NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA

Department of Conservation & Natural Resources

DIVISION OF ENVIRONMENTAL PROTECTION

Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

November 18, 2014

Jared Blumenfeld
Regional Administrator
OAR-1, USEPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

RE: SUBMITTAL OF NEVADA'S REGIONAL HAZE 5-YEAR PROGRESS REPORT

Dear Mr. Blumenfeld:

On behalf of Governor Sandoval, as his appointed designee, this letter transmits to you one hard copy and one exact duplicate of the hard copy in electronic format of the *Nevada Regional Haze 5-Year Progress Report* (Progress Report). Additionally, the Progress Report may be viewed on the Nevada Division of Environmental Protection's (NDEP) website at http://ndep.nv.gov/baqp/index.htm. The Progress Report is submitted pursuant to 40 CFR 51 section 308, "Regional haze program requirements." Under the authority in Nevada Revised Statutes 445B.205 and Nevada Administrative Code 445B.053, the Administrator of the NDEP has the authority to adopt and submit state implementation plans to the U.S. Environmental Protection Agency (USEPA) (see Appendix D, section 1.4). The NDEP requests approval of the Progress Report into the applicable Nevada state implementation plan (SIP).

The Progress Report satisfies the requirements for 5-year progress reports found in 40 CFR § 51.308(g), (h) and (i). Evidence of compliance with the consultation and public review processes required for the Progress Report is presented in Appendix C, *Federal Land Management Agency Comments and Nevada's Responses* and Appendix D, *Evidence of Public Participation; Public Comments and Nevada's Responses*. Copies of all formal comments on the Progress Report received by the NDEP and the NDEP's response to those comments appear in Appendices C and D.

We would like to point out that the Progress Report is based on data and analyses that existed as of March 1, 2014. The enclosed Progress Report describes the status of implementing committed control measures, summaries and analyses of emissions and monitoring changes, and assessments of impacts on Class I areas identified in Nevada's original regional haze SIP. The NDEP concludes that Nevada's 2009 regional haze SIP is being implemented appropriately; reasonable progress towards the 2018 visibility conditions goal for mandatory Class I areas impacted by sources in Nevada is being achieved; and no additional control measures are needed at this time. The NDEP urges USEPA to provide timely review and approval of Nevada's Progress Report taking into account the significant progress toward meeting the national visibility goals that Nevada's Progress Report demonstrates.

If you should have any questions about this submittal or require additional clarification, you may contact Jasmine Mehta, Chief, Bureau of Air Quality Planning at (775) 687-9495.

Sincerely,

for Colleen Cripps, Ph.D.
Administrator

Enclosures

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NEVADA REGIONAL HAZE
5-YEAR PROGRESS REPORT

To Satisfy
Sections 308(g), (h) and (i)
of the Regional Haze Rule
(40 CFR § 51.308)

State of Nevada
Division of Environmental Protection
901 South Stewart Street, Suite 4001
Carson City, Nevada 89701

NOVEMBER 18, 2014

NOTE TO READERS

Nevada's Regional Haze 5-Year Progress Report was developed for submittal to the U.S. Environmental Protection Agency under Section 308 of the Regional Haze Rule (40 CFR § 51.308) as a revision to the applicable Nevada state implementation plan (SIP). 40 CFR § 51.308(g) requires periodic reports every five years after the initial regional haze SIP was submitted. This report satisfies the first 5-year progress report requirement. The report is based on data that existed as of March 1, 2014.

Nevada's Regional Haze 5-Year Progress Report and related documents can be found on the following website: http://ndep.nv.gov/baqp/planmodeling/rhaze.html. Western Regional Air Partnership (WRAP) reports and documents can be found on the following websites: http://www.wrapair2.org/ or at the WRAP TSS website: http://vista.cira.colostate.edu/tss/.

Nevada has chosen to link to websites on the internet for many references cited in this report. We have backed up these links by putting electronic copies of reference documents on the Nevada Division of Environmental Protection's (NDEP) server. If any of the links in this document do not work for you, you may contact the NDEP Bureau of Air Quality Planning at 901 South Stewart Street, Suite 4001, Carson City, Nevada 89701 or by telephone at 775-687-9349 for assistance.

ACKNOWLEDGEMENTS

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The supporting technical information in this plan was assembled with the assistance of the WRAP and their consultants.

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EXECUTIVE SUMMARY

In 1977, Congress amended the Clean Air Act (CAA) to establish a national goal to protect visibility in Class I federal areas – national parks, forests and wilderness areas. The amendments called for 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." CAA § 169A. In Nevada, one area was designated: the Jarbidge Wilderness Area (Jarbidge WA) in the northeast corner of the state.

On July 1, 1999, the U.S. Environmental Protection Agency (USEPA) adopted the Regional Haze Rule (RHR). The RHR requires each affected state to develop and adopt an implementation plan that will improve the haziest days and protect the clearest days at each mandatory Class I area in the state with a goal of returning to natural visibility conditions by the year 2064. Each plan must provide a comprehensive analysis of natural and man-made sources of haze in each mandatory Class I area in the state and contain strategies to control anthropogenic emissions that contribute to haze. The plan must also address the transport of haze across state boundaries. The *Nevada Regional Haze State Implementation Plan* (2009 RH SIP), which addressed the initial planning period in the federal rule (2008 to 2018), was submitted to the USEPA on November 18, 2009. A comprehensive SIP revision is due on July 1, 2018 and every ten years thereafter.

USEPA's regional haze regulations also include provisions for 5-year progress reports. These progress reports must provide an assessment of whether the approved SIP is being implemented appropriately and whether reasonable visibility progress is being achieved consistent with the projected visibility improvement in the SIP. The requirements for these reports are found in Title 40 of the Code of Federal Regulations (CFR) Part 51 Sections 308 (g) and (h). Requirements for state and federal land manager (FLM) coordination are found in Part 51 Section 308 (i).

As discussed in the introductory chapter of this report, in Nevada nearly three-quarters of the visibility-impairing pollutants come from natural sources. Emission inventory data for the baseline period show that sulfur dioxide, oxides of nitrogen and coarse mass (dust) are the predominant anthropogenic pollutants in Nevada. For sulfur dioxide, 97 percent of the emissions statewide came from anthropogenic sources; for oxides of nitrogen, 86 percent were anthropogenic; and for coarse mass, 38 percent were anthropogenic. Nevada's long-term strategy for the first planning period focused on sulfur dioxide and nitrogen dioxide because they were the predominant anthropogenic pollutants and because of the controllable nature of these emissions. This report, therefore, focuses on the status of sulfur dioxide and nitrogen dioxide control measures and progress toward Nevada's 2018 visibility improvement goal.

Nevada continues to reduce emissions of the key visibility impairing pollutants. Point source emissions of sulfur dioxide alone decreased by 78 percent from the baseline inventory to the

2008 progress period inventory. Point source emissions of oxides of nitrogen decreased by over 50 percent between the baseline and progress period inventories.

Although natural wildfire smoke and windblown dust persist as the strongest drivers of reduced visibility on worst days at the Jarbidge WA, Nevada's strategies for reducing sulfur dioxide and oxides of nitrogen have lowered sulfate and nitrate particle concentrations at the Jarbidge WA. Monitored light extinction[1] due to both sulfate and nitrate has decreased between the baseline and progress periods for both the worst days and the best days. Trend analyses of the period 2000 to 2012 for the Jarbidge WA show that visibility impairment due to sulfate and nitrate extinction is decreasing through time for both the worst and best days. Thus, the long-term strategy embraced in the 2009 SIP is working to reduce emissions to reach the reasonable progress goals for 2018, as required. In the comprehensive 2018 SIP revision, Nevada will evaluate sources of visibility impairment at Jarbidge WA and revise its long-term strategy for the 2018-2028 planning period, as appropriate.

Since the development of the 2018 emissions inventory for the 2009 RH SIP submittal, additional State and federal regulations and actions have been imposed on various source sectors. These additional mandates will help ensure that reasonable progress goals are attained on or before 2018. In addition, the 2018 emissions projections included a coal-fired power plant that has since ceased operations and been decommissioned, and three proposed power plants whose permit applications have been withdrawn. These actions have led to substantial reductions in the actual and projected emissions of anthropogenic visibility-impairing pollutants from Nevada sources and will further ensure that reasonable progress goals are attained on or before 2018. Finally, as discussed in Chapter Two, all of the facilities in Nevada that are subject to best available retrofit technology (BART) requirements are on schedule to meet those requirements by the State or federal implementation plan compliance dates.

Reducing haze is a regional effort and Nevada continues to work with the other western states and the federal land managers to plan for the required 2018 revision of its RH SIP. The states are focusing on strategies for continued reduction of controllable emissions. Quantification of the impacts of wildfire smoke and other sources beyond State regulatory jurisdiction will continue for the purposes of defining the burden these sources place on achieving visibility goals.

As evidenced by reductions in all of the controllable anthropogenic point source emissions that contribute to haze in Nevada and the concurrent downward trend of sulfate and nitrate light extinction at the Jarbidge WA monitor, Nevada determines the current regional haze plan strategies are adequate for Nevada to meet its 2018 visibility improvement goals. Based on an analysis of Nevada's contribution to visibility impairment at nearby Class I areas, discussed in Chapters One and Six, and consultation with neighboring states, Nevada further concludes that

[1]Light extinction, or the impairment of visibility, occurs due to particles and gases that reflect and absorb light. For a more complete description, see Chapter One of the 2009 RH SIP.

emissions from Nevada sources are not impeding progress at any out-of-state Class I areas. Therefore, no further controls are necessary. In accordance with the requirements of the RHR, the Nevada Division of Environmental Protection (NDEP) hereby submits a negative declaration that no further substantive revision of the 2009 RH SIP is warranted at this time in order to achieve the 2018 reasonable progress goals for visibility improvement and emissions reductions.

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Acronyms, Abbreviations and Terms

2009 RH SIP	Nevada Regional Haze State Implementation Plan, October 2009
BART	Best available retrofit technology
Bext	Light-extinction coefficient, expressed in units of Mm^{-1}
Boardman	PGE Boardman Power Plant (Oregon)
CAA	Clean Air Act
CAMD	Clean Air Market Division
CFR	Code of Federal Regulations
CM	Coarse mass
DEASCO3	Deterministic and Empirical Assessment of Smoke's Contribution to Ozone
dv	deciview
EC	Elemental carbon
EGU	Electrical generating unit
ERG	Eastern Research Group
FWS	Fish and Wildlife Service
g/bhp-hr	Gram per brake horsepower-hour
IMPROVE	Interagency Monitoring of Protected Environments
Jarbidge WA	Jarbidge Wilderness Area
LNB	Low NO_x burners
Mm^{-1}	Inverse megameters
MM5	Meteorological Mesoscale 5
MW	Mega watts
NAAQS	National ambient air quality standards
NDEP	Nevada Division of Environmental Protection
NEI	National Emission Inventory
NH_3	Ammonia
Nitrate(s)	Ammonium nitrate(s)
NO2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPS	National Park Service
PM	Particulate matter
POA	Primary organic aerosol
POM	Particulate organic matter
ppb	Parts per billion
ppm	Parts per million
Reid Gardner	Reid Gardner Generating Station
RH	Regional Haze
RH SIP	Regional Haze State Implementation Plan
RHR	Regional Haze Rule
RPG	Reasonable progress goal
RPOs	Regional planning organization
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SO_x	Sulfur oxides

Sulfate(s)	Ammonium sulfate(s)
tpy	Tons per year
TSD	Technical Support Document
TSS	WRAP Technical Support System
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
VIEWS	Visibility Information Exchange Web System
VOC	Volatile organic carbon
VMT	Vehicle miles traveled
WRAP	Western Regional Air Partnership
WRAP TSD	Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report, June 2013

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Chapter One – Introduction

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1.1 Clean Air Act Requirements for Addressing Regional Haze

In 1977, Congress amended the CAA, establishing a national goal to protect visibility in Class I federal areas – national parks, forests and wilderness areas. The amendments called for 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." CAA § 169A. In 1979, the USEPA, in consultation with the Secretary of Interior, promulgated a list of 156 mandatory Class I areas in which visibility was determined to be an important factor. In Nevada, one area was designated: the Jarbidge WA in the northeast corner of the State.

On July 1, 1999, USEPA issued the RHR, thereby establishing a comprehensive visibility protection program for Class I federal areas. The rule is codified in 40 CFR 51.308. The intent of the RHR is to improve visibility over the long term in all 156 mandatory Class I areas across the country. It requires each affected state to develop and adopt an implementation plan that will improve the haziest days and protect the clearest days at each mandatory Class I area in the state, with a goal of returning to natural visibility conditions by the year 2064. Each plan must provide a comprehensive analysis of natural and man-made sources of haze in each mandatory Class I area in the state and contain strategies to control anthropogenic emissions that contribute to haze. The plan must also address the transport of haze across state boundaries. The 2009 RH SIP, prepared by the NDEP, was submitted to the USEPA on November 18, 2009. The 2009 RH SIP addressed the initial planning period of the RHR, 2008-2018, and is considered the foundational plan for subsequent planning periods.

The USEPA designated five Regional Planning Organizations (RPOs) to assist with the technical support, coordination and cooperation needed to address the visibility issue for the first regional haze SIPs. The multistate RPOs were established to perform the technical regional analyses for these SIPs. The RPO supporting the western states' regional haze effort is the Western Regional Air Partnership (WRAP).

Most of the technical data included in this progress report is from the *"Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report"* (WRAP TSD) (WRAP 2013) developed by the WRAP (www.wrapair2.org, last viewed 8/4/2014) in June of 2013 and the WRAP Technical Support System (TSS) (http://vista.cira.colostate.edu/tss/, last viewed 8/25/2014). The Nevada subsection in the "State and Class I Area Summaries" section of the WRAP TSD is included as Appendix A. The WRAP TSD was prepared to provide the technical basis for use by the western states to develop the first of their individual reasonable progress reports for the 116 federal Class I areas located in the western states. Data are presented in the WRAP report on a regional, state, and Class I area-specific basis that characterize the difference between 2000-2004 baseline conditions and current conditions, represented by the most recent successive 5-year average, that is, the 2005-2009 period. The WRAP report characterizes changes in visibility impairment using aerosol measurements from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network, and it analyzes the differences between emissions inventory years represented by the baseline and current progress periods.

1.2 Requirements for Periodic Reports and Premises

Section 51.308(f) of 40 CFR 51 requires the state to submit a comprehensive SIP revision July 31, 2018 and every 10 years thereafter. Section 308(g) requires periodic reports every five years after the initial regional haze SIP was submitted. Periodic reports must evaluate progress towards the reasonable progress goals (RPG) for each Class I area located within the state, as well as those located outside the state which may be affected by emissions from within the state. This report satisfies the first 5-year progress report requirement. The minimum elements required in each periodic report are listed in 40 CFR §§ 308(g)(1-7) and 308(h)(1-4). This report is organized according to those elements.

> *51.308(g) Requirements for periodic reports describing progress towards the reasonable progress goals. Each State identified in § 51.300(b)(3) must submit a report to the Administrator every 5 years evaluating progress towards the reasonable progress goal for each mandatory Class I Federal area located within the State and in each mandatory Class I Federal area located outside the State which may be affected by emissions from within the State.*

Five-year progress reports must include: 1) the status of implementation of control measures included in the original regional haze SIP, 2) a summary of emission reductions achieved through the implementation of control measures, 3) an assessment of visibility conditions, 4) an analysis of the changes in emissions of visibility-impairing pollutants, 5) an assessment of significant changes in anthropogenic emissions that may have limited or impeded progress in improving visibility, 6) an assessment of whether the current SIP elements and strategies are sufficient to meet reasonable progress goals, and 7) a review of the state's visibility monitoring strategy.

At the same time the state submits its progress report, the state must also make a determination of the adequacy of the existing implementation plan. This 5-year review provides a progress report on the initial 2009 RH SIP. It addresses each required element based on data that was available as of March 1, 2014. The 2000 through 2004 baseline period planning inventory was developed by the WRAP to represent baseline conditions for comparison with future year projected emissions, as well as for gauging reasonable progress with respect to future year visibility. The baseline inventory, Plan02d, was used in the initial RH SIP and is used in this report, also, as the reference planning period. To assess progress, this report relies on emissions information from the 2008 National Emissions Inventory (NEI) as updated by the WRAP through its WestJump Air Quality Modeling Study (WestJump 2008), 2011 NEI data, and visibility data from the 5-year period from 2008 to 2012.

In discussing the status of control strategies, USEPA guidance suggests that "[t]he report should focus on a targeted evaluation of important control measures that achieve reductions in visibility-impairing pollutant species." USEPA 2013, page 5. The WRAP technical analyses of causes of haze in the west show significant impacts from non-anthropogenic and otherwise non-controllable source sectors, such as fire, dust and sources outside Nevada's jurisdiction and, therefore, outside of Nevada's control. 2009 RH SIP Section 7.9.3. In Nevada, nearly three-quarters of the visibility-impairing pollutant emissions come from natural sources.

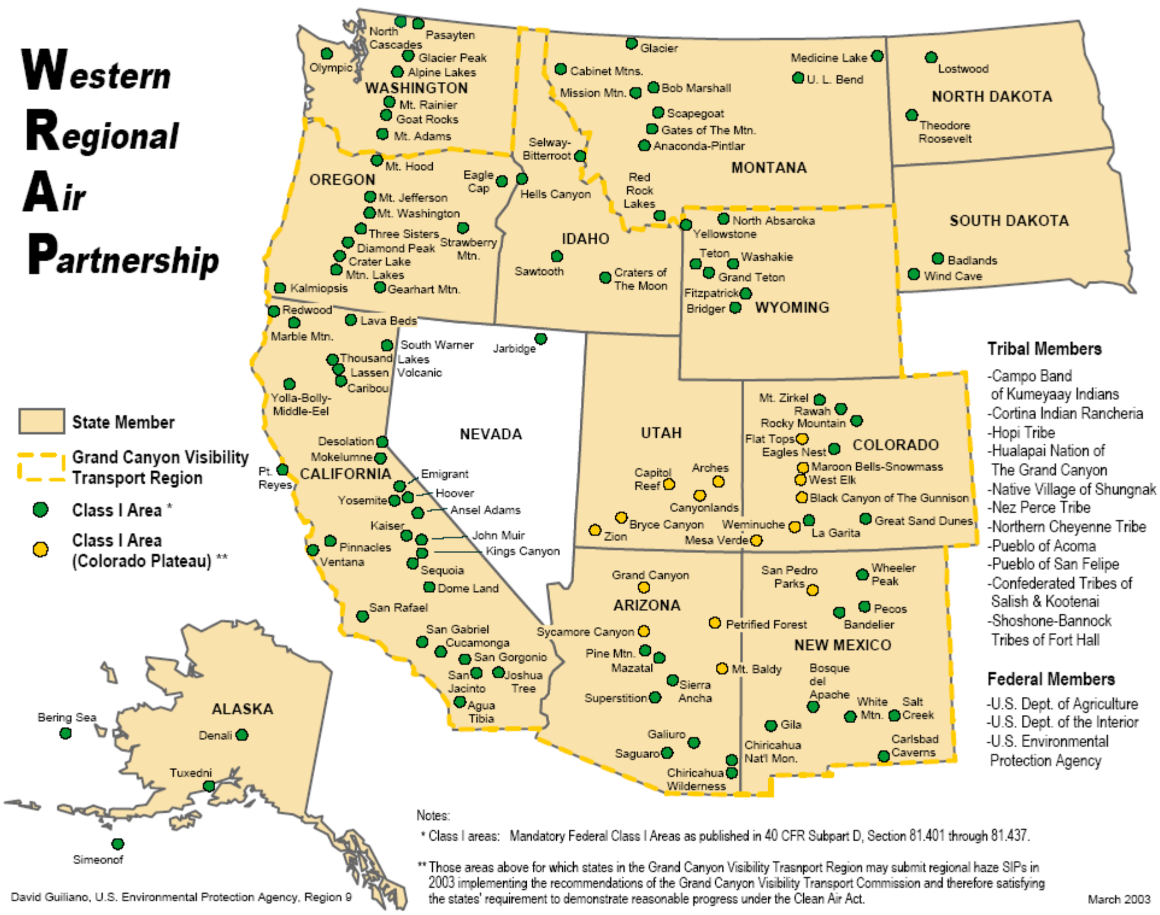
The 2009 RH SIP identifies the relative contribution of each visibility impairing pollutant from anthropogenic and natural emission sources. 2009 RH SIP Section 7.9.1. The data show sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) emissions are predominately from anthropogenic sources, such as point, mobile and area sources. Nevada's long-term strategy for the first planning period focused on these pollutants in part due to the important role of BART for the first planning period, but also due to the controllable nature of these emissions. This report, therefore, focuses on the status of efforts to date to control SO_2 and NO_2 emissions. In addition, controlling SO_2 and NO_2 emissions has a co-benefit of reducing other visibility-impairing pollutants.

40 CFR Section 51.308(i) sets forth the requirements for State and federal land managers (FLMs) coordination. Subparagraphs (2) and (3) require an opportunity for FLMs to consult with the state on visibility impairment, reasonable progress goals and control strategies for Class I areas in the state. Evidence of compliance with these requirements is included as Appendix C of this report. Subparagraph (4) requires a plan for continued consultation by the state with FLMs. In the 2009 RH SIP, Nevada committed to continuing consultation between the State and FLMs on the implementation of the visibility protection program, including development and review of implementation plan revisions and 5-year progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibility in any mandatory federal Class I area within the State. Nevada also committed to continued participation in the WRAP and coordination and consultation with nearby states and tribes. The State of Nevada reaffirms its commitment to participate in a regional planning process with the WRAP states, the U.S. Department of Interior (USDOI), the Fish and Wildlife Service (FWS) and the National Park Service (NPS).

1.3 Class I Areas in Nevada and Nearby

Nevada's single mandatory Class I area, the 113,167 acre Jarbidge WA, is located within the Humboldt National Forest in the northeastern portion of Nevada, as shown in Figure 1. Chapter Eight describes the geographic and physiographic setting of the Jarbidge WA. Chapter One of the 2009 RH SIP contains a more in depth description.

Figure 1-1. Location Map Showing Mandatory Class I Areas in the WRAP Region



The primary contributors to visibility impairment at Jarbidge WA for the worst days are particulate organic matter (POM), coarse mass (CM) and ammonium sulfate (sulfate). 2009 RH SIP, Table 2-2 and Chapter Four of this report. Elevated levels of particulate organic matter and its seasonal pattern suggest these particles are the result of volatile organic compounds (VOCs) and primary organic aerosols (POAs) emitted from biogenic sources and wildfires, respectively. Similarly, coarse mass is due mostly to naturally occurring emissions from windblown dust and fugitive dust events. Sulfate is the third highest contributor to light extinction on the worst days and the one most closely associated with anthropogenic sources of SO_2. Fine soil, elemental carbon (EC) and ammonium nitrates (nitrates) have only a minimal contribution to light extinction at Jarbidge WA. In summary, most of the light extinction at Jarbidge WA is due to natural sources (more than 70 percent) with SO_2 being the most significant anthropogenic pollutant contributing to visibility impairment.

In the 2009 RH SIP, Nevada established its 2018 reasonable progress goal for Jarbidge WA at 11.05 deciviews.[1] The goal was set equal to the 2018 visibility projection modeled by the WRAP's contractor, the Regional Modeling Center, and slightly under the uniform rate of progress glidepath[2] (11.09 deciviews). 2009 RH SIP, Chapter Two. In April 2011, the NDEP was notified that there had been an error in the Regional Modeling Center's modeling and the corrected 2018 visibility projection for Jarbidge WA was 11.8 deciviews.

In establishing a reasonable progress goal, the RHR requires that states "consider the uniform rate of improvement in visibility and the emission reduction measures needed to achieve it for the period covered by the implementation plan." 51.308(d)(1)(i)(B). The uniform rate of progress for Jarbidge WA in 2018 is 11.09 deciviews. In developing this progress report, the NDEP evaluated the status of control measures included in the 2009 RH SIP and changes in source activity that have occurred since the 2009 RH SIP that would affect emissions included in the corrected 2018 visibility projection. Chapter Two provides evidence not only of emissions reductions from the control measures included in the 2009 RH SIP, but also additional reductions from implementation of BART and new State legislation. Furthermore, the 2018 emission projections included a large coal-fired power plant that has since been decommissioned and three proposed power plants that are no longer viable. Chapter Five provides evidence that emissions from anthropogenic sources in Nevada as of 2008 are already lower than the emissions projections used by the WRAP in the 2018 regional air quality modeling. Considering all of this evidence, the NDEP concludes that it is appropriate to retain the reasonable progress goal of 11.05 deciviews for Jarbidge WA, which aligns with the glidepath value for 2018, and that reasonable progress toward the 2018 goal is being achieved.

The 2009 RH SIP looked at Nevada's contribution to visibility impairment in nearby Class I areas. The Particulate Matter Source Attribution Tracking modeling results (TSS, http://vista.cira.colostate.edu/tss/, last viewed 8/4/2014) were evaluated to determine which Class I areas in adjacent states might be affected by emissions from Nevada sources (2009 RH SIP Chapter Four). Visibility modeling results for 2018 indicated that, for best days, Nevada's largest contribution to light extinction due to sulfate at a nearby Class I area would occur at the Sawtooth Wilderness Area in Idaho, with a contribution of 7.2 percent. For the worst days, Nevada's maximum contribution was projected to occur at the Zion National Park in Utah, with a contribution of 5.6 percent. For nitrate extinction, 2018 modeling results of best days projected that Nevada's maximum contribution would occur at the Joshua Tree National Park in California, with a contribution of 12.4 percent. For the worst days, 2018 modeling showed Nevada's maximum contribution to nitrate extinction occurring at Bliss State Park in California,

[1] The deciview is a measure of visibility derived from calculated light extinction measurements that is designed so that uniform changes in the haze index correspond to uniform incremental changes in visual perception, across the entire range of conditions from pristine to highly impaired. See USEPA's *Guidance for Tracking Progress Under the Regional Haze Rule* at: http://www.epa.gov/ttn/oarpg/t1/memoranda/rh_tpurhr_gd.pdf. (last viewed 9/8/2014)

[2] The glidepath is one of the indicators used to set reasonable progress goals and is simply a graph portraying a straight line drawn from the level of visibility impairment for the worst days baseline period to the natural background level with 2064 as the attainment date.

with a contribution of 20.0 percent. The monitor located at Bliss serves the Desolation Wilderness Area and the Mokelumne Wilderness Area. 2009 RH SIP, Tables 4-3 and 4-4.

As discussed in Chapter Six, the NDEP's analysis of the State's contribution to visibility impairment at nearby Class I areas in 2018 demonstrates that the percentage of Nevada's anticipated emissions reductions or weighted emissions reductions exceed the percentage of Nevada's projected contribution. 2009 RH SIP Section 7.9.3.2. Thus, Nevada's impact on nearby Class I areas was determined to be insignificant. Chapter Two of this 5-year progress report evaluates the status of the control measures in the 2009 RH SIP and Chapter Three summarizes emissions reductions achieved through implementation of those measures. Both of these chapters confirm that the conclusions in the 2009 RH SIP still stand.

Chapter Two – Status of Implementation of Control Measures (40 CFR 51.308(g)(1))

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2.1 Status Summary

Chapter Two discusses the implementation of control measures included in Nevada's 2009 RH SIP to achieve reasonable progress goals for Class I areas in Nevada and nearby. Nevada's strategy for achieving reasonable progress during the initial planning period is based on the federal and state measures considered in developing the 2018 emissions inventory (PRP18a). Additional reductions will be gained by the implementation of Nevada Best Available Retrofit Technology (BART) regulations and other state measures. The federal measures incorporated in the 2018 projected emission estimates have all been enacted and are in full effect. The existing state measures described in the 2009 RH SIP not only remain in place, but have been enhanced by legislation mandating a reduction in coal-fired electrical generating unit (EGU) emissions and stronger renewable energy portfolio requirements. The 2018 emission projections also included a large coal-fired power plant that has since ceased operations and been decommissioned, and three proposed power plants whose permit applications have been withdrawn (Appendix B, Section 1). These actions have led to substantial reductions in both the actual and projected emissions of visibility-impairing pollutants from Nevada sources.

Finally, several new and proposed federal and state actions are discussed that will result in further reductions of visibility impairing pollutants through the next planning period, including the status of BART controls at Nevada facilities as well as those in adjacent states.

2.2 Nature of the Visibility Problem in Nevada

40 CFR 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 for Class I areas both within and outside the State. Visibility modeling was used to determine the expected 2018 visibility improvements for the Jarbidge WA resulting from existing federal and state regulations, including presumptive SO_2 BART limits for coal-fired EGUs with capacity greater than 750 megawatts (MW). The resulting modeled haze index in deciviews, as captured by the WRAP's projected PRP18a emissions inventory, was adopted as Nevada's reasonable progress goal for the first planning period. 2009 RH SIP Chapter Six.[1]

> *51.308(g) Periodic progress reports must contain at a minimum . . .*
>
> *(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.*

[1] See the discussion in Chapter One of the correction to the 2018 visibility projection for Jarbidge WA conducted by the Regional Modeling Center. Nevada concludes that it is reasonable to retain the reasonable progress goal of 11.05 deciviews, which aligns closely with the 2018 uniform rate of progress value for Jarbidge WA.

This chapter focuses on anthropogenic emission sources and describes the emission reduction measures that were included in the 2018 projected emission inventory modeling effort. The status and associated benefits of these controls and regulations are discussed below. The benefits are quantified where possible in Chapter Five. This chapter also discusses significant federal and state emission reduction measures that were not included in the 2018 inventory, including the status of existing and future expected controls for Nevada's EGUs. Finally, the status of the implementation of BART, both in Nevada and in adjacent states, is discussed as it relates to the reduction of baseline emissions.

2.3 Federal Programs

This section describes the existing federal programs that were included in the 2018 future year emissions estimate and new federal programs that will result in additional reductions of visibility impairing pollutants beyond those captured in the projections.

2.3.1 Existing Federal Measures

The emission reductions associated with the following existing federal measures were incorporated into the WRAP's 2018 projected emission inventory. These are the "on-the-way" and "on-the-books" federal control programs that are part of Nevada's long term strategy for reaching its reasonable progress goal. 2009 RH SIP, Chapter Seven.

Heavy-Duty Highway Rule -- 40 CFR Part 86
In this regulation, USEPA set a particulate matter (PM) emissions standard for new heavy-duty engines of 0.01 gram per brake horsepower-hour (g/bhp-hr), which took full effect for diesel engines in the 2007 model year. This rule also included standards for oxides of nitrogen (NO_x) and non-methane hydrocarbons of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These diesel engine NO_x and non-methane hydrocarbons standards were successfully phased in together between 2007 and 2010.

The rule also required that sulfur in diesel fuel be reduced to facilitate the use of modern pollution-control technology on these trucks and buses. The 97 percent reduction in the sulfur content of highway diesel fuel mandated by USEPA – from levels of 500 parts per million (ppm) (low sulfur diesel) to 15 ppm (ultra-low sulfur diesel) – became effective in Nevada in October 2006.

Tier 2 Vehicle and Gasoline Sulfur Program – 40 CFR Part 80 Subpart H; Part 85; Part 86
USEPA's Tier 2 fleet averaging program for on-road vehicles, modeled after the California low emitting vehicles (LEV) II standards, became effective in the 2005 model year. The Tier 2 program allows manufacturers to produce vehicles with emissions ranging from relatively dirty to very clean, but the mix of vehicles a manufacturer sells each year must have average NO_x emissions below a specified value. The program focuses especially on NO_x, because that is where the largest air quality gains can be achieved; however, it also reduces VOC and other

emissions. Mobile emissions continue to benefit from this program as motorists replace older, more polluting vehicles with cleaner vehicles.

Non-road Mobile Diesel Emissions Program – 40 CFR Part 89
USEPA adopted standards for emissions of NO_x, hydrocarbons, and carbon monoxide from several groups of non-road engines, including industrial spark-ignition engines and recreational non-road vehicles. Industrial spark-ignition engines power commercial and industrial applications and include forklifts, electric generators, airport baggage transport vehicles, and a variety of farm and construction applications. Non-road recreational vehicles include snowmobiles, off-highway motorcycles, and all-terrain vehicles. These rules were initially effective in 2004 and were fully phased in by 2012. Mobile emissions continue to benefit from this program as motorists replace older, more polluting vehicles with cleaner vehicles.

The non-road diesel rule sets standards that reduced emissions by more than 90 percent from non-road diesel equipment and, beginning in 2007, the rule reduced fuel sulfur levels by 99 percent from previous levels. The reduction in fuel sulfur levels applied to most non-road diesel fuel in 2010 and applied to fuel used in locomotives and marine vessels in 2012.

Maximum Achievable Control Technology (MACT) Programs – 40 CFR Part 63
Chapter Six of Nevada's 2009 RH SIP discusses reasonable progress for Jarbidge WA, including a discussion of emissions reductions due to existing air pollution control measures and specifically, in section 6.5.2.1, emissions reductions resulting from the implementation of federal rules. Although section 6.5.2.1 claims emissions from various MACT programs were incorporated into the PRP18a emission inventory, further review of two documents[2] prepared for the WRAP by their contractor, Eastern Research Group (ERG), indicate that MACT emission reductions from WRAP sources were not estimated. ERG concluded that credible estimates of the MACT impacts could not be developed based on readily available information and that substantial effort would be required to gather the necessary data.

This finding does not affect the outcome of the visibility modeling, or the selection of Nevada's reasonable progress goal. Rather, implementation of the MACT programs and their co-benefits will further reduce emissions from the subject sources beyond the WRAP's projection.

2.3.2 New Federal Measures

New federal programs will provide further reductions in visibility-impairing pollutants, either as a result of direct control requirements or as co-benefits. These reductions were not considered in the development of the WRAP's PRP18a future year emissions estimates. Any additional emission reduction benefits achieved by the implementation of these requirements will help

[2] ERG, 2006, *WRAP Point and Area Source Emissions Projections for the 2018 Base Case Inventory, Version 1*, available at http://wrapair.org/forums/ssjf/documents/eictts/docs/WRAP_2018_EI-Version_1-Report_Jan2006.pdf (last viewed 6/2/2014) and ERG, 2007, *WRAP 2018 Preliminary Reasonable Progress Emission Inventory – Final, Revised*, available at http://wrapair.org/forums/ssjf/documents/eictts/Projections/PRP18_EI_tech%20memo_061607.pdf (last viewed 6/2/2014).

ensure that all Class I areas in the WRAP region meet their reasonable progress goals in a timely manner.

Mercury and Air Toxics Rule

On December 16, 2011, USEPA finalized national CAA standards to reduce mercury and other toxic air pollution from coal and oil-fired power plants. 77 FR 9304 (Dec. 16, 2011). The final rule established power plant emission standards for mercury, acid gases, and non-mercury metallic toxic pollutants that will prevent 90 percent of the mercury in coal-fired power plants from being emitted to the air; reduce acid gas emissions from power plants by 88 percent; and cut power plant SO_2 emissions by 41 percent beyond the reductions expected by the Cross-State Air Pollution Rule. These reductions are expected in the 2016 time frame.

2010 SO_2 National Ambient Air Quality Standards

On June 2, 2010, USEPA strengthened the SO_2 national ambient air quality standards (NAAQS) by revising the primary SO_2 standard to 75 parts per billion (ppb) averaged over one hour. This short term standard is significantly more stringent than the revoked standards of 140 ppb averaged over 24 hours and 30 ppb averaged over a year. On August 5, 2013, USEPA designated planning areas with monitoring data from the years 2009 to 2011 indicating violations of the new standard as nonattainment. 78 FR 47191 (August 5, 2013). Under the CAA, these areas are required to attain the NAAQS as expeditiously as practicable, but no later than five years after designation. USEPA has indicated that it will designate the remaining areas once it has collected sufficient monitoring or modeling data on which to base a designation.[3] 79 FR 27446 (May 13, 2014). Additionally, the new standard must be taken into account when permitting new or modified major sources of SO_2 emissions such as fossil-fuel fired power plants. Any reductions in SO_2 emissions brought about by the 2010 SO_2 NAAQS will enhance protection of visibility in federal Class I areas.

2010 NO_2 National Ambient Air Quality Standards

On January 22, 2010, USEPA established an additional primary standard for NO_2 at 100 ppb, averaged over one hour, while retaining the annual standard. 75 FR 6474 (Jan. 22, 2010). Along with the new standard, USEPA set new requirements to monitor NO_2 levels near major roadways. Once the new monitoring network has collected three years of data, USEPA will redesignate areas in 2016 or 2017, as appropriate, based on the new data. Areas designated nonattainment will be required to reduce emissions to attain the NAAQS within a prescribed time. Additionally, the new standard must be taken into account when permitting new or modified major sources of NO_x emissions, such as fossil-fuel fired power plants, boilers, and a variety of other manufacturing operations. Any reductions in NO_x emissions brought about by the 2010 NO_2 NAAQS will enhance protection of visibility in federal Class I areas.

2012 $PM_{2.5}$ National Ambient Air Quality Standards

[3] USEPA's failure to promulgate area designations by the deadlines set forth in the CAA is in litigation as of May 2014. Several states, including Nevada, are pushing for tighter designation deadlines, as required by the Act.

On December 14, 2012, USEPA strengthened the annual NAAQS for fine particles to 12.0 micrograms per cubic meter. 78 FR 3086 (Dec. 14, 2012). Emission reductions from USEPA and states' rules already on the books will help 99 percent of counties with monitors to meet the revised $PM_{2.5}$ standards without additional emission reductions. These rules include clean diesel rules for vehicles and fuels, and rules to reduce pollution from power plants, locomotives and marine vessels, among others. Additionally, the new standard must be taken into account when permitting new or modified major sources of $PM_{2.5}$.

North American Emission Control Areas

On March 26, 2010, the International Maritime Organization officially designated waters off North American coasts as an area in which stringent international emission standards will apply to ships. These standards will reduce air pollution from ships and deliver air quality benefits that extend hundreds of miles inland. In 2020, USEPA expects emissions from ships operating in the designated area to be reduced by 320,000 tons for NO_x, 90,000 tons for $PM_{2.5}$, and 920,000 tons for SO_2, which is 23 percent, 74 percent, and 86 percent, respectively, below predicted levels in 2020 absent the Emissions Control Area designation.

Implementation of the Emission Control Area means that ships entering the designated area are required to use compliant fuel for the duration of their voyage that is within that area, including time in port as well as voyages whose routes pass through the area without calling on a port. The requirements for quality of fuel change over time. From the effective date in 2012 until 2015, the sulfur content of fuel used by all vessels operating in designated areas cannot exceed 10,000 ppm. Beginning in 2015, the sulfur content of fuel used by vessels operating in these areas cannot exceed 1,000 ppm. With regard to NO_x emissions, marine diesel engines installed on a ship constructed on or after January 1, 2011, must comply with the Tier 2 standard. Marine diesel engines installed on a ship constructed on or after January 1, 2015, will be required to comply with the more stringent Tier 3 NO_x standard.

Tier 3 Vehicle Emission and Fuel Standards Program

The Tier 3 program is part of a comprehensive approach to reducing the impacts of motor vehicles on air quality and public health and builds on USEPA's Tier 2 program. The program considers the vehicle and its fuel as an integrated system, setting new vehicle emissions standards and lowering the sulfur content of gasoline beginning in 2017. The vehicle standards will reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. The gasoline sulfur standard will enable more stringent vehicle emissions standards and will make emissions control systems more effective.

2.4 State Measures other than BART

In addition to federal programs and Nevada BART (discussed in the next section), there are other state measures that contribute to attaining Nevada's 2018 reasonable progress goal. As set forth in detail below, some noteworthy changes in Nevada since the 2009 RH SIP submittal include power plant closures and cancellations; legislation mandating a reduction in coal-fired power plant emissions; stronger renewable energy portfolio requirements; and attainment of the NAAQS throughout the state.

2.4.1 Closures and Cancellations

The PRP18a future year emissions estimate included emissions from power plants that have since been closed, as well as projected future power plants that are no longer viable. The Southern California Edison Mohave Generating Station (Mohave) located near the southern tip of Clark County, Nevada, was a coal-fired plant with 19,595 tons per year (tpy) of NO_x and 8,701 tpy of SO_2 included in the 2018 emission inventory. This power plant ceased operation on December 31, 2005 and has since been fully decommissioned and demolished. Its operating permit was officially cancelled on April 9, 2010. This closure eliminated the largest combined source of SO_2 and NO_x emissions in the state. Appendix B, Section 1.

Five proposed power plants were included in the projected emissions inventory for 2018. See Chapter Three, section 3.4.1. Of the five, only two have moved forward and are now operational. The largest coal-fired power plant application, White Pine Energy Associates/LS Power, was withdrawn. The power plant designated as "Future Coal EGU (A)" in the PRP18a regional modeling was considered a surrogate for the Sithe Global Toquop Energy Project (located 14 miles northwest of Mesquite); its application was also withdrawn. Finally, Sempra Energy and NV Energy withdrew their applications for natural gas and coal-fired plants, respectively, at Copper Mountain and the Ely Energy Center (the latter is not in Table 3-1 and was not included in the 2018 projected emissions inventory). Appendix B, Section 1.

2.4.2 Emissions from Coal-Fired Power Plants

In 2013, the Nevada Legislature enacted Senate Bill 123 (SB123), which establishes requirements for the reduction of emissions from coal-fired electric generating plants in Nevada. The new law requires major utilities in Clark County to submit a plan for the retirement of 800 MW of capacity from coal-fired power plants and replace that with renewable energy facilities and other electric generating plants. NRS 704.7316. The legislation mandates the retirement or elimination of not less than 300 MW of coal-fired capacity on or before December 31, 2014; an additional 250 MW on or before December 31, 2017; and an additional 250 MW on or before December 31, 2019. It further requires the construction or acquisition of 350 MW from *new renewable* energy facilities. The utility must issue requests for proposals for 100 MW of new renewable supply by December 31, 2014; 100 MW by December 31, 2015; and 100 MW by December 31, 2016. An additional 50 MW of new renewable energy capacity, owned and operated by the electric utility, must be completed by December 31, 2021. Finally, the utility must construct or acquire and own facilities with a total capacity of 550 MW to replace the coal-fired capacity eliminated between 2014 and 2019.

The major electric public utility serving Clark County is the Nevada Power Company d/b/a NV Energy. NV Energy submitted its Emissions Reductions and Capacity Replacement plan (ERCR

Plan) to the Public Utilities Commission of Nevada on May 1, 2014. Appendix B, Section 3.3. The ERCR Plan was developed pursuant to SB 123, and is designed to meet the requirement to eliminate 300 MW by December 2014 by retiring units 1, 2 and 3 at the Reid Gardner Generating Station (Reid Gardner) near Moapa in Clark County, Nevada. These units have a capacity of 100 MW each. The fourth unit at Reid Gardner has a capacity of 257 MW and is scheduled to be retired by December 31, 2017. This elimination of coal-fired capacity from Reid Gardner will result in the reduction of 1,758 tons of SO_2 and 8,893 tons of NO_x from the PRP18a inventory during the 2008-2018 regional haze planning period.

2.4.3 Renewable Portfolio

Nevada was one of the first states to adopt a renewable portfolio standard. The standard establishes a schedule requiring each provider of electric service in Nevada to generate, acquire or save a certain percentage of its electricity (sold to customers) from renewable energy systems or efficiency measures. NRS 704.7821. For calendar years 2015 through 2019, inclusive, not less than 20 percent must come from renewable energy or efficiency measures. For calendar year 2025 and for each calendar year thereafter, the percentage increases to 25 percent. However, the 25 percent must be solely from renewable energy, not energy efficiency measures.

The Nevada Legislature enacted the "Solar Energy Systems Incentive Program," which requires the Public Utilities Commission of Nevada to set incentive levels and schedules, with a goal of approving solar energy systems totaling at least 250,000 kilowatts (250 MW) of capacity in this State for the period beginning on July 1, 2010, and ending on December 31, 2021. NRS 701B.005 and NRS 701B.010-290. To date, $160 million has been spent installing a total of 38 MW of installed capacity in Nevada. Appendix B, Section 1.7. Similarly, Nevada has a "Solar Thermal Demonstrations Program," which has the goal of promoting the installation of at least 3,000 solar thermal systems in homes, businesses, schools and other governmental buildings throughout this State by 2019. Appendix B, Section 1.7. NRS 701B.300-345.

The "Wind Energy Systems Demonstration Program" establishes a goal of installing at least 5 MW of wind energy systems by 2012. NRS-701B.400-650. To date, $25 million has been spent installing a total of 9 MW of installed capacity in Nevada. The "Waterpower Energy Systems Demonstration Program" similarly provides for the installation of at least 5 MW of waterpower energy systems in Nevada by 2016. NRS-701B.700-880. To date, $1.4 million has been spent constructing a total of 600 kW of installed capacity in the State. Appendix B, Section 1.7. Table 2-1 itemizes new and proposed generation plants in Nevada as of December 2013. It is noteworthy that all of the generation comes from renewable sources.

Table 2-1. New and Proposed Generation Plants in Nevada as of December 2013

OWNER	PLANT NAME	COUNTY	SUMMER CAPACITY (MW)	ENERGY SOURCE	ACTUAL OR PROPOSED ONLINE DATE	STATUS
Sempra Energy	Copper Mountain 2	Clark	58 MW	Sun	Dec. 2014	Under Construction

OWNER	PLANT NAME	COUNTY	SUMMER CAPACITY (MW)	ENERGY SOURCE	ACTUAL OR PROPOSED ONLINE DATE	STATUS
NVT Licenses, LLC	Spectrum Solar	Clark	30 MW	Sun	Sept. 2013	Permitting
Gradient Resources	Patua Phase I	Churchill	30 MW	Geothermal	Nov. 2013	Under Construction
Ormat	Wild Rose	Mineral	16 MW	Geothermal	Dec. 2013	Under Construction
Tonopah Solar Energy, LLC	Crescent Dunes Solar	Nye	110 MW	Sun	Dec. 2013	Under Construction
NextEra Energy	Mountain View Solar	Clark	8 MW	Sun	Feb. 2014	Permitting
Ormat	McGinness Hills Expansion	Lander	48 MW	Geothermal	July 2016	PPA Pending PUCN Approval
Sempra Energy	Copper Mountain 3	Clark	250 MW	Sun	Dec. 2016	Under Construction
K Road Moapa Solar LLC	K-Road	Clark	250 MW	Sun	Dec. 2015	Permitting
First Solar Energy LLC	Silver State Solar Power South	Clark	250 MW	Sun	May 2017	Permitting

*PPA means Power Purchase Agreement
Source: State of Nevada Public Utilities Commission http://puc.nv.gov/Utilities/Electric/Generation/ (last viewed 9/8/2014).

Furthermore, the Public Utilities Commission of Nevada has authorized the largest electric and gas utilities serving nearly 95 percent of the population in the State to expend substantial monies to implement various energy efficiency programs (Appendix B, Section 1.7):

1. Nevada Power Company d/b/a NV Energy – $44,550,000 (2013).
2. Sierra Pacific Power Company d/b/a NV Energy – $6,100,000 (2013/electric).
3. Sierra Pacific Power Company d/b/a NV Energy – $445,000 (2014/gas).
4. Southwest Gas Corporation – $4,400,000 (2014).

2.4.4 State Implementation Plans

The 2009 RH SIP included a table showing the status of nonattainment areas in Nevada. 2009 RH SIP Table 6-2. For each nonattainment area, the air control agency with jurisdiction developed and implemented a state implementation plan with control measures to bring the area into attainment of the NAAQS. Currently, all nonattainment areas in Nevada have either been redesignated attainment and are operating under a maintenance plan or have been granted a "determination of attainment", indicating that the area is attaining the standard even though it has not yet been redesignated (Table 2-2). The control measures remain in place. These include fugitive dust regulations, oxygenated fuel programs, gasoline vapor recovery, transportation control measures, residential wood burning regulations, woodstove replacement programs and the State Alternative Fueled Vehicle program.

Table 2-2. Nonattainment Areas: Redesignation Status as of August 2014

PLANNING AREA (Hydrographic Area)	NONATTAINMENT DATE	REDESIGNATIONS
Carbon Monoxide		
Lake Tahoe Basin (HA90)	3/3/78	USEPA approved 12/15/03; effective 2/13/04
Las Vegas Valley (HA212)	3/3/78 and 11/15/90	USEPA approved 9/27/10; effective 9/27/10
Truckee Meadows (Reno, HA87)	3/3/78 and 11/15/90	USEPA approved 7/3/08
Ozone		
Washoe County	1/6/92 (1-hr) and 1/16/01 (1-hr)	6/15/05 1-hr NAAQS revoked; USEPA approved maintenance plan 1/18/08; effective 3/18/08
Clark County	9/13/04 (8-hr)	USEPA approved 1/8/13; effective 2/7/13
PM_{10}		
Las Vegas Valley (HA212)	11/15/90	clean data finding 8/3/10; USEPA proposed approval 7/21/14
Truckee Meadows (Reno) (HA87)	11/15/90	Request submitted 7/13/09; clean data finding 4/19/11
SO_2		
Central Steptoe Valley (HA179M)	3/3/78	USEPA approved 4/12/02; effective 6/11/02

2.5 Review of BART Determinations

The WRAP's PRP18a future year emissions estimate included presumptive SO_2 BART limits for coal-fired EGUs with capacity greater than 750 MW. For Nevada sources, the presumptive limits were not applied to the two candidate facilities, Mohave and Reid Gardner. Actual SO_2 emissions from Reid Gardner were below the presumptive emission limit, so actual emissions were modeled. Mohave was subject to a consent decree with an SO_2 emission limit equal to the presumptive limit; however, it has since been decommissioned.[4] No other emissions reductions resulting from the installation of BART at Nevada sources were included in the PRP18a inventory or resulting modeled reasonable progress goal.

2.5.1 Nevada's BART Implementation

Table 2-3 presents the current status of BART implementation in Nevada. The 2009 RH SIP requires that control measures will be installed and operating by January 1, 2015, with the

[4]The Mohave Generating Station has ceased all operations related to the generation of electricity from burning coal. NDEP approved Southern California Edison's request to terminate its Air Quality Operating Permit (No. AP4911-0774) on April 9, 2010. Appendix B, Sections 1.1 and 1.2.

exception of NO_x at Reid Gardner, which has a later compliance date. Therefore, IMPROVE monitoring data for this progress period will not reflect emissions reductions resulting from the implementation of BART in Nevada.

All of the facilities in Nevada that are subject to BART requirements are on schedule to meet the requirements by January 1, 2015; the compliance date for NO_x at Reid Gardner is June 30, 2016, but Units 1, 2 and 3 are expected to be retired before then. In fact, some of the BART controls are already being met as of February 2014: baghouses have been installed at Reid Gardner and the use of fuel oil has been eliminated at Fort Churchill Generating Station (Fort Churchill). Appendix B, Section 1.8. Furthermore, NV Energy has approval from the Public Utilities Commission of Nevada to retire Tracy Units 1 and 2 by the 2009 RH SIP compliance date. Appendix B, Sections 1.8 and 3.1. In April 2013, NV Energy was granted approval to implement alternative equivalent control technology for BART and supplemental control technology for Unit 3 at Tracy and Units 1 and 2 at Fort Churchill. This option is allowed under the 2009 RH SIP and Nevada Administrative Code. The control measures will be installed and operating by the compliance date to assure continuous compliance with the BART emission limits. No change to the BART emission limitations was proposed or approved. The approval of proposed alternative BART control technology and installation of approved alternative BART control technology for Tracy and Fort Churchill is detailed in Appendix B, Section 2.

For more information on the future status of the subject-to-BART units at Reid Gardner, see Section 2.4.2, Emissions from Coal-Fired Power Plants.

Table 2-3. BART Implementation Status

Facility	Emission Unit	BART Emission Limits (lb/MMBtu)			SIP-Required Control Date	BART Controls Implemented	Comments
		NO_x (12-month rolling average)	**SO_2** (24-hour average)	**PM_{10}** (3-hour average)			
NV Energy Tracy Generating Station	1	0.15	0.05	0.03	Jan. 1, 2015	▪Currently firing exclusively with natural gas ▪No other new controls installed recently	Units 1 and 2 did not operate during 2010 to 2012. NV Energy has stated its intent to retire these units by December 31, 2014.
	2	0.12	0.05	0.03			
	3	0.19	0.05	0.03			LNB and supplemental OFA, if needed; retrofit scheduled for Fall 2014.
NV Energy Fort	1	0.20	0.05	0.03	Jan. 1, 2015	▪Currently firing	LNB and supplemental

Facility	Emission Unit	BART Emission Limits (lb/MMBtu)			SIP-Required Control Date	BART Controls Implemented	Comments
		NO_x (12-month rolling average)	SO_2 (24-hour average)	PM_{10} (3-hour average)			
Churchill Generating Station						exclusively with natural gas	OFA, if needed; retrofit scheduled for Spring 2014
	2	0.16	0.05	0.03		▪No other new controls installed recently	LNB and supplemental OFA, if needed; retrofit scheduled for Summer 2014
NV Energy Reid Gardner Generating Station	1	0.20	0.015	0.015	SO_2 and PM_{10} controls by Jan. 1, 2015. NO_x controls by June 30, 2016	▪Baghouses (pulse-jet fabric filter) installed by April 15, 2009 ▪No other new controls installed recently	▪ Shutdown of Units 1, 2, and 3 called for in SB123. ▪ In May 2014, NV Energy applied for PUCN approval to shutdown these units in Dec 2014.
	2	0.20	0.15	0.015			
	3	0.28	0.15	0.015			
Southern California Edison Mohave Generating Station	1	-NA-	-NA-	-NA-	-NA-	-NA-	Facility ceased operations Dec 31, 2005. Permit terminated April 9, 2010. Facility has been fully decommissioned.
	2	-NA-	-NA-	-NA-			

2.5.2 Adjacent States' BART Implementation

The IMPROVE monitor (JARB1) representative of Jarbidge WA is situated on the northern flank of the Jarbidge Mountains less than 10 miles south of the Idaho border and within the Snake River Basin. This location topographically isolates the monitor from pollutants emitted in the rural Nevada portions of the Great Basin, but provides for monitoring of pollutants emitted and transported from the well-populated Snake River Plain largely located in Idaho. Source apportionment modeling conducted for Nevada's initial RH SIP (see Section 4.3) reveals that only 45 percent of the sulfate contributions to visibility impairment at JARB1 are emitted from sources in the entire WRAP region. However, source apportionment modeling did identify substantial contributions from Idaho and Oregon point sources. The NDEP reviewed the BART implementation status of subject-to-BART facilities in these nearby states with their air agency staff as discussed below.

<u>Idaho</u>

According to Mike Edwards, SIP and Maintenance Plan Analyst for the Air Quality Division of the Idaho Department of Environmental Quality (phone conversation with Frank Forsgren, NDEP, on February 19, 2014), two facilities in Idaho were subject to BART: Amalgamated Sugar Company in Nampa (also known as TASCO-Nampa) and Monsanto/P4 Production, LLC in Soda Springs (http://www.deq.idaho.gov/air-quality/air-pollutants/haze.aspx). For the Monsanto/P4 facility, no technically feasible NO_x controls were identified for the two subject units and no new BART NO_x controls were required. For SO_2, the existing lime-concentrated dual alkali scrubber, installed in 2005 with a control efficiency of roughly 97 percent was determined to be BART, as were the existing PM_{10} controls (see section 10.6 of Idaho's regional haze SIP available at the link above). Therefore, BART has been fully implemented at the Monsanto/P4 facility.

The BART process for the TASCO Nampa facility has had a more complex history. The EPA approved a BART determination based on Idaho's original 2010 RH SIP submittal, but Idaho submitted a revised BART determination in its 2012 RH SIP submittal. The 2012 submittal also included an SO_2 BART alternative measure, which EPA fully approved (79 FR 23273 (April 28, 2014)) with a compliance date of July 22, 2016. BART consists of low NO_x burners (LNBs) for NO_x control and the existing baghouse for PM_{10} control on the one subject-to-BART boiler, while the SO_2 BART alternative consists of imposing NO_x emission limits on two non-BART boilers coupled with the permanent shutdown of three non-BART coal-fired pulp dryers. In addition, unless the LNBs have been installed by the compliance date, the subject boiler may be fired only using natural gas and may not be fired with coal until the LNBs are installed and operated.

<u>Oregon</u>

Only one facility in Oregon was subject to a BART determination: the PGE Boardman Power Plant (Boardman). Five other facilities chose the option of a federally enforceable permit condition exempting them from BART determinations. According to Mark Fisher, a permit writer for the Oregon Department of Environmental Quality Eastern Region Office in Bend, Oregon, Boardman installed new LNBs with a modified over-fire air system during 2011 and is currently meeting the BART NO_x emission limitations (phone conversation with Frank Forsgren, NDEP, on February 26, 2014). Boardman completed installation of BART SO_2 controls consisting of a semi-dry flue gas desulfurization system in early 2014 and is expected to be in compliance with the BART SO_2 emission limitation when it resumes operation later in 2014. The compliance date for the BART SO_2 controls is July 1, 2014. Compliance with a further reduced BART SO_2 emission limit is required by July 1, 2018, and the facility must permanently cease burning coal by no later than December 31, 2020.

In summary, in this Chapter, Nevada has described the implementation status of measures from Nevada's 2009 RH SIP, including the status of control measures to meet BART requirements, the status of significant measures resulting from USEPA regulations, as well as measures that came into effect since the WRAP analyses for the 2009 RH SIP were completed.

3

Chapter Three – Summary of Emission Reductions Achieved (40 CFR 51.308(g)(2))

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3.1 Status Summary

Chapter Three discusses the emission reductions achieved as a result of implementation of control measures outlined in Nevada's 2009 RH SIP toward achieving Nevada's reasonable progress goal. SO_2 and NO_x emissions have decreased substantially in Nevada due to the implementation of these control measures and other noteworthy changes in source activity. Emission reductions have occurred in Nevada as a result of implementation of federal and state measures, closure of a large coal-fired power plant, as well as the withdrawal of permit applications that were included in the original 2018 emissions inventory. Since the baseline inventory, Nevada has reduced EGU emissions of SO_2 by more than 40,000 tons and emissions of NO_x by more than 37,000 tons. SO_2 point source emissions alone decreased by 78 percent between the baseline and 2008 inventories, while NO_x point source emissions decreased by over 50 percent. The majority of these decreases were due to the closure of the Mohave Generating Station, but as can be seen in Figure 3-1, there has been a steady continued decrease in SO_2 and NO_x emissions since the shutdown, as well.

3.2 Overall NO_x and SO_2 Emission Reductions

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)" and discussed in Chapter Two of this progress report. This chapter discusses the emission reductions due to these control measures, specifically the reduction of controllable anthropogenic emissions of SO_2 and NO_x. Since the submittal of Nevada's RH SIP in November 2009, the most significant decrease in emissions of SO_2 and NO_x has resulted from the closure of the Mohave. Other reductions stem from federal and state programs, cancellations of proposed coal-fired power plants, and BART upgrades at the Tracy and Fort Churchill power plants.

> *51.308(g) . . . Periodic progress reports must contain at a minimum . . .*
>
> *(2) A summary of the emissions reductions achieved throughout the State through implementation of the measures described in paragraph (g)(1) of this section.*

3.3 NO_x and SO_2 Emission Reductions from Federal Programs

Emission reductions will be seen as a result of several federal programs. However, these emissions are not easily quantified. As described in Chapter Two, these federal programs include:

- The Heavy-Duty Highway regulation, which focused on reducing PM, NO_x, and non-methane hydrocarbons from new heavy duty engines. It also mandated a reduction in sulfur content in fuel by 97 percent. These regulations were phased in between 2006 for sulfur and 2007 for NO_x.

- The Tier 2 Vehicle and Gasoline Sulfur Program, which requires average NO_x emissions below a specified limit on the mix of vehicles that a manufacturer sells each year and realizes a reduction in VOC and other emissions, as well.
- The Non-road Mobile Diesel Emissions Program, which focuses on reducing emissions of NO_x, hydrocarbons and CO. This rule set standards that reduced emissions by more than 90 percent with full implementation by 2012. Beginning in 2007, the rule also reduced the level of sulfur in non-road diesel fuel by 99 percent with full implementation by 2012.
- Maximum Achievable Control Technology Programs. As noted in Chapter Two, these programs were not estimated as part of the PRP18a emission inventory due to the substantial effort required to gather necessary data. However, these MACT programs will result in a reduction of emissions beyond projections that were made for the 2018 inventory. These programs are difficult to quantify due the sheer number of programs.
- The Mercury and Air Toxics Rule, which was finalized by USEPA in December 2011 to reduce mercury and air toxics from coal and oil-fired power plants. USEPA projects that this rule will also reduce sulfur emissions from power plants. These emission reductions are expected by 2016.
- Revised NAAQS, including the SO_2, NO_2 and $PM_{2.5}$ NAAQS. The SO_2 and NO_2 NAAQS were both revised in 2010 to add a 1-hour standard. Additionally, the annual $PM_{2.5}$ NAAQS was strengthened in 2012. These new and revised standards must be taken into account when permitting new or modified major sources resulting in additional reductions in emissions of these pollutants.
- The Tier 3 Vehicle Emission and Fuel Standards Program, which imposes stronger tailpipe and evaporative emissions standards, as well as a lower sulfur content for gasoline. These tighter standards will result in lower sulfur emissions from motor vehicles beginning in 2017.

3.4 EGU NO_x and SO_2 Emission Reductions due to State Measures other than BART

3.4.1 Emission Reductions due to Closures and Cancellations

As discussed in Section 2.4.1, the PRP18a inventory included estimates of emissions from Mohave, which was permanently closed at the end of 2005. This closure resulted in the elimination of 19,595 tpy of NO_x and 8,701 tpy of SO_2. Emissions from Mohave represented 19 percent of the projected PRP18a statewide SO_2 emissions and 14 percent of projected statewide NO_x emissions.

Five proposed power plants were also included in the projected PRP18a inventory (Table 3-1), however, three of these proposed plants withdrew their permit applications. The SO_2 and NO_x

emissions projected for the three plants were 5,814 tons and 6,136 tons, respectively. Additionally, the two power plants that began operating actually emitted fewer total tons per year of NO_x, PM_{10} and SO_2 combined than was projected. The two plants operated at a combined total of 472 tons of NO_x and 244 tons of SO_2 for 2012. This is 766 tons of NO_x and 431 tons of SO_2 less than projected for the PRP18a inventory. Total emissions of SO_2 and NO_x overestimated in the PRP18a inventory from these five power plants was 14,946 tons and 26,497 tons, respectively. These reductions would certainly result in lower modeled visibility impacts for the 2018 plan year, particularly at Class I areas adjacent to southern and eastern Nevada.

Table 3-1. Proposed 2018 EGUs and Current Permit Activity (shading indicates the project was withdrawn)

PROPOSED EGUS IN 2018 EMISSION INVENTORY (PRP18a)	NO_x (tpy)	PM_{10} (tpy)	SO_2 (tpy)
Future Coal EGU (Newmont TS Power Plant, 241 MW - Northern Nevada Energy) (*actual 2012 emissions*)	499 (*254*)	89 (*189*)	670 (*213*)
Future Natural Gas EGU (Copper Mountain - Sempra Energy)	887	71	6
Future Natural Gas EGU (Chuck Lenzie, 1,102 MW - NV Energy) (*actual 2012 emissions*)	739 (*218*)	59 (*185*)	5 (*31*)
Future Coal EGU (White Pine Energy Associates/LS Power)	3,909	670	4,356
Future Coal EGU (A)	1,340	261	1,452
Total Emissions from proposed 2018 EGUs	7,374	1,150	6,489
2018 Emissions Reductions due to Cancellations	6,136	5,814	5,814

Source: Modified from Table 3-5 in *Nevada Regional Haze State Implementation Plan*, *October* 2009 (2009 RH SIP), page 3-8.

3.4.2 Emission Reductions from EGUs

To account for year-to-year changes in emissions, annual emission totals for Nevada EGUs are presented in Table 3-2. EGU emissions are consistently reported and tracked in the USEPA's Air Markets Program Database for permitted Title V facilities in the state. http://ampd.epa.gov/ampd/, last viewed 9/2/2014. RHR implementation plans are required to pay specific attention to certain major stationary sources, including EGUs, built between 1962 and 1977.

Table 3-2 and Figure 3-1 depict annual EGU emissions of NO_x and SO_2 for Nevada EGU sources between 1995 and 2013, as reported in USEPA's Clean Air Markets Division (CAMD) Acid Rain Program. While these types of facilities are targeted for controls in state RH SIPs, it should be noted that many of the controls planned for EGUs in the WRAP states had not taken place yet in 2010, while other controls separate from the RHR may have been implemented. The

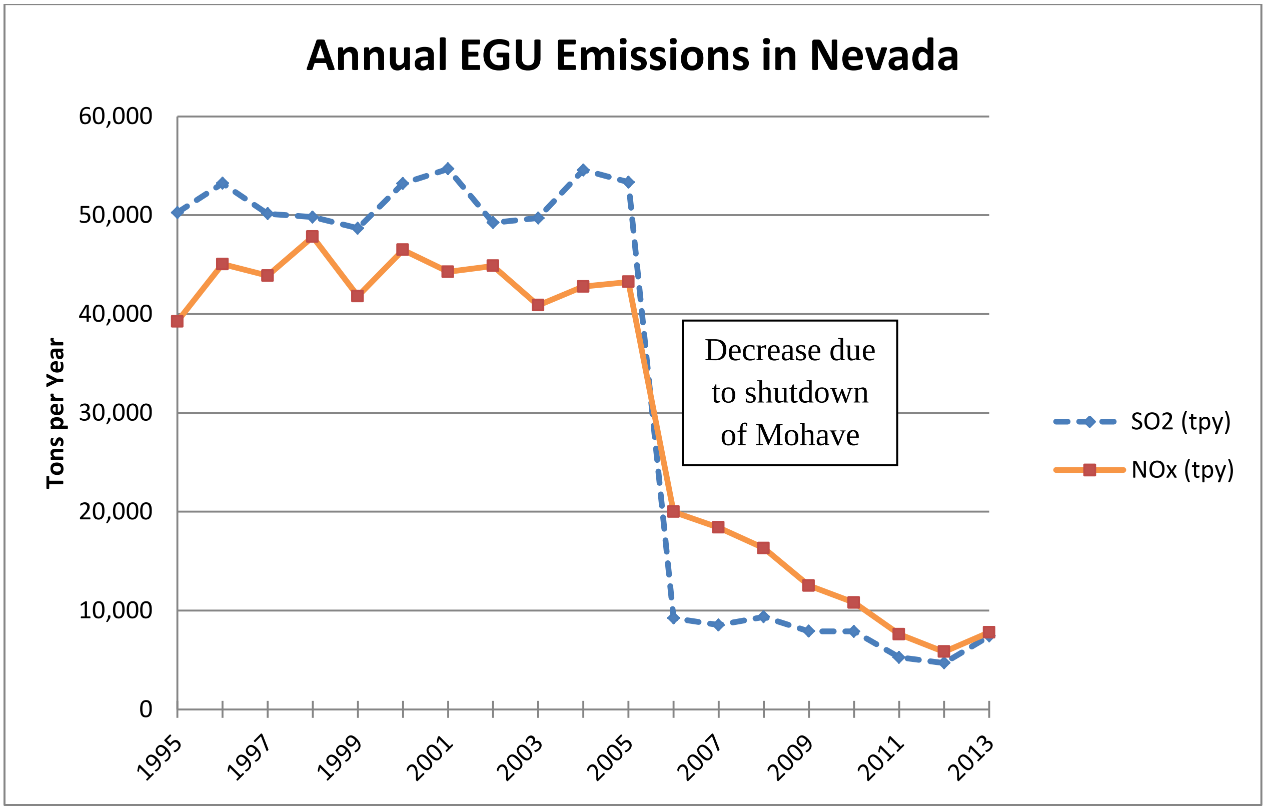
CAMD data show a sharp decline for SO_2 and NO_x between 2005 and 2006, mainly due to the closure of the Mohave Generating Station in Clark County, eliminating approximately 20,000 tpy of NO_x and 41,000 tpy of SO_2 emissions. Further discussion later in this section details the continued decreases in NO_x and SO_2 at Reid Gardner, Fort Churchill and Tracy, three of Nevada's subject-to-BART facilities. Table 3-2 shows that since the closure of Mohave on December 31, 2005, SO_2 emissions have continued to decline, while NO_x emissions have decreased by over 10,000 tpy.

Table 3-2. Nevada Acid Rain CAMD Data - Annual EGU Emissions of SO_2 and NO_x

Reporting Year	SO_2 (tpy)	NO_x (tpy)		Reporting Year	SO2 (tpy)	NOx (tpy)
1995	50,262	39,249		2005	53,346	43,242
1996	53,234	45,054		2006	9,239	19,985
1997	50,153	43,886		2007	8,545	18,405
1998	49,813	47,822		2008	9,365	16,306
1999	48,673	41,806		2009	7,913	12,514
2000	53,203	46,492		2010	7,889	10,812
2001	54,688	44,262		2011	5,272	7,598
2002	49,240	44,871		2012	4,691	5,832
2003	49,719	40,880		2013	7,427	7,796
2004	54,564	42,781				

Source: USEPA Air Markets Program Database (http://ampd.epa.gov/ampd/, last viewed 9/2/2014)

Figure 3-1. EGU Emissions of SO_2 and NO_x Reported in the CAMD Acid Rain Database between 1995 and 2013



Reid Gardner and Tracy are baseload power plants. Baseload plants are the production facilities used to meet some or all of a region's continuous energy demand. They produce energy at a constant rate and typically run at all times of the year except in case of repairs or scheduled maintenance. Fort Churchill is a peaking plant. Peaking power plants generally run only when there is a high demand for electricity.

Figure 3-2 and Figure 3-3 present CAMD Acid Rain data for SO_2 and NO_x, respectively, at Reid Gardner from 1995 through 2013. Data from Units 1, 2 and 3 are shown here, as they were the units that were identified as subject-to-BART. These units are scheduled to be retired by December 31, 2014. Appendix B, Section 3.3. Assuming emission levels based on the most recent year of Acid Rain data (2013), this would result in the immediate reduction of 721 tpy of SO_2 and 924 tpy of NO_x. If Unit 4 were to be retired by December 2017 (Appendix B, Section 3.3), this would result in an additional decrease in SO_2 of 533 tpy and NO_x of 924 tpy. In contrast, emission projections for the PRP18a inventory for Reid Gardner were 1,758 tons of SO_2 and 8,893 tons of NO_x. The closure of these units will eliminate all emissions of SO_2 and NO_x. Nevertheless, even without the closures, there has been a steady decrease in SO_2 and NO_x emissions since the baseline period.

Figure 3-2. CAMD Acid Rain Database SO_2 EGU Emissions for Reid Gardner 1995 - 2013

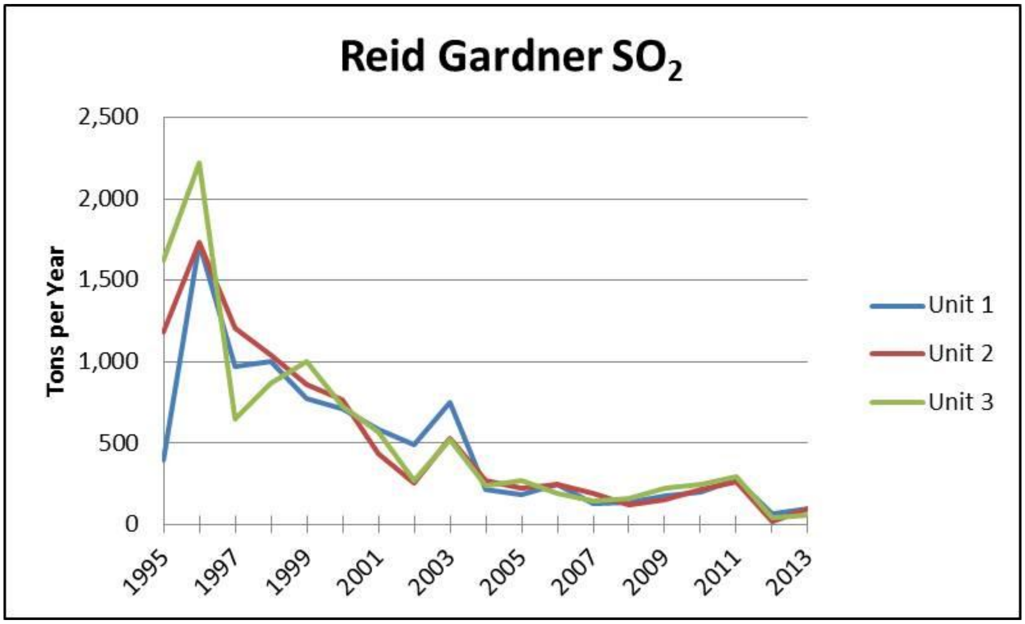


Figure 3-3. CAMD Acid Rain Database NO_x EGU Emissions for Reid Gardner 1995 - 2013

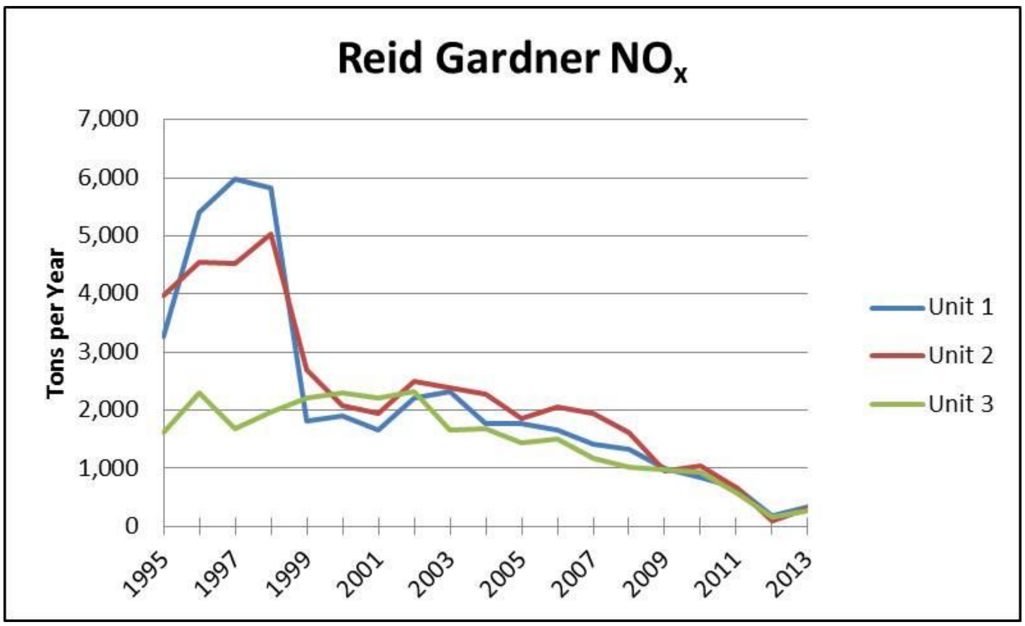


Figure 3-4 and Figure 3-5 show CAMD Acid Rain data for SO_2 and NO_x, respectively, at Tracy for years 1995 through 2013. Units 1, 2 and 3 are presented here because these units were identified as being subject-to-BART.

The Western U.S. Energy Crisis of 2000-2001 resulted in a shortage of electricity supply caused by a shortage of generating capacity, bottlenecks in related markets, wholesale generator market power, regulatory missteps, and faulty market design. Weare 2003. Responding to the energy crisis and high natural gas prices, Tracy combusted significant amounts of residual fuel oil in

2001, and all three units ran a significant number of hours during that year. Appendix B, Section 1.8. This resulted in greater than 2,500 percent increase in SO_2 emissions from 2000 to 2001. In 2002, after the energy crisis, SO_2 emissions dropped back to levels seen in 1999, a decrease of 99 percent. For NO_x, emissions increased seven percent from 2000 to 2001 and decreased by 52 percent from 2001 to 2002.

Tracy Units 1 and 2 will be retired by the end of 2014, and BART upgrades at Unit 3 will not allow for the continued use of oil-firing capacity beyond December 31, 2014. Appendix B, Sections 3.1 and 3.2.

Figure 3-4. CAMD Acid Rain Database SO_2 EGU Emissions at Tracy 1995 - 2013

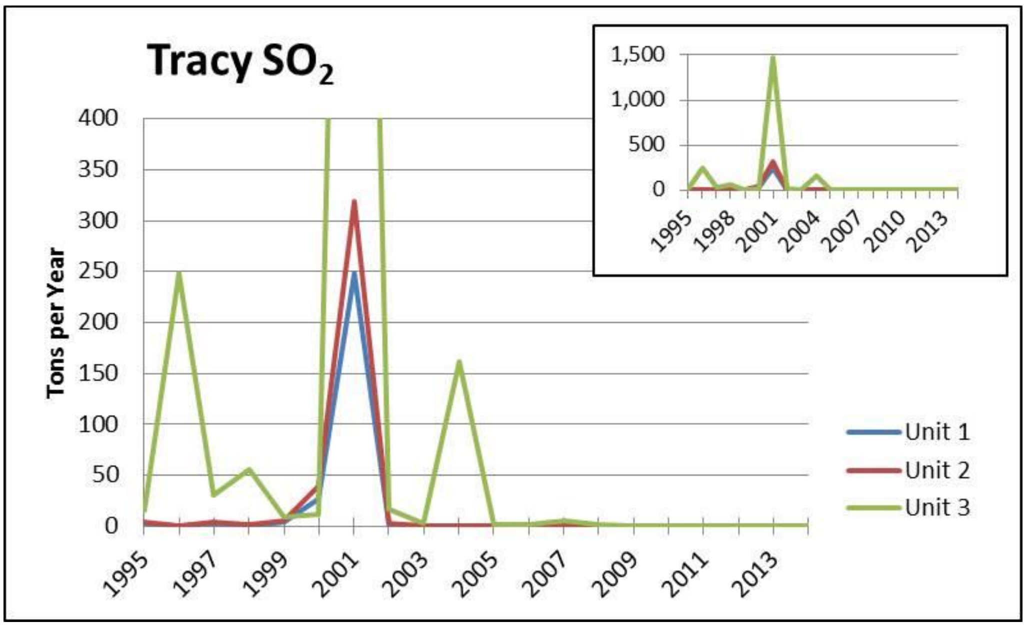


Figure 3-5. CAMD Acid Rain Database NO_x EGU Emissions at Tracy 1995 - 2013

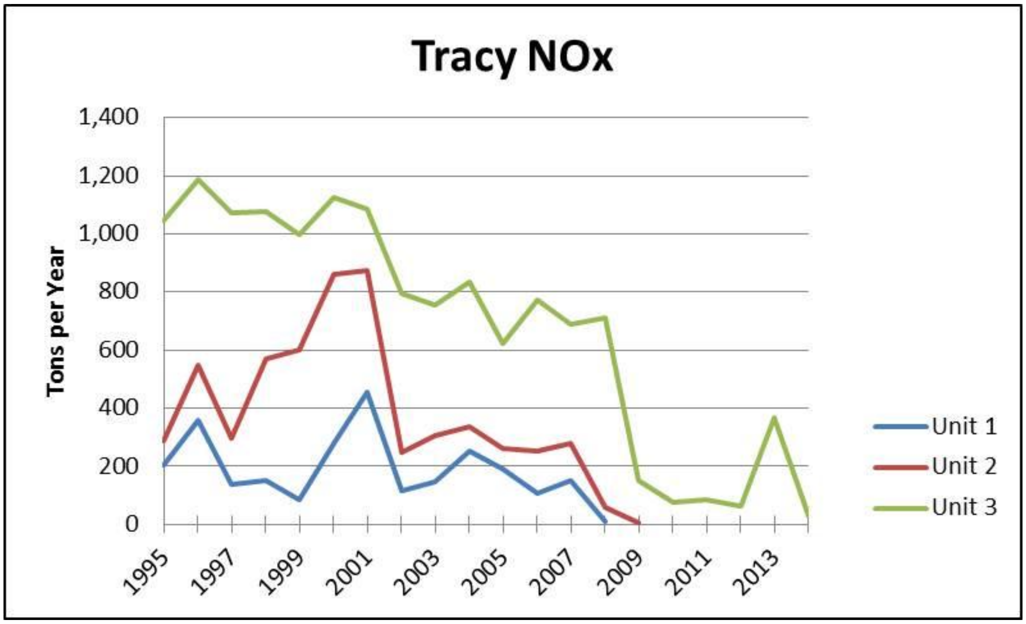


Figure 3-6 and Figure 3-7 represent CAMD Acid Rain data for SO_2 and NO_x at Fort Churchill (a peaking plant) for Units 1 and 2 for years 1995 through 2013. Like Tracy, the Western Energy Crisis affected fuel use at Fort Churchill. Fort Churchill combusted a significant amount of residual fuel oil and ran many hours over historical use in 2001. Appendix B, Section 1.8. Anomalously high values of SO_2 and NO_x are shown in both figures for 2001. This resulted in more than a 2,000 percent increase in SO_2 emissions and a 38 percent increase in NO_x emissions from 2000 to 2001.

In 2002, after the energy crisis, Fort Churchill reverted to primarily using pipeline natural gas, resulting in significant decreases in both SO_2 (74 percent) and NO_x (16 percent) below 1999 emission levels. Beginning in 2007, there was a notable decline in fuel oil use at Fort Churchill; in 2007, fuel oil was used a total of only 14 hours in Units 1 and 2. Since 2007, the sole source of fuel has been from pipeline natural gas. Appendix B, Section 1.8. Essentially, conversion to pipeline natural gas has already been implemented at Fort Churchill. Moreover, BART upgrades at Units 1 and 2 will not allow for the continued use of oil-firing capacity beyond December 31, 2014. Appendix B, Section 3.2. As can be seen in Figure 3-6 and Figure 3-7, there has been a steady decrease in SO_2 and NO_x emissions since the baseline period.

Figure 3-6. CAMD Acid Rain Database SO_2 EGU Emissions at Fort Churchill 1995 - 2013

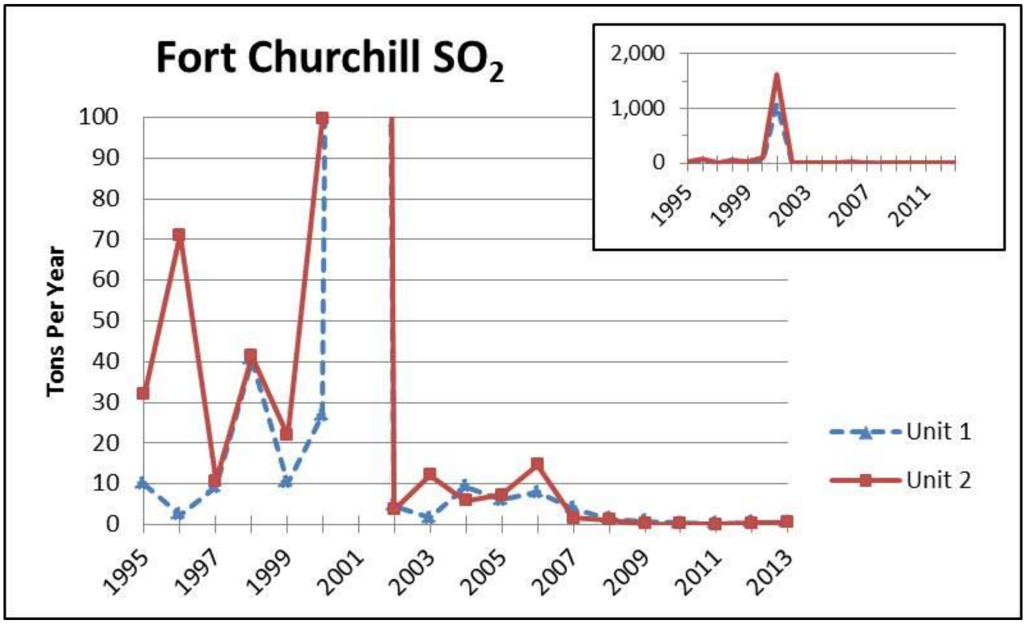
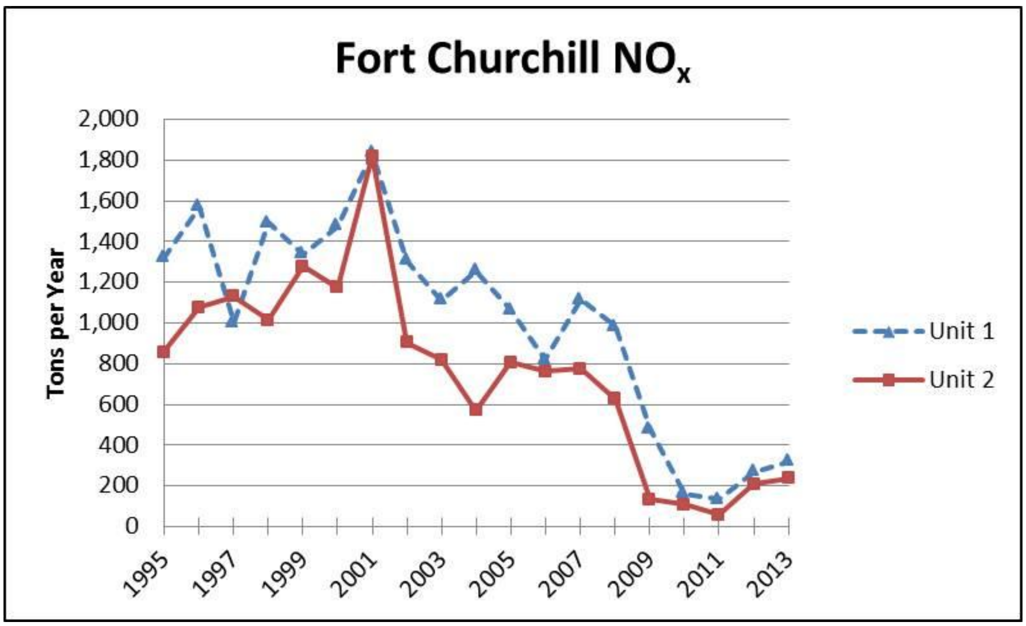


Figure 3-7. CAMD Acid Rain Database NO_x EGU Emissions at Fort Churchill 1995 - 2013



In summary, Nevada has shown evidence of a decrease in emissions of SO_2 and NO_x due to control measures implemented per Nevada's 2009 RH SIP, the closure of an entire coal-fired power plant and other State measures. In addition, future reductions will occur due to anticipated closure of specific EGUs.

4

Chapter Four – Jarbidge: Assessment of Visibility Conditions (40 CFR 51.308(g)(3))

Table of Contents

4.1 Status Summary

Current visibility conditions measured at JARB1, the IMPROVE monitor representing Nevada's only mandatory Class I area (the Jarbidge WA), are shown in Table 4-1. On the worst days, visibility impairment is strongly influenced by light extinction due to particulate organic matter, followed by coarse mass and sulfate. For the best days, visibility impairment is dominated by light extinction due to sulfate, followed by particulate organic matter and coarse mass. Annual conditions for the worst days show considerable variation from year to year, while the best days show much less variability.

The dominant source categories for sulfur dioxide (precursor of sulfate) are anthropogenic. In contrast, the dominant source categories for the particulate organic matter precursors, VOCs and primary organic aerosols, are natural. For coarse mass, the source categories are roughly equally divided between anthropogenic and natural sources in the WestJump2008 inventory. Section 5.5 of Chapter Five details the source categories for the emitted visibility impairing pollutants.

> *51.308(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 conditions;*
> *(iii) The change in visibility impairment for the most impaired and least impaired days over the past 5 years.*

Visibility conditions based on the rolling 5-year annual average haze index (in units of deciviews) have improved slightly for the worst days. Progress for the worst days is impeded by large contributions to visibility impairment by particulate organic matter. This is well illustrated by the huge contribution to visibility impairment from wildfires in 2012, which caused a corresponding spike in the 2008-2012 period for worst days. See Section 4.4. Better progress is shown for the best days. It is noteworthy that on the best days in both 2002 and 2018 source areas outside the jurisdiction of state or federal regulation and/or control (i.e., Outside Domain, Canada, Mexico and Pacific Offshore) contribute more than two thirds to the sulfate concentration at JARB1. 2009 RH SIP, Section 4.3.1.

Trend analyses of the period 2000 to 2012 show that visibility impairment due to sulfate and nitrate light extinction is decreasing through time for both the worst and best days. The trend lines fitted to the annual data have slopes comparable or better than, i.e., showing greater improvement, the respective speciated glide slopes for the Jarbidge WA. See Section 4.6 for additional discussion.

4.2 Visibility Conditions

40 CFR 51.308(g)(3) requires the state to assess the visibility conditions for the 20 percent most impaired (worst) and least impaired (best) days expressed in terms of the 5-year averages. The visibility conditions that must be reviewed include: 1) the current visibility conditions, 2) the difference between current visibility conditions compared to the baseline, and 3) the change in visibility impairment for the most and least impaired days over the past 5 years.

4.3 Current Visibility Conditions

This section addresses the requirement to report the current visibility conditions for the most impaired and least impaired days. 40 CFR 51.308 (g)(3)(i). The following sections discuss the differences between the most impaired and least impaired days, current versus baseline visibility conditions and trends.

Table 4-1 presents the annual visibility conditions at JARB1, the IMPROVE monitor representing Nevada's Class I area (the Jarbidge WA), for the current planning period represented by the 5-year period 2008 to 2012 as well as the 5-year annual averages for the haze index and light extinction by species (inverse megameters[1] or Mm-1). In its discussion of visibility conditions, the NDEP is using the period 2008 through 2012 to define visibility conditions for the current progress period. The term "current planning period" refers to this current, most-recent planning period. The WRAP TSD (WRAP 2013) also assessed Nevada's visibility conditions for the planning period 2005 through 2009. See Appendix A, Sections 6.8.1.1 and 6.8.1.2.

Table 4-1. Current Planning Period Annual Visibility Conditions and 5-Year Annual Averages for the Worst and Best Days Measured at JARB1

Year	Haze Index (dv)	Sulfate (Mm^{-1})	Nitrate (Mm^{-1})	POM (Mm^{-1})	EC (Mm^{-1})	Soil (Mm^{-1})	Coarse Mass (Mm^{-1})	Sea Salt (Mm^{-1})
Worst Days								
2008	12.5	3.72	1.12	12.06	1.48	2.61	4.84	0.04
2009	11.1	4.43	0.53	7.32	1.12	2.31	5.66	0.30
2010	10.0	3.30	1.04	4.33	0.77	2.49	5.66	0.06
2011	11.7	4.16	0.67	7.71	1.21	2.49	6.85	0.40
2012	14.9	3.87	1.18	23.97	3.11	2.63	5.17	0.21

[1] An inverse megameter is a unit of light extinction that can be directly related to gaseous and aerosol concentrations, while a deciview is a metric of haze proportional to the logarithm of the light extinction.

Year	Haze Index (dv)	Sulfate (Mm^{-1})	Nitrate (Mm^{-1})	POM (Mm^{-1})	EC (Mm^{-1})	Soil (Mm^{-1})	Coarse Mass (Mm^{-1})	Sea Salt (Mm^{-1})
Average	**12.0**	**3.9**	**0.9**	**11.1**	**1.5**	**2.5**	**5.6**	**0.2**
Best Days								
2008	1.9	1.14	0.22	0.23	0.09	0.12	0.27	0.05
2009	1.8	0.95	0.16	0.31	0.11	0.12	0.28	0.03
2010	1.8	1.09	0.15	0.30	0.12	0.06	0.24	0.03
2011	2.1	1.21	0.19	0.39	0.13	0.10	0.26	0.07
2012	2.0	0.95	0.18	0.37	0.18	0.10	0.37	0.04
Average	**1.9**	**1.1**	**0.2**	**0.3**	**0.1**	**0.1**	**0.3**	**0.0**

4.4 Differences between Current and Baseline Conditions

This section addresses the difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions. 40 CFR 51.308 (g)(3)(ii).

Table 4-2 presents the five-year annual average baseline and successive five-year planning period visibility conditions measured at JARB1 and the differences between the baseline and current conditions represented by the period 2008 to 2012 in units of haze index and speciated light extinction. A negative difference indicates a reduction in haze, i.e., improved visibility. The haze index declined slightly for the worst days, but showed a much greater reduction for the best days. Monitored light extinction due to sulfate, nitrate, and elemental carbon has decreased between the baseline and progress periods for the worst days, while light extinction resulting from all the monitored species has remained the same or decreased for the best days. Recall that the baseline period is represented by the years 2000 to 2004. Note the emissions sources for VOCs and primary organic aerosols, particulate organic matter precursors, are predominantly natural, while emissions sources for fine soil and coarse mass are approximately equally split between natural and anthropogenic sources in the WestJump2008 inventory. See Chapter Five.

Table 4-2. 5-Year Annual Average Baseline and Visibility Conditions for Successive 5-Year Planning Periods for the Worst and Best Days Measured at JARB1

Planning Period	Haze Index (dv)	Sulfate (Mm^{-1})	Nitrate (Mm^{-1})	POM (Mm^{-1})	EC (Mm^{-1})	Soil (Mm^{-1})	Coarse Mass (Mm^{-1})	Sea Salt (Mm^{-1})
Worst Days								
Baseline	12.1	4.0	1.1	10.0	1.6	2.4	5.5	0.1
2005-2009	12.4	4.4	1.4	10.0	1.7	2.6	5.9	0.2
2006-2010	12.2	4.0	1.1	9.6	1.6	2.7	6.1	0.1
2007-2011	11.7	3.9	1.0	8.4	1.2	2.7	6.2	0.2
2008-2012	12.0	3.9	0.9	11.1	1.5	2.5	5.6	0.2

Planning Period	Haze Index (dv)	Sulfate (Mm^{-1})	Nitrate (Mm^{-1})	POM (Mm^{-1})	EC (Mm^{-1})	Soil (Mm^{-1})	Coarse Mass (Mm^{-1})	Sea Salt (Mm^{-1})
Difference*	-0.1	-0.1	-0.2	1.1	-0.1	0.1	0.1	0.1
Best Days								
Baseline	2.6	1.2	0.3	0.8	0.3	0.1	0.3	0.0
2005-2009	2.2	1.1	0.2	0.5	0.2	0.1	0.3	0.0
2006-2010	2.0	1.1	0.2	0.4	0.1	0.1	0.3	0.0
2007-2011	2.0	1.1	0.2	0.3	0.1	0.1	0.3	0.0
2008-2012	1.9	1.1	0.2	0.3	0.1	0.1	0.3	0.0
Difference*	-0.7	-0.1	-0.1	-0.5	-0.2	0.0	0.0	0.0

* Calculated as the difference between the baseline period and current conditions represented by the 2008-2012 period. A negative difference indicates a reduction in haze, i.e., improved visibility.

USEPA guidance (USEPA 2013) suggests states consider a chart of rolling 5-year averages of the annual averages to avoid any confusion or discussion regarding whether the proper current planning period has been identified. Table 4-3 presents the current visibility conditions as rolling 5-year averages of the annual conditions in deciviews. Figure 4-1 and Figure 4-2 present the 5-year baseline average visibility conditions, average annual visibility conditions, and the 5-year rolling averages for the 20 percent worst days and 20 percent best days, respectively.

USEPA also suggests it may be useful to include additional monitoring data such as organic species. Figure 4-3 and Figure 4-4 present the annual speciated light extinction for the 20 percent worst and 20 percent best days, respectively, and also show the annual haze index (deciviews) for the period spanning the baseline to the current planning period. These figures show the large variability from year to year in light extinction by species. For the worst days, the variability between years ranges from 0.4 Mm^{-1} for Sea Salt (sea salt) to more than 18 Mm^{-1} for particulate organic matter, and are two to three Mm^{-1} for the remaining species: sulfate, nitrate, elemental carbon, soil, and coarse mass. The strong influence of particulate organic matter on the year-to-year variability in visibility conditions on the worst days is clearly shown on Figure 4-3 by the visibility trend mimicking the particulate organic matter trends. Levels of particulate organic matter spiked in 2012 as a result of huge fire emissions that year, causing a corresponding spike in the 2008-2012 period for worst days. As can be seen in Figure 4-4, visibility on the best days is generally improving with time with little variability from year to year.

Table 4-3. Five-Year Rolling Annual Average Haze Index for Baseline and Successive Planning Periods Measured at JARB1 (deciview)

2000 - 2004 (baseline)	2005 - 2009	2006 - 2010	2007 - 2011	2008 - 2012	Natural Conditions
20% Worst Days					
12.1	12.4	12.2	11.7	12.0	7.9
20% Best Days					
2.6	2.2	2.0	2.0	1.9	1.1

Figure 4-1. Worst Days: Annual Haze Index with 5-Year Baseline Average and 5-Year Rolling Averages (deciview)

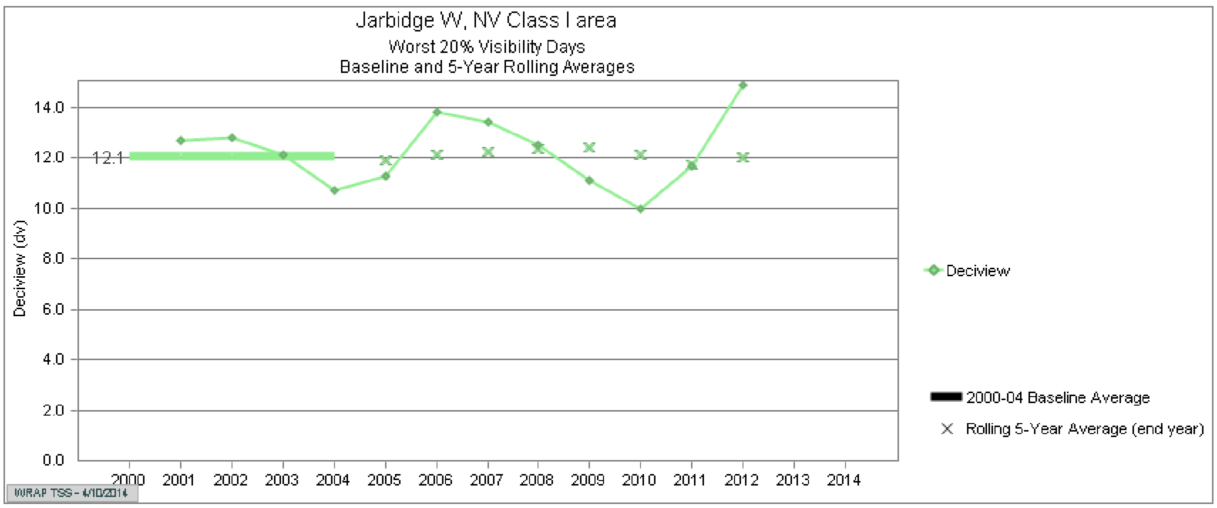


Figure 4-2. Best Days: Annual Haze Index with 5-Year Baseline Average and 5-Year Rolling Averages (deciview)

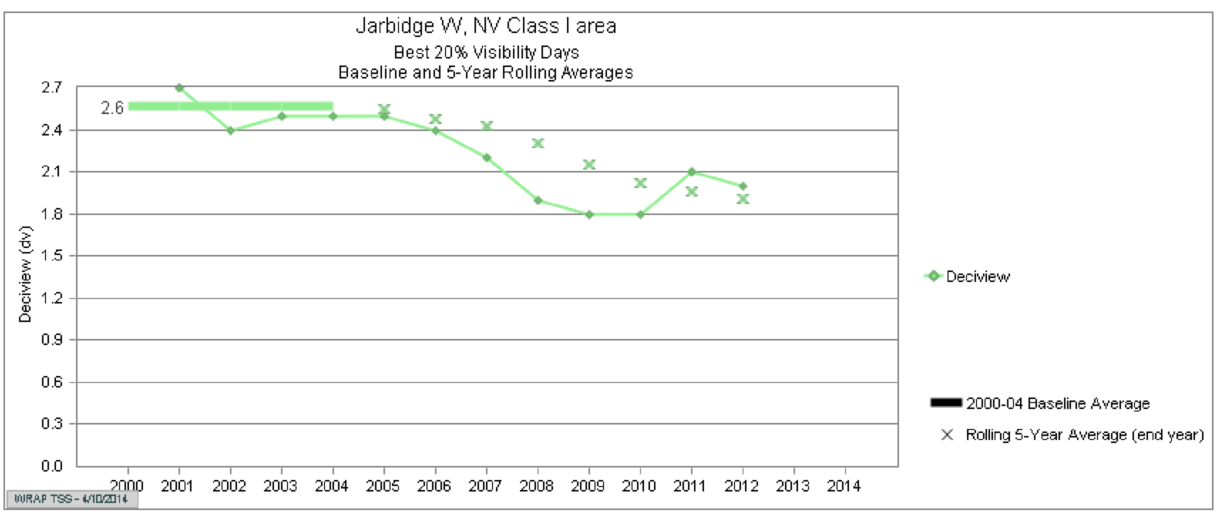


Figure 4-3. Worst Days: Average Annual Visibility Conditions at JARB1 Expressed in Deciviews and Speciated Light Extinction (Mm^{-1})

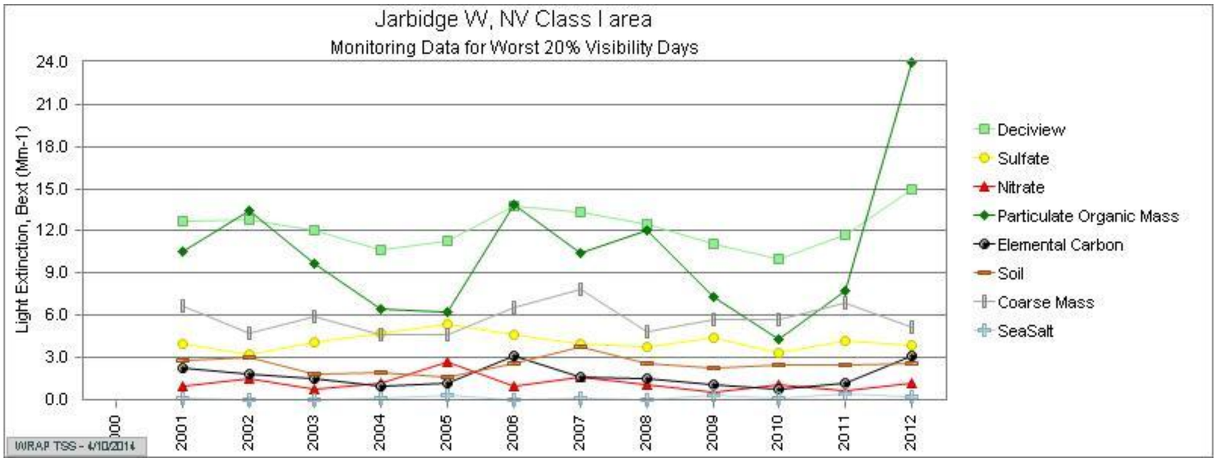


Figure 4-4. Best Days: Average Annual Visibility Conditions at JARB1 Expressed in Deciviews and Speciated Light Extinction (Mm^{-1})

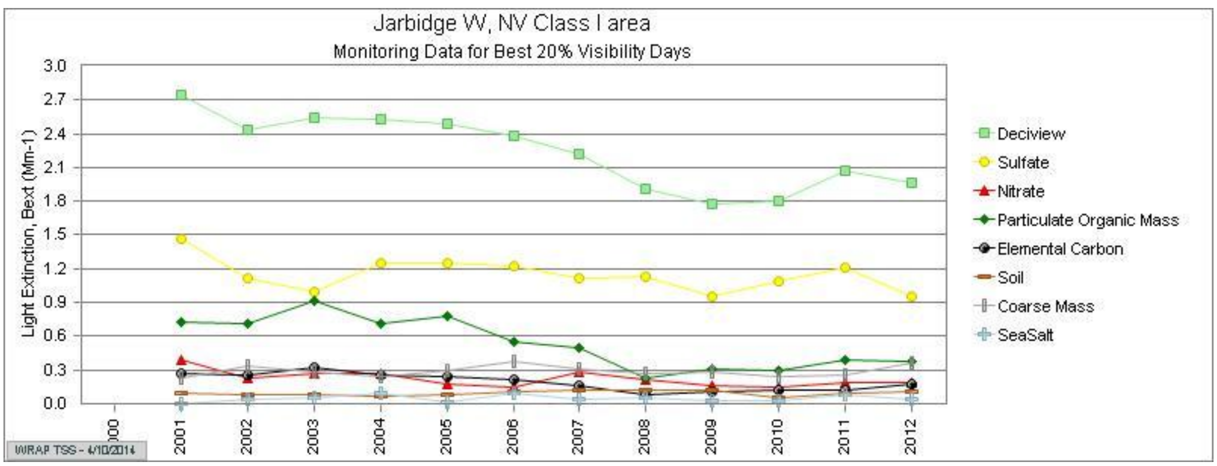


Figure 4-5 shows the differences between the 5-year average baseline speciated light extinction and the 5-year average speciated light extinction for each of the four successive progress periods on the worst days. Figure 4-6 presents the same information for the best days. For the worst days, the bars generally show the same contribution and magnitude for both the baseline and the current planning periods, although there are noticeable variations in visibility impairment due to particulate organic matter. For the best days, there is a noticeable reduction in visibility impairment due to sulfate, nitrate, particulate organic matter, and elemental carbon from the baseline to the current planning period with an overall reduction in visibility impairment on the best days.

Figure 4-5. Worst Days: Five-Year Average Speciated Light Extinction for Baseline and Successive 5-Year Planning Periods Measured at JARB1

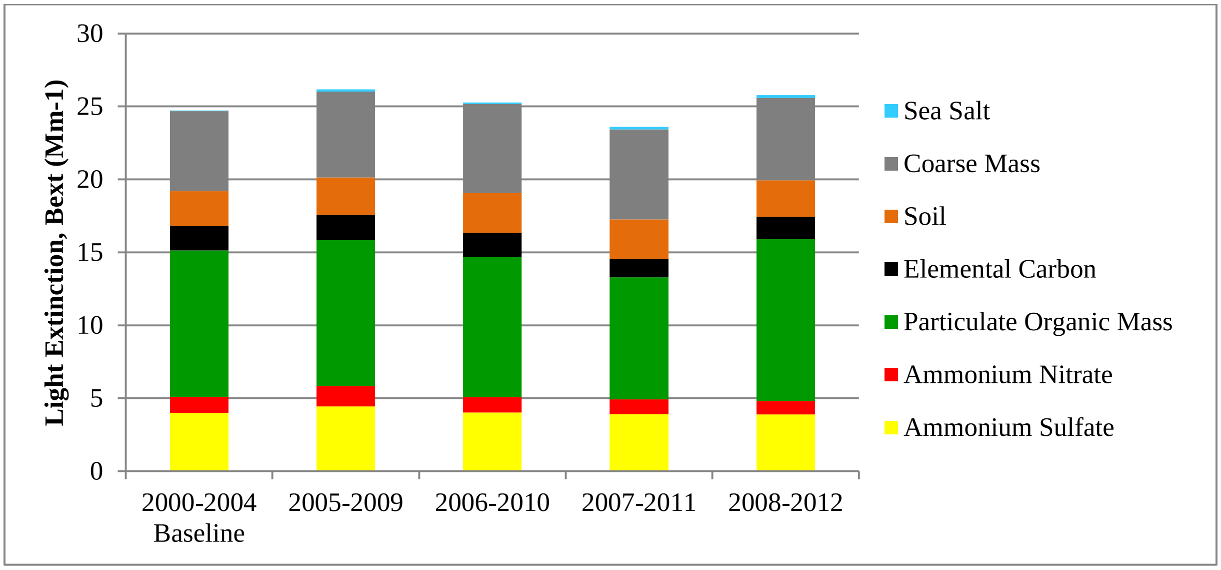


Figure 4-6. Best Days: Five-Year Average Speciated Light Extinction for Baseline and Successive 5-Year Planning Periods Measured at JARB1

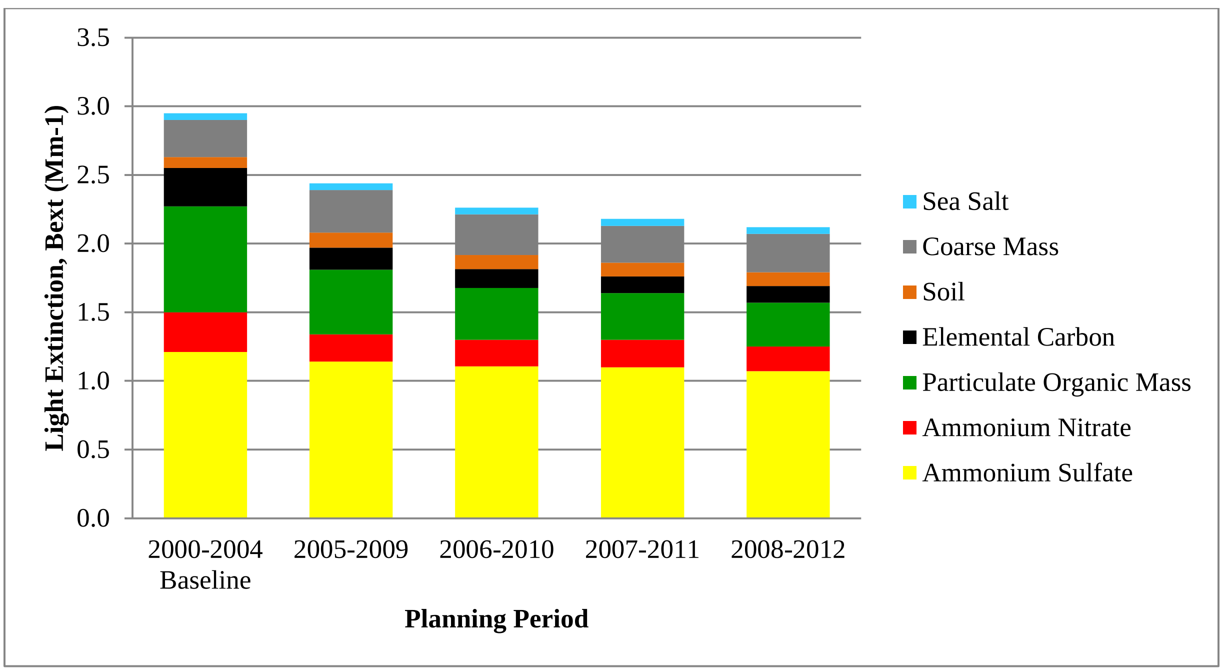


Table 4-4 presents the relative percentage contribution and rank of each species to worst and best day visibility impairment for the baseline and four subsequent planning periods as well as the 5-year average visibility impairment expressed in deciviews. The top three contributing species for each planning period are indicated on Table 4-4 by bold text.

For the worst days, particulate organic matter is by far the dominate contributor to visibility impairment for the baseline as well as all the subsequent planning periods, contributing between 35 and 43 percent of the visibility impairment. Particulate organic matter is followed by coarse mass, contributing between 22 and 26 percent of the impairment, and sulfate, contributing between 15 and 17 percent. Soil, elemental carbon, nitrate, and sea salt each contribute less to visibility impairment with contributions of roughly 10 percent for soil decreasing to less than one percent for sea salt.

For the best days, sulfate is the dominant contributor, contributing roughly 40 to 50 percent of the visibility impairment at JARB1. The sulfate contribution is most likely high because best days represent times when there are few emissions from natural sources, so emissions from anthropogenic source categories become more dominant. Although the percent contribution from sulfate increases from the baseline period to the progress period, Table 4-2 shows that monitored concentrations are in fact decreasing. Source apportionment modeling accessed in the TSS[2] indicates that Nevada emissions contribute only 12.4 percent to 15.4 percent to modeled sulfate concentrations at JARB1 on the best days for 2002 and 2018, respectively. 2009 RH SIP, Figures 4-10 and 4-11.

Particulate organic matter is the second largest contributor on best days with roughly a 25 percent contribution in the baseline period decreasing to 15 percent in the progress period. For the baseline period, nitrate is the third largest contributor with a contribution of roughly 10 percent, although elemental carbon and coarse mass also contribute roughly 10 percent each to baseline visibility impairment. Soil has a contribution of roughly three percent and sea salt roughly two percent during the baseline period. For the successive planning periods, the third largest contributor is coarse mass, contributing between 12 and 13 percent, followed by nitrate, contributing roughly eight to nine percent. Elemental carbon and soil contribute roughly six to seven percent and four to five percent, respectively. Sea salt contributes roughly two percent.

Although the ranking changes from worst days to best days, particulate organic matter, coarse mass, and sulfate are the three largest contributors to visibility impairment at JARB1 for the successive planning periods set forth in Figure 4-5 and Figure 4-6. As discussed in Chapter Five, emissions of VOCs and primary organic aerosols are primarily from non-anthropogenic sources. Gaseous VOCs are converted to particulate organic matter through chemical reactions in the atmosphere, while primary organic aerosols are emitted as particulate, both of these particulates are monitored as particulate organic matter. Roughly 40 percent of coarse mass emissions come from non-anthropogenic sources in the baseline period, while in the WestJump2008 inventory the source categories are roughly equally divided between anthropogenic and natural sources. SO_2, which combines with ammonia (NH_3) in the atmosphere to form ammonium sulfate, is the only one of the three largest contributors to visibility impairment at JARB1 that is dominantly

[2] http://vista.cira.colostate.edu/tss/, last viewed 8/25/2014.

emitted from anthropogenic sources; however, approximately two thirds of the sulfate monitored at JARB1 is attributed to sources out of Nevada's control (2009 RH SIP, Section 4.3.1).

Table 4-4. Average Visibility Conditions by Species for the Successive 5-Year Progress Periods at JARB1

Planning Period	Haze Index (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) Expressed as % of Mm^{-1} and [Rank]*						
		Sulfate* (%)	Nitrate (%)	POM* (%)	EC (%)	Soil (%)	Coarse Mass* (%)	Sea Salt (%)
20% Worst Days								
2000 - 2004	12.1	**16.2 [3]**	4.4 [6]	**40.6 [1]**	6.7 [5]	9.7 [4]	**22.1 [2]**	0.2 [7]
2005 - 2009	12.4	**17.0 [3]**	5.3 [6]	**38.2 [1]**	6.6 [5]	9.8 [4]	**22.5 [2]**	0.6 [7]
2006 - 2010	12.2	**15.9 [3]**	4.2 [6]	**38.0 [1]**	6.4 [5]	10.8 [4]	**24.1 [2]**	0.4 [7]
2007 - 2011	11.7	**16.6 [3]**	4.2 [6]	**35.5 [1]**	5.3 [5]	11.6 [4]	**26.1 [2]**	0.7 [7]
2008 - 2012	12.0	**15.1 [3]**	3.5 [6]	**43.0 [1]**	6.0 [5]	9.7 [4]	**21.9 [2]**	0.8 [7]
20% Best Days								
2000 - 2004	2.6	**41.0 [1]**	**9.8 [3]**	**26.1 [2]**	9.5 [4]	2.7 [6]	9.2 [5]	1.7 [7]
2005 - 2009	2.2	**46.7 [1]**	8.2 [4]	**19.3 [2]**	6.6 [5]	4.5 [6]	**12.7 [3]**	2.0 [7]
2006 - 2010	2.0	**48.9 [1]**	8.6 [4]	**16.6 [2]**	6.1 [5]	4.6 [6]	**13.1 [3]**	2.1 [7]
2007 - 2011	2.0	**50.5 [1]**	9.2 [4]	**15.6 [2]**	5.5 [5]	4.6 [6]	**12.4 [3]**	2.3 [7]
2008 - 2012	1.9	**50.5 [1]**	8.5 [4]	**15.1 [2]**	5.7 [5]	4.7 [6]	**13.2 [3]**	2.4 [7]

*Highest three aerosol species contributions per planning period are presented in bold font.

Table 4-5, drawing from the data in Table 4-2, presents the change in haze index as well as speciated light extinction from the baseline to the successive planning periods for both the worst and best days measured at JARB1. The change in light extinction is calculated as the planning period average minus the baseline period average. A negative difference indicates a reduction in haze, i.e., improved visibility. Figure 4-7 and Figure 4-8 portray these same data graphically for the worst and best days, respectively.

Table 4-5. Change in Aerosol Light Extinction by Species from 2000-2004 Baseline Period to Each Successive 5-Year Progress Period Measured at JARB1.*

Planning Period	Change in Haze Index (dv)	Change in Light Extinction by Species (Mm^{-1})						
		Sulfate	Nitrate	POM	EC	Soil	CM	Sea Salt
Worst Days								
2005 - 2009	0.3	0.44	0.30	*-0.04*	0.07	0.16	0.42	0.10
2006 – 2010	0.1	0.02	*-0.04*	*-0.43*	*-0.02*	0.33	0.63	0.04
2007 – 2011	*-0.4*	*-0.08*	*-0.10*	*-1.67*	*-0.41*	0.32	0.70	0.11
2008 - 2012	*-0.1*	*-0.10*	*-0.19*	1.04	*-0.11*	0.10	0.17	0.14
Best Days								
2005 - 2009	*-0.4*	*-0.07*	*-0.09*	*-0.30*	*-0.12*	0.03	0.04	0.00
2006 – 2010	*-0.6*	*-0.10*	*-0.10*	*-0.39*	*-0.14*	0.02	0.03	0.00
2007 – 2011	*-0.6*	*-0.11*	*-0.09*	*-0.43*	*-0.16*	0.02	0.00	0.00
2008 - 2012	*-0.7*	*-0.14*	*-0.11*	*-0.45*	*-0.16*	0.02	0.01	0.00

*Change in light extinction is calculated as the planning period average minus the baseline period average. Italicized, negative values indicate decreases in light extinction or improvement in visibility.

Table 4-5 shows that for the best days, visibility impairment decreases from baseline to planning period for the haze index, as well as light extinction due to sulfate, nitrate, particulate organic matter, and elemental carbon with 5-year each period, demonstrating continued improvements in visibility impairment with each successive 5-year planning period. Light extinction due to soil, coarse mass, and sea salt show little change between the baseline and planning periods.

Similarly, for the worst days, sulfate and nitrate show continued improvement beginning with the 2007 to 2010 and 2006 to 2010 planning periods, respectively. Sulfate and nitrate monitoring data measured at JARB1 during 2005 have some interesting characteristics that affect the 5-year averages and are discussed further in Section 4.5. Also noteworthy for the worst days is the large variability of impairment due to particulate organic matter light extinction, which demonstrates that one year of data can result in a difference of more than 2.5 Mm^{-1} in extinction from one 5-year planning period to the next (2007-2011 and 2008-2012). The haze index does not show any clear trends for the worst days due to the significant contributions to visibility impairment from particulate organic matter. Changes in light extinction due to elemental carbon, soil, coarse mass and sea salt varies from planning period to planning period.

Figure 4-7 presents the changes in speciated light extinction between 5-year planning periods and very clearly shows the variability between planning periods discussed above for worst days, particularly for particulate organic matter extinction. It also shows the reduction in sulfate and nitrate extinction for the most recent 5-year planning periods. Figure 4-8 shows the steady reduction of sulfate, nitrate, particulate organic matter, and elemental carbon contributions to light extinction with each successive planning period for the best days.

Figure 4-7. Worst Days: Change in 5-Year Average Light Extinction between Baseline and Successive Planning Periods Measured at JARB1

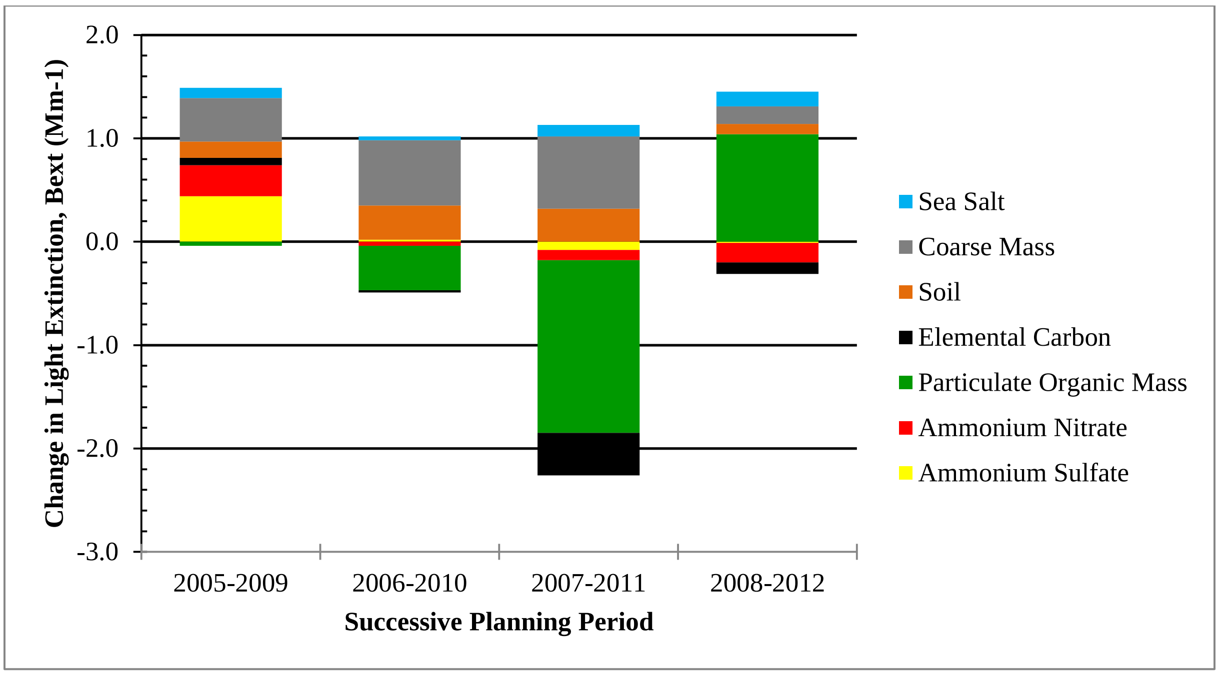
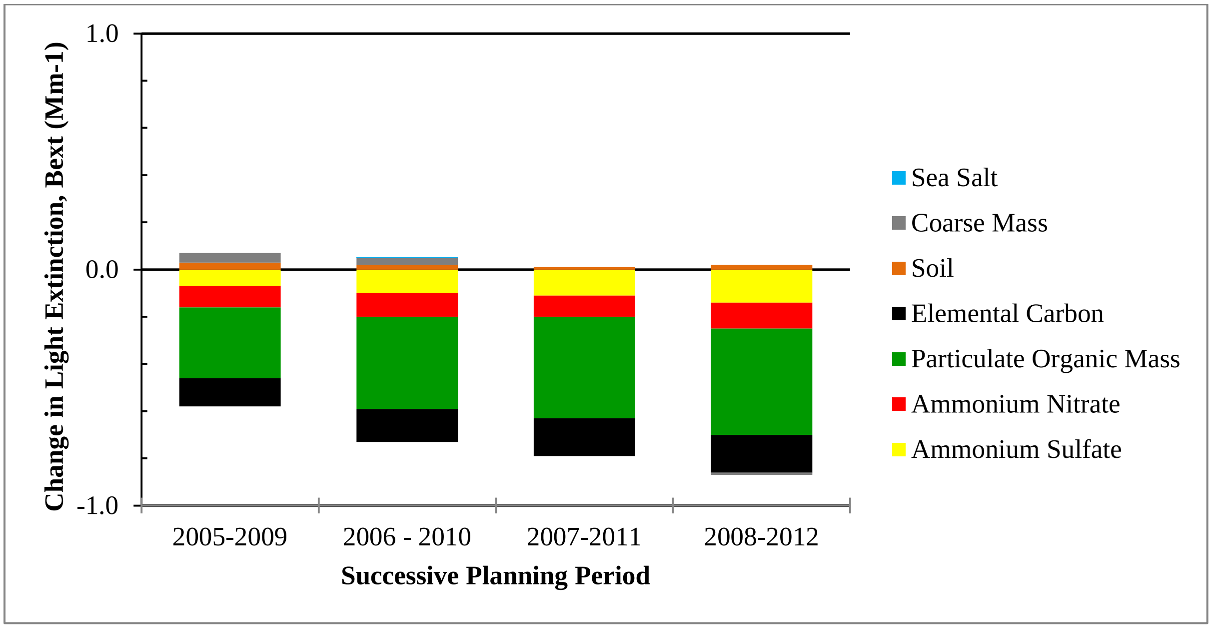


Figure 4-8. Best Days: Change in 5-Year Average Light Extinction between Baseline and Successive Planning Periods Measured at JARB1



4.5 Changes in Visibility Impairment

This section addresses the change in visibility impairment for the most impaired and least impaired days over the past 5 years. 40 CFR 51.308 (g)(3)(iii).

The uniform rate of progress glidepath for Jarbidge WA is shown in Figure 4-9. The glidepath is one of the indicators used to set reasonable progress goals and is simply a graph portraying a straight line drawn from the level of visibility impairment for the worst days baseline period to the natural background level with 2064 as the attainment date. The glidepath in Figure 4-9 is represented by the sloping line with the open triangles identifying the uniform rate of progress at five year intervals. The uniform rate of progress value at Jarbidge in 2018 is 11.09 deciviews. The 2018 reasonable progress goal for Jarbidge WA is 11.05 deciviews. [3]

[3] See the discussion in Chapter One of the correction to the 2018 visibility projection for Jarbidge WA conducted by the Regional Modeling Center. Nevada concludes that it is reasonable to retain the reasonable progress goal of 11.05 deciviews, which aligns closely with the 2018 uniform rate of progress value for Jarbidge WA.

Figure 4-9. Uniform Rate of Progress Glidepath for the Jarbidge Wilderness Area

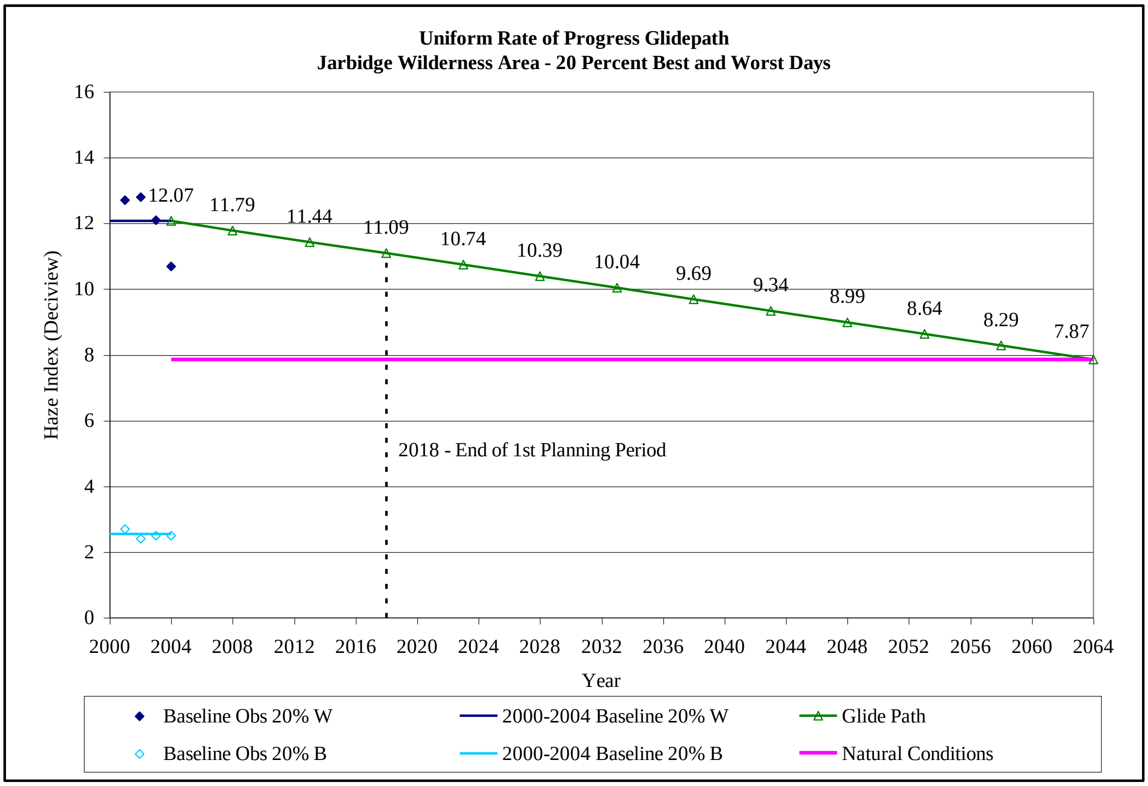


Table 4-6 presents the visibility change between the current and baseline worst days and best days, including the visibility changes as required by the RHR. It also compares worst days current conditions with the 2018 reasonable progress goal to show the percent progress achieved since the baseline using the 2008-2012 five-year average. Visibility impairment on the best days shows substantial improvement, while only modest progress is shown for the worst days due to significant contribution of particulate organic matter extinction, which results from emissions of VOCs and primary organic aerosols from natural sources.

Table 4-6. 2018 Reasonable Progress Goal Summary for JARB1

Best Days Baseline (dv)	Best Days 2008-2012 (dv)	Visibility Improvement (dv)	Worst Days Baseline (dv)	Worst Days 2008-2012 (dv)	Visibility Improvement (dv)	2018 RPG (dv)	Worst Days Progress to 2018 RPG by 2012
2.6	1.9	0.7	12.1	12.0	0.1	11.05	9.5%

Figure 4-10 and Figure 4-11 present the annual visibility conditions for the current planning period. Figure 4-10 shows the large year-to-year variability of particulate organic matter extinction for the worst days and its influence on the haze index as measured in deciviews. The large variability in particulate organic matter extinction during the 2008-2012 period overwhelms the relatively flat trends in all of the other species extinction for the 2008-2012 period when calculating the haze index. The annual extinction values for all of the monitored species other than particulate organic matter vary by 2.34 Mm^{-1} or less, whereas particulate organic matter varies by almost 20 Mm^{-1}. See Figure 4-1. The timelines representing the best days show much less year-to-year variability. See Figure 4-11.

Figure 4-10. Worst Days: Annual Visibility Conditions Measured at JARB1 for the Current Progress Period

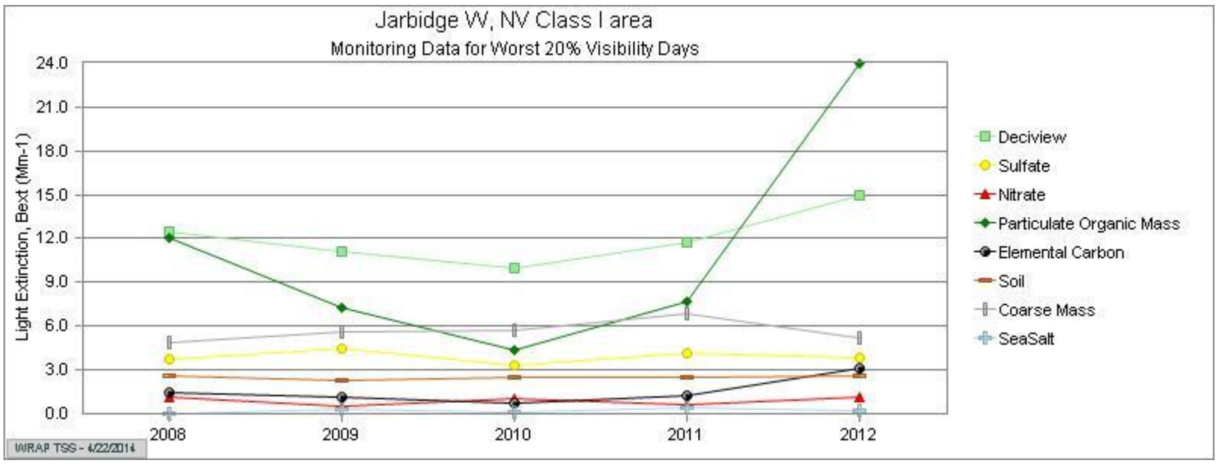
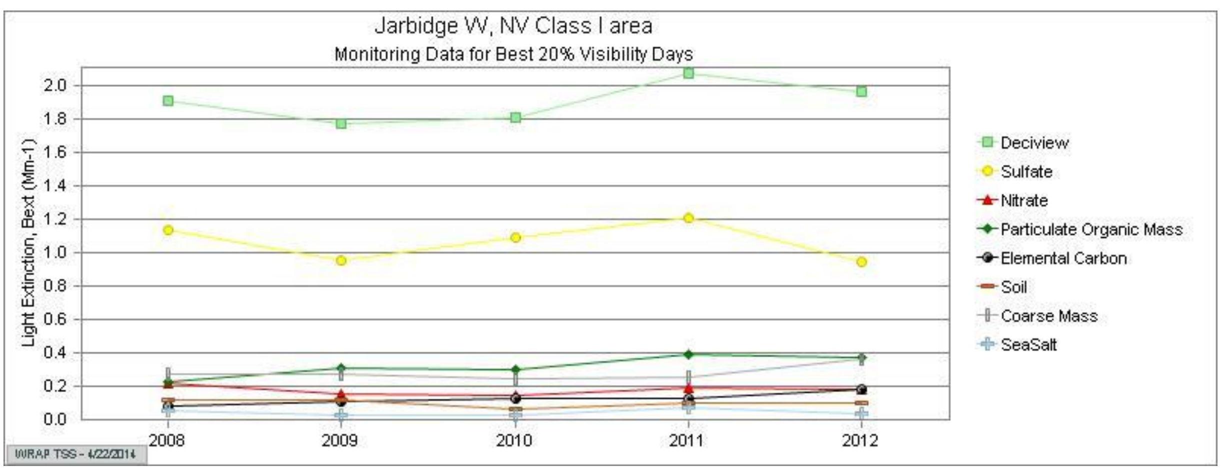


Figure 4-11. Best Days: Annual Visibility Conditions Measured at JARB1 for the Current Progress Period



4.6 Visibility Trends

This section discusses changes in visibility impairment as characterized by annual average trend statistics as well as rolling 5-year average trend statistics for sulfate and nitrate. The regulatory requirement calls for an analysis of change over the past 5-year period, but does not preclude looking at a longer time frame. Since trend analysis is better suited to longer periods of time, trends for the entire 13-year period, 2000 to 2012, are presented here. The trend lines represent linear regressions generated in Excel©.

Figure 4-12 presents the annual average sulfate light extinction trends for the worst days, all IMPROVE sampled days (all days), and the best days. The annual trends for the worst and best days are downward, indicating improvement in visibility impairment from light extinction due to sulfate. There is a slight upward trend for all days. The slope of the worst days trend line is -0.0187 Mm^{-1}/yr, comparable to the slope of the sulfate glideslope for Jarbidge WA from baseline conditions to natural conditions (-0.0533 Mm^{-1}/yr).

Figure 4-12. Annual Average Sulfate Light Extinction and Trends

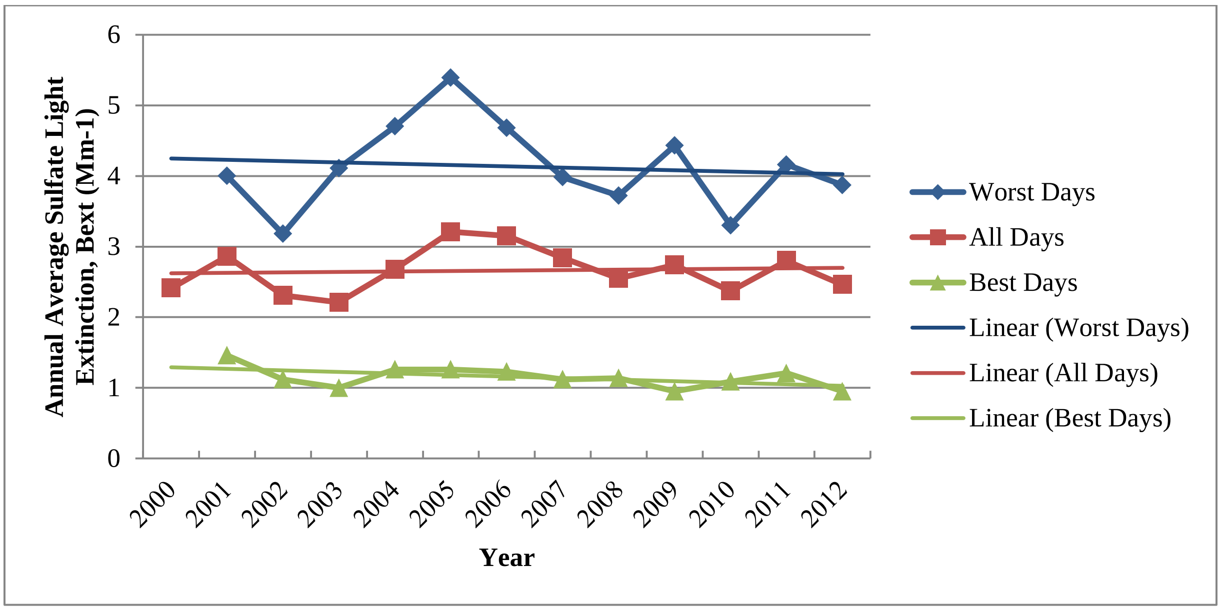


Figure 4-13 presents the light extinction trends due to sulfate for the worst days, all days, and best days based on rolling 5-year averages. The 5-year trends for the worst and best days are downward, again indicating improvements in visibility impairment resulting from sulfate extinction, while the all days data show variability with a slight upward slope. Thus, both the annual and the 5-year average data demonstrate improvement in visibility impairment due to sulfate light extinction on the worst and best days.

Figure 4-13. Rolling Five-Year Average Sulfate Light Extinction and Trends

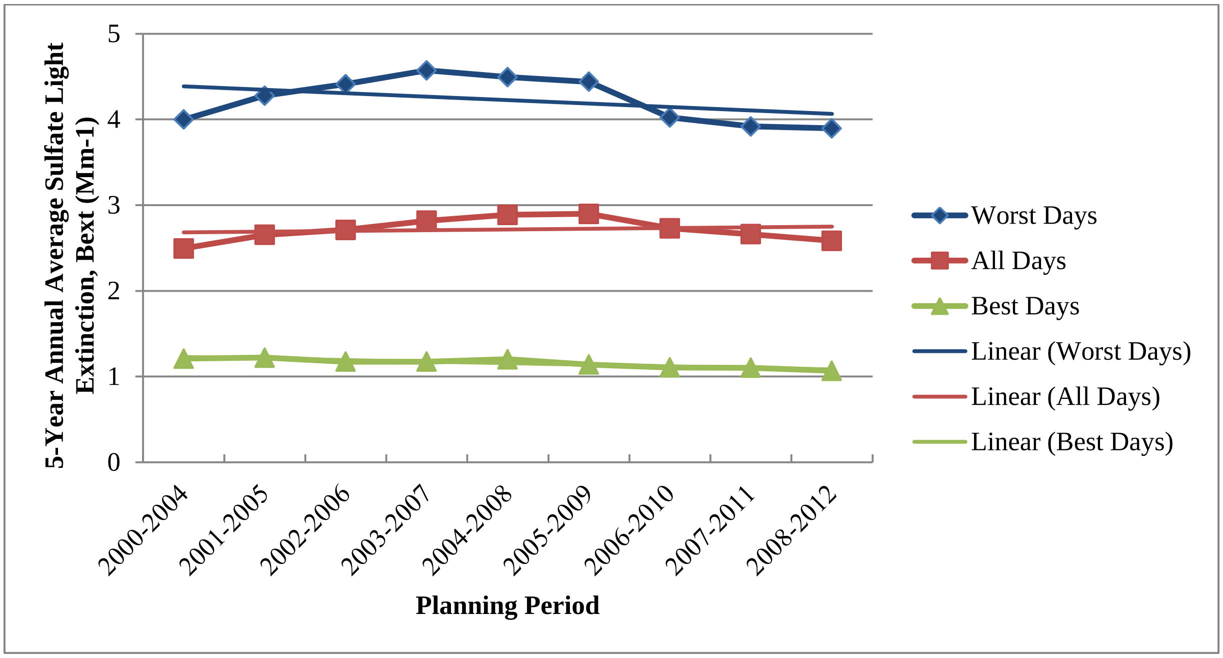


Figure 4-14 and Figure 4-15 present similar data for nitrate extinction. These data all show downward trends, clearly demonstrating improvement in annual visibility impairment resulting from light extinction due to nitrate for the worst, best, and all days. If the December 18, 2005 nitrate spike discussed in the next section were omitted from the data set, the downward slope on the worst days would be even stronger. The slope of both the annual average worst days trend line (-0.0373 Mm^{-1}/yr) and the 5-year average worst days trend line are an order of magnitude better than the slope of the nitrate glideslope for Jarbidge WA from baseline conditions to natural conditions (-0.0033 Mm^{-1}/yr).

Figure 4-14. Annual Average Nitrate Light Extinction and Trends

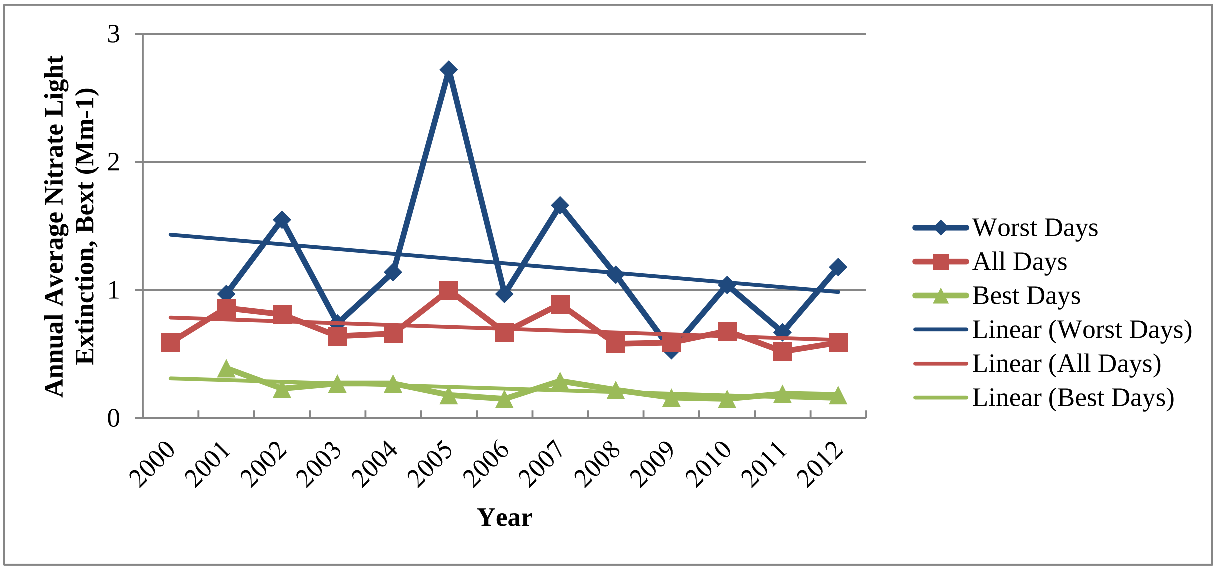


Figure 4-15. Rolling Five-Year Average Nitrate Light Extinction and Trends

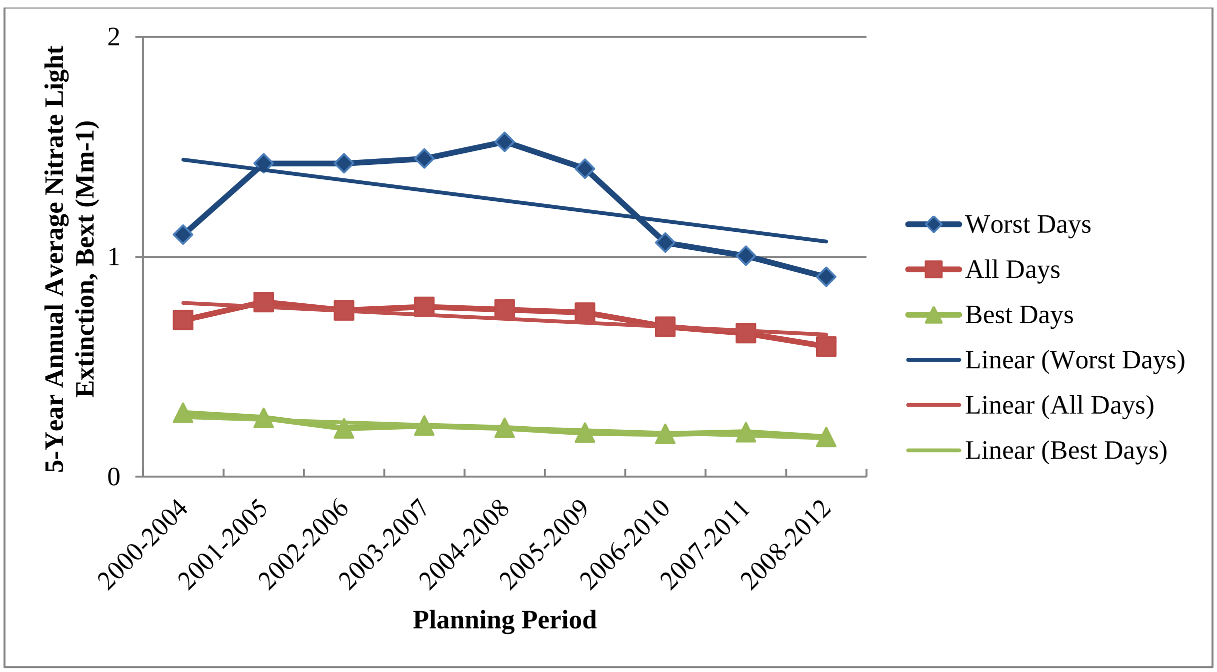


Figure 4-11 through Figure 4-15 all demonstrate that JARB1 worst and best days visibility impairment resulting from light extinction due to sulfate and nitrate is improving over time, both on an annual basis as well as for the 5-year planning period averages. The slopes of the annual trend lines for the worst days are comparable or better than the respective glideslopes for sulfate and nitrate light extinction. Sulfate and nitrate form from SO_2 and NO_x emissions, which are dominated by anthropogenic sources. Emission sources contributing to light extinction due to sulfate and nitrate at the Jarbidge WA are discussed in Chapter Six.

4.7 Effects of Outliers

As mentioned above, the 2005 monitor data from JARB1 has some interesting characteristics, especially in late December when a large spike (40+ Mm^{-1}, which is twice the next highest value recorded from 2000 to 2012) in monitored nitrate extinction occurred, corresponding to a smaller but distinct sulfate spike, as shown on Figure 4-16. The event that produced these spikes is not known to the NDEP, but similar spikes were seen across a wide-ranging geographic extent in the western United States, from Mount Hood Wilderness Area (WA) in Oregon (Figure 4-17) to Great Sand Dunes National Monument in Colorado (Figure 4-18). These figures present the nitrate and sulfate light extinction for all IMPROVE sample days in 2005 and show a consistent pattern of monitored nitrate light extinction during the December 2005 event although the values vary from site to site. Other IMPROVE monitoring sites across this vast region of the western United States record similar patterns of monitored nitrate light extinction for this event including, but not limited to, Mount Jefferson WA/Mount Washington WA/Three Sisters WA in Oregon; Great Basin National Park in Nevada; Zion Canyon National Park and Capital Reef National Park in Utah; Grand Canyon National Park and Petrified Forest National Park in Arizona; Rocky Mountain National Park in Colorado; and Bandelier National Monument in New Mexico.

Figure 4-16. 2005 Nitrate and Sulfate Monitor Data for the Jarbidge WA, Nevada

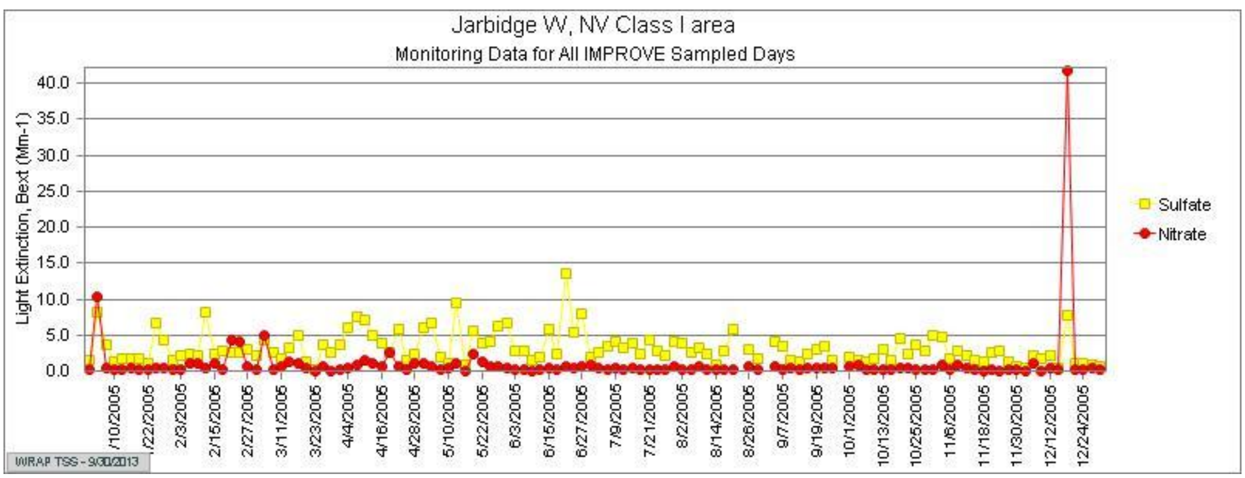


Figure 4-17. 2005 Nitrate and Sulfate Monitor Data for the Mount Hood WA, Washington

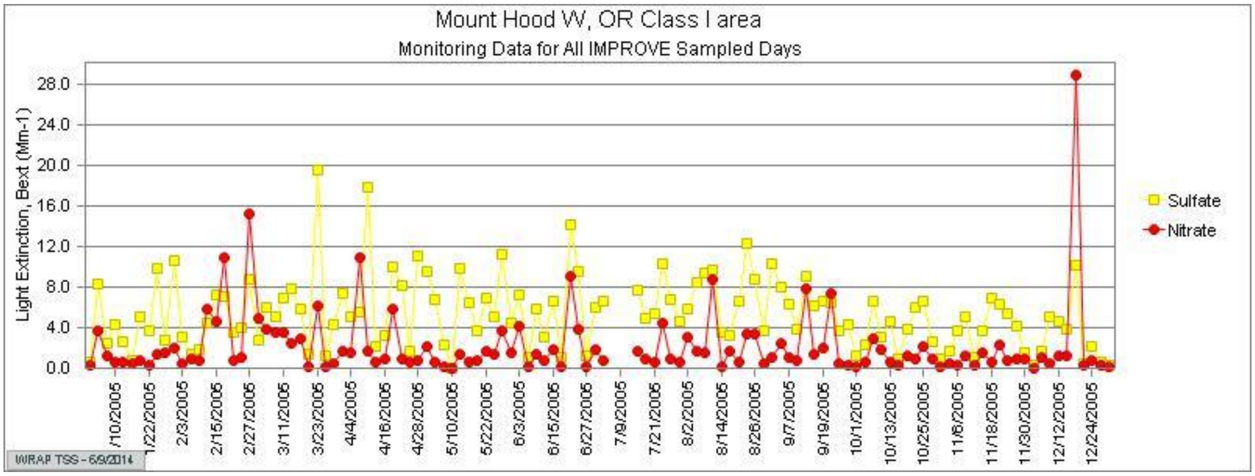
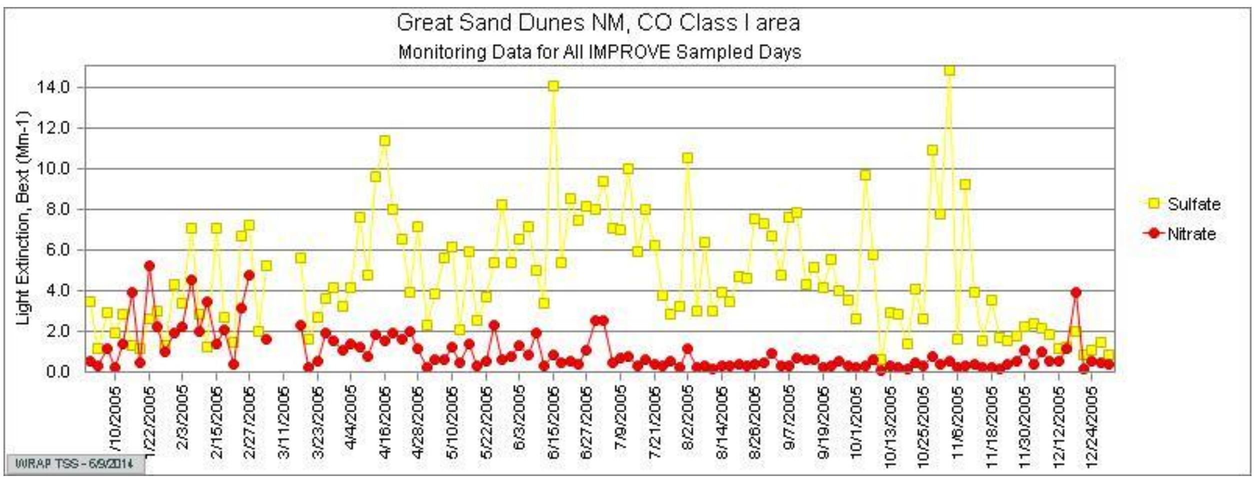


Figure 4-18. 2005 Nitrate and Sulfate Monitor Data for Great Sand Dunes NM, Colorado



The NDEP evaluated the impact of the December 18th nitrate extinction value on the annual average as well as the 5-year annual averages that include 2005 data. The 2005 41.88 Mm^{-1} extinction value was replaced with the average worst days nitrate light extinction (with the spike included in the average) from 2005, which is 2.72 Mm^{-1}. The worst days were re-identified and the substituted December 18th data remained as one of the worst days (2.72 Mm^{-1} is still the second highest nitrate light extinction for the 2005 worst days). The substituted data was used to re-calculate the worst days and all days annual light extinction and haze index, and the annual averages were then used to calculate the 5-year averages. This substitution lowered the average annual nitrate light extinction from 2.72 Mm^{-1} to 1.09 Mm^{-1} and lowered the annual average haze index from 11.3 deciviews to 10.9 deciviews. These are significant revisions based on conservative substitution of a single data point.

Figure 4-19 presents the annual nitrate light extinction for the worst, all, and best days using the substituted data for comparison with Figure 4-14, which presents the original data. Note the slope for both the worst days and all sample days decreased slightly from the original data. The best days data remain unchanged by the substitution. The slope of the worst days nitrate light extinction trend line still exceeds the glideslope by an order of magnitude.

Figure 4-19. Annual Average Nitrate Light Extinction and Trends, Substituted Data

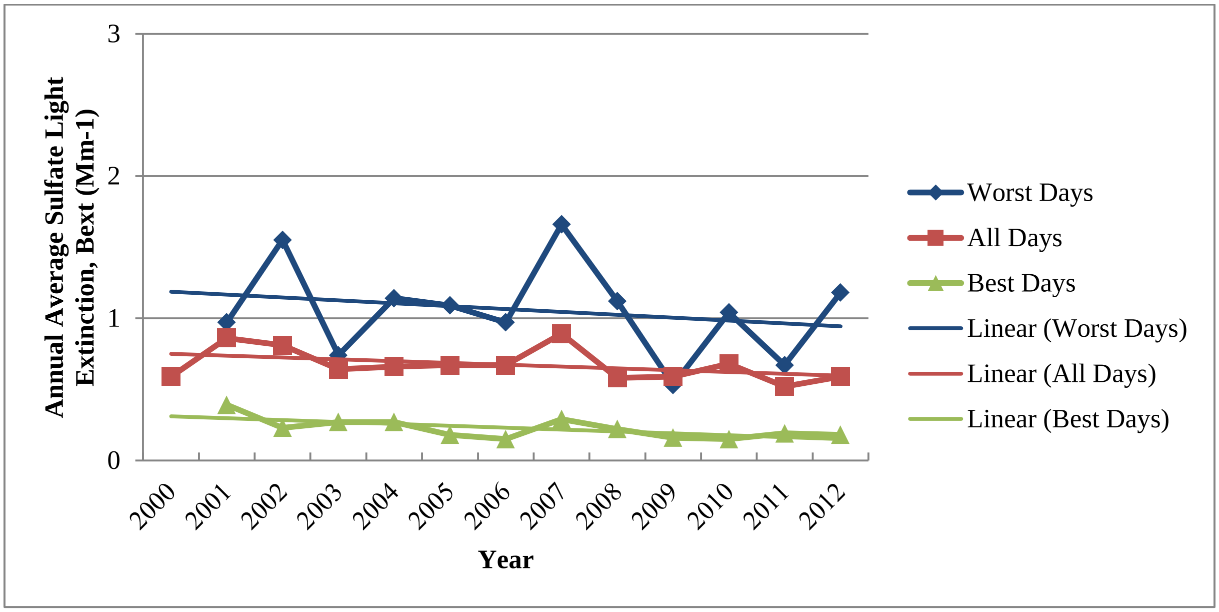
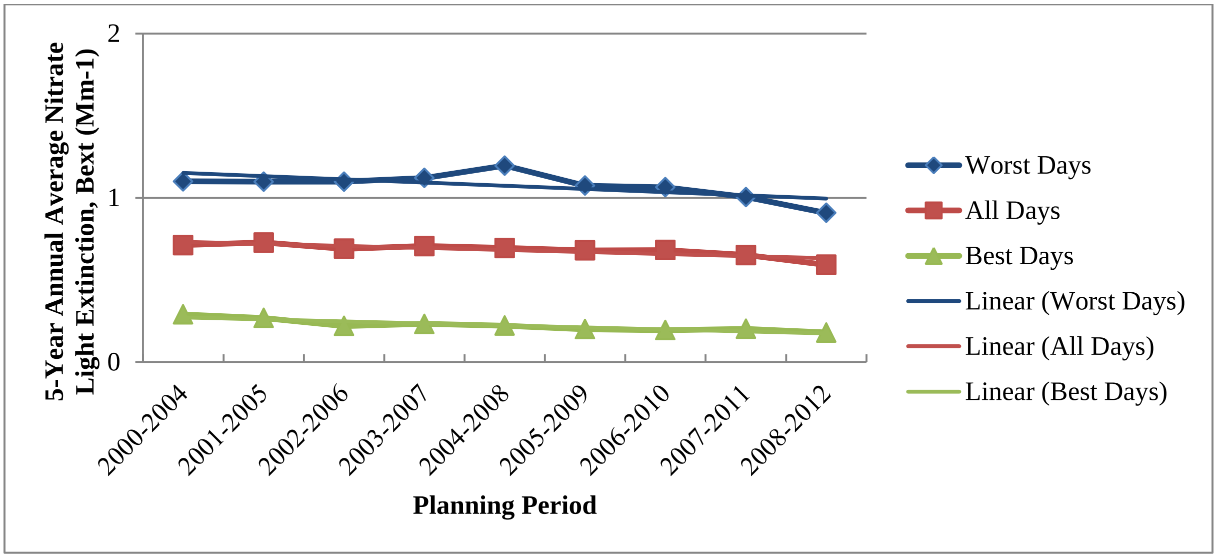


Figure 4-20 presents the 5-year average nitrate light extinction for the worst, all, and best days using the substituted data for comparison with Figure 4-15. Note on Figure 4-15 how the inclusion of the December 18th event increases all the 5-year averages that include data from 2005 (beginning with 2001-2005) and how quickly the 5-year averages drop when 2005 data is no longer included in the average (2006-2010). In addition, all the 5-year averages that include 2005 data exceed 1.4 Mm^{-1} with a high of 1.52 Mm^{-1}, while the high 5-year average of the substituted data is 1.2 Mm^{-1}.

Figure 4-20. Rolling Five-Year Annual Average Nitrate Light Extinction and Trends, Substituted Data



This data substitution exercise demonstrates the influence of one outlier data point on the annual average as well as the 5-year averages that incorporate the outlier data and how demonstration of progress can be stymied by a single data point. A more refined data substitution mechanism could be developed and may further reduce the annual nitrate extinction and haze index as well as the 5-year average nitrate extinction and haze index. Nevada urges the USEPA to acknowledge the influence of outliers and develop an acceptable regulatory mechanism to minimize the impact of outlier data on the evaluation of a state's status in meeting its reasonable progress goal.

5

Chapter Five – Changes in Emissions: All Sources within the State (40 CFR 51.308(g)(4))

Table of Contents

5.1 Status Summary

Table 5-1 shows that emissions of all visibility impairing pollutants decreased from the 2002 baseline inventory to the 2008 comparison year inventory developed by the WRAP, except for fine soil and coarse mass. The increases in fine soil and coarse mass were likely due to updates in inventory development methodologies rather than actual increases. Sections 5.5.7 and 5.5.8. Notably, actual 2008 emissions are lower than the projected 2018 emissions for all pollutants except fine soil and coarse mass. Point source SO_2 emissions alone decreased by 78 percent between the baseline and 2008 inventories (Table 5-5), while NO_x point source emissions decreased by over 50 percent (Table 5-7). This demonstrates a significant reduction in Nevada's anthropogenic emissions of SO_2 and NO_x and confirms the success of Nevada's long-term strategy for reducing emissions that are controllable within the State.

Table 5-1. Comparison of 2002, 2008 and 2018 Emission Inventories for All Visibility Impairing Pollutants*

Pollutants	2002 Baseline (tpy)	2008 Inventory (tpy)	2018 Projection (tpy)	2008 Actuals as a Percent of 2018 Projections
Sulfur Dioxide	67,743	17,058[1]	46,224	37%
Oxides of Nitrogen	162,397	119,513	135,496	88%
Ammonia	12,092	9,382	14,503	65%
Volatile Organic Compounds	897,102	351,142	897,707	39%
Primary Organic Aerosol	24,734	11,816	24,822	48%
Elemental Carbon	6,409	4,425	5,638	78%
Fine Soil	21,208	40,301	24,134	167%
Coarse Mass	161,142	321,257	188,287	171%

* The SO_2 and NO_x data include only gaseous emissions.

5.2 Baseline and Progress Periods for Tracking Emission Changes

40 CFR 51.308(g)(4) requires an analysis tracking the change over the past five years of the emissions of pollutants from all sources and activities within the state that contribute to visibility impairment. This chapter describes the change in emissions between the baseline period and the progress period. In doing so, it relies principally on the WRAP TSD prepared for the western states to support the development of 5-year progress reports. Appendix A and WRAP 2013. The WRAP TSD includes extensive analyses and comparisons of emissions data from source categories, displaying the differences between the baseline and progress period inventories for Nevada.

[1] Nevada over-reported 2008 NEI SO_2 emissions by 88 tons. This correction has been accounted for in Table 5-1.

The baseline period is represented by the 2000-2004 emission inventory developed by the WRAP for use in the initial RH SIPs. The development of the baseline (referred to as “2002” by the WRAP) or “Plan02” inventories was a cooperative effort between the WRAP and the western states. The emissions reported by the states in the 2002 NEI served as the starting point for the Plan02 inventories. The data were enhanced via efforts by contractors, WRAP workgroups, and consultation with the WRAP states. Point, area, mobile, oil and gas, fire and dust source categories were better characterized through this effort. Section 5.3 further describes the development of the Plan02d inventory.

> *51.308(g) Periodic progress reports must contain at a minimum . . .*
> *(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.*

The inventory year chosen for comparison with the baseline year is 2008 as provided in the WRAP TSD. WRAP 2013. The WRAP used the 2008 NEI as a starting point, then updated that inventory through its WestJump Air Quality Modeling Study (WestJump AQMS 2013), producing an updated and comprehensive inventory for year 2008. WestJump2008. Section 5.4 further describes the data sources used in developing the 2008 inventory. Emissions data is presented showing the change from the 2008 NEI to the 2011 NEI, where available.

Emission inventories were complicated by the fact that a number of changes and enhancements have occurred between development of the baseline and current period inventories. Thus, some of the differences between inventories are more reflective of changes in methodology, rather than changes in actual emissions. Some examples of the changes include using a revised mobile model, different meteorological models, incorporation of state-specific data, re-categorization of sources into more appropriate source categories, regulatory changes, revised emission rates, and improvements to activity data. The changes and enhancements are discussed more in Section 5.3 of this chapter and Table 3.2-1 of the WRAP TSD. WRAP 2013. These differences in methodologies will affect the ability to make comparisons of inventories used for 2002 and 2008 estimates.

In Nevada’s 2009 RH SIP, emission summaries compared both gaseous and particulate emissions of sulfur oxides (SO_x) and NO_x. Emission summaries in the WRAP TSD compared just gaseous emissions of SO_2 and NO_x. The difference between gaseous and particulate emissions and gaseous only emissions for point and area source categories, the primary sources of SO_2 and NO_x emissions, is less than one percent. For this report, Nevada is conforming to the analysis performed by the WRAP for the TSD. Therefore, a comparison of the gaseous emissions of SO_2 and NO_x is discussed in this chapter.

As evident in Section 5.3, the majority of anthropogenic point source emissions in the baseline period are SO_2 and NO_x. Thus, this chapter focuses on the emission reductions from point sources of SO_2 and NO_x. Table 5-2 lists the different source categories that comprise anthropogenic and natural sources of visibility-impairing pollutants generally.

Table 5-2. Anthropogenic and Natural Source Categories

Anthropogenic Source Categories	Natural Source Categories
Point Sources	Natural Fire Sources
Anthropogenic Fire Sources	Biogenic Sources
Area Sources	Wind Blown Dust
WRAP Oil and Gas Sources	
On-Road Mobile Sources	
Off-Road Mobile Sources	
Road Dust	
Fugitive Dust	

Table 5-3 lists the major emitted pollutants inventoried, the related monitored aerosol species, some of the major sources for each pollutant, and some notes regarding implications of these pollutants. Appendix A, Table 6.8-7

Table 5-3. Pollutants, Aerosol Species and Major Sources

Emitted Pollutant	Related Aerosol	Major Sources	Notes
Sulfur Dioxide (SO_2)	Ammonium Sulfate	Point Sources; On- and Off-Road 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 both on- and off-road diesel engines.
Oxides of Nitrogen (NO_x)	Ammonium Nitrate	On- and Off-Road 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)	Ammonium Sulfate and Ammonium Nitrate	Area Sources; On-Road Mobile Sources	Gaseous NH_3 has implications in particle formation because it can form particulate ammonium. Ammonium is not directly measured by the IMPROVE program, but affects formation potential of ammonium sulfate and ammonium nitrate. All measured nitrate and sulfate is assumed to be associated with ammonium for IMPROVE reporting purposes.
Volatile Organic Compounds (VOCs)	Particulate Organic Mass (POM)	Biogenic Emissions; Vehicle Emissions; Area Sources	VOCs are gaseous emissions of carbon compounds, which are often converted to POM through chemical reactions in the atmosphere. Estimates for biogenic emissions of VOCs have undergone significant updates since 2002, so changes reported here are more reflective of methodology changes than actual changes in

Emitted Pollutant	Related Aerosol	Major Sources	Notes
			emissions. See Section 3.2.1 of the WRAP TSD.
Primary Organic Aerosol (POA)	POM	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, and large wildfire events are generally sporadic and highly variable from year to year.
Elemental Carbon (EC)	EC	Wildfires; On- and Off-Road 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	Soil	Windblown Dust; Fugitive Dust; Road Dust; Area Sources	Fine soil is reported here as the crustal or soil components of $PM_{2.5}$.
Coarse Mass (PMC)	Coarse Mass	Windblown Dust; Fugitive Dust	Coarse mass is reported by the IMPROVE Network as the difference between PM_{10} 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.

5.3 Emissions from the 2002 Baseline Period

The baseline period emissions are represented by the 2002 inventory developed by the WRAP for the initial RH SIPs. This effort built upon 2002 emissions submitted by states to USEPA for the 2002 NEI and incorporated work by contractors and WRAP workgroups in consultation with states. Base02 was the first inventory, which used actual 2002 data and represented actual conditions in calendar year 2002. Subsequent to the Base02 inventory, a series of Plan02 inventories were developed (Plan02a, Plan02b, Plan02c and Plan02d) using 2000 through 2004 data. The purpose of the inventory series was to represent baseline emission patterns based on average, or typical, conditions rather than a single year. The Plan02d emission inventory was a result of minor changes to the Plan02c inventory. The Plan02d inventory provides the basis in this report for comparison with the 2018 projected emissions, as well as for gauging reasonable progress with respect to future year visibility.

Data comparisons were made between the baseline and 2008 emission inventory periods for nine source categories. A summary of the emission inventory descriptions for the Plan02d source categories follows. A more detailed description can be found in the WRAP TSD. WRAP 2013, Table 3.2-1.

1. Point source inventory –This inventory was generated using hourly USEPA CAMD continuous emission monitoring (CEM) data for EGUs. Other point source emissions were developed in consultation with states.

2. Area source inventory –This inventory was developed by the WRAP contractor, Eastern Research Group, in consultation with states.
3. Area oil and gas – The oil and gas inventories were developed for specific oil and gas basins using WRAP Phase II emissions methodologies. If Phase II emission methodologies were not available, then state-reported emissions were used. Nevada did not report oil and gas emissions. However, Nevada was included in the Phase II oil and gas inventory; therefore emissions for the baseline period for Nevada exist.
4. On-road mobile – This inventory was generated using USEPA's MOBILE6 model as applied by ENVIRON using inputs from states.
5. Off-road mobile – This inventory was generated using NONROAD2004 model as applied by ENVIRON using inputs from states.
6. Fugitive dust and road dust – This inventory was generated using the WRAP 2002 inventory by ENVIRON with initial inputs from states. Vegetative scavenging factors were applied pre-processing at the county level, as opposed to grid-level for 2008 data.
7. Windblown dust – This inventory was generated using the WRAP Windblown Dust Model and the 2002 Meteorological Mesoscale 5 (MM5) gridded meteorological data at 36 km grid cell resolution. Vegetative scavenging factors were applied pre-processing at the county level, versus post-processing at the grid cell level for 2008.
8. Biogenic – This inventory was generated using BEIS3.12 model, BELD3 land use and 2002 MM5 meteorological data, at 36 km grid cell resolution.
9. Fires (natural and anthropogenic) – This inventory was generated using the WRAP's Phase III fire inventory, which represented a 5-year average of fire activity from 2000 to 2004.

Table 5-4 provides Nevada emissions data by pollutant from the Plan02d baseline inventory. Point sources contribute 32 percent of the total anthropogenic emissions. Of that 32 percent, SO_2 and NO_x emissions account for 92 percent of the anthropogenic point source emissions and 29 percent of total anthropogenic emissions. Clearly, SO_2 and NO_x emissions from point sources are the primary, controllable visibility impairing pollutants in the baseline inventory.

Table 5-4. Emissions from Plan02d Baseline Inventory in Tons

Plan02d	Point Source Anthropogenic Emissions	Total Anthropogenic Emissions	Total Natural Emissions (fire + biogenic + dust)
SO_2	50,720	65,543	2,200
NO_x	59,864	139,353	23,044
NH_3	339	10,408	1,684
VOC	2,215	85,357	811,745

POA	256	2,233	22,501
EC	13	1,735	4,674
Fine Soil	2,158	9,364	11,845
Coarse Mass	4,093	62,020	99,122
Total	119,658	376,013	976,815

5.4 Emissions from the 2008 Progress Period

The progress period is represented by the WRAP's WestJump2008 inventory. Data comparisons were made between the baseline and 2008 emission inventory periods for Nevada in nine different source categories. The WRAP continues to refine inventories and conduct studies to better estimate emissions from the different source categories. A summary of the sources of data used for each source category for the progress period follows; a more detailed description of the inventories used in developing the WestJump2008 inventory can be found in the WRAP TSD. WRAP 2103, Table 3.2-1. When different models or data sources were used in the 2008 inventory as compared to the baseline inventory, those differences are noted below.

1. Point source – The WRAP WestJump2008 inventory was generated using hourly USEPA CAMD CEM data for EGUs. WestJump AQMS 2013. Other point sources emissions are from the 2008 NEI v2. Point source oil and gas inventories were inventoried separately for WestJump2008 and are included in this point source inventory.
2. Area source – The area source category is now referred to as the "non-point" emission sector category by USEPA. WRAP's WestJump2008 inventory used state-reported area source inventories from the 2008 NEI v2. The WRAP included stationary area sources, agricultural and natural ammonia emission sources, oil and gas production operations, and biogenic emissions for the non-point sector in addition to the typical area source emission categories.[2] Beginning in 2008, some sources that were previously considered "off-road" were incorporated into the area source inventory, i.e., commercial marine vessels, vessels on in-land waterways and in-transit locomotive emissions. For the WestJump2008 inventory, area oil and gas emissions were reported separately.
3. Area oil and gas – The oil and gas inventories were developed for specific oil and gas basins using WRAP Phase III emission methodologies, based on Version 2.0 of the 2008 NEI. Twelve additional categories were included for the 2008 progress period than were used in the 2002 baseline inventory. New emission methodologies, especially for VOC emission rates, were used. If WRAP Phase III emissions methodologies were not available, area source oil and gas emissions as reported by the states to the 2008 NEI were used. Nevada did not report oil and gas emissions to the 2008 NEI. Furthermore,

[2] TSS Stationary Area Source Emissions June 2011.doc (last viewed 5/21/2014), located on the TSS website, http://vista.cira.colostate.edu/docs/wrap/emissions.

since Nevada was not included in the oil and gas basins for the WestJump study, there were no estimates for 2008 oil and gas emissions for Nevada.

4. On-road mobile – USEPA's Motor Vehicle Emission Simulator (MOVES) 2010 model was applied to state inputs. Inputs were updated with new Vehicle Miles Traveled (VMT) and controls on vehicles.

5. Off-road mobile – The 2008 off-road mobile inventory was obtained from the 2008 NEI v2, using NONROAD model estimates from within the National Mobile Inventory Model. One important methodology change was the reclassification of some sources previously labeled off-road; these sources were included in the non-point (area) sources in 2008.

6. Fugitive dust and road dust –These emissions were extracted from state-reported area source estimates from the 2008 NEI v2. Vegetative scavenging factors were applied post-processing at a higher resolution grid cell level than for the 2002 data.

7. Windblown dust – Emissions were generated using the WRAP Windblown Dust Model and a different meteorological model, 2008 WRF, at 4 km and 12 km grid cell resolution versus 36 km resolution in the baseline period. There were significant updates to enhance the accuracy of the WRAP Windblown Dust Model; thus, it will affect comparisons between the baseline period and the 2008 inventory. Vegetative scavenging factors were applied post-processing at the grid cell level rather than pre-processing at the county level for 2002. The WestJump AQMS project included many technical updates and improvements including refinements to the grid, meteorology and land-cover data thus improving the data results for the dust modeling. The study on dust emission sources for the WestJump AQMS was presented as Technical Memorandum No. 6: Dust Source Emissions.[3]

8. Biogenic – A different model, Model of Emissions of Gases and Aerosols from Nature (MEGAN) 2.10, was used along with different meteorology data, 2008 WRF, at a finer grid cell resolution, 4 km and 12 km.

9. Fires (natural and anthropogenic) – The WRAP used DEASCO3[4] fire summaries to account for fires in 2008 rather than a 5-year average of fires as was used in the baseline inventory. The tables in this report compare fire inventories between the baseline period, a five-year average from 2000-2004, and 2008, one-year of data from the DEASCO3 study, although this results in a somewhat misleading comparison. There was separate reporting of anthropogenic and natural fires.

[3] http://wrapair2.org/pdf/Memo6_Dust_Mar11_2013review_draft.pdf (last viewed 5/21/2014)
[4] "Deterministic and Empirical Assessment of Smoke's Contribution to Ozone," https://deasco3.wraptools.org/ (last viewed 5/20/2014)

5.5 Emission Differences between the Baseline and Progress Periods

This section analyzes the change in emissions between the baseline (Plan02d) and 2008 (WestJump2008) inventories and includes comparison of some source category changes between the 2008 and 2011 NEIs. As noted earlier in this report, a number of changes and enhancements have occurred between development of the baseline and current period inventories. Where such changes in methodology affect the 2008 data, they are identified in the following discussion.

The data by source type are shown below for the following emission species: sulfur dioxide, oxides of nitrogen, ammonia, volatile organic compounds, primary organic aerosol, elemental carbon, fine soil and coarse mass.

5.5.1 Sulfur Dioxide

Table 5-5 shows SO_2 emissions by source category for the baseline and 2008 inventories. Table 5-6 presents 2008 and 2011 NEI data for the point and mobile source categories. The primary source of SO_2 in Nevada is from point sources. Nevada's point sources contribute 75 percent of total (anthropogenic and natural) statewide SO_2 emissions in the Plan02d inventory and 65 percent of total statewide SO_2 emissions in the WestJump2008 inventory. Point source SO_2 emissions alone decreased by 78 percent between the 2002 and 2008 inventories. The NEI point source inventory shows a further decrease of 44 percent in SO_2 emissions from 2008 to 2011 (Table 5-6).[5] Area source SO_2 emissions decreased 63 percent from 2002 to 2008. Due to the complexity of the calculation of the area source emissions, there are no area (aka non-point) emissions obtained directly from the NEI.

Table 5-5. Sulfur Dioxide Emissions by Category

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	50,720	11,067[6]	-39,653
Area	12,953	4,863	-8,090
On-Road Mobile	454	298	-156
Off-Road Mobile	1,403	322	-1,081
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	12	2	-10
Total Anthropogenic	65,543	16,552	-48,991 (-75%)
Natural Sources			

[5] Note that the 2008 NEI emissions are slightly different from the WestJump2008 inventory, which leverages more recent inventory development work performed by the WRAP.

[6] Nevada over- reported 2008 NEI SO_2 point emissions by 88 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-5 and Table 5-6.

Natural Fire	2,200	506	-1,694
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	2,200	506	-1,694 (-77%)
All Sources			
Total Emissions	67,743	17,058	-50,685 (-75%)

On-road mobile source SO_2 emissions decreased 34 percent from the Plan02d to the WestJump2008 inventory, while the NEI data show a further 47 percent decrease from 2008 to 2011. Off-road mobile source SO_2 emissions decreased by 77 percent from the Plan02d inventory to WestJump2008 inventory and 87 percent from 2008 to 2011 based on the NEI.

In sum, Table 5-5 shows all source categories of SO_2 decreased between the Plan02d and WestJump2008 inventories. Total anthropogenic and total anthropogenic plus natural emissions both saw a net decrease of 75 percent between the Plan02d and WestJump2008 emission inventories. The large reduction of SO_2 emissions for point sources is primarily due to the closure of Mohave in southern Nevada. The reductions in SO_2 emissions from mobile sources are likely due to the required use of low sulfur diesel fuel discussed in Chapter Three, Section 3.3.

There is a significant decrease in SO_2 emissions from point and mobile sources in the 2008 and 2011 NEI (Table 5-6). This is primarily due to reductions in coal-fired power plant emissions, as discussed in Chapter Three, as well as reductions from on-road and off-road mobile source emissions.

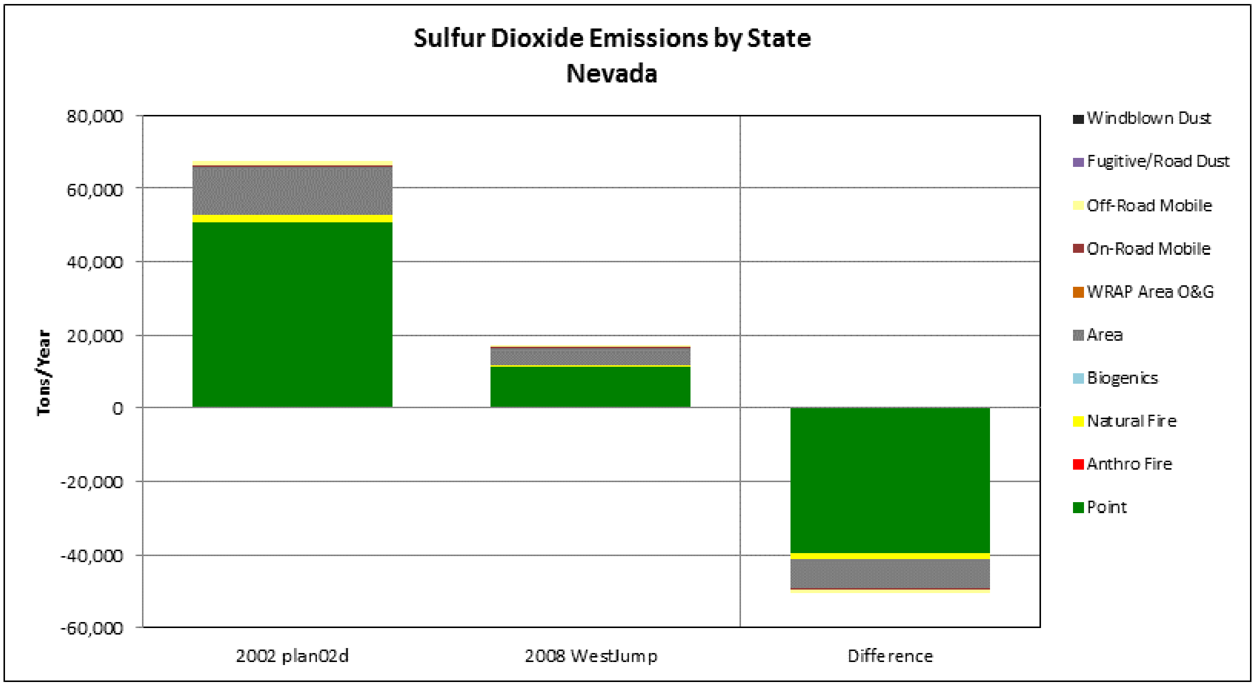
Table 5-6. SO_2 NEI Emissions (2008 and 2011)

Source Category	SO_2 Emissions (tons/year)	
	2008 NEI	2011 NEI (% change from 2008)
Point	10,409[7]	5,863[8] (-44%)
On-Road Mobile	511	270 (-47%)
Off-Road Mobile	316	41 (-87%)

Figure 5-1 presents a graphical display of the difference in SO_2emissions by source category for the baseline period and the current progress period from the WRAP TSD. Appendix A. While there are significant reductions in SO_2 emissions from both area and point sources, the reduction from point sources is especially noteworthy.

[7] See supra n.7.
[8] Nevada under-reported 2011 NEI SO_2 point emissions by 427 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-6. SO_2 NEI Emissions (2008 and 2011)

Figure 5-1. 2002 and 2008 Sulfur Dioxide Emissions and Differences by Source Category



5.5.2 Oxides of Nitrogen

Table 5-7 shows NO_x emissions by source category for the baseline and 2008 inventories; Table 5-8 presents 2008 and 2011 NEI data for the point and mobile source categories. The primary anthropogenic source categories of NO_x emissions in Nevada are point and on-road mobile, followed by off-road mobile, and area sources. Nevada's point sources contribute 37 percent of total statewide NO_x emissions in the Plan02d inventory, decreasing to 25 percent in the WestJump2008 inventory. Point source emissions alone decreased by over 50 percent between the 2002 and 2008 inventories. The NEI point source inventory shows a decrease of 57 percent in NO_x emissions from 2008 to 2011.

NO_x emissions from on-road mobile sources increased 22 percent from the Plan02d to the WestJump2008 inventory. The increase can be attributed in part to the use of a different model to estimate on-road mobile emissions. MOBILE6 was used for the 2002 baseline inventory, whereas a new model, MOVES2010, was used for the 2008 progress period. The MOVES2010 model results in higher overall NO_x and $PM_{2.5}$ emissions, but lower VOC emissions.[9] The increase may also be partly due to a growth in the vehicle population, coupled with the fact that reductions from the federal vehicle emission standards have not yet been fully realized (see Chapter Two). Four Nevada counties, comprising nearly three-quarters of the State's population, contributed over 70 percent of the increase: Clark County, 28 percent; Elko County, 18 percent; Pershing County, 12 percent; and Humboldt County, 12 percent. http://nvdemography.org/data-

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[9] Introduction to MOVES for Non-Modelers, August 2012, http://www.dvrpc.org/NTAQS/pdf/MOVES_training.pdf

and-publications/, 2008 data. NEI data show a 36 percent increase in on-road mobile NO_x emissions from 2008 to 2011, possibly related to a 2 percent population growth in Clark County and 3 percent in Washoe County.

Off-road mobile source emissions contribute 20 percent of total statewide NO_x emissions in the Plan02d inventory, decreasing to 14 percent in the WestJump2008 inventory. Off-road mobile source emissions alone decreased by 48 percent. NEI data also show a decrease in off-road mobile emissions from 2008 to 2011 of 12 percent (Table 5-8).

Overall, in the progress period 2002 to 2008, total anthropogenic emissions of NO_x in Nevada decreased by 23 percent (Table 5-7 and Figure 5-2). Total NO_x emissions saw a net decrease of 26 percent between the Plan02d and WestJump2008 emission inventories. Increases in on-road mobile and area source inventory totals were offset by larger decreases in point and off-road mobile totals. The increase in emissions for area sources from the 2002 to the 2008 inventory may be a result of a reclassification of some off-road mobile sources into the area source category. This reclassification may have also contributed to the decrease in the emissions for the off-road inventory totals.

Table 5-7. Oxides of Nitrogen Emissions by Category

Source Category	Oxides of nitrogen Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	59,864	29,344[10]	-30,520
Area	5,725	11,321	5,597
On-Road Mobile	41,089	50,068	8,979
Off-Road Mobile	32,565	17,081	-15,484
Area Oil and Gas	63	0	-63
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	48	13	-35
Total Anthropogenic	139,353	107,827	-31,526 (-23%)
Natural Sources			
Natural Fire	8,026	3,575	-4,451
Biogenic	15,018	7,364	-7,654
Wind Blown Dust	0	0	0
Total Natural	23,044	10,939	-12,105 (-53%)
All Sources			
Total Emissions	162,397	118,766[11]	-43,631 (-26%)

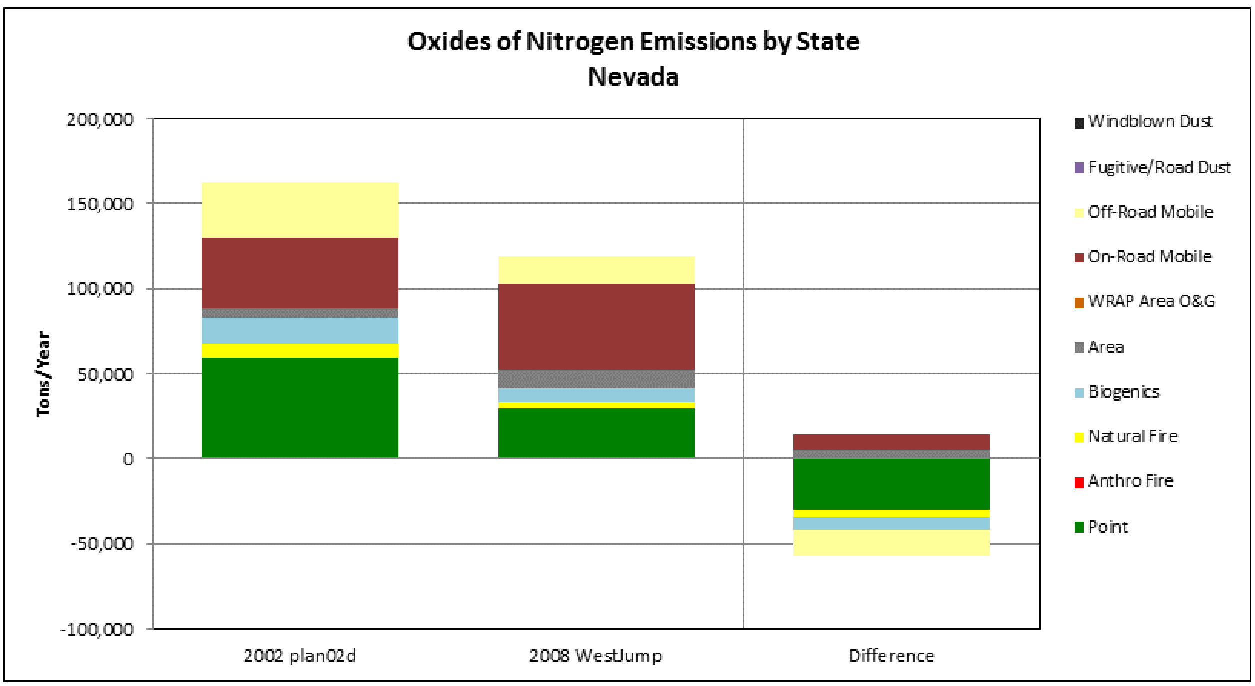
[10] Nevada over-reported 2008 NEI NO_x emissions by 746 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-7 and Table 5-8.
[11] See supra n. 10.

Table 5-8. NOx NEI Emissions (2008 and 2011)

Source Category	NOx Emissions (tons/year)	
	2008 NEI	2011 NEI (% change from 2008)
Point	20,934[12]	10,548[13] (-50%)
On-Road Mobile	40,643	55,389 (36%)
Off-Road Mobile	16,797	14,706 (-12%)

Figure 5-2 shows a graphical display of the difference in NO_x emissions by source category for the baseline period and the current progress period from the WRAP TSD. Appendix A. The reduction in emissions from point and off-road mobile sources is noteworthy.

Figure 5-2. 2002 and 2008 Oxides of Nitrogen Emissions and Differences by Source Category



5.5.3 Ammonia

Table 5-9 shows NH_3 emissions by source category, and Figure 5-3 shows the graphical display from the WRAP TSD. Appendix A. The primary source of anthropogenic emissions of NH_3 in Nevada is from area sources, while natural fire is the dominant natural source of NH_3 emissions.

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[12] See supra n. 10.

[13] Nevada under-reported 2011 NEI NO_x point emissions by 1,494 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-8.

Nevada's area sources contribute 66 percent of total statewide NH_3 emissions in the Plan02d inventory and 61 percent of total NH_3 emissions in the WestJump2008 inventory. Area sources of NH_3 emissions alone decreased by 29 percent between the Plan02d and WestJump2008 inventories.

On-road mobile sources showed a notable 58 percent decrease in NH_3 emissions between the 2002 and 2008 inventories. On-road mobile sources contribute 17 percent of total statewide NH_3 emissions in the Plan02d inventory and nine percent in the WestJump2008 inventory. Natural fire contributes 14 and 27 percent in the 2002 and 2008 inventories, respectively.

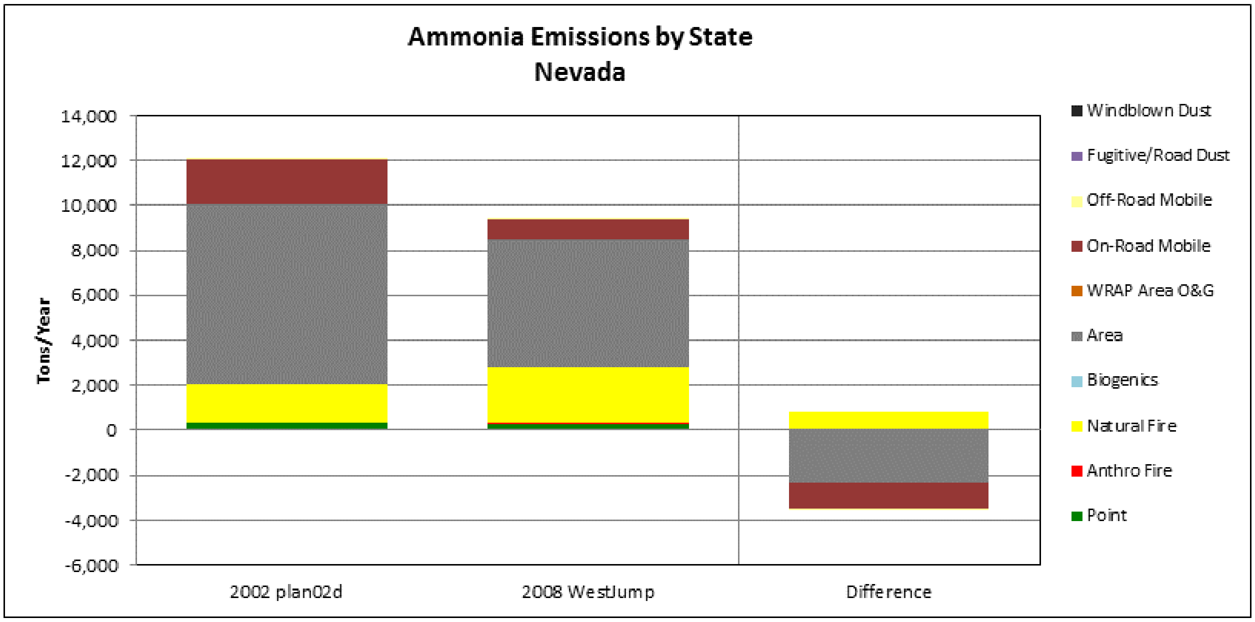
In sum, all anthropogenic source categories of NH_3 decreased between the Plan02d and WestJump2008 inventories. Total anthropogenic emissions of NH_3 saw a net decrease of 34 percent between the Plan02d and WestJump2008 emission inventories. In spite of the fact that emissions from natural fires increased by almost 50 percent, total NH_3 emissions still decreased by a net of 22 percent.

Ammonia is not a criteria pollutant and is not inventoried or reported to the NEI; thus, no NEI emissions data for NH_3 is provided.

Table 5-9. Ammonia Emissions by Category

Source Category	**Ammonia Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	339	302	-37
Area	8,009	5,717	-2,293
On-Road Mobile	2,030	849	-1,182
Off-Road Mobile	22	20	-2
Area Oil and Gas	0	0	0
Fugitive and Road	0	0	0
Anthropogenic Fire	8	6	-2
Total Anthropogenic	10,408	6,893	-3,515 (-34%)
Natural Sources			
Natural Fire	1,684	2,490	805
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	1,684	2,490	805 (48%)
All Sources			
Total Emissions	12,092	9,382	-2,710 (-22%)

Figure 5-3. 2008 and 2008 Ammonia Emissions and Differences by Source Category



5.5.4 Volatile Organic Compounds

Table 5-10 shows VOC emissions by source category; Table 5-11 presents 2008 and 2011 NEI data for the point and mobile source categories. Figure 5-4 shows a graphical display from the WRAP TSD. Appendix A. The data show huge reductions in VOC emissions from natural sources with lesser reductions from anthropogenic sources. Biogenic emissions from natural sources dominate the Nevada VOC emissions inventory.

VOC emissions showed a 61 percent decrease overall, mostly due to a decrease in the biogenic emission inventory (67 percent). However, estimates for biogenic emissions of VOCs have undergone significant updates since 2002, hence changes reported here are more reflective of enhancements in the inventory methodology rather than actual changes in emissions. Table 5-3. Specifically, the Plan02d inventory used the BEIS3.12 model, while the WestJump2008 inventory used the MEGAN2.10 model outputs. Also, different meteorological years were used, 2002 MM5 for the Plan02d inventory and 2008 WRF for the WestJump2008 inventory. In addition, higher temporal and spatial variability of land cover and improved emission factors based on better sources of data (e.g., satellites and field studies) were used for the WestJump2008 inventory.

There were also decreases in the on-road mobile, natural fire and anthropogenic fire source categories. The decrease in on-road mobile emissions of VOCs is partly due to the use of different models. MOBILE6 was used for the Plan02d inventory, while MOVES2010 was used for 2008. There were also new VMT data and new controls on vehicles (WRAP 2013, Table 3.2-1), which may account for some of the decrease in emissions. Specifically, VOC emissions are reduced due to implementation of the Tier 2 Vehicle and Gasoline Sulfur Program discussed Chapter Two.

For natural fire emissions, a detailed and comprehensive inventory was conducted for year 2008 in the DEASCO$_3$ study.[14] VOC emissions decreased significantly in the WestJump2008 inventory. However, only fire emissions from a single year (2008) are represented here for the progress period. Thus, not all fire events for the 2005-2009 period are represented in the WestJump2008 inventory. Due to the variability and sporadic nature of wildfire, a comparison between these inventories is complicated.

Table 5-10. Volatile Organic Compound Emissions by Category

Source Category	**Volatile Organic Compound Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	2,215	2,530[15]	338
Area	28,592	40,973	12,381
On-Road Mobile	36,257	21,302	-14,955
Off-Road Mobile	18,094	18,783	688
Area Oil and Gas	129	0	-129
Fugitive and Road	0	0	0
Anthropogenic Fire	70	16	-54
Total Anthropogenic	85,357	84,026	-1,331 (-2%)
Natural Sources			
Natural Fire	17,606	4,204	-13,403
Biogenic	794,139	262,912	-531,227
Wind Blown Dust	0	0	0
Total Natural	811,745	267,115	-544,630 (-67%)
All Sources			
Total Emissions	897,102	351,142	-545,960 (-61%)

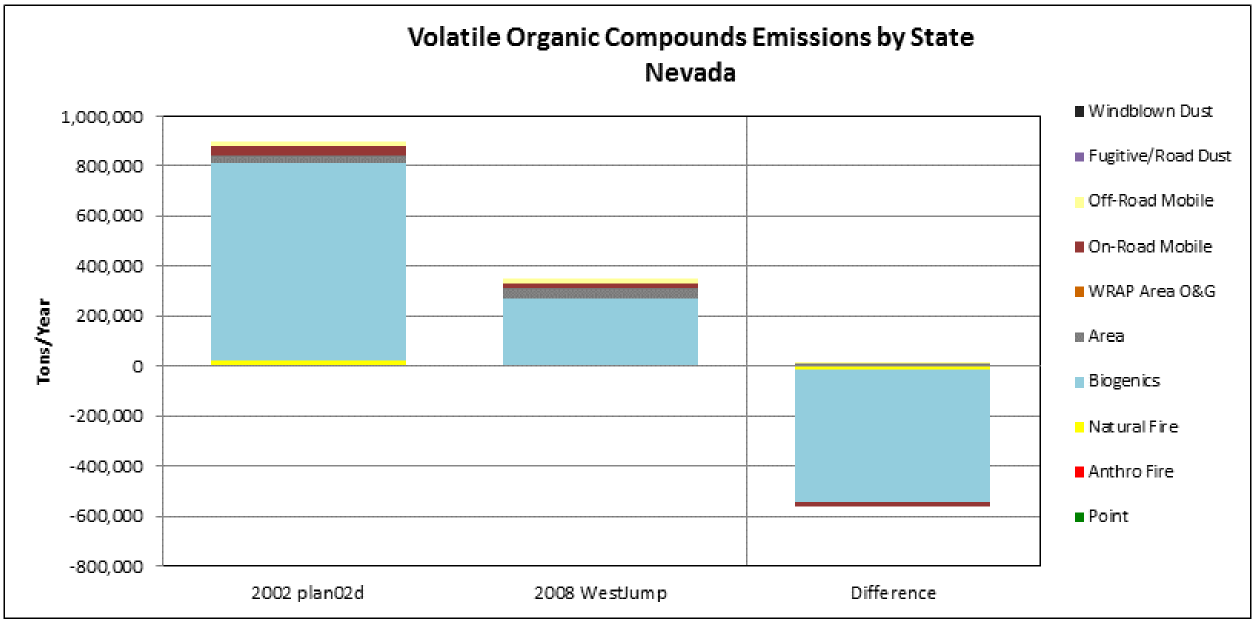
Table 5-11 shows a decrease in point source, on-road mobile and off-road mobile emissions of VOC from the 2008 NEI to the 2011 NEI of 17 percent, 20 percent and 18 percent, respectively.

[14] See supra n. 4.
[15] Nevada over-reported NEI 2008 VOC point emissions by 423 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-10 and Table 5-11.

Table 5-11. VOC NEI Emissions (2008 and 2011)

Source Category	VOC Emissions (tons/year)	
	2008 NEI	2011 NEI (% change from 2008)
Point	1,176[16]	971[17] (-17%)
On-Road	27,084	21,779 (-20%)
Off-Road	18,759	15,328 (-18%)

Figure 5-4. 2002 and 2008 Volatile Organic Compounds Emissions and Differences by Source Category



5.5.5 Primary Organic Aerosol

Table 5-12 shows primary organic aerosol emissions by source category, and Figure 5-5 shows the graphical display from the WRAP TSD. Appendix A. Wildfires dominate the primary organic aerosol emissions for both the Plan02d and WestJump2008 inventories at 90 percent and 58 percent, respectively, although anthropogenic sources (area and mobile) are also an important component of the inventory. Large wildfire events are generally sporadic and highly variable from year to year. This variability is seen in the large reduction of primary organic aerosol natural fire emissions between the Plan02d and WestJump2008 inventory years.

[16] See supra n. 15.
[17] Nevada under-reported NEI 2011VOC point emissions by 746 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-11.

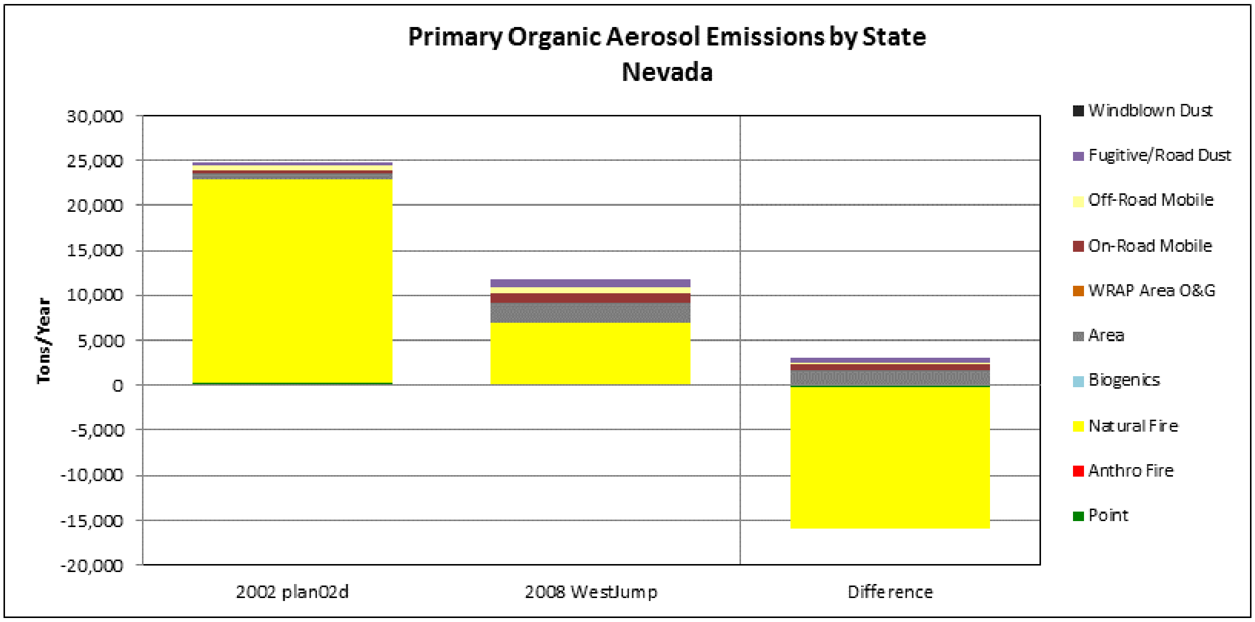
Overall, total emissions of primary organic aerosols decreased by 52 percent from the Plan02d to the WestJump2008 inventory. Point source emissions of primary organic aerosols decreased by 82 percent over that period. While source categories other than natural and anthropogenic fires and point sources saw increases in primary organic aerosol emissions, the total percentage of the other sources is eight percent and 42 percent of the total (anthropogenic plus natural) emissions for the Plan02d and WestJump2008 inventories, respectively. The increase in area emissions is explained in Section 5.4; beginning in 2008, some sources that were previously considered “off-road” were incorporated into the area source inventory. Clark and Washoe Counties, comprising 87 percent of the State population (http://nvdemography.org/data-and-publications/, 2008 data), contribute over 75 percent to total area emissions and 63 percent to total on-road emissions in the WestJump2008 inventory.

Table 5-12. Primary Organic Aerosol Emissions by Category

Source Category	**Primary Organic Aerosol Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	256	46	-210
Area	687	2,283	1,596
On-Road Mobile	314	1,053	739
Off-Road Mobile	572	689	117
Area Oil and Gas	0	0	0
Fugitive and Road	332	891	559
Anthropogenic Fire	73	22	-51
Total Anthropogenic	2,233	4,985	2,752 (123%)
Natural Sources			
Natural Fire	22,501	6,831	-15,670
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	22,501	6,831	-15,670 (-70%)
All Sources			
Total Emissions	24,734	11,816	-12,918 (-52%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

Figure 5-5. 2002 and 2008 Primary Organic Aerosol Emissions and Differences by Source Category



5.5.6 Elemental Carbon

Table 5-13 shows elemental carbon emissions by source category, and Figure 5-6 shows the graphical display from the WRAP TSD. Appendix A. Wildfires dominated elemental carbon emissions for the Plan02d inventory at 73 percent. Large wildfire events are generally sporadic and highly variable from year to year. Thus, variability is seen in the elemental carbon emissions from natural fire between the Plan02d and WestJump2008 inventory years.

Total elemental carbon emissions showed a 31 percent decrease between 2002 and 2008. This was mostly due to a 76 percent decrease in emissions from natural fire. On-road mobile, area and point source emissions increased from 2002 to 2008. On-road mobile sources dominated the elemental carbon emissions for the WestJump2008 inventory at 43 percent, while wildfires contributed 26 percent. Area and point source emissions contribute less than one percent each to the 2008 inventory.

Clark County and Washoe County, comprising 87 percent of the State population (http://nvdemography.org/data-and-publications/, 2008 data), are the biggest contributors to the area and on-road mobile emissions for the 2008 inventory. In the area source category, Clark County's contribution is 29 percent and Washoe County's contribution is 17 percent. In the on-road source category, Clark County's contribution is 43 percent and Washoe County's contribution is 16 percent.

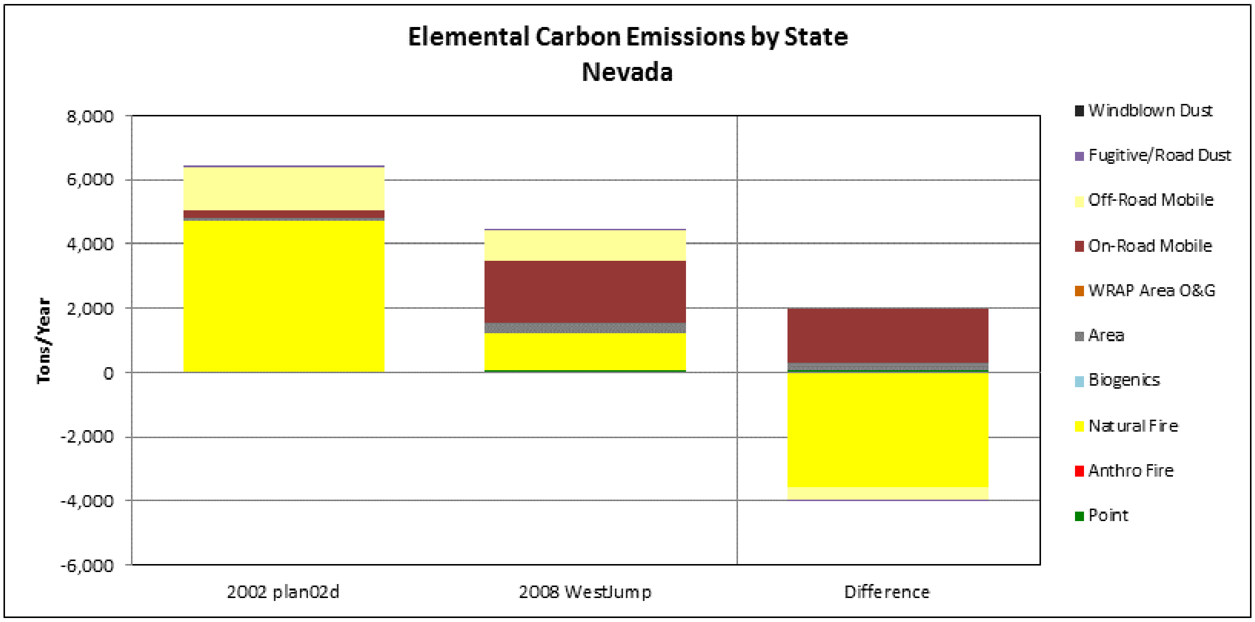
Table 5-13. Elemental Carbon Emissions by Category

Source Category	Elemental Carbon Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	13	64	51[18]
Area	96	368	272
On-Road Mobile	235	1,891	1,656
Off-Road Mobile	1,354	954	-400
Area Oil and Gas	0	0	0
Fugitive and Road	24	14	-10
Anthropogenic Fire	13	6	-7[19]
Total Anthropogenic	1,735	3,295	1,560 (90%)[20]
Natural Sources			
Natural Fire	4,674	1,130	-3,544
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	4,674	1,130	-3,544 (-76%)
All Sources			
Total Emissions	6,409	4,425	-1,984 (-31%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared, but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

[18] Note values in Table 5-13 are different than in the WRAP TSD, due to rounding.
[19] See supra n. 18.
[20] See supra n. 18.

Figure 5-6. 2002 and 2008 Elemental Carbon Emissions and Differences by Source Category



5.5.7 Fine Soil

Table 5-14 shows fine soil emissions by source category, and Figure 5-7 shows the graphical display from the WRAP TSD. Appendix A. Fine soil emissions were identified as PM fine emissions in the 2009 RH SIP. Fine soil emissions inventories show increases in fugitive dust and natural windblown dust from the Plan02d to the WestJump2008 inventory. These increases are likely due to updates in inventory development methodologies rather than actual increases. Appendix A, p. 6-2.

Table 5-14. Fine Soil Emissions by Category

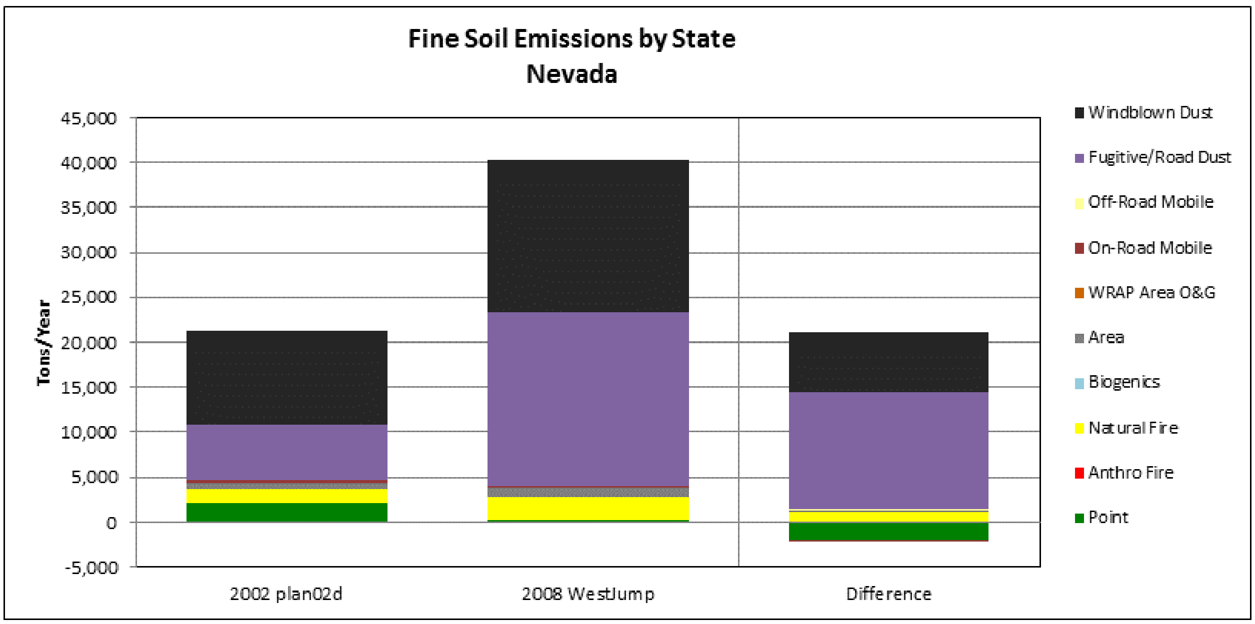
Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	2,158	209	-1,948
Area	830	1,024	195
On-Road Mobile	239[21]	190	-49
Off-Road Mobile	0	49	49
Area Oil and Gas	0	0	0
Fugitive	6,128	19,216	13,087
Anthropogenic Fire	9	10	1

[21] Fine soil emissions showed zero emissions for the on-road source category in the 2009 RH SIP. This was strictly an oversight and has been corrected here.

Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Total Anthropogenic	9,364	20,698	11,334 (121%)
Natural Sources			
Natural Fire	1,406	2,552	1,146
Biogenic	0	0	0
Wind Blown Dust	10,438	17,051	6,613
Total Natural	11,845	19,603	7,758 (65%)
All Sources			
Total Emissions	21,208	40,301	19,092 (90%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

Figure 5-7. 2002 and 2008 Fine Soil Emissions and Differences by Source Category



5.5.8 Coarse Mass

Table 5-15 shows coarse mass emissions by source category, and Figure 5-8 shows the graphical display from the WRAP TSD. Appendix A. Coarse mass emissions were identified as PM coarse emissions in the 2009 RH SIP. Coarse mass emission inventories showed increases in fugitive and road dust and natural windblown dust from the Plan02d to the WestJump2008 inventory. Fugitive dust includes sources such as agricultural operations, construction and mining operations and windblown dust from vacant lands. These increases in part can be attributed to updates in inventory development methodologies rather than actual increases. Appendix A, p. 6-2. However, increases in the fugitive dust inventories may also be due to increases in population, while increases in road dust may be due to increases in estimated VMT.

The WestJump2008 inventory for coarse mass emissions is dominated by emissions in Clark and Elko Counties at 61 percent and 13 percent, respectively. In Clark County, particulate air pollution is largely associated with windblown dust, re-entrained road dust, or construction activities.[22] The windblown dust category includes more of the natural influences such as wind erosion on natural lands. While point source and natural fire emissions decreased, most of the other sources of coarse mass showed emission increases.

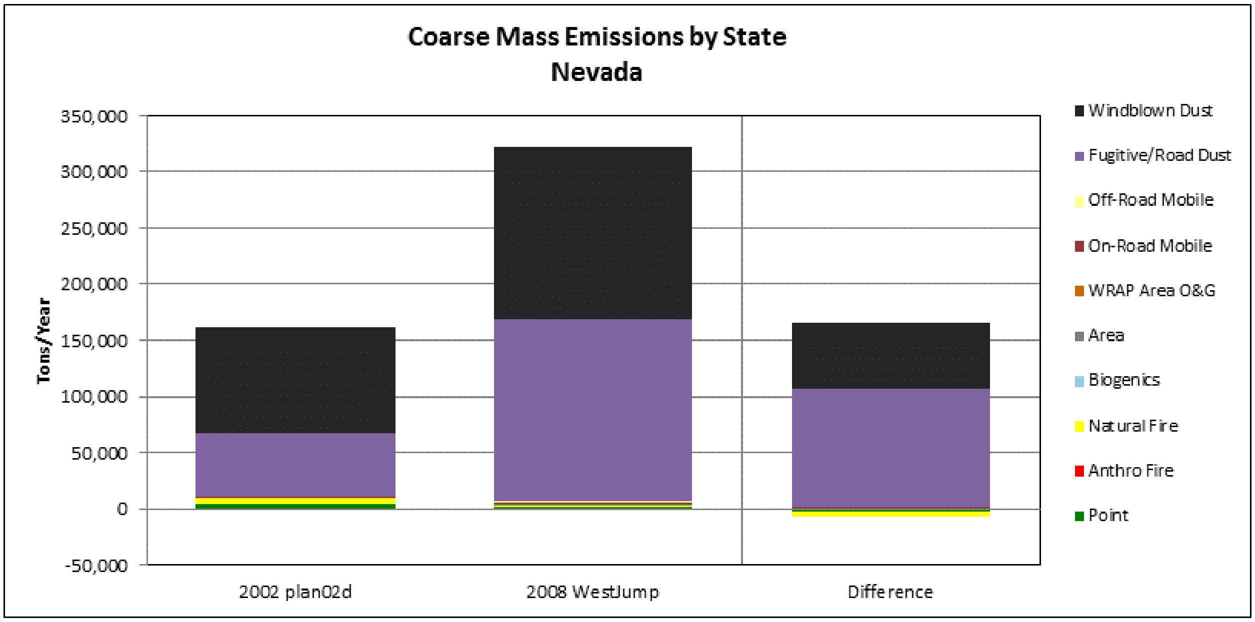
Table 5-15. Coarse Mass Emissions by Category

Source Category	Coarse Mass Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	4,093	1,761	-2,331
Area	897	1,094	198
On-Road Mobile	245	2,014	1,769
Off-Road Mobile	0	82	82
Area Oil and Gas	0	0	0
Fugitive and Road	56,779	161,532	104,753
Anthropogenic Fire	7	4	-3
Total Anthropogenic	62,020	166,488	104,468 (168%)
Natural Sources			
Natural Fire	5,176	1,310	-3,866
Biogenic	0	0	0
Wind Blown Dust	93,946	153,459	59,513
Total Natural	99,122	154,769	55,647 (56%)
All Sources			
Total Emissions	161,142	321,257	160,115 (99%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

22 http://www.clarkcountynv.gov/Depts/AirQuality/Documents/Planning/SIP/PM10/PM10_SIP_PLAN_without_Appendices.pdf (page 3-1; last viewed 8/29/ 2014)

Figure 5-8. 2002 and 2008 Coarse Mass Emissions and Differences by Source Category



As can be seen from the tables and figures in this chapter, visibility-impairing emissions from point sources have significantly decreased with the exception of volatile organic compounds and elemental carbon. Point sources of both of these two pollutants contribute only a minor fraction of the anthropogenic emission sources.

6

Chapter Six – Assessment of Changes Impeding Visibility Progress (40 CFR 51.308(g)(5))

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6.1 Status Summary

This chapter evaluates visibility conditions measured at JARB1 from the baseline to the 2008 through 2012 progress period, and triennial NEI years from 2002 to 2011 (and 2012 for Nevada point sources) to determine if progress has been impeded by changes in anthropogenic emissions within the State. It further considers changes in anthropogenic emissions, or the status of BART, in neighboring states that could affect progress at the Jarbidge WA. Finally, Nevada's contribution to Class I areas in nearby states is reviewed. Nevada concludes that progress towards achieving its 2018 visibility conditions goal has not been impeded by any significant anthropogenic emissions changes within or outside the State.

> *51.308(g) . . . Periodic progress reports must contain at a minimum . . .*
>
> *(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.*

6.2 Significant Emission Changes within Nevada

40 CFR 51.308(g)(5) requires "[a]n 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." Figure 6-1 shows the baseline and rolling 5-year averages of speciated light extinction at JARB1 for the 20 percent worst days from 2005 through 2012. Figure 6-2 presents similar information, but for the best days. For the worst days, the data show a reduction in sulfate and nitrate for the three most recent 5-year periods (see also the assessment of visibility conditions at Jarbidge WA in Chapter Four). Figure 6-1 also shows very clearly how the worst days data is influenced by natural sources from year to year. Note how the most recent rolling 5-year average data is skewed by an exceptionally high year of wildfires (particulate organic matter) in 2012, contributing to an increase of more than 2.5 Mm^{-1} from the preceding 5-year average (discussed in detail in Chapter Four).

For the best days, there are noticeable reductions in visibility impairment due to sulfate, nitrate, particulate organic matter, and elemental carbon from the baseline to the current planning period. Light extinction for soil, coarse mass and sea salt remain fairly constant for the best days.

Figure 6-1. Worst Days for Baseline and Rolling 5-Year Averages Speciated Light Extinction through Planning Period Measured at JARB1

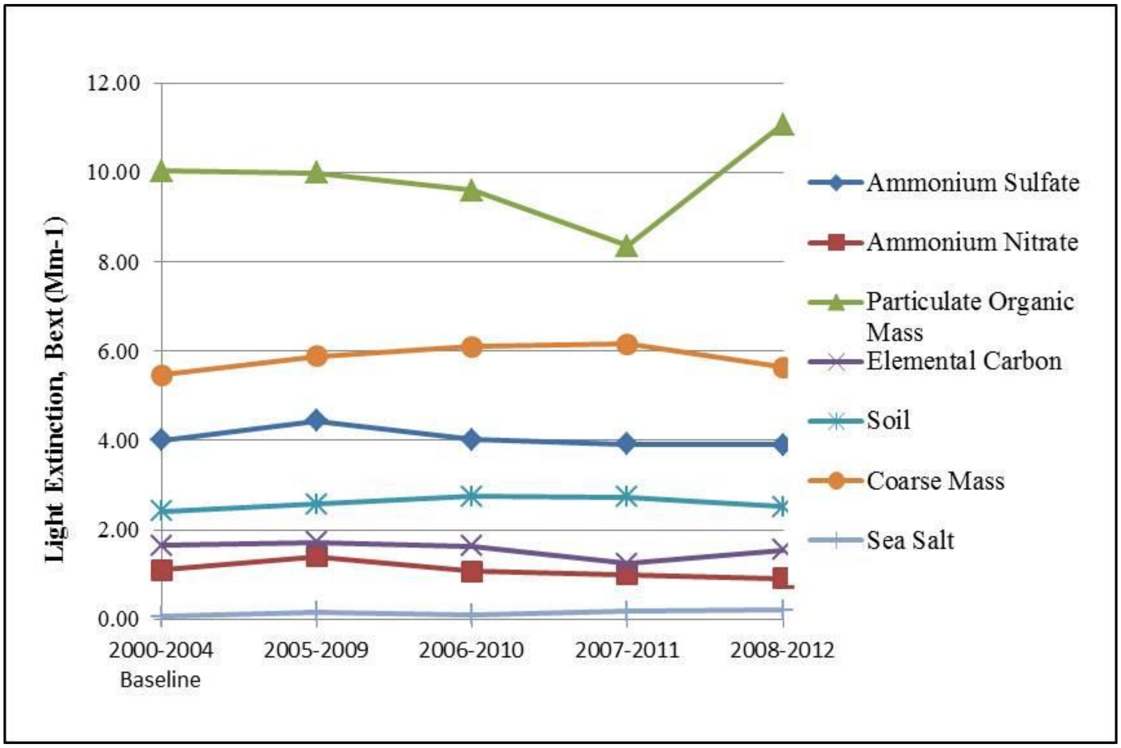

Figure 6-2. Best Days for Baseline and Rolling 5-Year Averages Speciated Light Extinction through Planning Period Measured at JARB1

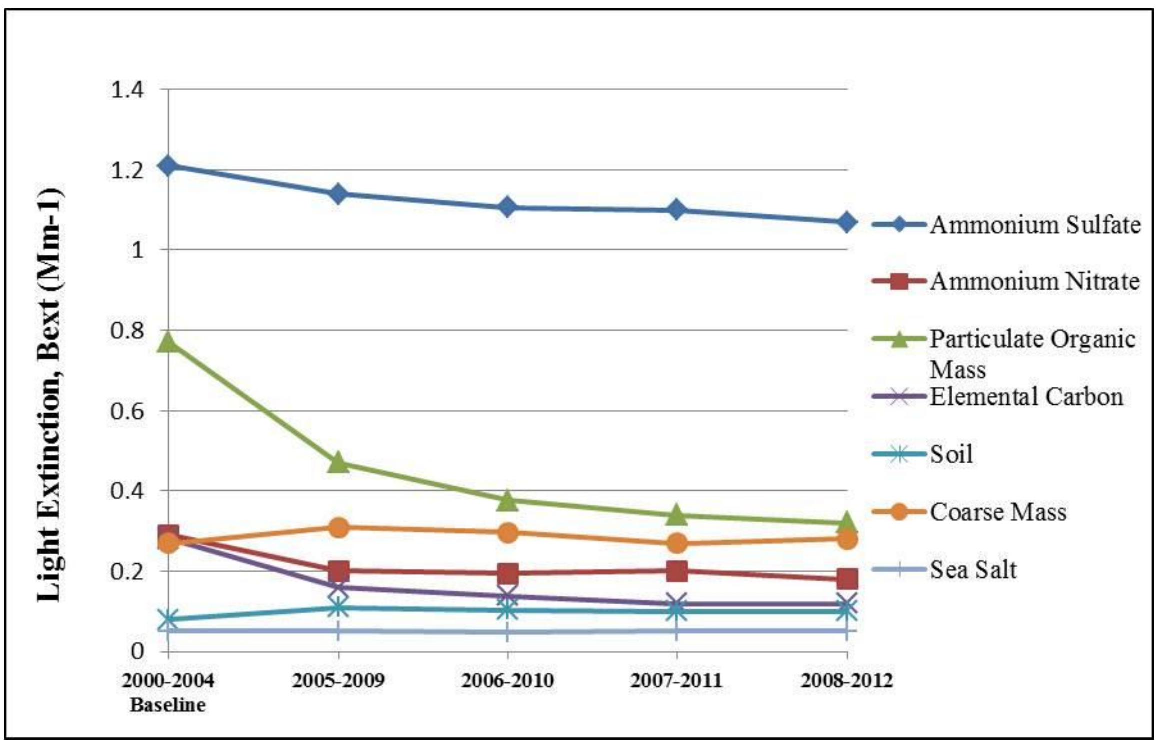

Table 6-1 presents actual emissions in tons per year for Nevada point sources for SO_2, NO_x, PM_{10} and VOC for years 2002, 2005, 2008, 2011 and 2012. Years 2002, 2005, 2008 and 2011 were chosen as they are the most complete inventory years submitted to USEPA for the NEI. 2012 was the most recent dataset available for Nevada's point sources. It is noteworthy that for all four pollutants, there has been a decrease realized in actual emissions over the ten-year period. SO_2 decreased by nearly an order of magnitude and NO_x decreased almost seven-fold. Further reductions are expected as BART is implemented in Nevada. These reductions in emissions could only help to assist the progress toward improving visibility, not impede it.

Table 6-1. Actual Emissions (tpy) for Nevada Point Sources 2002, 2005, 2008, 2011, 2012*

Year	SO_2	NO_x	PM10	VOC
2002	50,619	55,876	6,868	2,132
2005	54,243	52,087	4,643	1,646
2008	10,497	21,680	3,465	1,600
2011	5,959	10,548	3,331	971
2012	5,278	8,324	2,629	986

*2002 through 2011 data are actual emissions values submitted by the NDEP to the NEI. 2012 data are actual emissions values for major and minor point sources from the NDEP permitting database.

6.3 Non-Nevada Sources Impacting the Jarbidge Wilderness Area

Chapter Two discusses the status of implementation of proposed regional haze control measures, including Section 2.5.2, which specifically addresses the status of BART implementation in states adjacent to Nevada that may impact Jarbidge WA. Because of the location of the Jarbidge WA, it is likely more strongly affected by emissions originating from within the Snake River Plain than those emitted from within the Great Basin (see Chapter Two). 2018 source apportionment modeling, discussed in Chapter 4 of Nevada's 2009 RH SIP and summarized in Table 4-5 of that document, indicates that Idaho is the second largest contributor (contributing 10.3 percent) to modeled sulfate concentrations at JARB1 on the worst days and Oregon is the third (contributing 7.2 percent) (Outside Domain is first at 43.8 percent). Idaho is the highest contributor to modeled nitrate concentrations at JARB1 on the worst days (Outside Domain is next at 27.5 percent). Therefore, this section discusses the changes to anthropogenic emission sources in Idaho and Oregon focusing on the implementation of BART during this first 5-year progress period.

As discussed in Section 2.5.2, two facilities in Idaho were subject to BART: the Monsanto/P4 Production in Soda Springs and the Amalgamated Sugar Company (aka TASCO Nampa) in Nampa. The emissions changes resulting from BART implementation at these facilities are detailed below and summarized in Table 6-2.

Table 6-2. Comparison of Projected 2018 and Actual 2011 Emissions from BART Facilities in Idaho and Oregon

Facility	NO_x (tpy)			SO_2 (tpy)		
	Plan 02d	2011 NEI	PRP18a	Plan 02d	2011 NEI	PRP18a
Monsanto/P4	1,531	2,520	2,231	12,197	1,020	3,397
Amalgamated Sugar (TASCO)*	1,101	1,042	944	1,798	1,659	1,235
Boardman**	8,378	4,049	4,960	12,248	13,103	3,235
Totals	11,010	7,611	8,135	26,243	15,782	7,867

* BART compliance required by July 22, 2016.
** BART compliance required by July 1, 2014.

At the Monsanto/P4 facility, no new NO_x controls were required for BART, and existing SO_2 controls were determined to be BART. Emissions of NO_x in the PRP18a inventory were predicted to increase by 700 tpy from the Plan 02d inventory, while SO_2 emissions were predicted to decrease by 8,800 tpy. Emissions reported in the 2011 NEI for NO_x are consistent with the projected PRP18a inventory, while SO_2 emissions are even lower than predicted. Annual NO_x emissions in the projected 2018 inventory are 2,231 tpy with actual emissions of 2,520 tpy reported in the 2011 NEI, while annual SO_2 emissions were projected to be 3,397 tpy with actual emissions of 1,020 tpy reported in the 2011 NEI.

SO_2 emissions from the TASCO Nampa facility were predicted to decrease 563 tpy and NO_x emissions by 157 tpy from the Plan02d to PRP18a inventories. Emissions reported in the 2011 NEI are somewhat greater than those in the projected PRP18a inventory. Projected 2018 annual NO_x emissions were 944 tpy and actual 2011 emissions were 1,042 tpy; projected 2018 annual SO_2 emissions were 1,235 tpy and 2011 actual emissions were 1,659 tpy. Thus, the TASCO Nampa facility emitted more pollutants in 2011 than projected in the PRP18a inventory. However, full compliance with BART is not required until July 22, 2016 and is fully expected. Thus, one of Idaho's BART facilities is currently achieving the emissions reductions which Nevada depended on in setting its RPG, while a second BART facility in Idaho is not, yet.

As discussed in Section 2.5.2, one facility in Oregon was subject to BART: the PGE Boardman Power Plant (Boardman). The emissions changes resulting from BART implementation at this facility are detailed below and shown in Table 6-2.

SO_2 emissions from Boardman were projected to decrease by 9,013 tpy and NO_x emissions to decrease by 3,418 tpy from the Plan02d to the PRP18a inventory. However, SO_2 emissions reported in the 2011 NEI are much greater than those in the projected PRP18a inventory. The projected 2018 annual SO_2 emissions are 3,235 tpy, while SO_2 emissions reported in the 2011 NEI are 13,103 tpy. Boardman's actual NO_x emissions are lower than the 2018 projection of 4,960 tpy at 4,049 tpy reported for 2011. Thus, the Boardman facility emitted more SO_2 and less

NO_x in 2011 than projected in the PRP18a inventory. However, compliance with the BART SO_2 emission limitation is not required until July 1, 2014, and significant SO_2 reductions are anticipated when the facility resumes operations in 2014 with the required controls.

NDEP staff spoke with Doug Walsh, Senior Environmental Engineer with the Oregon Department of Environmental Quality Eastern Regional Office in Pendleton, Oregon, regarding the status of implementation of SO_2 controls (phone conversation with Frank Forsgren, NDEP, on August 19, 2014). Mr. Walsh informed the NDEP that the facility had resumed operations and was refining operation of the SO_2 controls and undergoing testing. At this time there is insufficient data to confirm that the Boardman facility is meeting the BART SO_2 emission limits.

Table 6-2 presents the 2002 baseline emissions, 2018 projected emissions, and 2011 actual emissions for the three subject-to-BART facilities located in Idaho and Oregon. The sum of actual 2011 NO_x emissions from these facilities is approximately 500 tpy less than the 2018 projected emissions, while the sum of 2011 actual SO2 emissions is nearly 8,000 tpy greater than the 2018 projected emissions. Note that 2011 precedes the compliance dates for TASCO and Boardman.

Because visibility impairment resulting from nitrate and sulfate is trending downward at Jarbidge WA and emission reductions from BART controls in Idaho and Oregon are either in accordance with the projected 2018 inventory or are expected to be before 2018, Nevada concludes that there are no significant changes in anthropogenic emissions from outside the State that are impeding progress at Jarbidge WA.

6.4 Nevada's Impacts on Nearby Class I Areas

This section reviews Nevada's impacts on nearby Class I areas based on particulate source apportionment modeling conducted by the WRAP. Analysis of the data demonstrates that Nevada is reducing its contributions to neighboring states consistent with its impacts. Section 4.3.3 of Nevada's 2009 RH SIP discusses the results of the source apportionment modeling and identifies Nevada's contributions to modeled sulfate (Table 4-3) and nitrate (Table 4-4) at all Class I areas in the five states adjacent to Nevada. The tables show Nevada's extinction contribution (as a percentage) for the best and worst days for 2002 and 2018. Nevada's maximum 2018 best days sulfate contribution (7.2 percent, the fourth largest contributor at this site) occurs at the Sawtooth Wilderness Area in Idaho and for the worst days at Zion National Park in Utah (5.6 percent, the sixth highest contributor). For nitrate, Nevada's maximum 2018 best days nitrate contribution (12.4 percent, the fourth largest contributor) occurs at Joshua Tree National Park and for the worst days at Bliss State Park (20.0 percent contribution, third highest contributor) in California. The Bliss IMPROVE monitor represents the Desolation Wilderness Area and Mokelumne Wilderness Area in California. Table 7-6 of the 2009 RH SIP shows Nevada's share of required emissions reductions to achieve reasonable progress goals at nearby Class I areas.

Chapter Five of this document summarizes the changes in emissions from all sources within the State resulting from the implementation of Nevada's 2009 RH SIP. Tables 5-5 through 5-15 present the 2002 and 2008 emission inventories and the difference between the two for each visibility impairing pollutant. Table 5-5 documents a 75 percent reduction in the state-wide sulfur dioxide emissions, while Table 5-7 presents similar data for nitrogen oxides and documents a 26 percent reduction in state-wide nitrogen oxide emissions. These emissions reductions far exceed Nevada's contribution to visibility impairment in Class I areas in the five adjacent states.

Chapter Seven – Assessment of Current SIP Strategy for Meeting Reasonable Progress Goals (40 CFR 51.308(g)(6))

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7.1 Status Summary

This progress report clearly demonstrates that the current implementation plan elements and strategies outlined in the 2009 RH SIP are sufficient to enable Nevada to meet the reasonable progress goals for those extinction species that originate from anthropogenic sources. As shown in Chapter Five, 2008 actual emissions are less, and in some cases far less, for all visibility impairing pollutants, except fine soil and coarse mass, than the projected 2018 emissions used to determine Nevada's reasonable progress goal. Moreover, the expected future reductions in anthropogenic emissions based on further controls, shutdowns, and conversions to either natural gas or lower sulfur fuels will serve to enhance this downward trend in the coming years. See Chapter Two.

Chapter Four clearly demonstrates that the visibility benefit from anthropogenic emission reductions is hidden due to contributions from natural sources. Nonetheless, there are improvements in the haze index for the worst days, as well as in light extinction due to sulfate, nitrate and elemental carbon from the baseline to the current planning period. Visibility conditions for the best days show considerable improvement with a significant decrease in the haze index. Light extinction on the best days for all monitored species decreased or held steady from the baseline to the current planning period.

Trend analysis of the 2000 to 2012 nitrate and sulfate annual extinction values demonstrates that the slopes of the trend lines are comparable to (sulfate) or better than (nitrate) the speciated glide slopes. Chapter Four, Section 4.6.

> *51.308(g) . . . Periodic progress reports must contain at a minimum . . .*
>
> *(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.*

7.2 Requirements

40 CFR 51.308(g)(6) requires an assessment of whether the current SIP elements and strategies are sufficient to enable the state, or other Class I areas affected by emissions from the state, to meet all established reasonable progress goals.[1] Because of the large contributions to visibility impairment due to natural source (non-anthropogenic) emissions, Nevada has focused its assessment of implementation plan elements and strategies on

[1] See the discussion in Chapter One of the correction to the 2018 visibility projection for Jarbidge WA conducted by the Regional Modeling Center. Nevada concludes that it is reasonable to retain the reasonable progress goal of 11.05 deciviews, which aligns closely with the 2018 uniform rate of progress value for Jarbidge WA

impairment due to sulfate and nitrate light extinction resulting from largely anthropogenic emissions of SO_2 and NO_x, although other visibility impairing pollutants are also assessed. The RHR uses the uniform rate of progress (glidepath), measured as a haze index, toward "natural conditions" as the metric for determining whether a state is making reasonable progress. However, this measure puts most western states like Nevada, where visibility impairment from natural sources like wind-blown dust and wildfire overwhelms the visibility benefit from reduction of anthropogenic emissions, in an untenable position. The NDEP urges USEPA to revisit the RHR to establish a more appropriate and meaningful metric for measuring reasonable progress.

7.3 Emissions Analysis

An analysis of emission reductions in Nevada indicates that the state is on track to achieve its emission reduction goals in 2018. Chapter Five presents visibility-impairing pollutant emission data for Nevada, which demonstrate the 2008 emission inventory is less than the projected 2018 inventory with the exception of fine soil and coarse mass. See Table 5-1. Notably, actual 2008 SO_2 emissions are approximately 40 percent of the 2018 projected emissions, while the actual 2008 NO_x emissions are roughly 90 percent of the 2018 projection. Chapter Five compares sector-specific 2008 and 2011 NEI data, demonstrating further reductions in anthropogenic SO_2 and NO_x emissions from Nevada point sources. See Tables 5-6 and 5-8. The expected future reductions in anthropogenic emissions based on further controls, shutdowns, and conversions to natural gas, lower sulfur fuels, or renewables (see Chapter Two) will serve to continue this downward trend in the coming years.

7.4 Visibility Analysis

Improvement in visibility conditions at JARB1 for the worst days has not kept pace with Nevada's emissions reductions due to large contributions from particulate organic matter. The improvement in visibility impairment, as measured by the haze index at JARB1, is not on the glide path for the worst days as discussed in Chapter Four. However, Table 4-2 shows that the five-year annual average haze index and sulfate, nitrate, and elemental carbon light extinction values all improved from the baseline to the current planning period represented by 2008-2012 for the worst days. In addition, light extinction values for all the visibility-impairing pollutants decreased for the best days.

Figure 4-3 shows the large year-to-year variability of particulate organic matter extinction and its significant contribution and influence on the annual haze index, as well as the relatively flat contributions of the other species' extinction for the worst days over time. Figure 4-4 demonstrates the downward trends of the haze index and speciated extinction values, indicating continued improvement of visibility for the best days from 2001 to 2012.

Visibility impairment at JARB1 for the worst days is dominated by emissions from natural sources that form particulate organic matter, and coarse mass emissions that originate roughly equally from anthropogenic and natural sources. Sulfate is the only significant contributor to visibility impairment at JARB1 that originates from anthropogenic sources. Nitrate originates from anthropogenic sources, but has only a small contribution to visibility impairment on the worst days.

Trend analysis of the worst days annual JARB1 sulfate and nitrate monitor data from 2000 to 2012 (see section 4.6) documents that the slopes of the trend lines for sulfate and nitrate are comparable to or better than the corresponding speciated glideslopes. The annual monitored sulfate and nitrate values are expected to continue or improve these trends in the coming years as BART control measures and other reasonable progress controls are implemented throughout the western United States.

7.5 Conclusions

Nevada concludes that the current implementation plan elements and strategies outlined in the 2009 RH SIP are sufficient to enable Nevada and other neighboring states to meet the reasonable progress goals for those extinction species that originate from anthropogenic sources given the following observations:

- Nevada has achieved significant emissions reductions in the first progress period.
- Emissions from natural sources play a much more dominant role in visibility impairment at JARB1 than emissions from anthropogenic sources.
- Visibility impairment resulting from sulfate and nitrate is decreasing at rates comparable or better than the speciated glideslopes.
- BART and other reasonable progress controls have not yet been fully implemented and the corresponding emission reductions have not yet been fully realized. Therefore, corresponding monitor results were not expected for this progress report.

The NDEP committed in the Nevada RH SIP to re-examine the need for additional non-EGU controls during the State's five-year progress report. As evidenced by the current and expected SO_2 and NO_x emissions reductions from EGUs, further reductions from non-utility, industrial point sources are unnecessary at this time.

Chapter Eight – Assessment of Current Monitoring Strategy (40 CFR 51.308(g)(7))

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8.1 Assessment

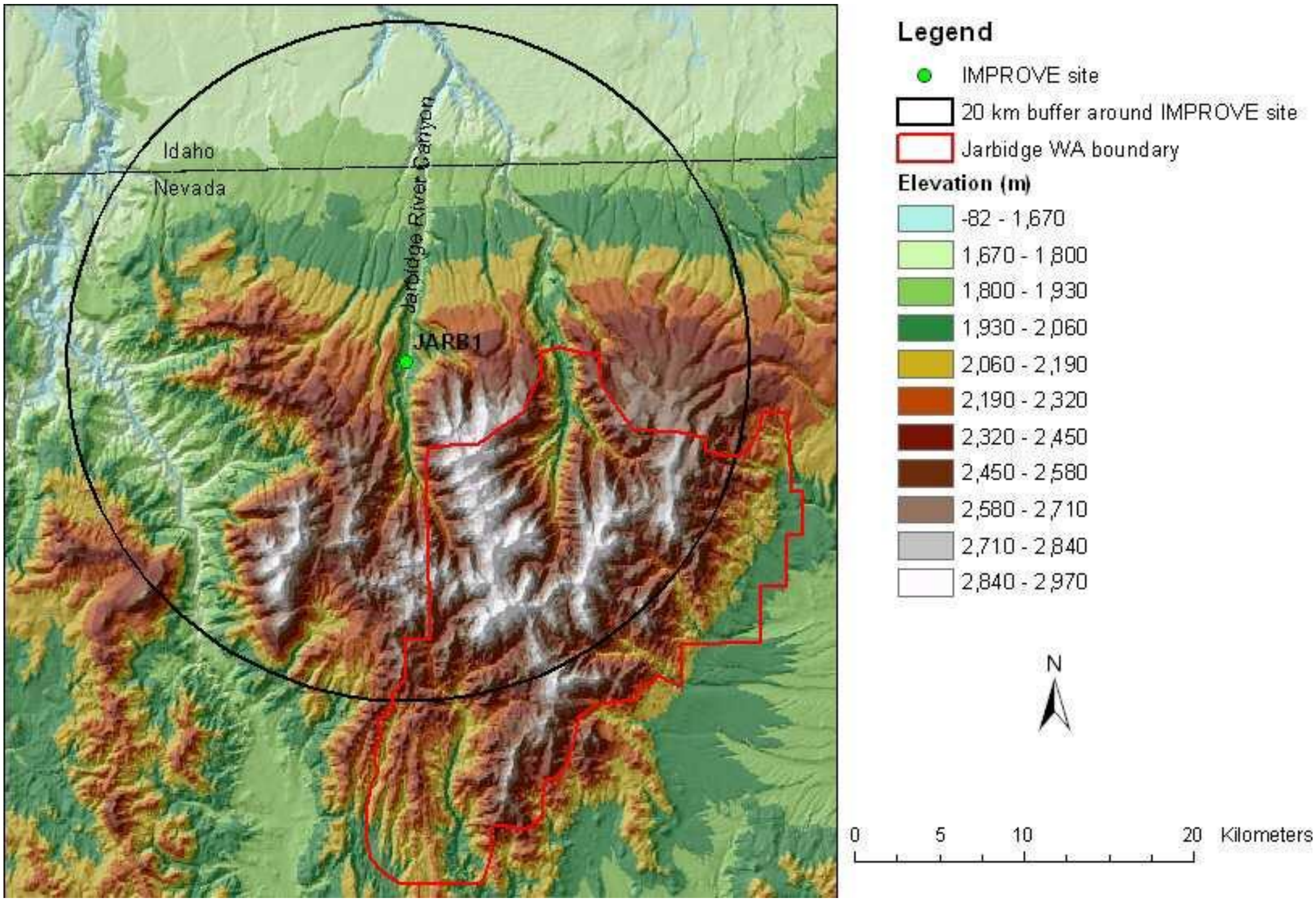
Section 51.308(g)(7) requires states to review their visibility monitoring strategy and discuss any modifications to the strategy as necessary. The primary monitoring network for the measurement and characterization of the contributors to regional haze, both nationwide and in Nevada, is the IMPROVE network. The IMPROVE network documents the visual air quality in wilderness areas and national parks throughout the United States. Given that IMPROVE monitoring data from 2000-2004 serve as the baseline for the regional haze program and for tracking progress, the regional haze monitoring strategy must necessarily be based on, or directly comparable to, the IMPROVE program. The IMPROVE measurements provide the only long-term record available for tracking visibility improvement or degradation. Therefore, Nevada intends to rely on the continued availability of quality assured data collected through the IMPROVE network to comply with the regional haze monitoring requirement in the RHR.

> *51.308(g) . . . Periodic progress reports must contain at a minimum . . .*
>
> *(7) A review of the state's visibility monitoring strategy and any modifications to the strategy as necessary.*

There is currently one IMPROVE site in Nevada: JARB1. This site represents Nevada's single Class I area. Figure 8-1 depicts JARB1 and the Jarbidge WA. The wilderness area lies just north of the physical geographic boundary separating the Columbia Plateau region, including the Snake River Plain, and the Great Basin region to the south. It encompasses the headwaters basin of the Jarbidge River East Fork that flows north from the center of the wilderness area, and the headwaters basin of Marys River that flows south from the center of the wilderness area, part of the Columbia River/Great Basin hydrographic divide. The terrain encompassed by the wilderness area consists of deep canyons with steep slopes.

JARB1 is situated in the Jarbidge River Canyon on the northern flank of the Jarbidge Mountains less than 10 miles south of the Idaho border. JARB1 is located northwest of the wilderness area boundary, within the Snake River Basin. The Jarbidge River Canyon comprises the upper main headwaters of the Jarbidge River proper and is oriented south to north, with its mouth several miles to the north where it drains into the Bruneau River.

Figure 8-1. Jarbidge Wilderness Area and Vicinity



Nevada's 2009 RH SIP found the IMPROVE site representing Nevada's Class I area at the Jarbidge WA to be sufficiently representative to support a determination of reasonable progress. Nevada will continue to use data produced by the IMPROVE monitoring network as the basis for preparation of the five-year progress reports and the ten-year SIP revisions, each of which relies on analysis of the preceding five years of data. Nevada expects the IMPROVE program monitoring operation and data collection to continue, with the fundamental assumption that network data collection operations will not change, or if changed, will remain directly comparable to those operated by the IMPROVE program during the 2000 through 2004 RHR baseline period.

The WRAP has analyzed, reduced and provided information on relative contributions to visibility impairment using the data reported by the IMPROVE program. Nevada has and will continue to use the regional technical support analysis tool found at the Visibility Information Exchange Web System (VIEWS, last viewed 9/9/2014) and WRAP's TSS (last viewed 9/9/2014), as well as other analysis tools and efforts sponsored by the WRAP. The State will continue to participate in the regional analysis activities of the WRAP to collectively assess and verify the progress toward reasonable progress goals, as the RHR continues to be implemented.

Nevada concludes that no modifications to Nevada's visibility monitoring strategy are necessary at this time. Because Jarbidge WA is the only Class I federal area in Nevada, JARB1 satisfies the RHR requirement for a monitoring strategy that is representative of all Class I areas in the State. Nevada is committed to continue using the IMPROVE monitoring network. If economic challenges are faced by the IMPROVE monitoring program, Nevada commits to working with federal agencies as a team to try to resolve the situation.

Chapter Nine – Determination of Adequacy, Procedural Requirements and Conclusions (40 CFR 51.308(g), (h) and (i))

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9.1 Determination of Adequacy

Section 51.308(h) requires states to make a determination as to the adequacy of the existing RH SIP. Based on the evidence presented in the preceding chapters, the NDEP hereby makes a negative declaration that further revision of Nevada's 2009 RH SIP is not warranted at this time in order to achieve the 2018 reasonable progress goals for visibility improvement for mandatory Class I areas in Nevada and those outside the State that may be affected by Nevada emissions. The NDEP concludes that no additional controls are necessary pursuant to this five-year progress evaluation.

> *51.308(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) . . . 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 States . . . must also collaborate with the other States through the regional planning process for the purpose of developing additional strategies to address the plan's deficiencies;*
> *(3) . . . the implementation plan is or may be inadequate . . . due to emissions from sources in another country, the State shall provide notification, along with available information, to the Administrator; or*
> *(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.*

As evidenced by very substantial reductions in anthropogenic source emissions in Nevada and the concurrent improvement in visibility at Jarbidge WA, the NDEP determines that Nevada is making adequate progress overall in improving visibility due to reductions in emissions from the control measures included in the 2009 RH SIP. Additional anticipated reductions in emissions from control measures that are not yet fully implemented and changes in source activity that were not included as part of Nevada's strategy further support this conclusion.

Many of the control measures included in the initial RH SIP were not fully implemented during the period covered by this 5-year progress review. Additional emissions reductions from full implementation of both new and "on-the-books" and "on-the-way" federal programs, as well as BART, will occur in the period between this review and the 2018 SIP revision. For example, the compliance date for the installation and operation of BART in Nevada is January 1, 2015 (with the exception of NO_x at Reid Gardner, which is later). Therefore, monitoring data at JARB1 for this progress period do not reflect emissions reductions resulting from the implementation of Nevada BART.

Visibility conditions at Nevada's only Class I Area, Jarbidge WA, have improved slightly for the worst days with better progress shown for the best days, based on the rolling 5-year annual average haze index. Progress for the worst days is impeded by large contributions to visibility impairment from natural sources. Trend analyses of the period 2000 to 2012 show that visibility impairment due to sulfate and nitrate extinction is decreasing through time for both the worst and best days. The slopes of the trend lines clearly indicate improvements in visibility due to reduced sulfate and nitrate extinction.

The IMPROVE monitor (JARB1) representing the Jarbidge WA and most of the wilderness area itself lies within the Snake River Basin. JARB1 is situated in the Jarbidge River Canyon on the northern flank of the Jarbidge Mountains less than 10 miles south of the Idaho border. The Jarbidge Mountains, in part, form the divide between the Snake River Basin and Great Basin. The Snake River Basin encompasses the southern two thirds of Idaho, a portion of eastern Oregon, a portion of southeastern Washington, and small portions of Utah and Wyoming, in addition to a piece of northern Nevada. Because of its location, visibility impairment measured at JARB1 is likely more strongly affected by emissions originating from within the Snake River Basin than those emitted from within the Great Basin. Therefore, emissions reductions at facilities in Nevada may not be reflected by the monitor data from JARB1. The NDEP will continue to evaluate the implementation of BART and other control strategies in neighboring states to assess their impact on reasonable progress at Jarbidge WA.

9.2 Procedural Requirements

The RHR contains several procedural requirements for 5-year progress reports. 40 CFR 51.308(i)(2) and (3) require that states consult with the federal land managers in developing an implementation plan and include a description of how the State addressed any comments provided by the federal land managers. 40 CFR 51.308(g) requires that progress reports must be in the form of implementation plan revisions that comply with the procedural requirements of sections 51.102 and 51.103.

In keeping with the USEPA's requirements related to consultation, the NDEP enlisted the support of appropriate state and local air pollution control agencies, as well as the federal land managers in preparing this report. As part of this commitment, the NDEP made an advance, draft copy of this report available to the aforementioned agencies, as well as USEPA Region 9, and sought their input. The NDEP received informal comments from USEPA Region 9 staff, and those comments have been addressed. Formal comments received as part of this consultation together with the NDEP's responses can be found in Appendix C. In addition, the NDEP also provided a 30-day public comment period along with a proposed public hearing on October 15, 2014. Appendix D. Pursuant to 40 CFR 51.102, the NDEP cancelled the public hearing as no requests to hold it were received. The NDEP received one set of public comments; the comments and the NDEP's responses are included in Appendix D.

40 CFR 51.308(i)(4) requires a plan for continued consultation between the state and federal land managers over visibility protection in Class I areas. The NDEP recommits to continued participation in the WRAP and consultation among the states, federal land managers and tribes with respect to any SIP revisions and/or the implementation of other programs having the potential to contribute to visibility impairment.

9.3 Conclusions

The NDEP has prepared this progress report in response to the RHR requirements in 40 CFR 51.308(g) and (h) and in accordance with 51.308(i). The requirements addressed in the previous chapters include the status of implementing committed control measures, summaries and analyses of emissions and monitoring changes, and assessments of impacts on Class I areas identified in the original RH SIP. The evaluation presented in this report leads the NDEP to conclude that Nevada's 2009 RH SIP is being implemented appropriately; reasonable progress towards the 2018 visibility conditions goal for mandatory Class I areas impacted by sources in Nevada is being achieved; and no additional control measures are needed at this time.

In summary, the *Nevada Regional Haze 5-Year Progress Report* fulfills all requirements for progress reports pursuant to 40 CFR 51.102, 51.103 and 51.308 (g), (h) and (i), and thus meets USEPA criteria for full approval.

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