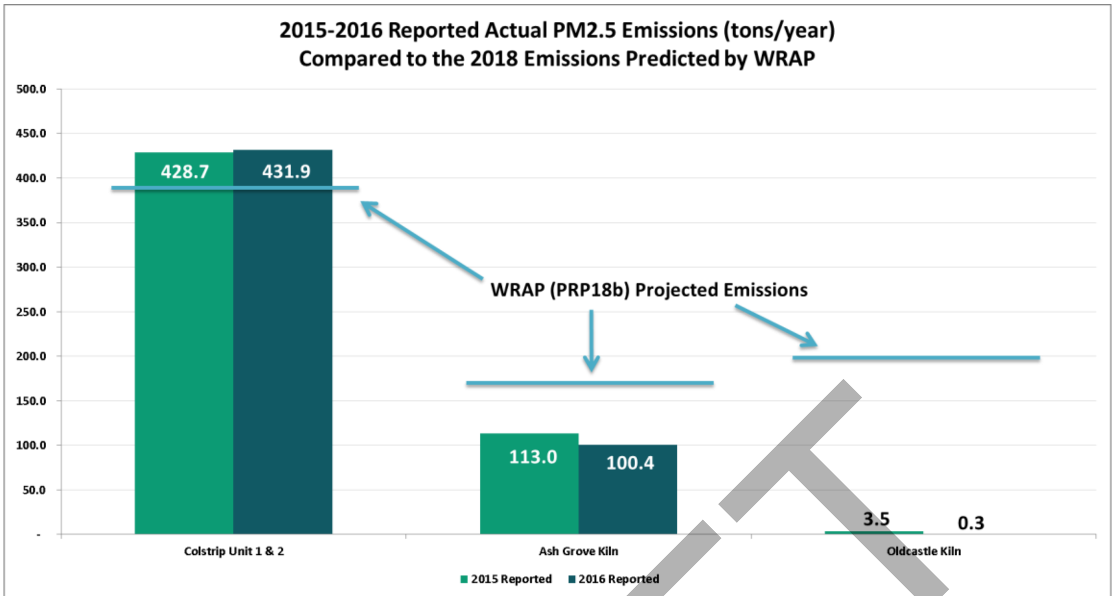


FIGURE 5-3. $PM_{2.5}$ REPORTED VS. PROJECTED EMISSIONS AT BART SOURCES



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.

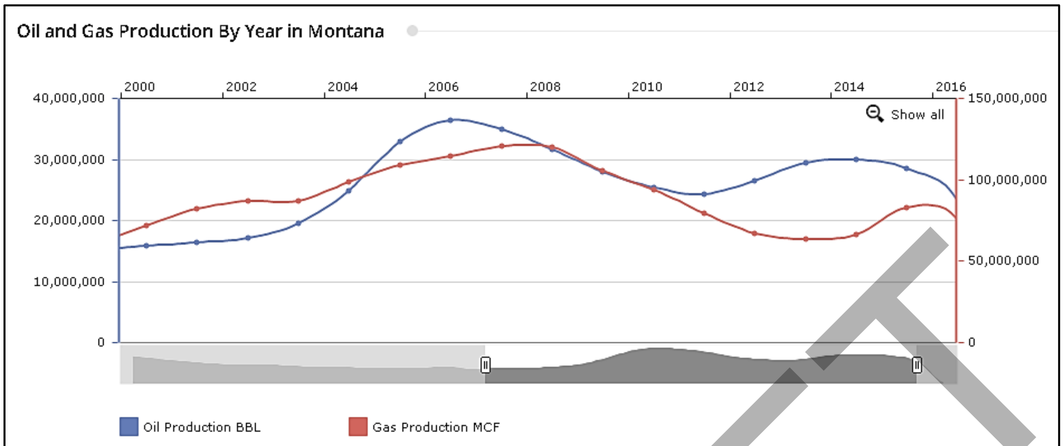
5.2. Oil & Gas Development in Montana, North Dakota, and Wyoming

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.[73] In the graphs, gas production is shown in million cubic feet (MCF) and oil production in barrels (BBL).

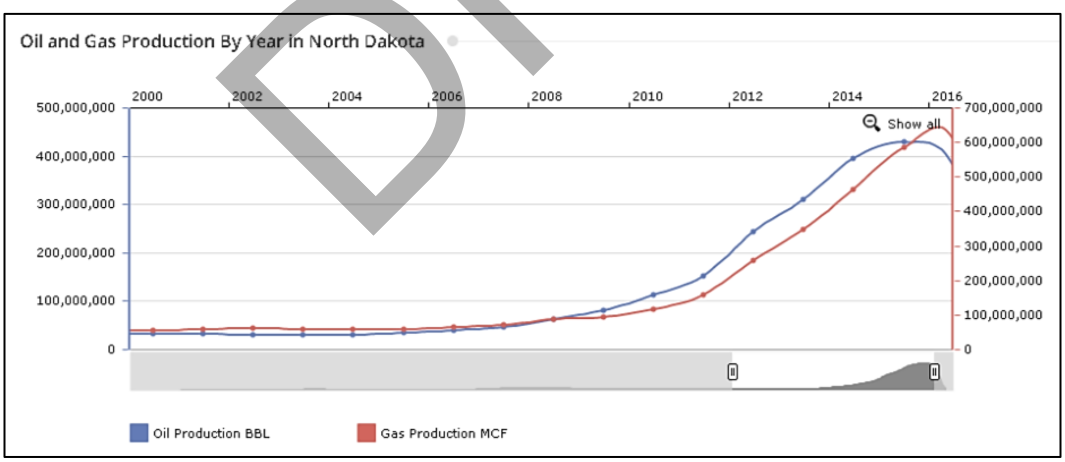
FIGURE 5-4. CHANGES IN MONTANA OIL & GAS PRODUCTION



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. [74]

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



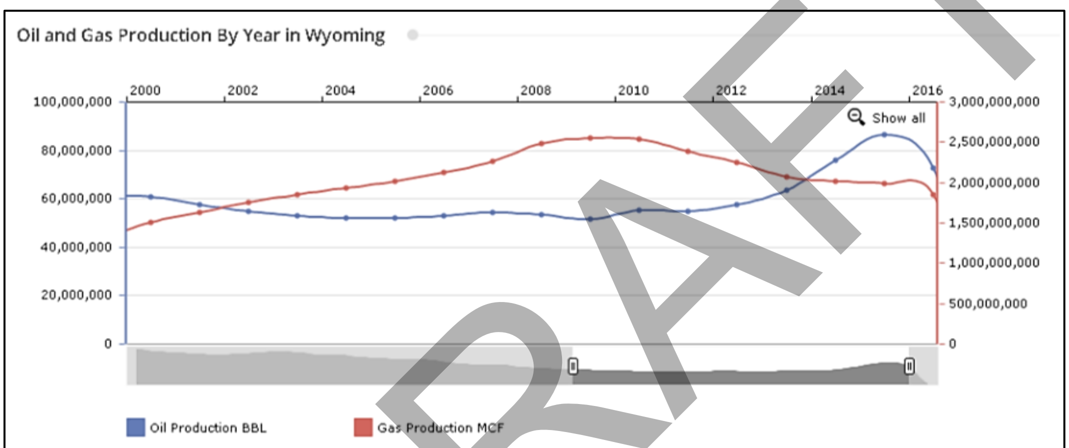
[73] All production data and charts from Drilling Edge, Oil and Gas Data across the United States, www.drillingedge.com (accessed 4/3/2017).
[74] Drilling Edge, North Dakota, www.drillingedge.com/north-dakota.

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

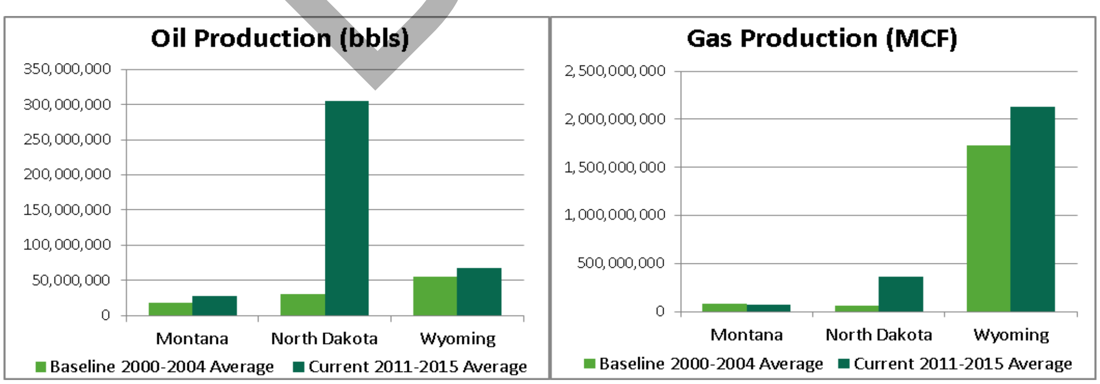
Wyoming also experienced a change in oil and gas production during the time of interest but its production did not reflect a boom but rather minor increases and decreases. Wyoming's gas production was twenty times higher than Montana's during the baseline period and almost 30 times higher for the current 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.[75]

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).

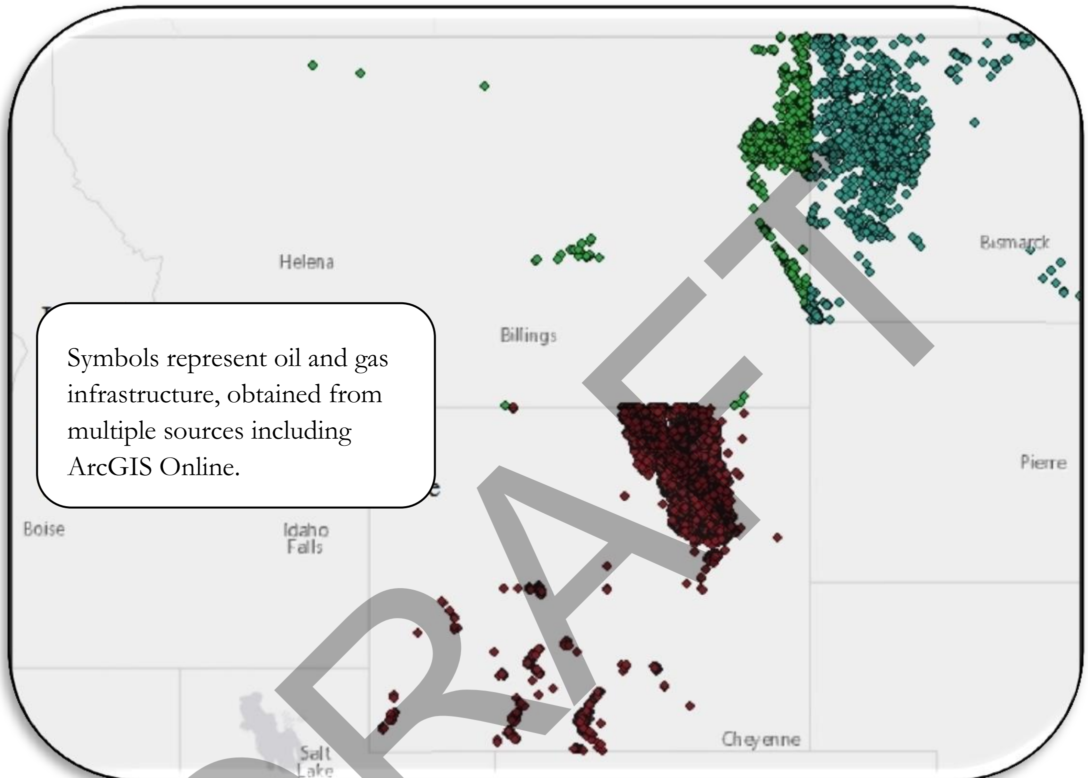
FIGURE 5-7. CHANGE IN OIL & GAS PRODUCTION – BASELINE TO CURRENT[76]



[75] Ibid., Wyoming, www.drillingedge.com/wyoming.
[76] Ibid., www.drillingedge.com.

The map below is an approximation of the most recent oil and gas infrastructure in Montana and North Dakota. 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.[77]

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.

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

[77] Montana DEQ, Air Quality Bureau, Oil & Gas Registration Program. See also, www.ArcGIS.com.

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.

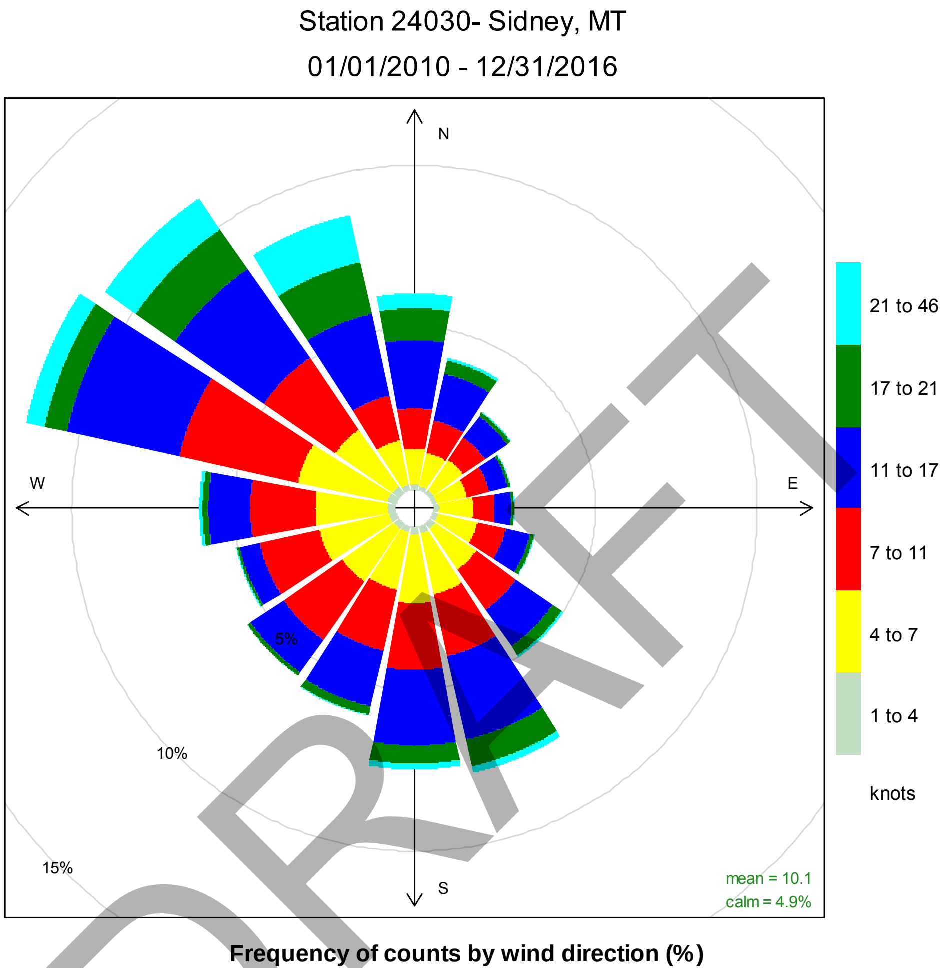
It is possible that increased oil and gas development has contributed to visibility impairment and slowed the rate of progress at Medicine Lake. As discussed above, eastern Montana has experienced a boom in oil and gas development since the time of the Regional Haze baseline period. Although the boom 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.

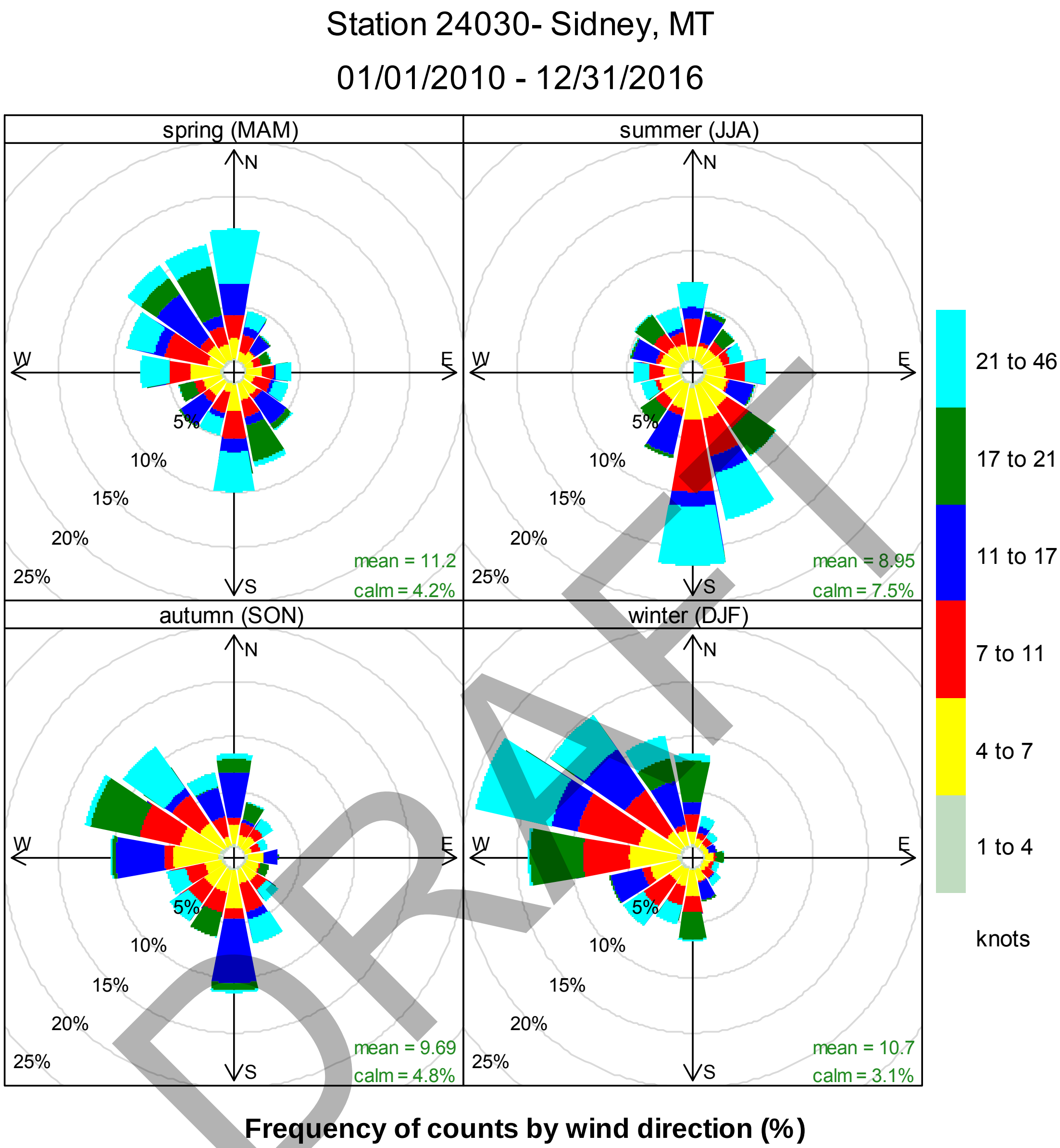
Wind roses from Sidney, MT, were used to analyze the weather patterns influencing Medicine Lake. Sidney is located 56 miles south of Medicine Lake. Halfway between Sidney and Medicine Lake, the Missouri River flows from west to east, otherwise there are no large terrain features to influence weather 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[78]



[78] 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[79]



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.

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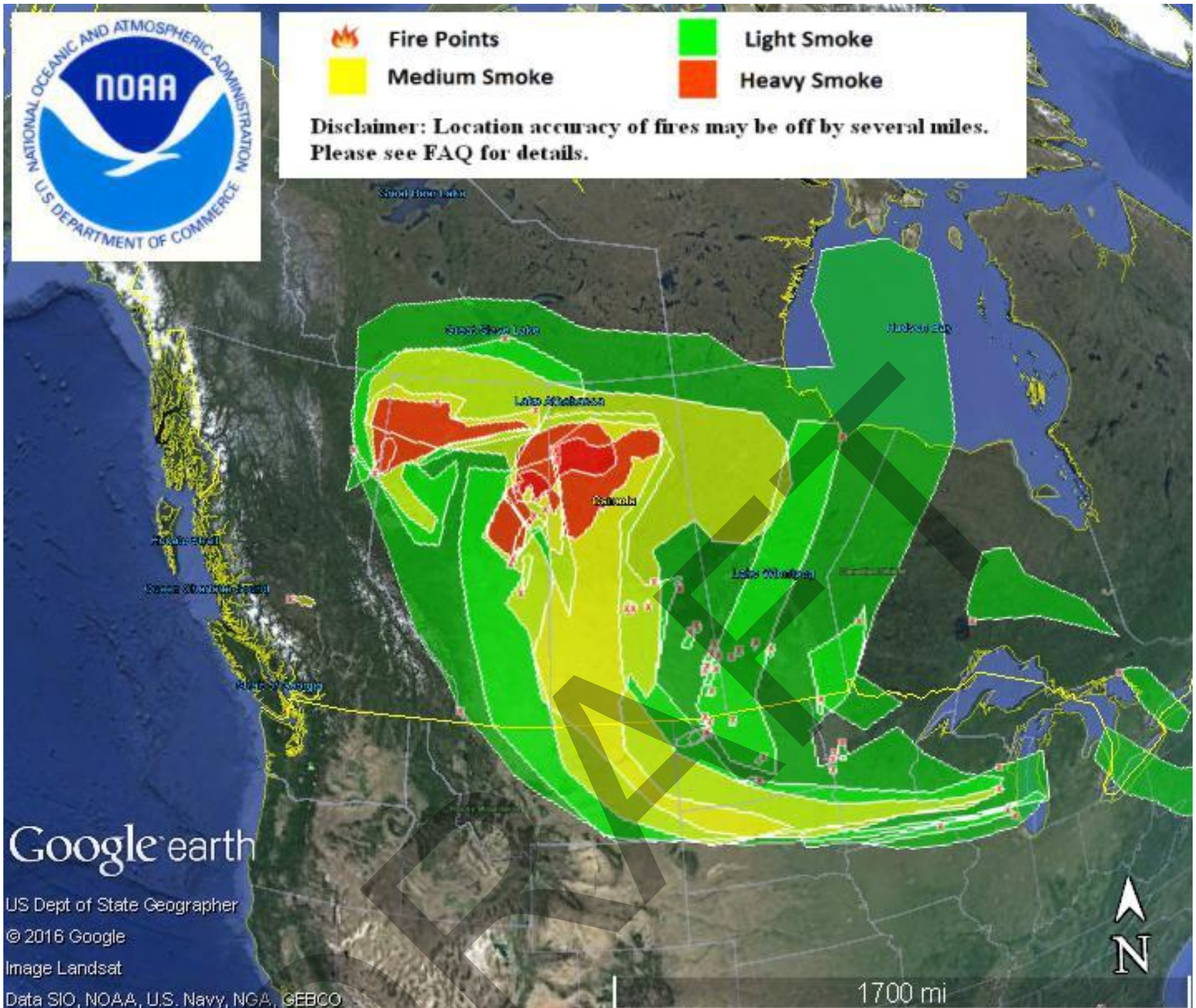
79 Ibid.

FIGURE 5-11. SMOKE MOVEMENT DETECTED ON SATELLITE ON MAY 17, 2016[80]



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.[81] Figure 5-12 and Figure 5-13 show regional contributions to sulfate and nitrate, respectively, on the worst days in the baseline inventory.

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

[81] 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[82]

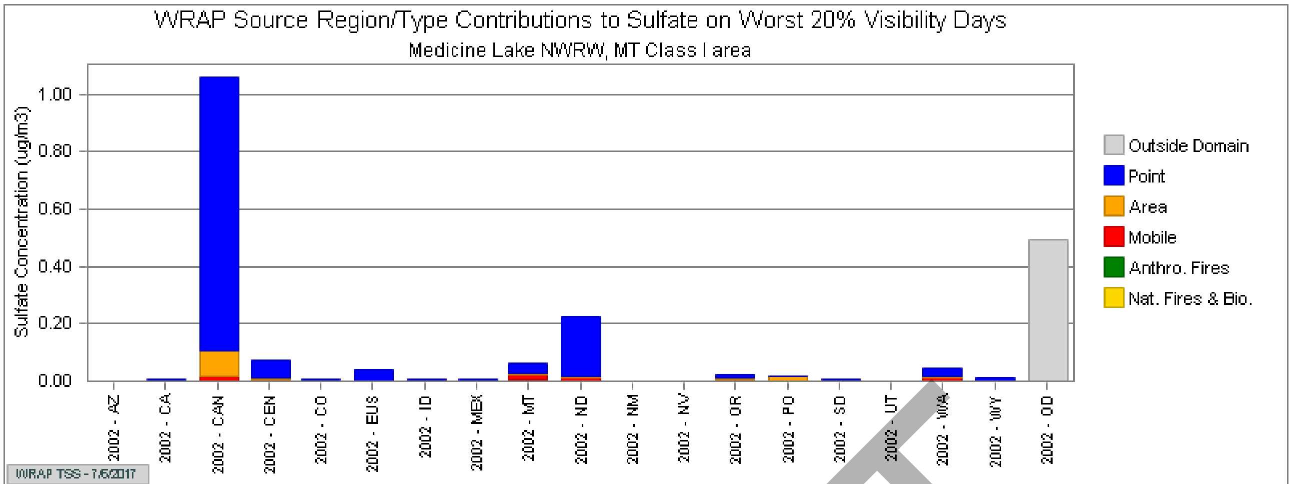
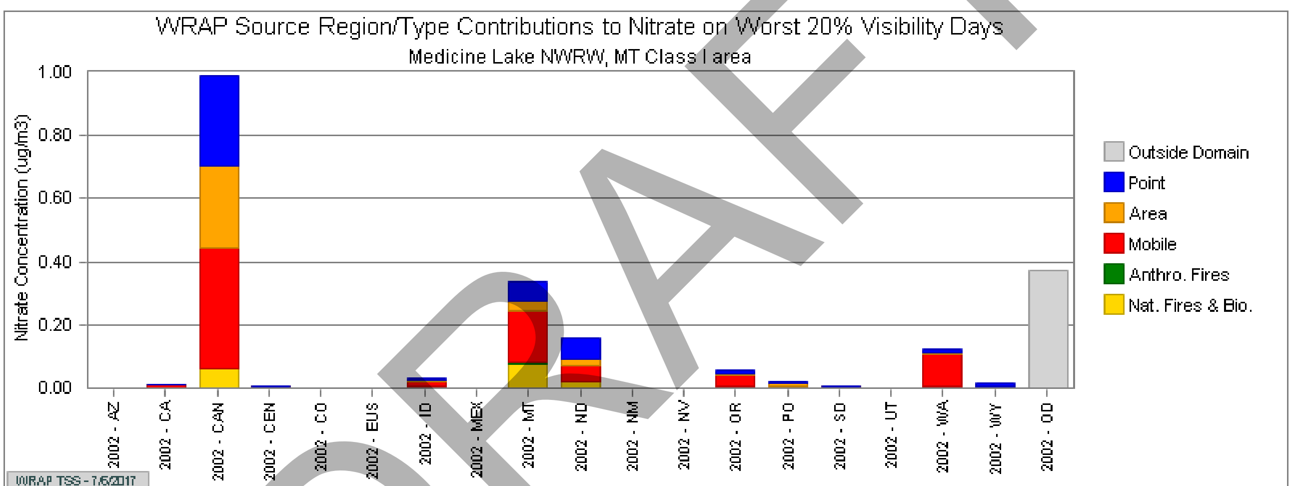


FIGURE 5-13. BASELINE REGIONAL CONTRIBUTION TO NITRATE AT MEDICINE LAKE



In the figures above, it is evident that emissions from Canada far outweigh contributions from other areas, including Montana and 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.[83]

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[82] WRAP, TSS, http://vista.cira.colostate.edu/tss/Results/HazePlanning.aspx.
[83] 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

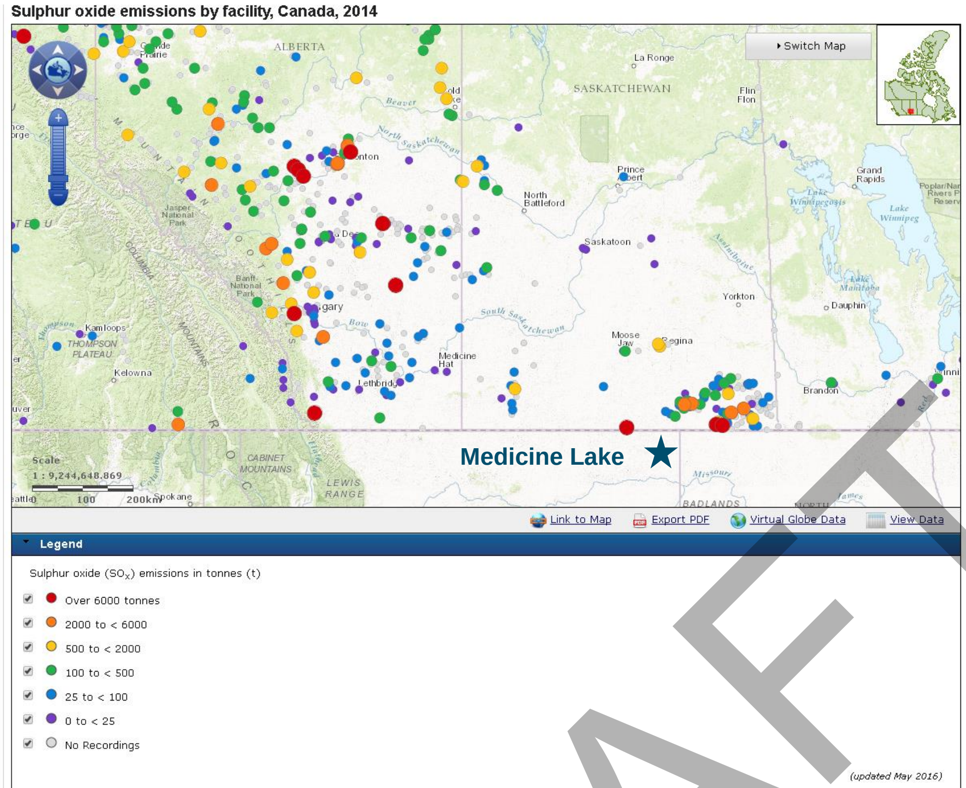


FIGURE 5-15. RELATIVE NO_X EMISSIONS BY FACILITY - CANADA

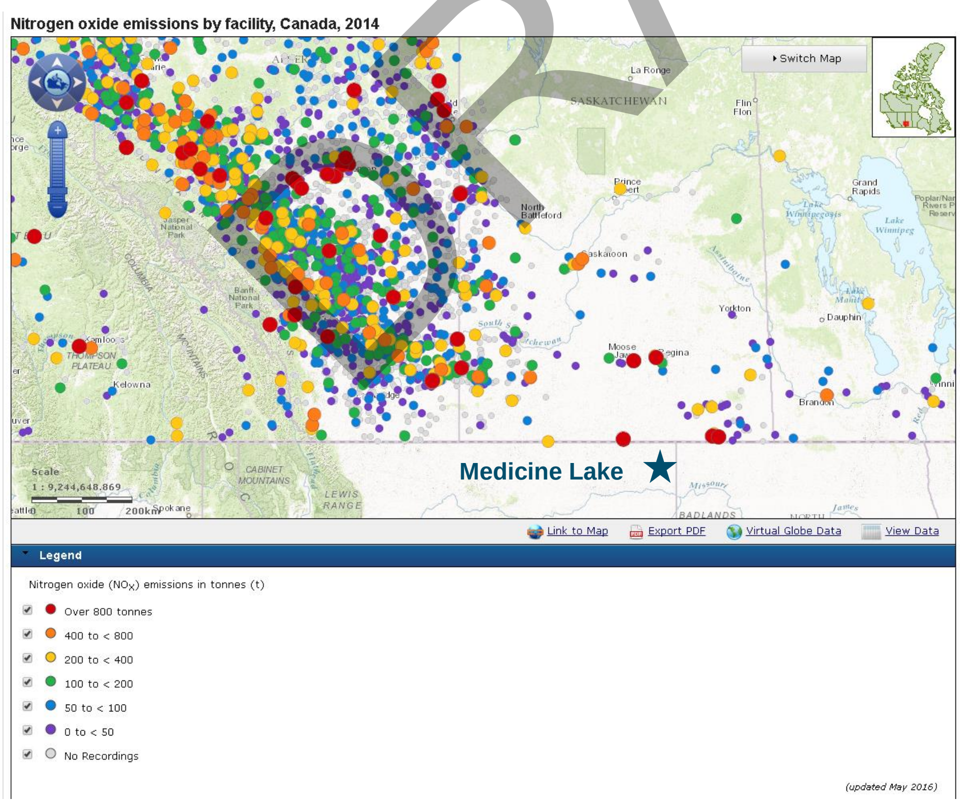
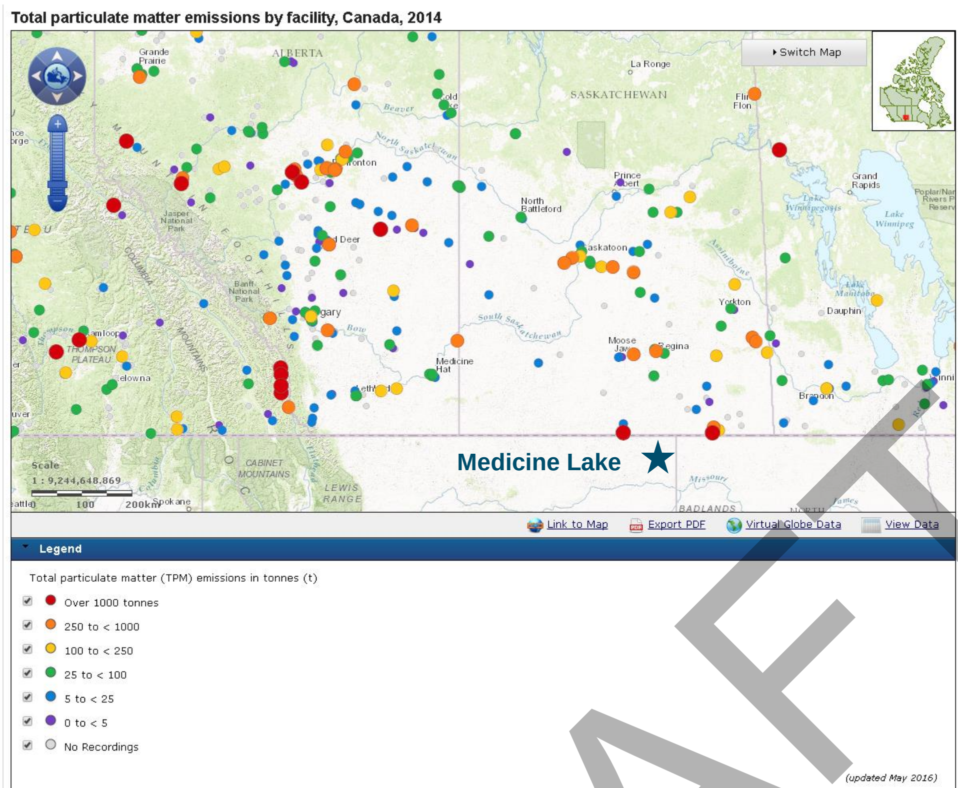


FIGURE 5-16. RELATIVE PM EMISSIONS BY FACILITY - CANADA



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.[84]

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.[85] Figure 5-17

[84] 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).
[85] 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[86]

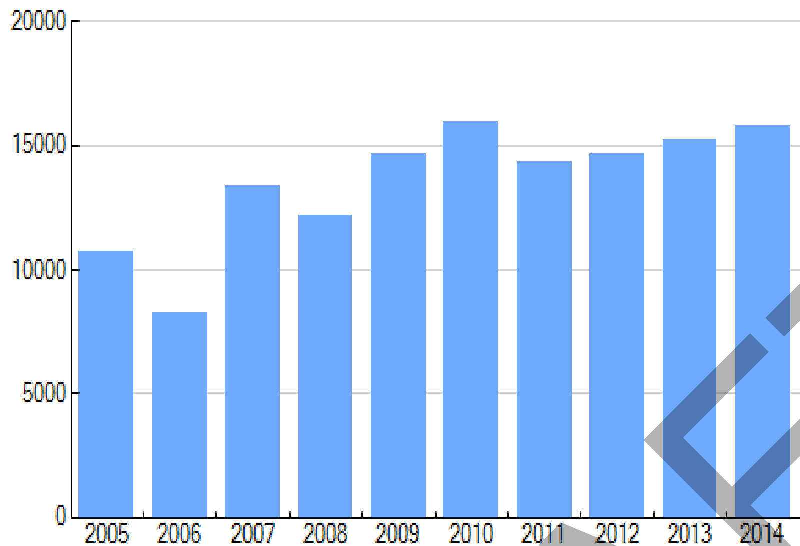
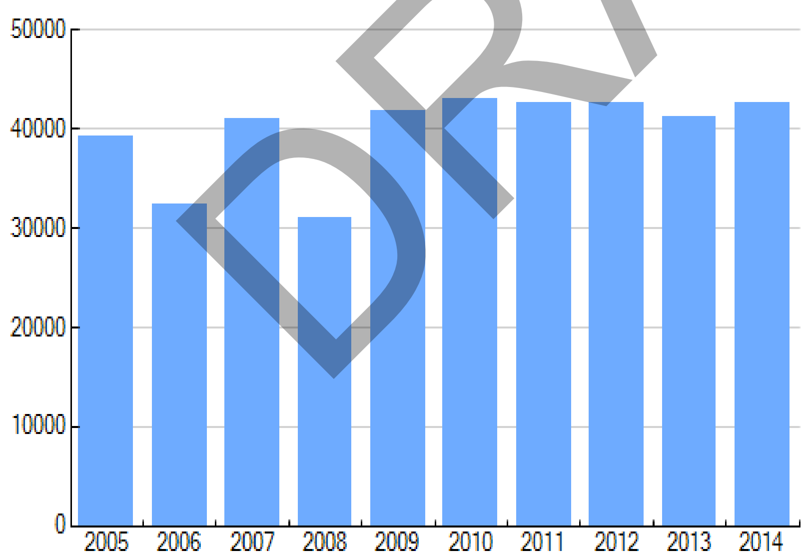


FIGURE 5-18. SULFUR OXIDE EMISSIONS (TONNES), 2005-2014 – POPLAR RIVER



[86] 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)[87]

		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**

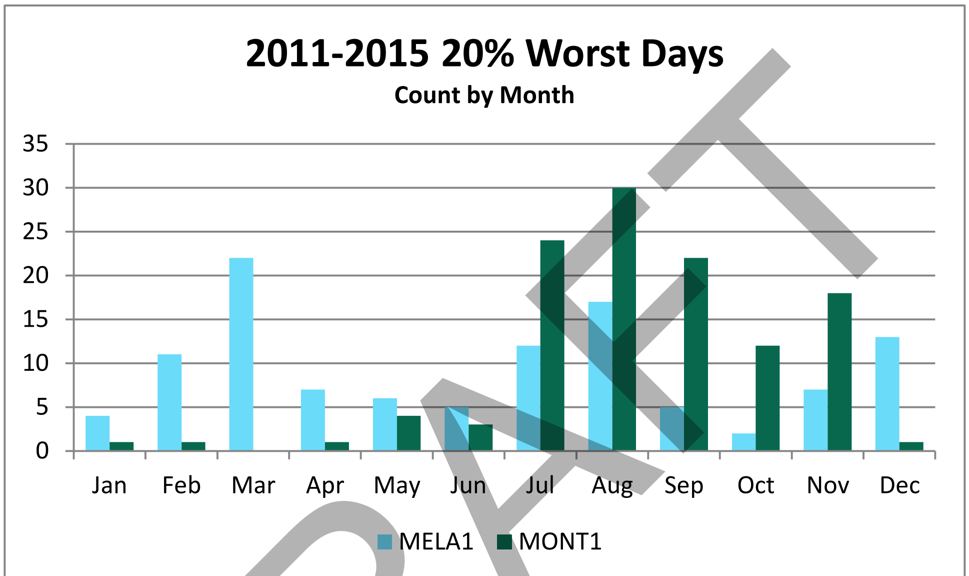
5.3.3. Contribution to Light Extinction at Medicine Lake

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

[87] 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[88]

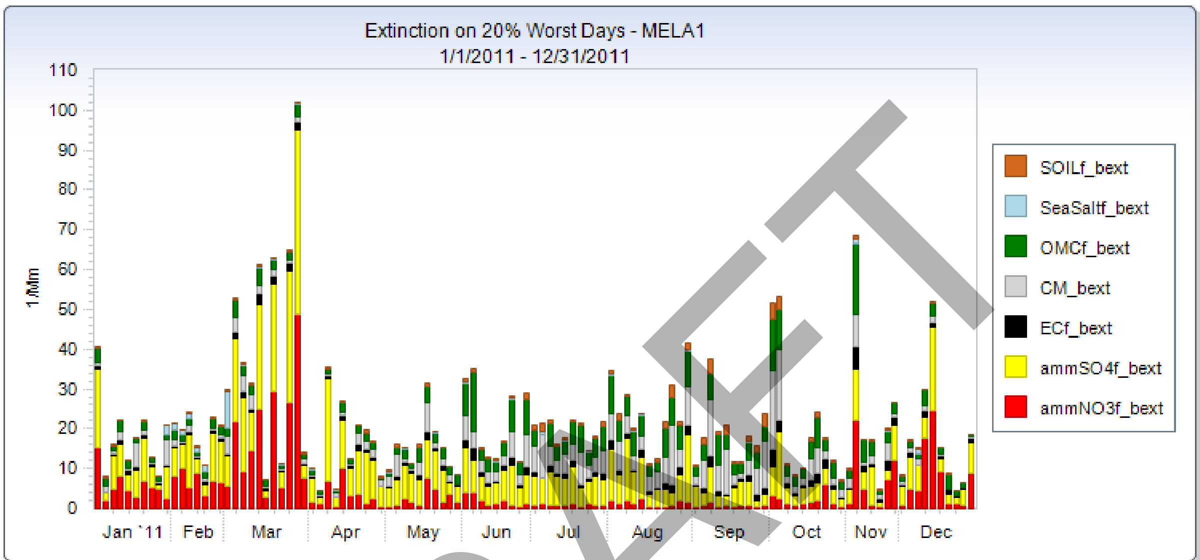
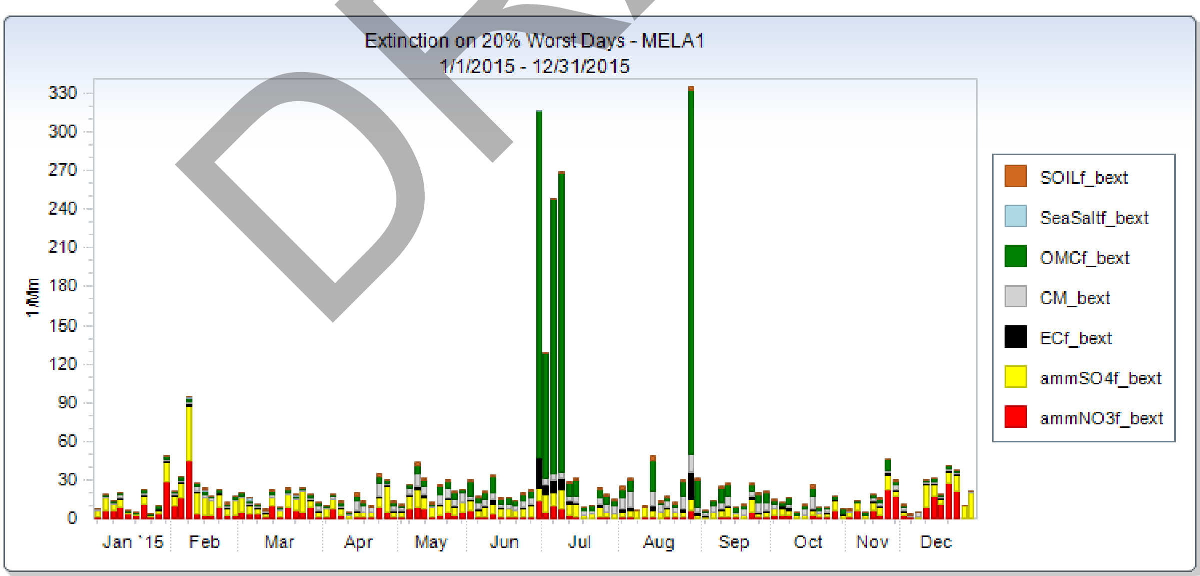


FIGURE 5-21. 2015 LIGHT EXTINCTION ON 20% WORST DAYS AT MELA1



[88] 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

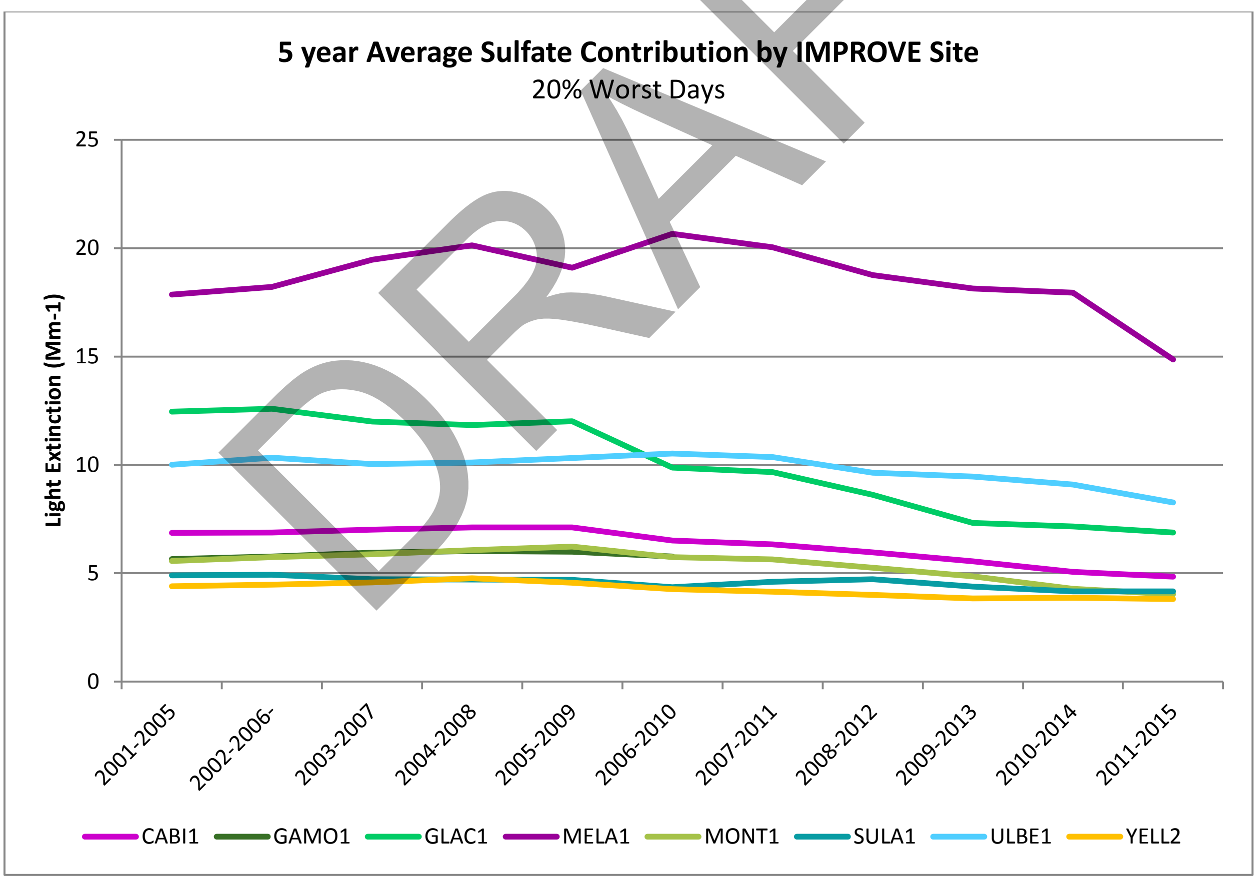
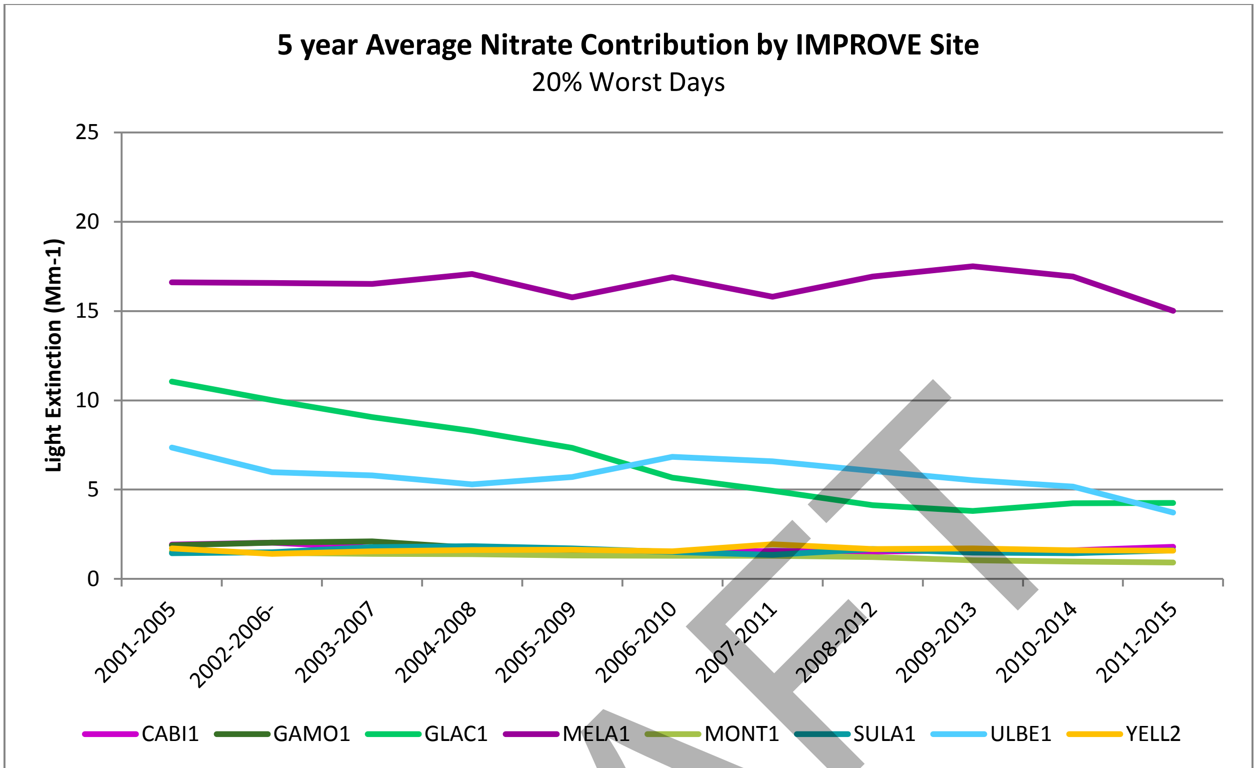


FIGURE 6-2. TRENDS IN NO_x CONTRIBUTION TO LIGHT EXTINCTION



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.[89]

[89] 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

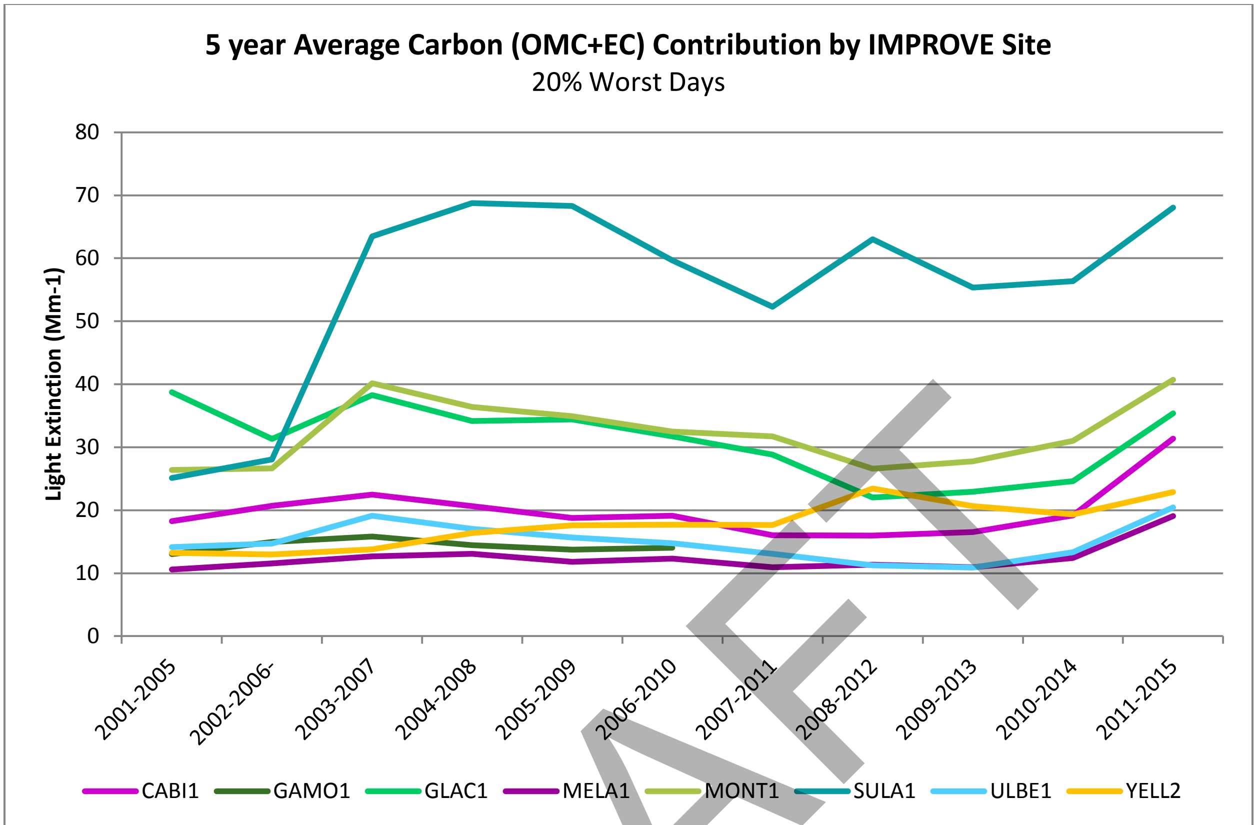


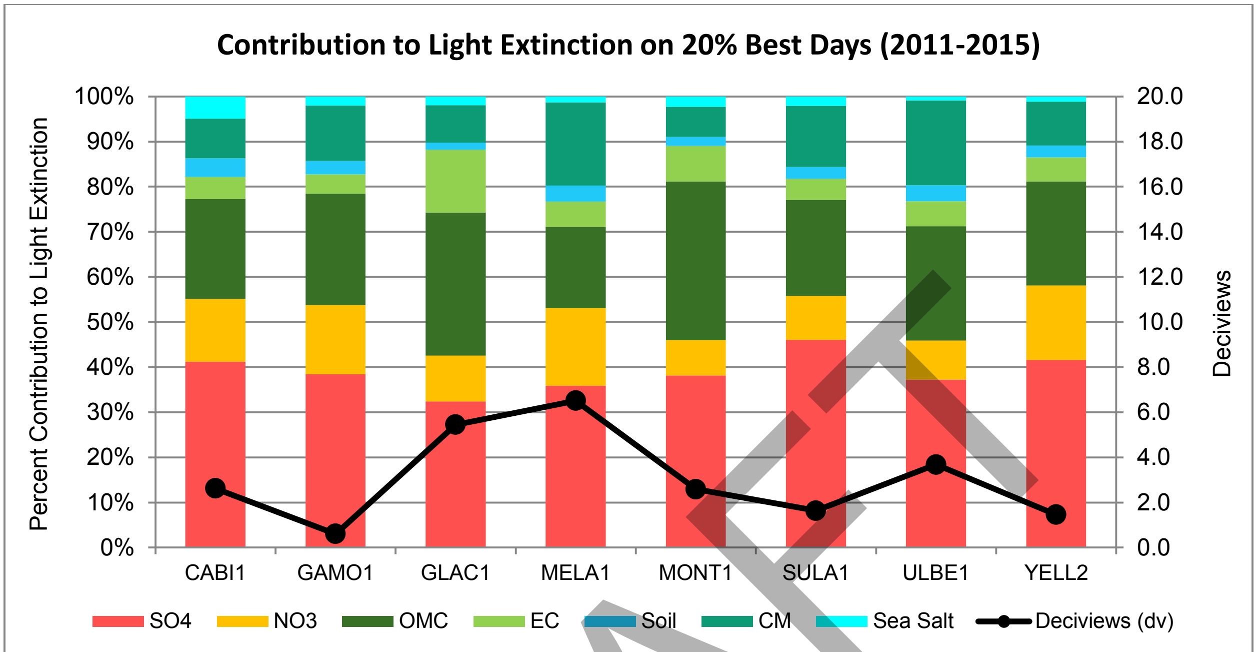
Figure 6-3 shows that the carbon contribution on the worst days increased between the baseline and current periods at nearly every site. Only Glacier National Park (GLAC1) saw a decrease, but that site also started with the highest carbon contribution of any site in Montana.

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.

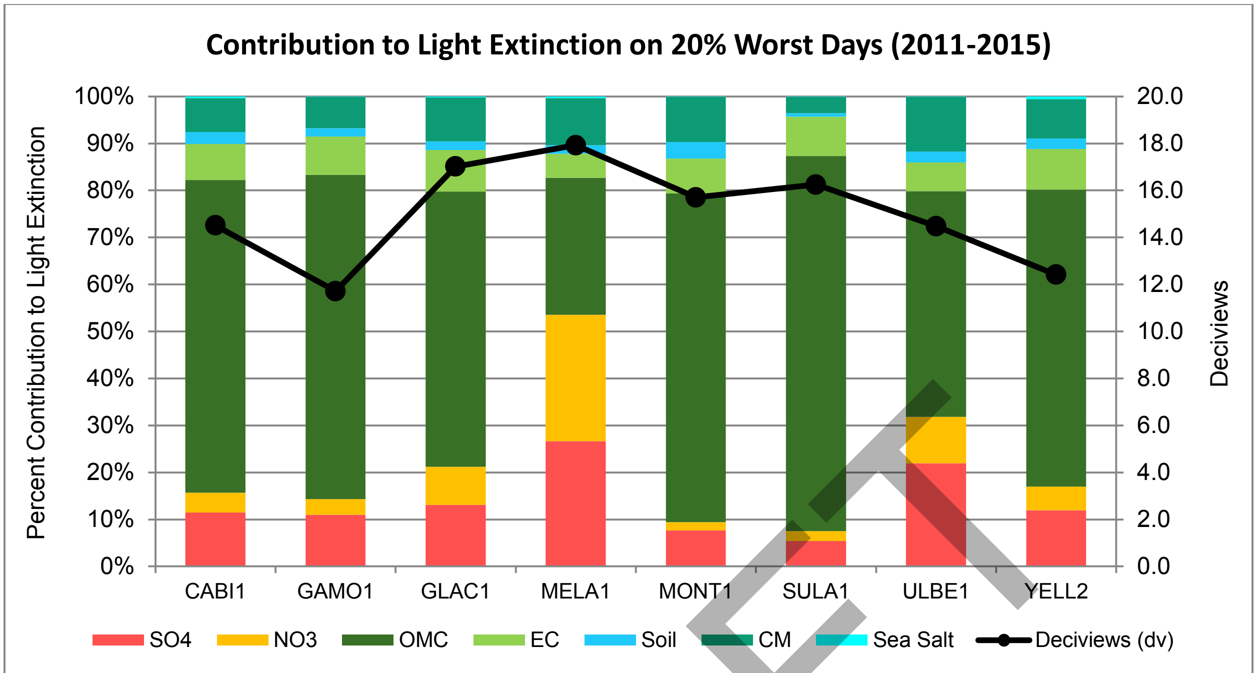
FIGURE 6-4. CONTRIBUTION TO LIGHT EXTINCTION ON THE 20% BEST DAYS



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.

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

APPENDIX B. EMISSION INVENTORY DETAIL

APPENDIX C. DETAILED VISIBILITY ANALYSIS

APPENDIX D. DOCUMENTATION OF FEDERAL LAND MANAGER CONSULTATION & PUBLIC NOTICE PROCESS

[PLACEHOLDER - Content will be added following public notice.]